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Made in Turkey: A Review of Contemporary Challenges In The Turkish Textile Industry By Emirhan Tahiroğlu

ABSTRACT

The Turkish textile industry, a cornerstone of the national economy with significant contributions to employment and export revenues, faces a landscape of evolving challenges. This paper systematically examines three core areas that are currently shaping the landscape of the Turkish textile industry: the implications of irregular migration and informal labor, the impact of supply chain disruptions, and the problems associated with skills and knowledge shortages.

This study aims to explore the challenges hindering the Turkish textile industry and the opportunities available to create a more facile environment. It also points to investigating opportunities in the division. This work will discuss the complex crossing point of risk and prospects within the Turkish textile industry, highlighting the requirement for key adjustment and arrangement.

1. INTRODUCTION

The Turkish textile industry is at a crossroads, where challenges and opportunities combine to define the future in light of the rapidly changing global economic environment. Turkey's textile industry, deeply rooted in the country's economic history, is at a critical juncture, facing many challenges and opportunities that will mark its path to global markets. Known for its rich textile heritage, Turkey is an important player in the international textile scene. However the industry now stands at the intersection of tradition and modernity, struggling with that shift by evolving its structure, and facing many challenges. Supply chain and raw material issues, technological advancements, and shortage of skilled workers create an unstable environment that affects the industry and its sustainability and growth.

Undoubtedly, the worldwide request for economical and morally created materials is developing. Shoppers and worldwide brands are progressively organizing naturally inviting and socially capable items. This requires significant investment in research and development to introduce sustainable technologies and practices and challenge traditional industry practices. Fashion brands are increasingly pursuing their environmental goals through efforts to reduce plastic waste and improve textile farming practices. The demand for vegan leather is changing the way fashion is completed, and big brands are encouraging a more social approach to clothing. Textile manufacturers invest in recycled fabrics and sustainable packaging to improve environmental protection.

Fast fashion refers to the production of stylish clothing that is made quickly and sold at low prices that moves quickly from the plan to retail stores in reaction to the most recent patterns (Bick et al., 2018). This trade demonstrates competitive weight on setting up clothing brands to deliver at lower costs, prioritizing speed and reasonableness. In any case, this approach does not offer any assistance for the industry to meet with developing natural requests of buyers. The worldwide request for maintainable and morally delivered materials is expanding, driven by

increased natural mindfulness and changing client needs. This move opens up modern improvement openings for brands committed to mindful practices. In reaction, online retailers are advancing brands that follow eco-friendly practices, recognizing the significance of supportability in today's advertisement.

Indeed, the Turkish textile industry faces difficult conditions and challenges that require flexibility and adaptability. At the same time, the possibilities offered by technology and the growing role of consumers present ideal opportunities for growth and change. Based on the latest academic publications, reports and news articles, the study aims to review how those challenges are documented by relevant literature. The challenges facing the Turkish textile industry highlight the paths of innovation and growth while addressing these challenges.

2. THE TURKİSH TEXTILE İNDUSTRY

2.1. Historical review

The history of Turkey's textile industry is a testament to the country's enduring experience and ability to integrate innovation into economic development. The story unfolds against the backdrop of centuries in a country where the art of manufacturing textiles is as much a cultural tradition as it is a source of economic prosperity and a driving force. From the dynamic patterns of traditional carpets to modern innovations in high-tech fabrics, Turkey's textile industry has witnessed a noteworthy development that reflects the country's flexibility and adaptability. Turkey's textile industry is one of the most advanced industries, dating back 3,000 years, and is one of the oldest industries, dating back to Hittite times and Assyrian. Over time, trade between Iran and Syria transferred new techniques and types of fabrics to Turkish culture. Between the 17th and 18th centuries, cotton fabrics from India spread throughout the country, but after a short time, Turkish weaving masters produced similar types of Indian fabrics, and they returned to their old powers. At that time, the textile sector was divided into different fields of expertise, such as spinning, pattern preparation, weaving and painting. Thus, it became a major source of income for hundreds of thousands of people. After the 18th century, Western techniques and fabrics were introduced to Turkey. At first, British and French cotton was chosen by the wealthy part of the society, but then, with further falling prices, it spread throughout the whole country.

Early 19th century textile industry manufacturing collapsed and only small looms that met local needs remained. Just a few factories left to provide clothes to the Turkish army. Textile manufacturing factories after the declaration of the Republic were begun to increase by the government and with the establishment of Sümerbank which was declared on April 29, 1933, to be opened as a public institution to realize the large industrial facilities planned to be established by the state, industrialization in general should be compatible with national needs and interests, as seen in the first attempts a well-organized approach in which all resources and economic elements are used is essential for efficient industrialization. The Government should collaborate with both national and private initiatives for priority sectors, and the development of the textile

sector started to increase again. New textile factories and workshops were opened with the opportunity provided by the Industrial Incentive Law (No. 1055, 28 May 1927) and in the 1930's textile had a 23% share of the economy. Until the 1950's Sümerbank and their government establishment were the biggest on the capital and labor. Also after the 1950's Turkey capital and labor rapidly increased. The export-based industrialization policy (24 January 1980), accelerated the rebirth of the textile sector, especially. In addition to the textile centers known to encourage the textile industry in the 1990s, new factories were opened in many cities, production capacity and employment capacity increased and in the late 1990s, the share of textile manufacturing in the manufacturing industry increased to 45%. Turkey has continued to increase its capital and labor even today.

2.2. Contribution to the economy and employment

The Turkish textile industry is a cornerstone of the national economy, contributing significantly to GDP, exports and employment. The industry not only highlights Turkey's economic development but also its role as a key player in the country's labor market. The textile and clothing industry is one of Turkey's largest industries, accounting for about 7% of the country's GDP. It plays a vital role in Turkey's industrial production and has a well-developed supply chain that integrates all aspects from raw material production to finished products. By 2020 with the employment and foreign trade surplus they provide to the textile ready-made clothing and leather products sectors constitute 15% of the manufacturing industry production value and provide 16% of the added value created in the manufacturing industry. The Turkish textile industry is a significant source of employment, providing employment opportunities for about 1.1 million people. This accounts for almost 27.5% of Turkey's manufacturing workforce. The industry offers a wide range of employment opportunities, from skilled workers in textile and garment factories to design, marketing and management positions. The industry's broad employment base ensures livelihoods across the country, especially in the KEV textile hub.

Textile ready-made clothing and leather products Sectors Basic Indicators	Production Value 2020 by billion Turkish lira	Export of 2020 by billion	Employment of 2020	Workplace of 2020
Textile	34,28	12,34	460.399	17.751
Apparel	153,60	14,99	608.587	. 35.934
Leather/Leather Products	20,91	1,37	66.785	6.557
Total	408,78	28,70	. 1.135.771	. 60.242

Table 1: Export rate (Esi, 2017)

The textile industry makes an important contribution to Turkey's export economy. It remains one of the most important export sectors and generates significant foreign exchange earnings. Textile and clothing exports are valued at approximately $16,065 billion in 2023, highlighting the importance of the industry in maintaining a positive trade balance. Major export destinations include China, Europe, the United States, and India.

2.3. The Global Position

The Turkish textile industry has established a strong position globally thanks to its geographical advantages, diverse product range and technological advancements. In 2020, the textile industry's global exports were $361 billion, the clothing industry's global exports were $420 billion, and the leather/leather products industry's global exports were $218 billion. Turkey's strategic location as a bridge between Europe and Asia offers significant logistical advantages. Proximity to key markets in Europe, the Middle East and North Africa shortens delivery times and reduces transportation costs. This geographical advantage is a crucial factor for international brands that want reliable, timely delivery of textiles.

Major textile exporters and export amounts for the biggest of the five countries are: China ($156,07 billion), USA ($18,69 billion), India ($17,38 billion), Germany ($14,34 billion) and Turkey ($12,34 billion). Major apparel exporters and export amounts for biggest the five countries are: China ($124,59 billion), Bangladesh ($36,14 billion), Vietnam ($27,03 billion), Germany ($22,62 billion), Italy ($20,56 billion) and the Turkey is 6th country with the $14,99 billion. Major Leather/Leather Products Exporters and Export Quantities for the biggest of the five countries are: China ($64,73 billion), Italy ($23,38 billion), Vietnam ($20,40 billion) France ($13,59 billion), Germany ($11,49 billion) and Turkey are not at the top 10 with the $1,37 billion. The Turkish textile industry has a wide range of products, including yarns, fabrics, apparel and home textiles. This versatility enables the industry to meet a wide range of consumer needs and preferences.

China produces more than half of the world's synthetic fiber production which means China is a major opponent for Turkey and other countries in the textile industry. It is also the second largest producer of cotton and the largest consumer of this commodity. Important countries in cotton production are India, China, the United States, Brazil, Pakistan, Australia and Turkey. The United States, India and Brazil account for 65% of world cotton exports. Considering only organic cotton production, my country is the second largest cotton producer after India and is an organic cotton producer. Turkey ranks seventh among cotton-producing countries and 5th among consuming countries. Turkey's annual cotton production is 800,000 tons and consumption is 1.8 million tons.

The textile ready-made clothing and leather products sector in European countries stands out with its design and fashion concepts that shape consumer habits. In the textile ready-made clothing and leather products sector, Germany, Italy and Spain stand out among the European countries that export to large manufacturers such as China, Turkey, Bangladesh and Vietnam.

Turkey's trade relations and its access to international markets are crucial to the growth of the industry. The country benefits from various trade agreements, including a customs union with the European Union, which allows for easier access to European markets. Turkey is the 5th biggest exporter of textile in the world, with a share of 3.4% by 2020 and the 6th biggest exporter of apparel with a share of 3.6%. Furthermore, Turkey is the 23rd exporter of leather/leather production, with a share of 0.6% in the country-based ranking.

3. Challenges Of The Turkish Textile Industry

Despite its significant contribution to the economy and its strong global position, the Turkish textile industry faces several challenges that could affect its future growth and sustainability. These challenges include global competition, supply chain disruptions, the effect of irregular migration, energy consumption structure of Turkish industrial sectors, lack of knowledge and regulatory barriers

3.1. Global Competition

Turkey faces stiff competition from low-cost Asian producers, such as India, Pakistan, Vietnam, Bangladesh and Indonesia. These countries benefit from lower labor costs and larger production capacities, allowing them to offer textiles and clothing at more competitive prices.

The most recent Intergovernmental Panel on Climate Change (IPCC) report by the International Textile Manufacturers Federation (ITMF) measures the fabricating costs of material items within the essential textile industry, analyzing various cost components at each stage of the value chain. The 2021 edition includes Central America and Mexico, along with historical cost analyses from countries like Bangladesh, Brazil, China, Egypt, India, Indonesia, Italy, the Republic of Korea, Pakistan, Turkey, the USA, and Vietnam. The report provides cost factors, manufacturing costs, and total production costs for different textile products in spinning, draw texturing, weaving, knitting, and finishing segments. For example, it shows that producing one meter of woven fabric from cotton 1-1/8" in a continuous open width (COW) process costs an average of 1.36 USD per meter in 2021, with varying costs in different countries.
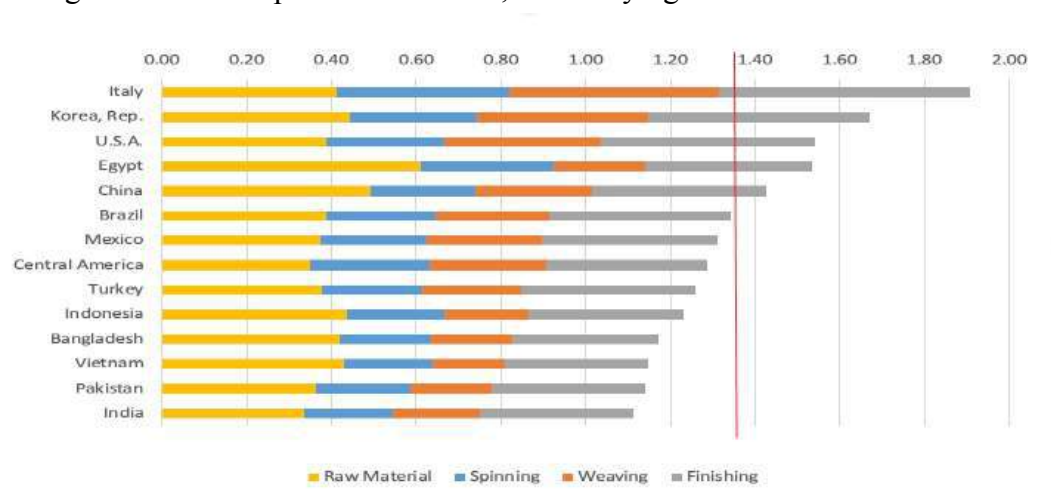
Figure 1: Total cost of producing a finished meter of woven fabric (CO, COW), by segment (UDSD/m).

Yarn accounts for about 19% of the total cost to produce one meter of finished fabric, on an average basis across all regions: from 15% in South Korea (the smallest share) up to as much as 22%, which is observed in Central America. Across the board, weaving this yarn increases total fabric production costs by 19 percentage points on average from 14 percentage points in Egypt to 26 percentage points in Italy. Lastly, confectioning one meter of fabric here costs 31 percentage points more than what is charged in the production process: from 26 percentage points in Egypt to 33 percentage points in Turkey, India and United States as highest percent. The research also reveals that the raw material cost per meter of fabric is on average 31% of production costs. By comparison, it is in Italy that costs are lowest at 22% and highest in Egypt with a rate of 40%.
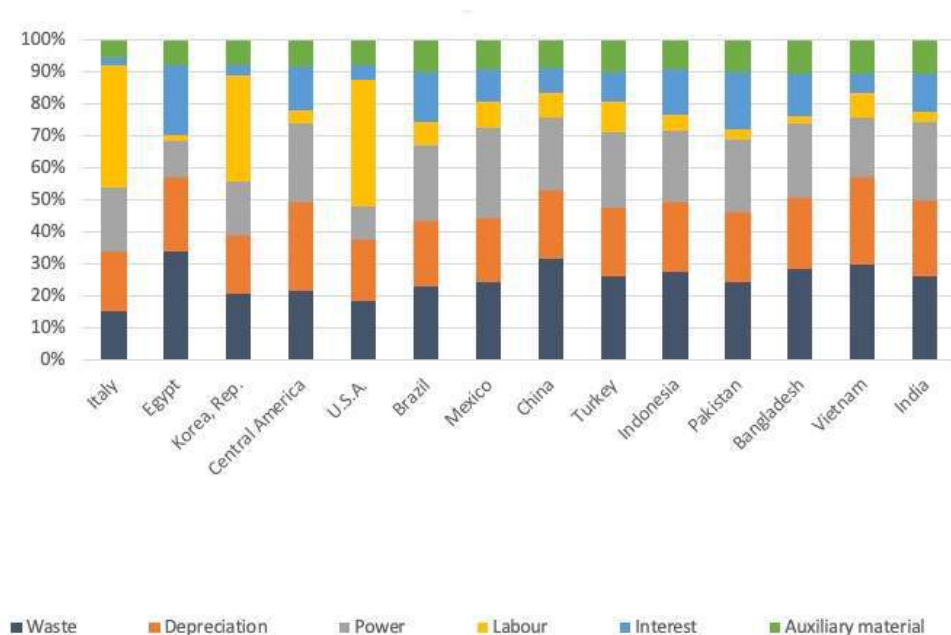
Figure 2: Manufacturing cost for spinning Ring/NE30 (USD/Kg).

The publication also demonstrates that the energy costs to produce NE/30 yarn in Mexico and Central America are relatively high by comparison with other countries included in our panel (Figure 2). These costs represent 28% and 25%, respectively, of manufacturing input expenditures in those nations. The United States and Egypt, however, benefit from a lower cost of energy which amounts to 10% for the former and as much as 11%. Italy and the U.S. have some of the highest labor cost burdens, which amount to 40% or more than a third in manufacturing costs for both countries. This cost factor is only 2-3% of total manufacturing costs in India, Pakistan, Bangladesh and Egypt. For example, capital cost for NE/30 yarn spinning mills in Egypt, Central America and Pakistan where the capital costs comprise more than 40% of their manufacturing costs. In Italy and South Korea, capital costs are significantly lower (21% in 2021).

3.2 Supply Chain Disruptions

Definition of supply chain disruptions: Any event that causes a deviation from the normal course or progression, within any process in the flow of goods and materials. These can be external (natural disasters, terrorist attacks), or internal (third party supply chain failures). The disruptions may be local (e.g., industrial accidents) or global (e.g., epidemics), and might hit different industries in multiple regions of the world simultaneously. Past disruptions were characterized according to their nature of happening or how they affected the supply chain. DuHadway et al. They also expanded the categories first introduced in Mahoney et al. (2019), such as exogenous/endogenous disruptions and intentional/unintentional disruption types In order to mitigate disruptions, the literature concentrates on risk source detection, with operational (i.e. supply-demand imbalances or delivery time uncertainties) and long-term risks (natural disasters such as earthquakes or meteor strikes; terrorism being prime examples). Strategies for Mitigating DisruptionManagement of operational and longer-term risks should provide approaches to improve the operation of the supply chain. In the literature, supply chain risks are split into two categories as stated in Table 2: disruption risks (e.g. natural disasters) and operational risk (such as mis-forecasts of either demand or feeling inadequate for a surge). This extended to the internal and external along with supply chain risks as noted by Christopher & Peck (2003). They defined the types of risks in two ways; macro risk an external or natural; micro-risk internal or synthetic which further narrows down into demand, manufacturing supply and infrastructure under subset local risks. Not only does this allow better identification of supply chain risks but also helps in the management and mitigation processes.

Supply Chain Risks		
Disruption Risks	**Operational Risks**	
External Risks	**External to the firm but Internal to the supply chain**	**Internal to the firm**
Natural Disasters	*Supply Risks*	*Process Risks*
Earthquakes, droughts, floods, storms, cyclones, volcanic eruptions, etc.	Quality issues, variability of replenishment lead time, capacity fluctuations, supplier bankruptcy, etc.	Bottlenecks, product quality issues, machine failure, IT infrastructure failure, labor strikes etc.
Man-made Disasters	*Demand Risks*	*Control Risks*
Terrorism, economic downturn, technology changes, political instability, war	Demand volatility, market changes, forecast errors, competitor's moves, etc.	Poor visibility through supply chain, safety stock policy, order quantity and batch size policy, lack of collaborative forecasting, bullwhip effects

Table 2: Classification of Supply Chain Risks (Christopher and Peck, 2003, p.19)

Supply chain disruptions can be natural or man-made and resilience is essential to minimizing risk. Resilient supply chains have been proposed as key capabilities to help firms adjust and succeed in the face of changing operating conditions (Abeysekara et al., 2019; Hohenstein et al., 2015; Yao & Meurier, 2012). According to Cantor et al. (2014), Chopra and Sodhi (2004) and Sodhi & Tang, (2012) respectively the effectiveness of risk management starts with designing disruption resistant supply chains which may sometimes demand reconceptualization. Disruptions can also happen at different speeds such as the 9.0 magnitude earthquake in Japan which greatly affects its supply chain globally (Lohr, 2011). Natural catastrophes like earthquakes can strike suddenly, while others such as famine develop gradually over a period and are therefore precipitate with specific natural signs (Van Wassenhove 2006).

Origin/Speed	Slow-onset	Sudden-onset
Natural Disasters	climate change, famine, drought, deforestation, poverty,	earthquakes, tsunamis, cyclones/storms/hurricanes/typhoons, volcanic eruptions, floods, tornadoes, landslides, wildfires
Man-made Disasters	political crisis, refugee crisis, economic crisis, environmental pollution	terrorism, Coup d'Etat, chemical leaks

Table 3: Types of Disasters

Epidemics and pandemics offer distinct supply chain threats gaining disruptions inside or outside. Many enterprises, this time round the whole of society were impacted rather than individual companies and compared to COVID-19 much more stronger on the global supply chain. Sodhi and Tang will see extreme supply chain management as necessary to cope with pandemics, geopolitics, war, climate change or biodiversity collapse. Resilient supply chains have to be designed in a way that they are able to tackle such challenges, and supply workchain capabilities play an essential role in curbing the risk. To enhance supply chain resilience, orcs must evaluate where vulnerabilities and strengths in their network are widespread.

3.2.1 The Effect of COVID-19 Pandemic to the Industry in Turkey

Among the countries whose textile exporters have been hit hardest by COVID-19, Turkey is home to leading manufacturers of yarns and textiles in cities like Bursa where blue chip companies with years-long relationships woven into global supply chains typically reign supreme. Not only has the pandemic led to people losing their lives but also it disrupted supply chains and hampered business operations. In any case, these two cities managed to achieve a higher level of textile exports in 2021 versus the previous year, which appears an insignificant but still relatively good performance among other significant challenges faced. Besides, whereas the total amount of textiles and raw materials that are exported in Turkey decreased just a little from $12.51 billion to 2020 until it reached at least one year ago with an export value of $12.32 billion; Volatility, therefore, was partially a result of pandemic-induced disruptions. On the other

hand, Bursa and Gaziantep increased their exports by 32.2% and 36.7%, respectively in the year of comparison with before" For this purpose, a questionnaire is applied in an analysis to textile companies using the data of 422 firms located at Bursa and Gaziantep. Original Article: This study aimed to explore the economic consequences of the COVID-19 pandemic with a focus on certain characteristics related for companies such as number of years in business, form of legal organization, time present in market and monthly turnover. The study found substantial variations in the effect of these factors on firm responses to COVID-19.

In total, despite the enormous difficulties which met with Turkish textile sectors due to COVID-19 such as Bursa and Gaziantep showed us its resistance ability through their flexibility whilst exciting brands to stay there in a fluctuating pattern recovered over export volumes post-coronavirus.

3.2.2 Dependency on Imported Raw Materials

Although the Turkish textile industry has an important part in it, as a general fact; very many imported materials are used. Traditionally, the industry depended on domestically produced raw materials, However domestic manufacturing has not kept pace with rising demand and large quantities of cotton,textile chemicals,machinery etc. are imported into India incurring heavy exchange losses for local manufacturers. The United States is the biggest cotton supplier to Turkey, also sixth largest producer of Cotton in the world and imports around 400,000 tons of cotton annually. And its reliance is, in part, unhealthy, because of delays on the CAP (Southeast Anatolia Project) and slow implementation of socio-economic adjustments. The textile and clothing sector in 2015 amounted to 11-12% of the gross national product, approximately 30% Turkey's exports, and is also estimated that it was responsible roughly for thirteen-eighteen Above average. The industry was 12.8% of GNP in 2004, with $19.2 billion worth of exports making up one third of all Turkish exports that year; The import dependence of these effects negatively on the cost structure and global competitiveness of the Turkish textile industry. Despite making big contributions to the economy and creating plenty of jobs, this dependence needs addressing these efforts like local production improvement as well as ambitious projects such CAP are seen in that respect.

3.2.3 Logistics problems

Numerous hefty transport and logistics troubles, typically the Turkish clothings and also starch. As its global footprint expands, these challenges are fast becoming apparent.

First, the nature of the existing supply chain is complex and fragmented. What makes this complex is the number of activities involved, right from sourcing raw materials to sales and marketing. However, the process and coordination of these activities are critical to manage but hard to do well, leading them often to be done inefficiently or causing delays. And the second most important issue is infrastructure constraints, particularly in multimodal transport (road, rail; sea, air), where logistics infrastructure is not meeting industry expectations. This deficiency

leads to increased logistics costs, extended delivery times and inhibits supply chain efficiency which delays product distribution.

Similarly, absence of dedicated logistics centers which can address the specific requirements of the textile and clothing sector is another main issue. Such centers are imperative for dealing with the businesses related to transportation, warehousing and distribution etc. The creation of all such amenities is required for the industry to attain desired efficiency and economy. Moreover, the relatively little amount of outsourcing in this sector presents logistic struggles as well. While the benefits of outsourced logistics are concerned with cost and time saving, the textile-clothing industry in Turkey prefers to keep control over important logistical activities. This has an effect on the capabilities and heaps operations onto companies. Geographic concentration makes logistical problems worse. There is a regional logistics bottleneck especially around Istanbul where the main part of the industry is intensively aggregated. The density of population in a city means ample pressure on local infrastructure resulting in bottlenecks and delayed outputs. And lastly, the timely manner which is a huge issue we are currently working on in the rapid world of fashion. If you want to stay in the race, it is mandatory to pursue what the market is asking for.

However, many times logistics in place today operate with slowed time by the manufacturing process and infrastructure limitations within supply chains that not only allow opportunities to pass unaddressed for upgrade but also lower levels of customer satisfaction. In conclusion, the Turkish textile/clothing sector has various problems: complex supply chains, inadequate infrastructure, non-existent logistic centers and/or well beyond requirement levels rather than dedicated onesand last but not least low outsourcing ratios, high geography dependencies v.s. time delays and inefficiencies. Solving these problems is key to improving the payment industry, making it more efficient and affordable for participants on a global scale.

3.3 The Effect of Irregular Migration on the Wages of Native Workers

An analyst was able to measure by how much wages of local workers in small studios were reduced due to migrant workers. No one directly blames migrants for the low wages in this country, but definitely cold heads have a tough time mastering all these thermodynamics. By even receiving wages, although in-between -or reduced- and late-paid for migrant workers, a business threatens the environment making local workers retort that their skills are worth more because they have experience. This creates tension at workplaces as some employers cannot deliver what is asked or, in many cases, will not produce it, with a rising local discontent. In other cases, this wage disparity has forced local labor unions to go on strike, leading these very same companies into great business instability and vulnerability. The difficulty of hiring enough skilled workers has led some employers to look for ways other than rising wages to attract or keep them, in at least one case, inspired resentment over the fact that even trained rail technicians are living here but not working. Many migrants have claimed that they are being paid either below the statutory minimum wage or not at all, which led to production halts in several textiles companies. Employers say this is based on experience and performance not ethnicity, but

concede abusive practices are taking place in some firms. While the industry is able to carry out its day-to-day orders with the help of migrants, criticism has been heaped on arrangements under which they negotiate wages below those for people from here.

And there are worries of a backlash that would eventually disrupt the flow of migrant labor, upon which many employers say they depend to keep their businesses running. Recruiting migrants is considered by many as a key part of operating in an increasingly tough corporate environment with waning migrant numbers likely to result in the closure of numerous studios. Collectively, the increase in migrants has had a dual influence on salaries and dynamics at small studios across Turkey underlining the complexity of how employers and workers are approaching their worlds inside this industry.

3.4 Energy Consumption Structure of Turkish Industrial Sectors

The National Energy Conservation Center (NECC), in collaboration with the Turkish State Statistics Institute (DIE), conducted a comprehensive industrial database survey to evaluate energy consumption, potential energy savings, energy management approaches and systems, and technical infrastructure within the industrial sector. This includes infrastructure such as boilers, motors, and furnaces. As part of this study, questionnaires were distributed to 1,300 manufacturers consuming more than 500 tons of oil equivalent (toe) of energy (Ozturk, 2005).

According to studies conducted by DIE in 1992 and 1995, based on results obtained from approximately 1,200 of these manufacturers, their total energy consumption, for those consuming 500 tons of oil equivalent (toe) or more annually, constitutes 75% of the industrial energy consumption of Turkey. Table 6 delineates the industrial sub-sectoral energy consumption and the share of the cost of energy production in Turkey. As shown in Table n.5, the iron and steel sectors account for a significant portion (approximately 35%) of this consumption, while the textile and woven industry comprises 5.9% of the total consumption. When examining the cost of energy, this share is distributed as follows: 48% in the iron and steel sector, 32.5% in the ceramics industry, 55% in the cement industry, and 8-10% for the textile and woven industry.
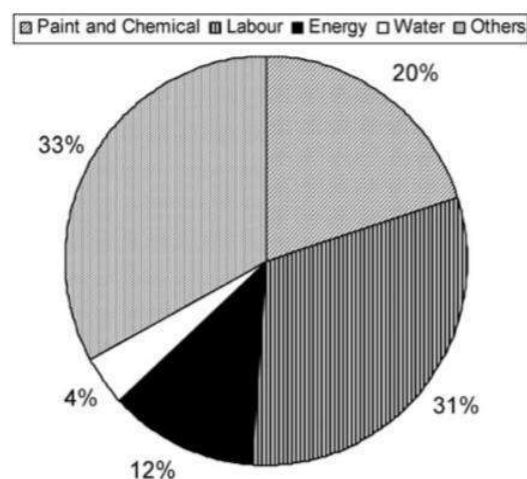
Figure 3: Comparison of textile input as cost (Ozturk, 2005, p.5)

Since the Turkish industrial sector accounts for 35% of total energy consumption and 54% of total electricity consumption, the sector is a focus of energy conservation research. In addition, Turkey's industrial energy consumption is expected to increase from 34.7% in 1996 to 37% in 2000 and 56% in 2010. These projections indicate that the Turkish industrial sector needs to be examined from an energy conservation perspective. The Turkish textile industry, one of the oldest and largest industrial sectors in Turkey, is energy-intensive, so optimizing energy consumption and conservation is essential. The industrial processes in the textile industry consume a large amount of fuel and electricity. Minimizing energy costs and consumption is essential for the textile industry to reduce overall costs and remain competitive. In the meantime, due to increasing global competition Turkish textile companies strive for further cost efficiency primarily by reducing their energy costs and using power more efficiently.

	Heavy fuel-oil for industry (ton)	Electricity for industry (kW h)
Canada	208.98	0.03
Chinese	222.55	0.06
Germany	189.42	0.05
India	198.13	0.07
Italy	230.50	0.09
Japan	236.56	0.16
Korea	285.27	0.06
Spain	199.35	0.05
Turkey	191.17	0.09
United Kingdom	202.13	0.05
United States	182.50	0.04

Table 4: Electricity and heavy fuel-oil prices for some countries ($/Unit) (Ozturk, 2005)

Industry	Total energy (toe)	Rate of industrial consumption (%)	Rate of energy in total cost (%)
Iron/steel	4,863,328	34.9	11.5 and 48
Non-ferrous metals	312,947	2.3	6.2 and 47.4
Ceramics	627,789	4.5	32.5
Cement	2,736,165	19.7	55
Glass	234,898	1.7	22–42
Paper and cellulose	468,823	3.4	9–30
Textile and woven	822,305	5.9	8–10
Petro chemical	606,423	4.6	28.5
Main chemicals	308,138	2.2	24
Chemical fertilizer	718,962	5.2	40
Petrol refineries	406,006	2.9	4
Dye, varnish	7149	0.05	1.6
Medicine	17,693	0.12	1.5
Soap, cleaners	41,190	0.3	2.1
LPG	34,082	0.24	1
Others	558,000	4	–
Forest products and furniture	72,143	0.52	6
Metal furniture	41,251	0.3	4
Flour products	8132	0.06	4
Tea	72,053	0.52	3.5
Sugar	415,759	2.99	8.5
Oil	137,731	0.99	3.7–6
Vegetable and fruit industry	65,762	0.47	6.44
Tobacco/beverage	107,287	0.77	0.7–6
Total	13,923,448	100	

Table 5: Industrial sub-sector energy consumption and the share of the cost of energy production in Turkey (Ozturk, 2005)

Kalliala and Talvenmaa (2000, as cited in Ozturk, 2005) analyzed six Finnish textile companies to create an environmental impact profile of wet processing, which included yarn production, weaving, dyeing machines, and wet processing of knitted and woven fabrics. Tang and Mohanty (1996, cited in Ozturk, 2005) studied improving energy efficiency in the Thai textile industry through combined heat and power generation. A report by the United Nations Industrial Development Organization (UNIDO) identified energy efficiency opportunities in the textile industries of Japan, Malaysia, and Indonesia. Tiwari (2000, as cited in Ozturk, 2005) assessed the energy intensity of various economic sectors in India and found that the energy intensity of coal tar, wool, silk, synthetic materials, and textiles increased between 1983 and 1990. Mozes et al. (1998, as cited in Ozturk, 2005) evaluated the conventional textile washing process using exergy analysis and concluded that electrical heating has the highest energy consumption. Feasibility studies on superheated steam drying of paper and textiles by Deventer showed that this method has advantages over conventional methods in terms of energy efficiency, drying speed and product quality. Muneer et al. (2004, as cited in Ozturk, 2005) proposed a sustainable alternative for water heating in the dyeing process, which is energy intensive in the textile industry.

In conclusion, the survey by the National Energy Conservation Center (NECC) and the Turkish State Statistical Institute (DIE) highlights the critical role of energy management in

Turkey's industrial sector. Since a large part of energy consumption comes from manufacturers that consume more than 500 tons of oil equivalent per year, especially in the steel and textile industries, there is a clear need for targeted energy conservation strategies. The results highlight the importance of optimizing energy consumption in the highly energy-intensive Turkish textile industry to remain competitive in the global market. Evidence from international studies shows that the adoption of advanced energy-saving technologies and sustainable practices can lead to significant energy savings. In view of the projections of rising industrial energy consumption, Turkey needs to prioritize energy conservation measures. By investing in energy-efficient technologies and implementing effective energy management strategies, Turkey can reduce energy costs, improve competitiveness and achieve long-term sustainable development of its industrial sector.

3.5 Lack of Knowledge

The piece refers to a common misunderstanding regarding circular product design concepts in companies. Companies A and H were identified as "ignorant of cyclicity" and both cited that instead of the logic behind circular product design, they are concentrating on circle sewn marketiscriments. Company A touched on how the COVID-19 pandemic is affecting the circular sewn goods market and Company H highlighted durable, eco-friendly options of knit fabrics. When asked how circularity can be incorporated into product design, the 3R model (Reduce, Reuse and Recycle) was strongly mentioned. However, the business representatives had a rather vague idea about reuse and recycling, which is necessary to better understand some aspects of the circular economy. Companies B, D, E and H faced more difficulties than companies A, C, F and G. Many sources mentioned certifications rather than design elements related not only to recycling but also to reduction and reuse.

Product design concerns around natural and organic fibers were raised by Companies A, B, C D G and K to a greater extent with reference only at high level but there was little understanding for mono-materials or fiber blends impact in the product life cycle. There were companies who valued durability more than recyclability, at the same time Company D recommended blending cotton and polyester for printing. Company K stressed the significance of designing sustainable and reusable products instead of just recyclable ones. Three companies failed to consistently list fabric composition (A, D and G). J Purchase fiber blends instead of 100% cotton for cost saving, C Believe that it's all fabric made from Cotton is more environmentally friendly and easier to recycle. For Company A, a competent workforce was another knowledge inhibitor it identified stating they do not emphasize any certain prior education and knowledge when hiring employees. In conclusion, this information indicates companies must evolve to meet consumer needs for circular product design, specifically via fabric composition, durability and recyclability.

In the end, this data highlights how critical it is for companies to get smart on these circular product design principles in order to make sustainability a reality. Plugging the knowledge gaps and designing products in a holistic manner is what businesses would need to

think of if they plan on being more sustainable in their operations. While profiling employees based on company values may not technically stand in the way of transitioning towards circularity, it could theoretically make folks a little less likely to stick their neck out against established company norms. However, when product design key competencies are considered, we frequently prioritize creativity and aesthetic skills above manufacturing applications that enable circularity. Those at Company H send off their design work to freelance designers, whereas those over at the desk of Company F are looking for fashion graduates who have interned in a few countries and know what real pain is. However, as a result of economic crises in some countries there are few options for international experience. Companies B and C neglect the product life cycle in favor of trend cycles, which also stops circular approaches being put into place from the beginning.

For these companies, the top priority when it comes to hiring designers is trends and customer expectations. Hence, this method may suppress the adaptation of reduce reuse and recycle practices in product life cycle due to lack of systems approach perspective within industry.

General Theme	Summarized Statement
Unfamiliar with key terms within the concept of circular textiles	Refers to certificates when asked about the durability, reusability and recyclability of their products (Company A; Company B; Company C; Company D; Company E; Company G; Company H; Company K)
	Unable to differentiate between reuse and recycle (Company B; Company D; Company E; Company H)
	Discusses circular knitting when asked about circular textiles (Company A; Company H)
Difficulties with competent personnel	Personnel working within product design are not required to have previous knowledge about circularity and instead are taught company rules and values (Company A)
Lack of holistic approach	Competencies sought after within product design are of the creative and aesthetic kind, no mention of pattern making and other practical skills that might aid circularity (Company A; Company B; Company E; Company F; Company H; Company I; Company J)
	The life-cycle of a product is exclusively connected to fashion trends (CompanyB; Company C)
Lack of nuance in the view of each fibre's impact on a product and it's circularity	Focus on organically produced natural fibers instead of on their life-cycle (Company A; Company B; Company C; Company D; Company G; Company K)

	Does not consider recyclability when choosing material composition (Company A; Company J; Company K)
	Lack of consideration for the effects of blending fibers (Company A; Company C; Company D; Company G; Company J)
	Advocates for mixing fibers to lower costs as long as the fibers are sustainable (Company J)
	States that monomaterials of cotton are easier to recycle than mono-materials of polyester (Company C)

Table 6: Concepts within the knowledge based barrier

Getting a skilled labor force is the major problem in companies of Turkey and big to small enterprises. The field experience needed to service numerous product groups and colonize ideas for high volume cannot scale down the curve much farther from small companies. Conversely, bigger companies cannot find the specialized competences that allow for innovative processes because of an old educational system. We lack the necessary expertise and technology in the area of product design for the manufacturing process. This makes it more difficult to create durable products that can be recycled or further processed in the cardboard cycle. A number of organizations argue that production experience is not learned in older age and recent graduates do not provide a fresh view from the younger perspective. The labor conditions in Turkish textile sector does not seem very attractive for the recruitment of qualified personnel,

3.6 Regulatory barriers

In Turkey, the harbor activities are limited to a few harborsThere is no industrial integration in places, so there may be communication and collaboration problems within supply chains. Companies observed a lack of industrial clustering or vertical integration, making it difficult for fabric and garment suppliers to leverage their investments. Although Turkey has a broad manufacturing base, the supply chain is still rather old-fashioned and cuts through volumes of scale as from the Far-East. The dramatic short-term variability of turnover in Turkish textile manufacturing can throw the sophisticated calculations into disarray, destabilizing investment decisions and choking ROI on new processes. Companies in Turkey will have to make a crucial decision on whether or not they should maintain operations due to the extremely high cost of production. These factors have raised the cost of importing textiles that are in demand, and a government policy to protect local textile production through taxation has driven up costs on those imports. This leaves companies to expand, switch gears or stop producing altogether. On a different note, imported materials are taxed an extra 50% which is then reflected in prices making it difficult to compete with other markets such as the US and China. One is more resilient types of fabric and the other, items that make better use of raw resources, and some are taxed at 18% today.

Ultimately, businesses need to decide: are the costs of Turkey still worth bearing? It will have a major effect on the future of manufacturing in Turkey.

3.7 Sustainability and environmental impact

As one of the largest in both its own economy and on the global market, Turkey conquers a significant place within the textile industry albeit durable interruptions. This covers the environmental, economic and social dimensions which in themselves are significant areas of focus. The industry has also been working diligently to address these factors, which are all essential for reducing the environmental footprint of textile production and promoting better economic results and social welfare.

The Turkish textile industry is therefore sized accordingly, and while its environmental impacts are considerable in Turkey they mirror the challenges of textiles production worldwide. Textile production has some of the highest levels in terms of water and energy consumption, it also uses a vast number of chemicals which can lead to pollution and waste. The industry has been called out as one of the major sources of water pollution in Turkey, especially for regions where textile manufacturing activities were dense. The effluents from dyeing and finishing processes have been identified as one of the main causes of water pollution by high values of Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD), which negatively affect aquatic ecosystems. Moreover, this results in air pollution from emission of greenhouse gasses (CO_2 and N_2O), which lead to global climate change and other aerial pollutants such as NO_x or SO_x. Industry has begun to respond by finding ways out of the dilemma posed. It means the use of eco dyes, water recycling and energy saving. But there's a long way to go. Efforts to these practices from the industry need a fillip so that it reduces its load on the environment in terms of water, energy and waste management.

However, the Turkish textile industry lies at the base of an relentlessly advancing industrial sector that earns a larger portion of GDP and exports with little contribution in employment. The global textile industry was estimated at USD 3 Trillion, making up to 2% of the world GDP in the year 2020. Turkey has been a key beneficiary of this growth and textile exports play a significant part in generating foreign exchange reserves for the nation. But economic sustainability in this field is not just about profit; it also means reconciling profitability with environmental and social responsibility.

A major issue to solve is the cost of being sustainable which continues to be high, amongst array challenges we are faced with gaining economic sustainability. While these practices result in cost-savings or competitive edge over a long-term, the startup costs can form an entry barrier for most companies with the biggest hit taken by small and medium enterprises (SMEs). However, the move to sustainable production is important not only in order to minimize environmental impacts but also because sustainability increasingly plays a role when it comes down to competitive advantages on international markets.

In the Turkish textile industry, labor rights come under social sustainability which covers labor issues such as working conditions and community impact. This sector has created employment

for nearly one-fifth of Turkey's population, as well. However, it has been criticized for poor working conditions and also low wages and lack of worker safety measures. These are especially prevalent among lower-tier suppliers, where law enforcement is weak.

This realization is important, and speaks to the role of continuous improvement in addressing social sustainability issues within the textile industry; with stronger enforcement of labor laws, better wage payments and working conditions for workers at every node on a supply chain. Conversely, companies must actively seek to provide positive contributions towards community development and must work closely with local stakeholders so that their operations are not simply extractive of resources from communities in which they operate.

When all is said and done, there are of course positive steps made towards sustainability but more work still needs to be carried out within the Turkish textile industry. Textile production contributes greatly to environmental impact and must be continued with cleaner technology as well as effective resource management. It creates an economic problem for the industry since it must remain profitable and at the same time not spend too much on making these products in a sustainable way to keep their recognition high within global markets. From a social perspective, labor conditions need to improve and the industry needs to become more involved with local communities if growing further at such an impressive rate is going to benefit everyone. The elimination of these challenges in the Turkish textile industry is a step towards ensuring that production practices are more sustainable, with profits enriching both the economy and improving society's well-being as part, albeit small but an essential part thereof.

 4. Recommendations

In order to cope with the market pressure from global competition, as the Turkish textile industry, they must focus on three key points: high-quality production, innovative design, and sustainability. That means investing more in premium materials, engineering refinement and differentiation with bespoke designs that work to the market's advantage. The competitive edge can be found in appealing to eco-sensitive consumers, exploration of new business segments and the differentiation from low-cost producers.

One of the main concerns that pose a threat to the industry's stability is supply chain disruptions. For resilience, the experts call upon diversification of supply sources through adoption of additional suppliers from across geographical zones. Second, it lessens the dependence on particular sources and therefore reduces risks from geopolitical tensions while ensuring that a firm supply chain is up and running. Similarly, the use of technology and automation tools like modern logistics solutions or real-time insights in tandem with inventory management systems can help to ensure processes are as efficient (and automated) as possible while allowing disruptions to be dealt with more quickly.

To combat the impact of wage dampening and labor dynamics aggravated industry-wide by irregular migration, bolstering social sustainability in our community is a must. It will require a multi-faceted strategy, which should include stricter enforcement of labor laws but also better wages and working conditions as well as cleaner supply chains. Dialogue with community: The

process where they engage local communities so that the industry will be beneficial to their development rather than being dependent on resources and labor.

Through the application of sustainable production technologies, this is a factor that can be improved dramatically for industry's energy consumption structure. In contrast, technological innovations allow for a significant reduction in water and energy consumption (water-saving technologies) as well as in the use of chemicals – the N2O footprint can be reduced by 88% compared to initial estimates based on wastewater emissions – and CO2 emissions from the production process are optimized. They are not only environmentally friendly and improve energy efficiency but also reduce costs, thus increasing economic performance.

It is important to tackle this ignorance within the industry in order for growth, sustainability and society as a whole. There is the need for companies to develop training programs based on principles of circular product design and sustainable manufacturing. The best way to seed innovation and elevate production standards is by arming employees with the right knowledge and skills, thus providing a unique capacity to stay ahead in an ever-evolving market. To break these regulatory barriers, policy reforms that allow Nicaragua to pursue agricultural modernization and take advantage of the benefits innovative solutions provide are crucial. This involves cutting down on bureaucracy simply by working together and creating awareness as well, and ensuring a clear environment for the industry to flourish. The alignment of policy, with reduction of operational inefficiencies and enhancement in competitiveness by companies.

Eco-friendly practices can also help mitigate sustainability and environmental impact concerns across a supply chain. To this end we will develop sustainable packaging, reduce our energy consumption and work with cleaner production technologies. Embracing these practices can propel the Turkish textile industry forward to become a groundbreaker in sustainable fashion, therefore reaching unexplored territories and consumer needs as all stakeholders strive for an environmentally responsible product.

The use of technology in the Turkish textile industry, particularly sustainable ways to produce textiles is bringing a lot of change and betterment for this sector environmentally as well economically. This case study illustrates the benefit of adoption and integration of innovative-technologies and practices, to decrease resource consumption, specifically focusing on operational efficiency in textile manufacturing at a woven fabric plant located at Bursa, Turkey. Some of the biggest changes come in sustainable production, which has led to reductions across water and energy use. Waste reduction: The study found that the factory's overall water use was reduced by 40.2% and wastewater generation by 43.4%, a direct result of industrial raw material savings. This was due to the use of water-saving technologies and irrigation systems that helped optimize production processes. These advances are a must for Turkey, as the textile industry accounts for 15% of industrial water use and is the second largest consumer of industrial water. Energy efficiency was and is another important technological change perspective for the transformation of the textile industry. According to the case study, overall energy consumption fell by 17.1%, and CO2 emissions fell even more - by 13.5%.

This progression aptly demonstrates the industry's dedication to achieving sustainability goals, reducing its carbon footprint and energy costs during a time when Turkey has been ranked as having one of the third leading energy-consuming sectors in the country only after iron/steel industries & cement. Cleaner production technologies have also contributed to major reductions in chemical use, particularly those employed in dyeing and finishing. The reduction of $NaCl$ (salt) consumption by 46% through optimized chemical processes and new improved technologies is a key example. The reduction with this method will also decrease the environmental footprint of textile production and reduce raw material costs, increasing the overall economic viability of sustainable methods.

In addition, the economic merits of these technological advancements is evidenced by sub-two year paybacks for investments in sustainable production technologies. The lessons from the case study show that the true payback period of all above implemented measures is around 1.5 months, and this alone presents an attractive business opportunity to invest in sustainable practices. Not only do these developments ensure the continued competitiveness of Turkish textiles on a global scale, but they also contribute to environmentally sustainable industrial expansion.

Thus, technological developments in the Turkish textile industry have significantly contributed to improvements in environmental as well as economic performance. Sustainability: The industry is taking important steps towards sustainability by the reduction in water and energy consumption, decreasing chemical use, optimizing resource efficiency etc. They show the blueprint for how technological advancement can inform sustainable growth in one of Turkey's key industrial sectors.

5. Conclusion

A major turning point for the Turkish textile industry, deeply part of its cultural and economic fabric. As Turkey's one of the oldest and most well structured industries, it has been the driving force behind each part of the economy until today such as GDP, employment and exports. Yet in a rapidly evolving global market and increasingly challenging regulatory environment, the industry must overcome an array of hurdles to bridge gaps that imperil both its sustainability and prospects for growth.

Now one of the most salient challenges in front of the Turkish textile industry is stiff global competition. There is fierce competition for market share by countries with relatively low labor costs and higher production capabilities like China, India, Bangladesh and Vietnam in Turkey. The Turkish producers are facing challenges as their cost structures are higher than those of competitors in the global textile and clothing markets, particularly from China. Rather, the Turkish industry needs to concentrate on distinguishing itself through quality production and innovation; features where it can create a competitive advantage that appeals to international consumers. This has also become one of the biggest challenges exacerbated by global events such as COVID-19 pandemic leading to supply chain disruptions. The pandemic and its related disruptions exposed fault lines in the supply chains of an industry that requires innovation to

achieve increased resiliency and adaptability. The Turkish textile sector needs to make investments so that its supply chain is strengthened and made more flexible, and can operate in natural disasters from pandemics or geopolitical tensions. This means technological investment and strategic partnerships with the development of local supply networks that takes off pressure from international suppliers. The Turkish textile industry should also need to give importance in the field of environmental sustainability. It is not just a trend that brands can capitalize on rather than offering the same old, but consumer-driven change and increased regulation in all facets of manufacturing. Their heavy reliance on traditional manufacturing processes, which are often resource-intensive and have devastating consequences through slash-and-burn agriculture and environmental degradation, can quickly become a liability. If Turkish manufacturers want to keep up, they have no choice but to go green, and sustainable manufacturing, reusing raw materials, reducing water and energy consumption, cleaner processes, could be the future for 21st century industrialists. This move not only falls in the line of global environmental objectives, but also creates a market for like-minded consumers and brands. At the same time, we believe that some strategic reasons may push the Turkish textile industry to benefit from such a crisis. Turkey's strategic location between Europe and Asia provides key operational advantages, allowing faster delivery times and lower shipping costs for European customers in addition to tapping violet into Middle Eastern markets. The base offers proximity to important markets, along with well developed infrastructure and a highly skilled labor force that makes the Turkish manufacturer's competitive edge in comparison its far eastern rivals.

In addition, the industry has a longstanding reputation for quality and craftiness in areas such as cotton and wool production to high-end textiles & apparel at scale. With a stream of technology advancements such as high-tech fabrics and smart textiles, the Turkish textile industry can enhance its reputation going forward to new frontiers of this trillion-dollar business with further investments in research and development. There seem to be exciting opportunities in the Revival of the Textile industry which has not only its core advantages but is slowly emerging with us targeting digitalisation. With globalization and increasing connectivity across the globe among digital technologies, there is ample growth opportunity in doing e-commerce business or working as a freelancer in any designing work related to digitally equipped machines outsource your supply management. It is these technologies that Turkish manufacturers can harness to be more efficient, save costs and respond quickly to market trends.

To sum up, the Turkish textile industry has important challenges that include global competition and problems in supply chains on one hand, while it also enjoys substantial strengths and opportunities to become a sustainable future. Through innovation, sustainability and strategic adaptability the industry can face these challenges head on access emerging as a leader in global textiles. Moving forward, manufacturers are under a shared obligation from policymakers and consumers alike to enable this shift of the industry towards sustainability in order to thrive.

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Ridiculing Reason - An Examination of Blurred Reason By Daniel Yao

In George Orwell's *1984*, there's the concept of Newspeak – a propagandistic language simplified and limited to hinder an individual's ability to criticize or think critically (Courtine, 71). While my underclassmen read this book, ranting about how ridiculous the concept is, I see Newspeak all over campus. When I ask my fellow schoolmates anything regarding our school, there is an evident hindrance of language, careful choice of word not to offend the bureaucracy at our school. This fear is unnatural. This fear is unbecoming of the student.

Immanuel Kant's essay *What is Enlightenment* highlights the concept of a private and public use of reason (Kant, 5-7). A private use of reason shall be defined as any use of reasoning that is based on an identity or persona (Kant, 5). A public use of reason shall then be defined as any use of reasoning free of identity, of one's own accord (Kant, 7). To exemplify this, the lawyer. Our lawyer here may not agree that their client is innocent. Hell, they may even understand that they are guilty as charged. However, their private use of reason dictates that they use their reason to defend them to the best of their ability, as their role as a lawyer compels them to defend even if it was against their own belief. On the other hand, their public use of reason can be the total opposite. With their associates, they may ridicule their client, say that they are guilty beyond reason and that it is horrible that they must defend such a monster. This is the key difference between public and private use of reason I aim to highlight within this essay.

According to the 35th page of my school's student handbook, "Students are expected to exhibit the school ESLRs (our version of a code of conduct) while on-campus, off-campus, and through their digital presence" (SMIC-I HS, 35). Since the publication of this rule, student life and personal life has been muddled together beyond a separable state. This means that private use of reason has overpowered public use of reason, leading to cases of self-censorship and the development of Newspeak. Returning to the rule, it dictates that people demonstrate a student's code of conduct off-campus, including times where they do not wish to nor think of themselves as students. When I go home and eat dinner with my family, I am a son. When I go on bikes with friends, I am a friend, a confidant. When I go perform at a local jazz bar, I am a performer, an entertainer, a music expert. In those moments, I do not wish to be seen as a student, a classmate or a schoolboy. I wish to be seen as me, a human with a multitude of identities. When I speak I wish not to be restricted by ideas set forth by only one of my identities, but to be restricted only by the identity I am seen as in that moment. To be constricted by the ESLRs is to be forced to conform to one identity.

In total, the previous rant is to exemplify how this legislature has fundamentally altered the view of public and private use of reason. It has completely erased public use of reason and replaced it with <u>one and one only</u> form of private reasoning: that of a student who shall follow the ELSRs. Now these ESLRs are not necessarily bad. They include being a Global Citizen, Person of Character, Motivated Learner and Healthy Individual. But please, if you were to entertain my banter for a little while more you'll soon understand how intriguing this whole case is. If I choose to go to McDonalds and eat a Big Mac, does that mean I have violated the ESLRs off-campus and thus should be punished? If so then I should be expelled by now! If I don't

donate to charity (a key tenet of being a global citizen), does that mean I shall be expelled? That seems very discriminant against the lower income families of our school. The list of ridiculous examples go on and on yet that is only the beginning. As stated in that same rule "students are expected to exhibit the school ESLRs … through their digital presence" (SMIC-I HS, 35). So if I were to post a cat photo that slightly leaned into political themes, say Israel V Gaza or the Russo-Ukraine war, I could be punished. Let's expand on that point. If a student were to repost an article on those very same things, supporting or condemning either side, they could be punished.

Further along the rule, it states "[g]ood digital citizenship means being respectful, using appropriate language, not spamming, not posting inappropriate memes/images/videos, holding others accountable for inappropriate behavior" (SMIC-I HS, 35). Yet, it never defines what is inappropriate or appropriate. Would the word "gay" count as appropriate or inappropriate language? Would I, posting a picture of a cheese wheel, constitute as inappropriate. Hell, would eating a banana count as sexually explicit? These questions are being debated even within big content circles such as YouTube and Instagram. Yet a student, unaware of these boundaries, could be affected for life as they could just as easily have something written on their transcripts, permanent records or even directly expelled (though unlikely).

This is not to say we should not hold people accountable for their actions online, but rather to separate the action from identity. We shall hold them accountable according to their public opinion rather than due to one of their identities: a student. This idea may seem abstract, but I will attempt to explain this alternative method of judging. A concern with a student saying non-politically correct statements outside of campus is that it may be linked back to that school. This is to say that an individual is bound to a singular organization on a perception level. So, to prevent these statements from being traced back to the school, the school decides to nip it in the bud. Therefore, the wording of the rule within the handbook is exactly to prevent this. The reputation of the school depends on its students, the same way a nation's reputation depends on its citizens. However, if we strip these societal labels, we are left with not a student, not a citizen but a person with their own opinions and own thoughts. Though, it can be argued notions like nationalism are not of their own volition, rather an effect of the educational systems, family influence and societal pressures, these ideas are not linked to one identity. Rather, these ideas are linked to an individual's understanding of themselves independent of societal labels. Association to an organization should not be of concern when judging a person's actions, for it is not necessarily the institution that has taught them to act in that way. Rather, when a person acts they act in the way that suits their beliefs most. If schools are really concerned about their reputation being tarnished by association, they should instead focus on educating students to be moral characters instead of threatening them with more punishment.

Additionally, if an action is done they will be punished regardless. Punishing this student once more at school would be meaningless, in fact may elicit stronger conflict between the student and institution. As stated, if a student were to commit an action that is against the school charter, this would most likely not be socially acceptable thus will be punished to a certain

degree. Considering (and respecting students as young adults) that they will have understood through this punishment that action is incorrect, there is no need to further humiliate them within their academic setting. A simple talk from an SA director or counselor should suffice to reinforce that idea. Through further punishment, the institution exercises authority over a subject who may already be hostile towards it, fueling that hatred and leading to a "crash out." Again, additional punishment will serve to do nothing at best and cause a meltdown at worst as an individual should have already been punished by society itself.

The implication that a student's identity is inseparable from the school is tragic, simply antithetical to what a school should do. Educational institutions should cultivate an environment suitable to think critically and freely. Part of that free environment is learning to deal with consequences. Yes, they may explore this on campus, but they should not be subjected to institutional surveillance off campus. This rule, in its most barebones straw-man form conditions students to self-censor, evaluating each little decision that could be interpreted as a violation of the school charter, even off-campus, at home or engaging with their personal lives. The home, a place understood globally as a place of sanctity and safety has been invaded by a surveillance not seen. This unseen, parasitic surveillance has been planted in our identity through rules just like these. If the school wanted their students to be independent (and thus prepared for college), they should empower the individual and allow them to develop who they are non-academically, whether that be in line with societal expectations or not. Instead, we are trained to see the world as an extension of the worst aspects of the classroom, where a break in their bureaucratic standard is met with harsh punishment.

This teaches students compliance. Compliance to rules that may not seem fair. Compliance to systems that no longer work. Compliance to punishments that should not be there. When students leave this school, they are not daring enough to challenge what's wrong with the world. When students leave, they are conditioned for compliance, self-censorship hardwired into their minds. If the world wants pioneers, we need the confidence to rebel. Rebel against oppressive systems. Rebel against outdated systems. Rebel against useless systems. Yet if we teach kids to hold their tongues, this becomes a massive hurdle in their goals to rebel. This destruction of rebellion thus allows such a system to continue producing compliant boys and girls, ready for the factories of the industrial age.

As I close out this essay, I implore schools to re-examine their rules. Rules such as this conflate student identity with school authority, eroding away at the delicate yet essential border between private and public use of reason. It creates an environment where in extreme cases, students are punished for navigating the world as multifaceted individuals, compelling them to operate within the constraints set forth by one institution and one identity. Encourage our students to rebel, explore and express. They shall not constantly fear institutional repercussions, only then can we truly foster an environment fit for enlightenment, in which students can grow not just as students, but as human beings.

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How Belt and Road Initiative Can Transform Kazakhstan's Economy in the Next 10 Years?
By Nuriya Abulgazina

Introduction

In the 21st century, China has rapidly become the world's manufacturing hub and largest goods exporter, establishing itself as a rising global superpower. Over the past few decades, China's economy has grown to the second largest in the world by value and the largest in terms of purchasing power parity (PPP), with an average economic growth rate of over 9% (World Bank, 2024). This success is due to significant investments in heavy industry, research and development (R&D), science, education, textile manufacturing, construction, transportation and logistics, consumer goods, and electronics. To further solidify its global superpower status, China initiated the Belt and Road Initiative (BRI), which is the focus of our research.

The BRI is based on five pillars:

1. Policy coordination: Aligning economic strategies and resolving cooperation-related issues.
2. Unimpeded trade: Improving investment and trade facilitation.
3. Financial integration: Establishing an investment and finance system.
4. People-to-people bond: Promoting cultural and academic exchanges.
5. Infrastructure connectivity: Forming an infrastructure network linking Asia, Europe, and Africa (National Development and Reform Commission, 2017).

The BRI comprises six major land corridors, including the China-Central Asia-West Asia Economic Corridor, which is vital to Kazakhstan. This initiative helps Kazakhstan by opening markets and building transport infrastructure, boosting exports, and potentially enhancing GDP

Kazakhstan's involvement in the BRI is significant, given its strategic location. The BRI was announced by Chinese President Xi Jinping in 2013 in Astana, Kazakhstan. It addresses infrastructural, economic, technological, and cultural gaps, particularly in developing countries, helping them realize their economic potential. Kazakhstan was the first country to join the BRI, highlighting its crucial role as a connector between East and West

However, there are anti-Chinese sentiments among Kazakhstan people, who fear Chinese neo-colonialism and repression of Muslims. A survey showed that 70% of Kazakhs believe Chinese investments prioritize Chinese interests over local needs (vlast.kz, 2023)

Despite these concerns, the BRI presents significant opportunities for Kazakhstan. Development in key nodes like Aktau and Khorgos shows promising growth. For instance, Aktau's container traffic increased significantly, and Khorgos received substantial Chinese investment to boost cargo processing. The World Bank estimates the BRI could increase Kazakhstan's exports by 3.7% globally and up to 16% in the future with necessary reforms (World Bank, 2020).

Our study aims to update existing data on Kazakhstan's role in the BRI and demonstrate how the country can benefit from this project, relying on expert opinions, official sources, and relevant statistics. The main hypothesis of our research is "How Belt and Road Initiative Can Transform Kazakhstan's Economy in the Next 10 Years?". And the research questions we've formed: 1. What is the role of Kazakhstan in BRI? 2. How has the BRI affected Kazakhstan's economy already from 2013? 3. Which segments of Kazakhstan's economy will be boosted the most? 4. What projects will be deployed in Kazakhstan within BRI? 5. How strong will the rapprochement of Kazakhstan and China be in terms of cultural, scientific and educational exchange? 6. Are there any risks and challenges for Kazakhstan?

Literature review

In the research "Economic and Political Impacts of the Belt and Road Initiative on Kazakhstan" (2022), Tekir highlights how investments and infrastructure development have positively impacted Kazakhstan's economy.

Kazakhstan plays a crucial role in the BRI, with three of its six economic corridors passing through its territory. The development of key nodes, Khorgos and Aktau, demonstrates the positive economic impact of Chinese investments. Khorgos, a major hub of the New Eurasian Land Bridge, has seen significant investment, including $600 million from China, aiming to process 4 million tons of cargo annually. This has led to increased trade and tourism, with 15,000 daily visitors and a trade volume of $12.037 billion in 2015.

Aktau has also benefited from substantial Chinese investment, along with contributions from Dubai-based DP World and Iran. Container traffic in Aktau increased from 10 million tons in 2013 to 19 million tons, thanks to new terminals and the China-Khorgos-Aktau railway project. Future developments, including the Sarzha seaport and a new subzone, are expected to further boost capacity and create jobs.

Beyond Khorgos and Aktau, China invests in other regions of Kazakhstan, such as polypropylene production in Pavlodar and automobile manufacturing in Kostanay. Investments in the logistics sector have enhanced trade relations with the EU, making it Kazakhstan's largest trading partner, accounting for 29.7% of total trade in 2020.

The BRI also reduces Central Asian countries' reliance on Russia for transporting goods to Europe by improving north-south axis roads. Future projects and reforms aim to further integrate Kazakhstan into the BRI and boost trade. The World Bank estimates that the BRI could increase Kazakhstan's exports by 3.7% globally, higher than 70 other countries, potentially reaching 16% with trade facilitation reforms.

Kazakhstan launched its domestic infrastructure plan, "Bright Road" (Nurly Zhol), to address infrastructure deficits and leverage the BRI for growth. For example, only 3% of Kazakhstan's highways meet the highest standards, and 50% are not asphalted. The BRI provides an opportunity for Kazakhstan to improve its infrastructure and drive economic growth.

Assel Bitabarova, the author of the research paper "Unpacking Sino-Central Asian engagement along the New Silk Road: a case study of Kazakhstan" (2019), discusses how the

Belt and Road Initiative is being implemented in Kazakhstan and the public stigma associated with it.

Through several projects, China and Kazakhstan have demonstrated active industrial cooperation. The two governments have approved 51 cooperative projects totaling $27.7 billion. Four projects totaling $372 million were operational as of the beginning of 2018. Projects in the fields of electric power, metallurgy, chemical industry, agriculture, and machinery construction are among the initiatives. For instance, in 2015, a Kazakh company United Chemical Company jointly with Chinese Hualu Engineering and Tianchen Engineering agreed on constructing the Chemical Park "Taraz" in Shu district, Zhambyl region. Chemical Park "Taraz" is a developed transport hub with directions in all regions of the country and neighboring countries, such as Russia, China, Uzbekistan and Kyrgyzstan. Furthermore, China has constructed its first international oil pipeline, which allows it to import crude oil directly from Kazakhstan. Additionally, it has built lines A, B, and C of the Central Asia-China gas pipeline (CACGP), which connects Turkmenistan to Khorgos in China's Xinjiang province via Uzbekistan and Kazakhstan.

Transportation infrastructure, such as expanding the capacity of roads and trains, and improving logistical capabilities, are also included in the collaborative projects between China and Kazakhstan. The establishment of the Khorgos International Border Cooperational Centre (KIBCC), China's great gateway to the Kazakhstani markets, is one of the most notable examples. Daily improvements in its efficiency are shown in the 2.584 million tonnes of rail cargo that were transited across the Khorgos between 2013 and April 2016. This amount is predicted to increase to 31.5 million tonnes by 2035. In addition, compared to 2015, the region's trade volume grew by 6.75% to $11.87 billion between January and November of 2016. Chinese investments have totaled 23.45 billion yuan, or roughly $3.7 billion, distributed among 26 major projects in Kazakhstan. This indicates the importance of Chinese investments and their beneficial impact on the economy. Additional projects in Kazakhstan under the SREB include the second tracks of the Almaty 1-Shu, the Arqalyq-Shubarkol railway link, the Zhezkazgan-Beineu railway, which links central Kazakhstan to the Caspian Sea and Persian Gulf, and a new railway hub in Astana that will improve connectivity and trade. According to Kazakh Ex-Prime Minister Bakytzhan Sagyntaev, cooperative initiatives are anticipated to provide over 20,000 new jobs for locals. These and other developments demonstrate Kazakhstan's reliance on Chinese investments as a major source of funding.

Currently, Kazakhstan supplies mostly raw materials to China, while importing Chinese-manufactured goods, such as technologies, which creates unequal trade between two countries and causes unease among people. Kazakhstan thus wants to diversify its exports to China, concentrating on agricultural and high-tech products. Negotiations were conducted for exporting Kazakh wheat, meat, vegetable seeds, oil, and honey to China. As a result, in 2016, China lifted the ban on Kazakh meat exports from nine regions. Furthermore, the Kazakh government guaranteed that Chinese investors would collaborate with Kazakh counterparts instead of obtaining land ownership. Numerous collaborative Kazakh-Chinese initiatives were

formed: joint venture of "EurasiaAgroHolding" and "Rifa Investment" in Eastern Kazakhstan that processes meat and exports it to China and joint venture in Northern Kazakhstan that produces vegetable oil.

However, despite the governmental support and multiple benefits of the Chinese investments, there are several public concerns related to environmental damage, corruption, management of strategic assets, and debt trap. Negative sentiments are reinforced by Xinjiang's treatment of ethnic Kazakhs. Chinese authorities have systematically persecuted ethnic minorities in Xinjiang, including Uyghur, Kazakh, Kyrgyz, sending them to "re-education camps" for both real and perceived threats of "three evils", terrorism, extremism and separatism, and "politically incorrect" views. This securitization negatively affects interactions between ordinary citizens of Xinjiang and Central Asian states, contrasting with the BRI's goal of promoting people-to-people bonds, making its acceptance in Central Asian societies a bit difficult. Kazakhstan and Xinjiang are also connected by cross-border populations and their migrations. The largest overseas Kazakh community – about 1.59 million people as of 2015 resides in Xinjiang, whilst Kazakhstan is home to the largest Uyghur diaspora with a population of 261,000 people as of 2017. The above-mentioned ongoing securitization in Xinjiang has a direct impact on them. In particular, China's Kazakhs are under increasing pressure for being muslim or having "foreign contacts" abroad, such as relatives and friends in Kazakhstan. There have even been cases reported in which Xinjiang-born Kazakhs who currently reside in Kazakhstan, some with Kazakhstan's citizenship, were detained and sent to re-education camps during their short-term visits to China. Kazakhstan's officials have begun raising concerns about the Kazakh diaspora in Xinjiang during talks with Chinese counterparts, indicating growing discontent in Kazakh society over the situation with China.

Marcella Daye addresses the effects of the BRI on tourism in Kazakhstan, as well as how to improve people's attitudes towards the development of the sector. The research paper "Exploring local stakeholders' views on the prospects of China's Belt & Road Initiative on tourism development in Kazakhstan" explores these topics. Tourism is very important to Kazakhstan because it contributes to economic diversification. Additionally, 150 565 jobs, or 1.7% of all jobs in the entire country, are supported by tourism, which generates employment in retail, transportation, and hospitality. Kazakhstan's tourism development plan sets a goal to increase the contribution of the tourism industry to the country's GDP from 1% to 8% by 2025. The Belt and Road Initiative is vital to Kazakhstan's tourism industry because it provides investments in infrastructural development, including roads, rail networks, and modernization of energy, which helps address difficulties, such as Kazakhstan's low population density, steppes, deserts, and mountainous areas. By enhancing tourist infrastructure and services: hotels, restaurants, and attractions, BRI offers opportunities to grow global tourism. Numerous perspectives exist about the idea of Kazakhstan's tourism growth. Some people support tourism development because it will improve Kazakhstan's reputation abroad and contribute to the prosperity of local communities. However, negative opinions exist, because it puts local communities in danger. More mobility caused by looser visa policies and improved

transportation infrastructure may give rise to criminal threats like drug and people trafficking by transnational mafia gangs. Negative media stories that depict Kazakhstan as a "sex tourism hotspot" contribute to these feelings of unease among people. Concerns have also been raised about how BRI projects can encourage international terrorism, radical Islamist rebellions, and the establishment of refugee camps for foreign terrorists and Uighur separatists. Most importantly, because of Chinese involvement in infrastructure projects, issues with job displacement and economic dependency, and widespread fears of an invasion of national sovereignty and loss of autonomy, there is fear that China's dominance in the region will increase in tandem with a decline in Russian influence.

Despite negative opinions on Kazakhstan's tourism industry's growth, improvements are possible. Policymakers should address stakeholders' concerns about safety, autonomy, and cultural impacts. They should balance highlighting the economic benefits of the BRI, such as infrastructure development, with cautious discourse on cultural components, avoiding overemphasis on Chinese cultural integration. Public education should raise awareness about BRI and local business prospects. Adopting bottom-up decision-making can address local concerns and build trust. Collaborating with other Silk Road nations can help adapt approaches to national contexts. Strategic partnerships for sharing best practices will ensure sustainable and accepted BRI-related tourism developments while maintaining local identity and considering community feedback

In "The Impact of the Belt and Road on Kazakhstan," Christopher Schagerl explores how the Belt and Road Initiative (BRI) affects Kazakhstan in agriculture, logistics, renewable energy, and the economy, highlighting both potential benefits and challenges. Key issues include the need to improve Kazakhstan's trade routes, the quality of infrastructure in neighboring countries, and the risk of over-reliance on China and losing sovereignty.

In order to improve trade efficiency and develop industrial partnership, Kazakhstan and China have demonstrated strong cooperation by establishing new logistical hubs within Kazakhstan, facilitating customs, tax, financial, and other trade-related processes, and initiating joint initiatives. For example, a major decision was made in September 2015 to move 51 Chinese enterprises to Kazakhstan. Furthermore, by 2016, 19 cooperative initiatives focused on the deep processing of agricultural goods such as meat, oil-bearing plants, grain crops, and tomatoes were either planned or in progress. The establishment of feeding stations is also one of these projects' main objectives, which is to increase Kazakhstan's agricultural export capacities by exporting processed goods to China. Industrial collaborations extend to methanol and ammonia production, polypropylene production, modernization of oil refineries, elevator and lift equipment production, cement production, chemical production, polyethylene terephthalate waste processing, mining and processing plant construction, nuclear fuel production, automobile manufacturing, and oil refinery modernization.

Positive effects anticipated from the BRI include increased transit potential, modernization of transport infrastructure, increased trade, and GDP growth. The BRI also offers Kazakhstan an opportunity to diversify its economy beyond natural resources, as it is expected to

draw significant investments into a number of local industries. These investments will support the growth of other industries and lessen Kazakhstan's exposure to fluctuations in the price of natural resources.

However, concerns remain, such as Chinese companies overshadowing local businesses, Kazakhstan's primary role as a logistics center not fully benefiting the country, as it mostly relies on mineral and oil exports, potential environmental impacts from Chinese enterprises, and the need to balance BRI with Kazakhstan's involvement in the Eurasian Economic Union (EAEU).

In "The China-Central Asia-West Asia Economic Corridor of the Belt and Road Initiative's Economic Impact on Kazakhstan," Muge Cinar analyzes the BRI's effects on Kazakhstan's economy using statistical data. Initially, there were high expectations for economic growth due to the BRI, but indicators such as GDP and FDI suggest otherwise, as they show that cooperation with China under the BRI has not yet led to a direct economic advancement in Kazakhstan.
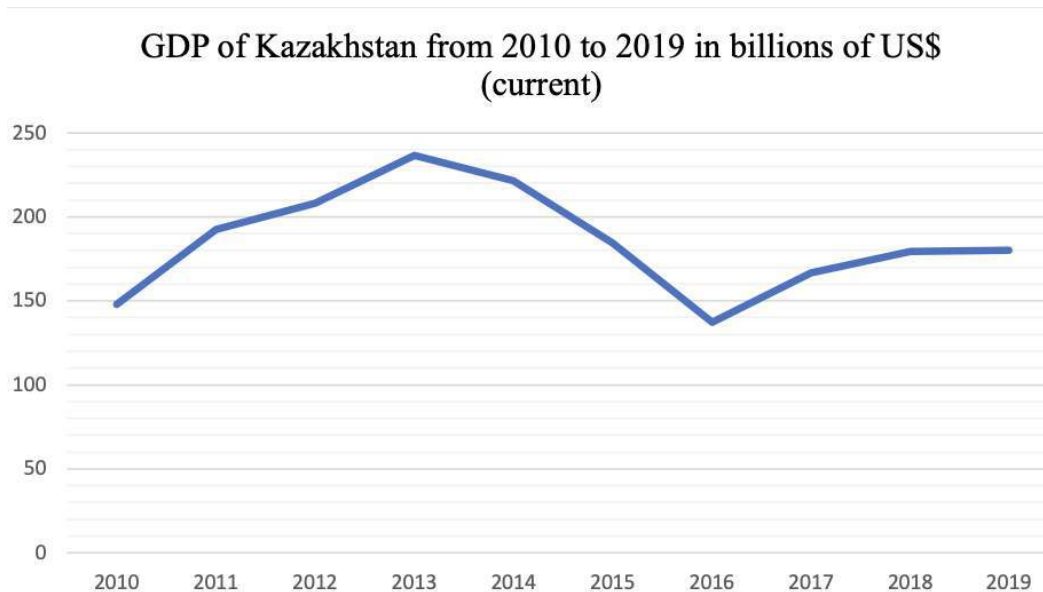
Fig. 1. GDP of Kazakhstan from 2010 to 2019 (in billions of US dollars)

According to the graph above (from World Bank), in 2013, when the BRI was announced, Kazakhstan's GDP was $237 billion. The GDP then dropped significantly to $133 billion in 2016 due to the oil price drop and currency devaluation. After 2016, Kazakhstan's GDP began to grow slowly, reaching $180 billion in 2019. The significant fluctuations in oil prices heavily influenced the rise and fall of Kazakhstan's GDP during this period, making it challenging to see a direct effect of the BRI on the nation's economic performance.
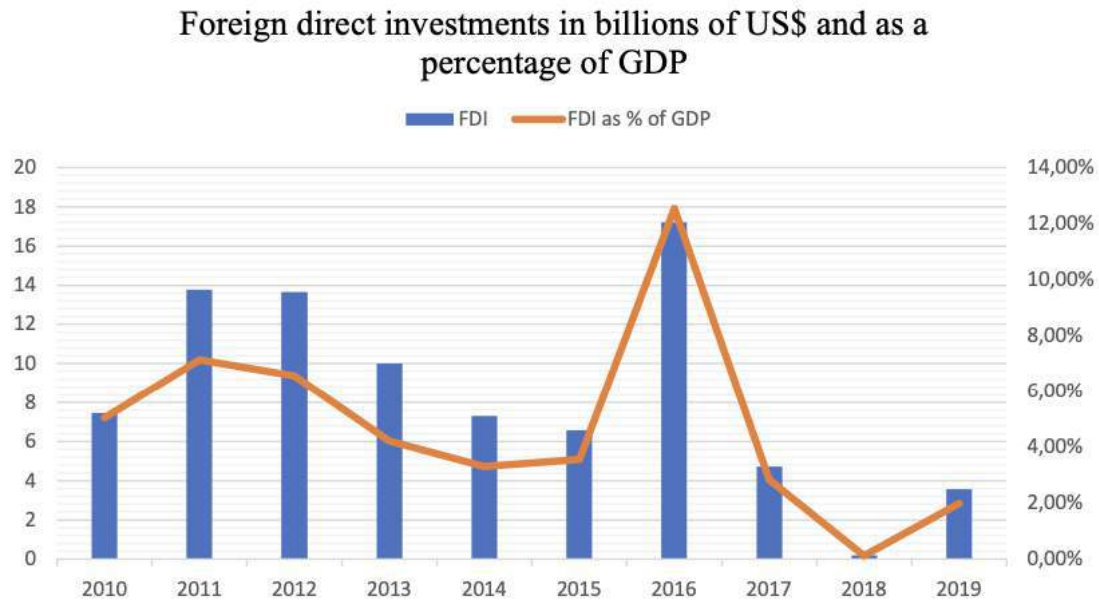
Fig. 2. Foreign direct investments in billions of US dollars and as a percentage of GDP

This graph (from The Global Economy) also shows frequent fluctuations. In 2013, the FDI of Kazakhstan was $10 billion. In 2016, due to Chinese investments under the BRI, the nation's FDI rose dramatically, reaching $17 billion. However, after 2016, FDI began to decline significantly, hitting $3.5 billion in 2019. This graph shows that Kazakhstan's role as a logistics hub for the BRI has not yet led to the increase in the FDI beyond the initial Chinese investments.
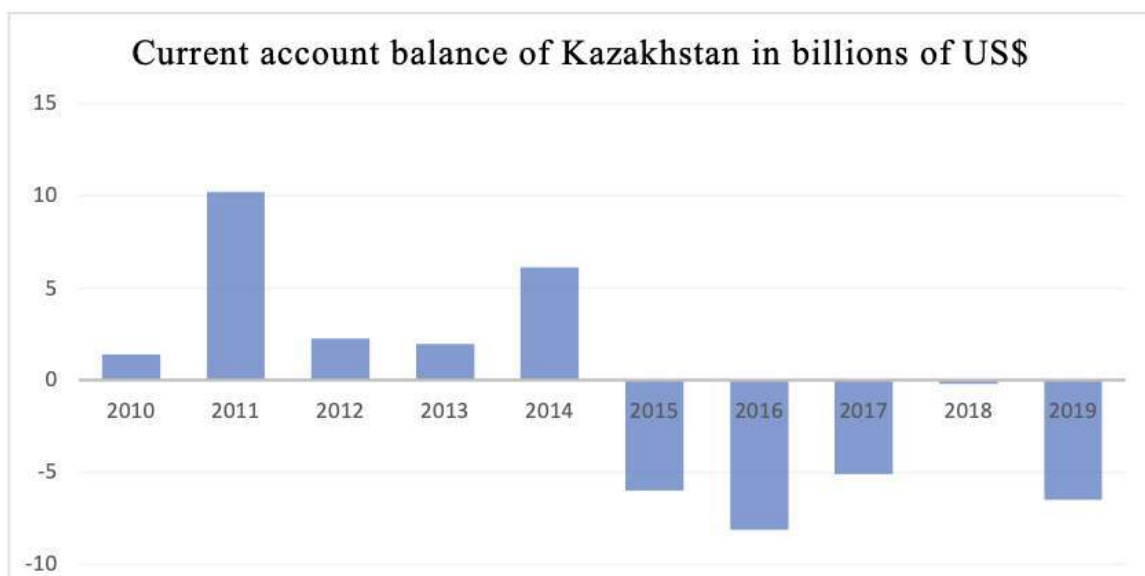
Fig. 3. Current account balance of Kazakhstan in billions of US dollars

The last graph shows the current account balance of Kazakhstan in billions in USD. In 2013, Kazakhstan had a positive current account balance of $1.95 billion. However, since 2015, the country has maintained a negative current account balance, standing at minus $6,5 billion in 2019. This major fall indicates that Kazakhstan had to get significant external loans to finance infrastructure projects, despite Chinese investments.

In addition to the fact that the BRI's direct positive impact on Kazakhstan is still unknown, there are also concerns and doubts about it. First, Kazakhstan relies too much on oil, particularly in exports. Second, instability and corruption in Kazakhstan and its neighbors might hinder foreign investment and threaten BRI-related projects. Thirdly, despite claims that BRI projects will create jobs, there is worry about local employment because Chinese participation frequently puts Chinese interests first. Fourthly, it is still unclear how successful the BRI projects will be, as a 2018 study conducted by a US firm revealed that 32% of the $419 billion worth of BRI projects encountered problems like performance delays, public opposition, and national security issues.

However, the World Bank's "Kazakhstan Country Case Study" highlights potential benefits of BRI transport projects, such as reduced shipment times, increased non-oil exports, and a predicted 6.5% rise in GDP, offering opportunities to diversify Kazakhstan's economy. In the research paper "China-Kazakhstan Economic Cooperation and "One Belt, One Road" initiative", the author, Gelvig Svetlana, discusses the economic partnership between the two countries, and new opportunities and challenges that the BRI brings for Kazakhstan.

China and Kazakhstan have shown active cooperation through several cooperative projects and mutual support. Firstly, the Kazakhstan-China oil pipeline is China's first direct oil import pipeline allowing oil import from Central Asia. Furthermore, the Kazakhstan-China natural gas pipeline followed along the Kazakhstan-China oil pipeline, showing the mutual benefit that two countries offer each other. Secondly, in December 2011, the China-Kazakhstan Khorgos-Atenkori railway port was opened, marking the opening of the second international railway channel to Central Asia, West Asia, and Europe. The railway from Jinghe station of Lanzhou-Xinjiang Railway in China to Horgos station of China-Kazakhstan border port spans 292 km. The successful connection of Kazakhstan's "Getken-Horgos" railway in December 2011 shortened the railway transportation mileage between China and Central Asian countries by 550 km. This improvement enhances Kazakhstan's transport capacity, promotes the development of related industries, and strengthens Kazakhstan's economic ties with China and Southeast Asian countries. Thirdly, China supports Kazakhstan in maintaining its roads. The average travel time between Almaty and Astana has decreased from 30-40 hours to about 16 hours due to road maintenance support. This is because foreign suppliers, primarily from China, have increased their spare part supply to address the issue of local suppliers lacking certain equipments' spare parts.

Kazakhstan's exports to China predominantly consist of base metals, mineral products, and chemical products. Kazakhstan, on the other hand, imported primarily base metals, rubber and plastic products, as well as mechanical and electrical items from China, demonstrating a

significant trade imbalance in favor of Chinese exporters. This trend highlights Kazakhstan's high reliance on raw material exports and its low manufacturing capacity. Furthermore, as an example of a one-sided dependency, China's imports from Kazakhstan are mostly motivated by its need for energy and resource products. The overall trade relationship is unequal, shown by a lack of economic interdependence between the two countries.

Experts' opinion

Hussein Askary (see Appendix 2), who works at the Belt and Road Institute (BRIX) in Sweden, discusses the advantages of the BRI as well as Sweden's participation in it in the interview. Through a number of projects, BRIX seeks to raise awareness of the BRI in Sweden and demonstrate the advantages of taking part in the initiative. According to BRIX studies, the studies have shown that building and developing other nations may assist in reviving economies that are in a state of stagnation. Also, as individuals would remain in their developing, less developed nations, immigration will decline.

Additionally, he said that trade has expanded as a result of the Belt and Road Initiative. One illustration of the growth of trade is the construction of the China-EU railway corridor, of which 85% of the trains pass through Kazakhstan. Over the past ten years, the railway has significantly expanded the number of products traded between China and Europe. Furthermore, the railway was still used for transporting commodities even after the conflict in Ukraine.

The global crisis of 2008 demonstrated how the West mismanaged the crisis, printing money to keep up the financial sector rather than investing in infrastructure, improving healthcare, or improving education. This demonstrated how the US and the EU entered a downward cycle. This crisis has demonstrated how critical it is to establish new industries and markets. China began investing in domestic growth and the establishment of new markets as a result of the crisis. The world's balance is shifting as a result of China's rapid advancement, making it a global superpower.

According to Hussein Askary, there are still certain concerns even though the benefits far outweigh the drawbacks. For example, nations run the risk of becoming overly dependent on China as their elite begins to assume that China will handle their domestic issues. The Belt and Road Initiative (BRI) won't be useful if the nation doesn't attempt to improve its internal political and economic institutions and address the corruption issue. Instead, it will become overly dependent.

Hussein Askary contends that China's goals are not inspired by the colonization of other nations and that the debt trap is untrue. His studies on nations caught in the "debt trap," including Pakistan, Zambia, and Sri Lanka, have shown that all those countries were already in the debt trap before the BRI for external and internal reasons. For instance, Pakistan faced economic problems because of its 40 years war with Afghanistan that caused huge expenditures on arms and reparations after attacks. In addition, Pakistan has internal issues as well, such as corruption and lack of productivity. Lack of electricity is also a very significant issue, as it forced Pakistan to take loans from other countries to buy oil and gas to produce electricity, and caused many

industries in Pakistan to disappear because there is not enough electricity. All these problems made Pakistan start negotiations with the IMF, which imposed several regulations on Pakistan, causing Pakistan's debt to increase each year and putting it in the debt trap before the BRI. Furthermore, most of the projects built by China were built not as the result of loans, but as the result of direct foreign investments, meaning that the Chinese companies build power plants, run them and sell electricity to Pakistan's market, benefitting both countries. In case of Sri Lanka, through the study it was discovered that more than 47% of Sri Lanka's debt is not to China, but to Western financial firms, who bought Sri Lanka's banks with very high interest, the rest of the debt was caused by other Western institutions, such as IMF, the World Bank, etc, while debt to China makes up only 10% of all Sri Lanka's debt. Additionally, Chinese loans given to countries are investments in infrastructure, showing the quality difference between Chinese loans and Western loans. Loans that China gives are meant to facilitate progress in countries and make them self sufficient, while motivation behind the loans from the West is accumulation of wealth.

In the case of Kazakhstan, the physical economy is an important aspect of maximizing Kazakhstan's productivity in the BRI. Physical economy is the economy that relies on the human creativity and scientific developments that the government nurtures. It's essential for Kazakhstan, as its relative potential population density is bad, which means that the country must invest even more in physical economy, such as infrastructure and industrial development, in order to efficiently connect its vast territories, use them efficiently and fully leverage its strategic location in the Belt and Road Initiative. The effectiveness of Kazakhstan's participation in the BRI is closely tied to its ability to strengthen key physical economic factors such as industrial infrastructure, scientific advancements, and innovation.

Oyuna Baldakova

Oyuna Baldakova, a Lead Researcher for Kazakhstan at the ERC-funded DIGISILK project at the Digital Humanities Department, gave valuable methodological aspects for our research, which involves geopolitical anмalysis to understand Kazakhstan's strategic position as a key transit country between China and Europe. Economically, quantitative assessments of trade flows, infrastructure investments, and their impacts on Kazakhstan's economy are essential. This should be complemented by qualitative methods, such as case studies of specific BRI projects, stakeholder interviews, and policy analysis, to gauge the socio-political effects on Kazakhstan's governance, regional influence, and development priorities. Additionally, spatial analysis using geographic information systems (GIS) can track infrastructure developments, transport routes, and logistical hubs, offering insights into Kazakhstan's evolving connectivity within the BRI framework.

Jessica Neafie

Jessica Neafie, a lecturer at Nazarbayev University, has studied how the public views the Belt and Road Initiative (BRI), focusing on relations between China and Kazakhstan, the entry of Chinese businesses into Kazakhstan, and Chinese investments. She discovered via her research

that anti-Chinese sentiment is widespread in Kazakhstan.

Numerous risks related to the Belt and Road Initiative generate negative public perceptions. These risks include Chinese corporations giving preference to their workers and businesses over local ones, which might potentially overshadow local businesses and limit job opportunities for Kazakh workers. Jessica Neafie claims that despite concerns about protecting domestic markets, governments occasionally may be more prepared to put a risk on local businesses that may have to compete with Chinese firms because of Chinese support and investments. It can be explained by the fact that the government is very market-oriented, meaning that they see the introduction of competition into the market as the prospect of growth for locals. Nevertheless, the government did make an effort to save jobs for people by limiting the number of foreign workers in local companies.

Another significant concern about the Belt and Road Initiative (BRI) is that the participating developing or underdeveloped countries may find themselves in a "debt trap." Jessica Neafie states that it is unlikely that Kazakhstan will deal with the debt trap issue because many of the nations that are caught in China's debt trap are impoverished nations without the GDP to pay back China, which has led to China claiming ports and harbors to recover the money that it had loaned to those nations.

There are also some obstacles that might reduce the effectiveness of Kazakhstan's participation in the BRI. Firstly, Kazakhstan's exports are overly reliant raw materials. When sent to China, raw materials are typically returned to Kazakhstan in the form of manufactured goods at a significantly higher cost. Therefore, by improving its manufacturing capabilities and increasing its domestic manufacturing investments, Kazakhstan can make the most of the BRI. A Digital Silk Road is one of the ideas that might encourage growth in Kazakhstan, as it might help digital entrepreneurship evolve and expand the digital market. This is especially true given the existence of already successful digital initiatives like Kaspi, which is even used throughout China

To summarize, the interviews with experts have given us following insights:

1) No debt trap for KZ
2) Kazakhstan needs to stop relying on its rich resources and start to manufacture and innovate
3) Kazakhstan is necessary as an alternative logistical path to Europe because of war in Ukraine, West-Russia crisis
4) BRI is a big opportunity for economical and technological growth, Kazakhstan continues to strengthen its leadership in the CIS, create and develop a local market, become more independent and self-sufficient as a country
5) Big development in transport, logistical infrastructure

Rapprochement

Through increased travel accessibility, collaboration in education, and cultural exchange, the Belt and Road Initiative has greatly improved ties between China and Kazakhstan.

First and foremost, education plays a crucial role in rapprochement for several reasons, including increasing student opportunities, eliminating anti-Chinese prejudice in Kazakhstan, and promoting innovation and research. A growing number of young Kazakhs are interested in studying in China, primarily due to the high cost and limited availability of local education. China is one of the most popular study-abroad destinations for approximately 30,000 young Kazakhs annually. In 2020 alone, 15,000 students from Kazakhstan studied in China — approximately 18 percent of the estimated 85,000 Kazakh students abroad. In 2019 Kazakhstan ranked 9th in the list of countries sending students to China (globalvoices.org, 2021). In Kazakhstan, Chinese universities actively promote themselves at HEIs and schools. As a result, middlemen businesses were established to facilitate communication between Kazakh applicants and Chinese university representatives. Today, a whole network of companies is established in the Kazakhstani market providing similar services, attractive and affordable by price. For example, through a similar company "MyChina" more than 2,000 students are studying in China. Partnerships between Kazakh universities and Chinese universities help more students to receive education in China. China is highly active in Kazakhstan's education market, offering scholarships, admission without mandatory entrance exams, and various discounts for accommodation, creating opportunities for Kazakh students. Kazakhstani students can apply for a variety of scholarships from the Chinese government through the BRI and initiatives funded by the Shanghai Cooperation Organisation. For example, students from countries in the BRI can apply for the Silk Road Scholarship, which grants flat-rate stipends for bachelor's, master's, and doctoral degrees. Furthermore, the primary state-owned oil business in China provides scholarships for engineering degrees. Also, numerous commercial agencies such as chinese.kz, mychina.kz, pandaedu.kz and uchina.kz, which is supported by China's ministry of education, offer Chinese language courses and assistance in submitting applications to Chinese universities. The collaboration between China and Kazakhstan in education also creates numerous opportunities in the fields of innovation, research, and development of skills. As part of the Belt and Road Initiative, the Luban Workshops were established. Named after the well-known ancient Chinese artisan Lu ban, the program is a Chinese workshop that helps individuals of BRI countries develop their professional technical talent by combining education with practical training. Together with the Tianjin Vocational Institute, the Luban workshop in Kazakhstan opened its doors in December 2023 at the Serikbayev East Kazakhstan Technical University in Oskemen (ektu.kz, 2023). Additionally, activities of the Shanghai Cooperation Organization University are crucial for fostering cooperation among countries within the BRI, as it promotes international cooperation among scientists, teachers and students. There are 75 universities from five countries represented at SCO: Russia, China, Kazakhstan, Kyrgyzstan and Tajikistan. This project is aimed at mutual knowledge exchange and academic mobility of students from different countries and at improving the level of education in the fields of study chosen by the

participating countries. Last but not least, two colleges in China offer majors in Kazakh, while four universities have established Kazakhstan research centers.

The growth of tourism and an increase in possibilities for traveling are significant factors that contribute to a partnership between China and Kazakhstan. The first step made to promote tourism between China and Kazakhstan was the establishment of China's first tourist office in a Central Asian country, in Astana, in 2017. The office has actively supported travel and cultural connections between the two nations. The second major step was the implementation of mutual visa exemption between China and Kazakhstan in 2023, which increased the demand for travel by tourists from both countries. The agreement excludes people of both nations from the need for a visa when traveling for business, tourism, and medical care. Citizens of China and Kazakhstan are granted visa-free entry for a maximum of 30 days, with a total of 90 calendar days allowed in 180 days, under the terms of the document. According to data from the Chinese online travel service Ctrip, the number of bookings made by Chinese tourists for travel to Kazakhstan this year increased by 229 percent year over year and 262 percent compared to 2019 as a result of all the measures implemented (Antara News, 2024). Since March, the number of flight reservations to Kazakhstan has more than tripled compared to the same period last year, according to data from another Chinese online travel agency, Figgy. The most recent significant development that has facilitated international travel is Kaspi.kz's partnership with AliPay+, a Chinese company. It's now possible to pay for purchases in Chinese stores, cafes, taxis and other retail outlets throughout China using a QR code. This has increased the frequency and convenience of tourism for many Kazakhs who travel, work, and study in China.

Another essential component of rapprochement is cultural exchange. For example, on July 2, in Astana, there was a cultural exchange event called "A New Chapter of Good Neighbourly Relations," which highlighted the different cultural efforts that have strengthened ties between China and Kazakhstan. "The Shared Dream," a Chinese-Kazakh documentary about cross-cultural discoveries, was premiered during the event. Along with delegates from Chinese organizations in Kazakhstan, the event was attended by a hundred representatives from the political, business, media, and intellectual circles in Kazakhstan. Further evidence of these developing cultural ties comes from the March 2024 founding of a Beijing Language and Culture University (BLCU) branch in Kazakhstan, which was approved by President Tokayev, who previously attended BLCU to study Chinese. In addition, a film depicting the life of renowned Kazakh musician Bakhytzhan Baikadamov and the legendary Chinese composer Xian Xinghai has been released. Lately, Kazakhstan has seen the airing of numerous Chinese TV series and films, including "A Bite of China". Lastly, in an effort to improve China's image in Kazakhstan, Beijing has also launched several soft power projects, with the Confucius Institutes being the main initiative in Central Asia. There are five such institutes in Kazakhstan, where students study the Chinese language, history, and spiritual and cultural values. Through these institutes, Beijing aims to increase China's attractiveness and to eliminate prejudices, hostility, and perceptions of threats that were allegedly cultivated during the Soviet period (cabar.asia, 2023). This strategic

cultural diplomacy plays a crucial role in enhancing mutual respect and reducing barriers between the two nations.

Risks and Challenges

In Kazakhstan, the Belt and Road Initiative and the growing partnership with China have sparked significant concerns among the population.

The first concern is Kazakhstan's overdependence on raw materials, especially as an exportation and supply source. Kazakhstan supplies mostly mineral and oil exports to China, while importing Chinese-manufactured goods, such as technologies, which creates unequal trade between two countries and causes unease among people. Additionally, given Kazakhstan's major reliance on raw materials it is unclear if the country will truly benefit from its primary role as a logistics center for Chinese commodities traveling to Western markets. Thus, Kazakhstan has to diversify its exports to China, concentrating on agricultural and high-tech products.

Secondly, there are negative sentiments because of Xinjiang's treatment of ethnic Kazakhs. Chinese authorities have systematically persecuted ethnic minorities in Xinjiang, including Kzakhs and Kyrgyz, sending them to "re-education camps" for both real and perceived threats of "three evils", terrorism, extremism and separatism, and "politically incorrect" views. This securitization negatively affects interactions between ordinary citizens of Xinjiang and Central Asian states, contrasting with the BRI's goal of promoting people-to-people bonds, making its acceptance in Central Asian societies difficult. Kazakhstan and Xinjiang are also connected by cross-border populations and their migrations. Meanwhile, the largest overseas Kazakh community – about 1.59 million people as of 2015 resides in Xinjiang, whilst Kazakhstan is home to the largest Uyghur diaspora with a population of about 261,000 people as of the beginning of 2017 (Bitabarova, 2018). The above-mentioned ongoing securitization in Xinjiang has a direct impact on them. In particular, China's Kazakhs are under increasing pressure for having "foreign contacts" abroad, such as relatives and friends in Kazakhstan. There have even been cases reported in which Xinjiang-born Kazakhs who currently reside in Kazakhstan, some with Kazakhstan's citizenship, were detained and sent to re-education camps during their short-term visits to China. Kazakhstan's officials have begun raising concerns about the Kazakh diaspora in Xinjiang during talks with Chinese counterparts, indicating growing discontent in Kazakh society over the situation.

People are also concerned about the security of local communities. More mobility caused by looser visa policies and improved transportation infrastructure create the possibility of a rise to criminal threats like drug and people trafficking by transnational mafia gangs. Negative media stories that depict Kazakhstan as a "sex tourism hotspot" contribute to these feelings of unease among people. Concerns about security have also been raised about how BRI projects can encourage international terrorism, radical Islamist rebellions, and the establishment of refugee camps for foreign terrorists and Uighur separatists (Central Asia Program, 2018).

Furthermore, increasing China's political and economic power on the global stage is one of the main goals of the Belt and Road Initiative, which will also expand China's influence and

dependence on other countries. Due to Chinese involvement in infrastructure projects, economic dependency, and widespread fears of an invasion of national sovereignty and loss of autonomy, there is fear that China's dominance in the region will increase in tandem with a decline in Russian influence. Thus, smaller economies like Kazakhstan must maintain political and economic independence to resolve the problem and prevent becoming overly reliant and losing sovereignty. The other problem related to the increase of the Chinese influence in Kazakhstan is the fact that Chinese companies may prioritize their workers and businesses over local businesses, putting Chinese interests first and potentially overshadowing local enterprises and limiting job prospects for Kazakh workers. As a result, local businesses and communities may face challenges as a result of the influx of Chinese workers and businesses.

Environmental issues are also a big concern, as Kazakhstan may become the location of the migration of environmentally impactful enterprises as a result of China's transition to an ecological civilization model, which will require careful monitoring to maintain local ecological norms.

There are also important issues that might hinder the effectiveness of the BRI. Firstly, there is a need to maintain and improve the quality of Kazakhstan's trade routes, on which the country has already been investing significantly to improve the situation. According to the World Bank's evaluation (World Bank, 2020), the country's dependence on the quality of cross-border transport for economic exchange with other countries is high, making infrastructure improvements critical. Secondly, the quality of infrastructure in neighboring countries has been an obstacle to Kazakhstan's exchange with the rest of the world, creating a challenge for trade. Additionally, Instability and corruption in Kazakhstan and its neighbors might hinder foreign investment and threaten BRI-related projects.

Lastly, it is still unclear how successful the BRI projects will be. A 2018 study conducted by a US firm revealed that 32% of the $419 billion worth of BRI projects encountered problems like performance delays, public opposition, and national security issues (The Impact of the Belt and Road on Kazakhstan, 2023).

From these we may conclude on how to maximize the advantages.
Kazakhstan presents a compelling case for economic and entrepreneurial growth, because of its positive entrepreneurship ecosystem for start-ups and established companies, and the improving level of IT infrastructure of specialists. This positive environment is exemplified by the success of companies like CerebraAI and Higgs Field AI. Cerebra is an AI-powered software for early stroke detection for faster and more accurate treatment. It identifies brain stroke within 10 minutes, helping to prevent neurologic deficit and brain cells death, which allows the patient to receive immediate treatment and minimizes risks of function loss and neurologic deficit. Similarly, Higgsfield AI is making strides with innovative solutions in technology. Higgsfield is a creative AI platform that creates personalized videos in a matter of minutes. These Kazakh companies show the entrepreneurship flourishing within Kazakhstan and show the potential for further growth and competition with foreign companies. Additionally, the Digital Silk Road will

stimulate further growth in the IT sector, give rise to further innovations, and expand digital technologies. The ongoing development in this sector is likely to bolster Kazakhstan's position as a significant player in the global technology landscape.

Despite these strengths, Kazakhstan faces notable challenges that could impact its economic trajectory. The country's economy remains heavily reliant on the export of raw materials, particularly minerals and oil. This dependency creates a trade imbalance, as Kazakhstan primarily exports these resources to China while importing Chinese-manufactured goods, such as technology products. This unequal trade relationship poses economic risks and has led to domestic unease due to the perceived disadvantage in the trade dynamics. Furthermore, Kazakhstan's role as a logistic center for Chinese commodities traveling to Western markets might not be beneficial, as the extent to which Kazakhstan will benefit economically from this is not entirely clear, particularly if the country continues to focus predominantly on raw materials.

There are opportunities for Kazakhstan in higher education and tourism as a result of this partnership. Education plays a pivotal role in strengthening the relationship between Kazakhstan and China. The growing number of Kazakh students seeking higher education in China underscores this collaborative effort. The appeal of Chinese universities is driven by the high cost and limited availability of local education options in Kazakhstan. Approximately 30,000 young Kazakhs pursue studies in China annually, a trend supported by the active promotion of Chinese educational institutions within Kazakhstan. In 2014, about 11,200 Kazakh students were enrolled in Chinese universities, with around 700 graduating in 2013. Companies such as "MyChina" have emerged to facilitate these exchanges, with over 2,000 students benefiting from their services. China's commitment to supporting Kazakh students is evident through various initiatives, including scholarships and admission without mandatory entrance exams. The Belt and Road Initiative (BRI) and the Shanghai Cooperation Organisation (SCO) provide scholarships like the Silk Road Scholarship, which offers stipends for bachelor's, master's, and doctoral degrees. Additionally, China's state-owned oil company offers scholarships for engineering degrees. Commercial agencies such as chinese.kz, mychina.kz, pandaedu.kz, and uchina.kz assist with language courses and university applications, further enhancing educational opportunities. The establishment of the Luban Workshops, named after the ancient Chinese artisan Lu Ban, represents another significant development. These workshops, part of the BRI, aim to develop technical skills through practical training. The recent opening of a Luban Workshop at Serikbayev East Kazakhstan Technical University highlights the growing educational collaboration between the two countries. Furthermore, the Shanghai Cooperation Organization University, which includes 75 universities from Russia, China, Kazakhstan, Kyrgyzstan, and Tajikistan, fosters international cooperation and academic mobility, promoting mutual knowledge exchange and enhancing educational standards. Tourism also benefits from the strengthened ties between Kazakhstan and China. The establishment of China's first tourist office in Central Asia in Astana in 2017 marked a significant step in promoting travel and cultural connections. The mutual visa exemption agreement implemented in 2023 further

facilitates this exchange, allowing visa-free travel for up to 30 days at a time and a total of 90 days within 180 days. This agreement has led to a dramatic increase in travel demand, with bookings to Kazakhstan from China rising by 229% year-over-year and 262% compared to 2019. The partnership between Kaspi.kz and AliPay+ also enhances travel convenience, enabling Kazakhs to use QR codes for payments in China, thus boosting tourism.

However, Kazakhstan's over dependence on China is evident through several threats that can undermine Kazakhstan's autonomy. The reliance on Chinese firms for infrastructure development, means that Kazakhstan's critical infrastructure is under Chinese control. The heavy importation of steel, such as LRT steel from China, not only causes price fluctuations and supply chain disruptions in Kazakhstan, but also undermines the growth of its domestic steel industry. In the energy sector, significant stakes held by Chinese companies like China National Petroleum Corporation (CNPC) can increase energy pricing and decrease Kazakhstan's control over its own resources. Financially, the dependence on Chinese loans for BRI projects, such as Khorgos Gateway, increases Kazakhstan's debt burden and financial vulnerability. Moreover, Kazakhstan's economy might become too reliant on buying and selling goods, with limited progress in developing industrial capital and diversifying its economic depth. This lack of growth, debt dependency, and dependency on external markets can lead to a "debt trap". Additionally, Kazakhstan's dependence on BRI participants, like Russia, can cause problems with Kazakhstan's autonomy and decision-making power.

Conclusion

In conclusion, BRI is a huge opportunity for Kazakhstan to transform its economy, which is proved by notable advancements, such as the development of key logistic hubs in Khorgos and Aktau, enhancement of logistical capabilities, collaborative projects, and growth of tourism due to visa-free policy, that show improvements in Kazakhstan's economic landscape. Additionally, BRI has fostered collaboration in education and cultural exchange, which didn't only improve ties between Kazakhstan and China, but also provided more opportunities for Kazakh citizens. Moreover, BRI has the potential to diversify Kazakhstan's economy beyond raw materials, particularly in agriculture and manufacturing sectors. Joint projects with China don't only provide an opportunity to generate employment, but to broaden Kazakhstan's economy, despite the concerns about local businesses and workers being overshadowed. However, for Kazakhstan to fully capitalize on these benefits, it must address numerous problems, such as developing the manufacturing sector more, reducing dependence on raw material exports, and dealing with issues of corruption will be essential.

Overall, BRI is a big opportunity for economical and technological growth, as Kazakhstan continues to strengthen its leadership in the CIS, develop its local market, and become more independent and self-sufficient in the country, especially if it will address all concerns and issues that don't allow Kazakhstan to maximize its effectiveness with the BRI.

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**Problems of Collection and Disposal of Solid Waste in Kazakhstan.
Case Study of Karaganda City By Sagynysh Kuanysheva**

Abstract

The article analyzes the situation with the collection and disposal of solid household waste (hereinafter referred to as MSW, municipal solid waste) in Karaganda city, Kazakhstan. Paying attention to the materials of previous years, the article solves the problems they did not resolve, e.g. the lack of feedback from public and private authorities dealing with MSW issues, comparing the measures taken with international experience, as well as pointing to research that can find practical application in the construction and environmental industries. At the end, constructive proposals are given to improve the policy to increase the efficiency of solid waste collection and environmental awareness of the population.

Introduction

To date, the problem of unauthorized landfills, accumulation of solid household waste (hereinafter referred to as MSW) in the cities of Kazakhstan, and in particular in Karaganda, remains relevant. So, in 2023, 143 unauthorized landfills were identified in Karaganda, and although 137 of them were eliminated (Rabrodova, November 17, 2023), it is not a fact that such a problem will not happen again. The accumulation of solid waste in large volumes is the cause of air and soil pollution in the city, it also causes public discomfort, spoiling the appearance and aesthetic appearance of the city. In addition, the problem has a negative impact on the development of tourism and on the conservation of biodiversity in the city.

Governmental and non-governmental organizations, as well as enterprises in the city, have been working for years to solve the problem, but every year new cases of garbage accumulation sites appear. Although measures are being taken in the city to eliminate solid waste pollution in the city, the problem is not fully reflected in the media and, in particular, in scientific research. Articles and research on the problem are published every few years and, in general, describe only certain aspects of the problem. Often, the opinions of experts and executive bodies are not included in the research, which does not provide the completeness of the research work.

This study describes the measures taken by the state to solve the problem of pollution of the city with garbage, as well as feedback (interviews) on these measures from environmental experts (Department of Ecology of the Karaganda region; Recycling Company VSK). The study will be useful for the government, business and the media in a general understanding of the situation with solid waste in Karaganda.

Literature review

Due to the specific nature of the topic, there is little scientific literature on it. In some small works (Ospanova et al., 2019), it is briefly described who is involved in the collection of solid waste (namely, GorKomTrans LLP), however, both the results of the declared measures and the opinion of the residents of the city about the work being carried out are not given.

A general overview of the problems of solid waste in the Karaganda region, made by Baibatshaev A. N. (2021), synthesized that, although 74% of the population of the Karaganda region are provided with solid waste removal services, and that 43 billion tons of garbage have accumulated at landfills in the country, only 10% are recyclable. Moreover, as it was shown, 82% of landfills and landfills do not comply with environmental and sanitary standards. This information is useful in that it allows us to understand the seriousness and scale of the problem, however, the author did not present the view of those specialists and bodies dealing with MSW issues, and therefore the study turned out to be one-sided, with an exclusively negative coloring of the problem. However, in comparison with other authors, the results of measures over several years are given.

It is also worth noting the sociological survey on the assessment of the environmental situation in the city of Karaganda, conducted in 2016 (Chergizova et al, 2016). This study is useful because the authors address the residents of the city directly, receiving from them a reflection on the ongoing environmental work. However, firstly, such events should be held regularly to ensure reproducibility of the research results and, secondly, for a qualitative sociological survey, the sample (212 people in 2016) should be wider, approximately 1000 people, according to the "gold standard" of sociological surveys.

The topic, since it is related to daily practice, is often covered in the media (EKaraganda, April 15, 2024). They are useful because they reflect the mood of the population, but do not include a solution to the problem, as well as a critical analysis of the situation. In this study, taking into account the experience of previous scientists and the media, along with the analysis of the problem and its solution, feedback from representatives of executive bodies on the activities carried out to collect solid waste will also be given. In addition, taking into account the successful experience of developed foreign countries, new measures and methods will be proposed to solve the problem of garbage disposal.

The current situation in solid waste in Karaganda

Several methods are used for waste disposal. First, municipal waste is sorted into wet and dry. Dry waste is transferred to organizations that recycle it. According to the data of the Department of Ecology of Karaganda (hereinafter referred to as the Department of Ecology, see Appendix 1), 70% of garbage in the region is incinerated. These data confirm the relevance of Baybatshayev's fears (2021) that "that all garbage can be burned rather than recycled due to its improper sorting." Moreover, the possibility of obtaining energy from incineration of garbage is not used. The other part of the garbage is recycled. For the disposal of hazardous waste, such as syringes, Vesta Plus incinerators have begun to be purchased.

Inspections for violations of environmental safety standards are carried out by the National Hydrometeorological Service of Kazakhstan (hereinafter – Kazhydromet). If, according to the results of the inspection, any indicators exceed the norm, the Department of Ecology also checks organizations to understand which, for example, dumps garbage into rivers.

To identify unauthorized landfills, a group of representatives of the regional akimat

(municipal authorities), the Department of Ecology and the police is being created, which conducts weekly raids. When an unauthorized landfill is found, the akimat is engaged in liquidation. For example, in 2023, the Akimat of the Karaganda region eliminated 137 unauthorized landfills out of 141 identified (Akimat of the Karaganda region, December 26, 2023)

According to the Department of Ecology (see Appendix 1), the decisive factor in the formation of landfills is the lack of landfills for solid waste. In this regard, to solve the problem, new landfills are currently being opened at the expense of the state budget in the rural districts of Topar, Priozersk, Nura, in the city of Balkhash and in the Bukhar-Zhyrau district of the Karaganda region.

In addition to the appearance of unauthorized landfills, there is a problem of accumulation of garbage in recreation areas such as the Fedorov reservoir, or on the banks of the Bukpa River. To solve this problem, the Department of Ecology, together with the Akimat, conducts clean-up days in previously specified places. According to the VSK recycling company (see Appendix 2), these clean-up days are an effective measure in the fight against garbage and "carry an informational and educational component." In addition, it is planned to impose fines on individuals, the introduction of fines will be announced on the department's social networks and at briefings. Raids will also be conducted to inform the public about the introduction of fines. The Department of Ecology uses Facebook to cover such events among the population, and also holds briefings on regional TV channels. However, according to the survey, which was previously mentioned, "most of the survey participants feel a lack of environmental information (77%, 163 people)" (Chergizova et al., 2016). Moreover, according to the VSK company, the main difficulty they face is the lack of awareness of the population on waste separation. For example, often in mesh containers for recyclables, the VSC finds packages with household garbage, and improperly parked cars prevent the emptying of mesh containers for recyclables that are installed on garbage sites (see Appendix 2). These facts indicate problems in the field of environmental culture promotion. Also, research and the media often mention the problem of soil pollution, where unauthorized landfills are located, this problem is solved by identifying the enterprise that arranged the landfill, then this enterprise should be engaged in land reclamation.

The most problematic type of garbage in the Karaganda region today is construction debris, since it is mostly not recycled and it accumulates in large volumes. So far, no solution has been found for this problem in the Karaganda region. Usually, the development of solutions for construction waste begins directly with the study of the amount and location of this garbage in a given region or country. For example, interesting research on the management of construction waste in Russia was conducted by A. Aleksanin (2019), and in India conducted a thorough review of construction debris control methods (Gulghane & Handve, 2015). In the Kazakh context, the economics of construction debris have recently been developed by researchers from Nazarbayev University (Karaca & Tleuken, 2024). The authors suggest that Kazakhstani construction companies implement a closed-loop economy in the management of construction waste, as the most effective and cost-effective method. Both construction companies and the

Department of Ecology should familiarize themselves with this study.

To improve the garbage collection system, the Akimat of the Karaganda region is developing a separate accumulation program, that is, 3 separate containers for plastic, paper and glass will be supplied to make it easier to recycle waste. An investment project for the construction of an incineration plant is also being implemented.

Also, the Department of Ecology called the control of entrepreneurs in the processing of solid waste a difficulty in solving the problem of solid waste disposal. The Department of Ecology called the lack of ecological culture the reason for the problem of constant accumulation of garbage. Despite this, given the low level of public awareness shown above, it is worth noting that people have an interest in obtaining environmental knowledge, however, the methods of education used by the Department of Ecology are not as effective as we would like.

VSK has installed containers for separate collection of plastic garbage. Fines are applied to legal entities for dumping garbage in the wrong place. According to the Department of Ecology, it is planned to impose fines for dumping garbage in the wrong place to individuals. The Akimat of the region is developing a program for installing containers for separate collection of plastic, paper and glass garbage.

International practice in the collection and disposal of solid waste

Many modern waste disposal technologies in Kazakhstan for 2024 are under development. For example, the construction of waste-to-energy plants, separate collection and recycling of garbage.

To successfully develop environmental solutions, you can turn to international practice. One of the ways to solve the problem is education. For example, the Institute for Global Environmental Strategies and the United Nations Environment Programme have developed a series of lesson plans for primary school teachers in Cambodia who wish to include environmental education and waste management in their curricula. Students can take lessons on waste reduction, waste separation, recycling and composting and apply them at home (Yagasa et al., 2019). In Kazakhstan, such programs are mostly not used in schools. Environmental education is provided by environmental organizations and trainers, but a separate environmental education program has not been introduced in schools.

Another important method of solving the problem is to comply with the "waste hierarchy". By observing the waste hierarchy, the most environmentally sound steps can be taken by reducing the amount of waste sent to landfills. The US Environmental Protection Agency has developed the following MSW management hierarchy (Best Practices for Solid Waste Management: A Guide for Decision-Makers in Developing Countries, 2020, p.26):

1) Prevention of new waste (reduce) and reuse of items (reuse);
2) Recycling and composting
3) Obtaining energy from waste (energy recovery);
4) Waste disposal to landfills (treatment and disposal).

In the hierarchy, according to, for example, Swedish and European legislation, the prevention of new waste is the most important step. In Sweden, it is the responsibility of all municipalities to develop a waste management plan, including waste prevention. Since 2020, all municipalities have become obliged to provide households with information on waste prevention measures. The Swedish company Avfall Sverige, which is the coordinator for solid waste management in Sweden, conducts preventive work on waste prevention, for example, informing the population about "invisible waste". "Invisible waste" is waste that occurs during the production process. For example, when producing a mobile phone that weighs about 200 grams, 86 kilograms of waste is generated. By taking measures to prevent waste before the production stage, significant environmental benefits can be achieved. Avfall Sverige has already developed and made available materials for informing about invisible waste (Avfall Sverige, 2022).

One of the successful practices for the processing of organic waste has been implemented since 2015 in the city of Sao Paulo, Brazil. The city has an effective and inexpensive technology of local composting. Every day, up to 100 tons of organic waste from local markets are sent to 5 urban enterprises. Recycled waste is used as compost for landscaping public spaces, urban gardens, increasing plant health and productivity. The project began to be implemented from the Lapa district, where 170 tons of organic waste were composted from 26 markets per year. Environmental education played an important role in this project. The city government, in cooperation with local cleaning companies, conducted trainings for sellers on how to properly separate waste. Sellers are given special bags for the disposal of organic waste, which is collected by the cleaning company after the market closes. Thanks to the bags, the counters and the surrounding area are kept clean. Also, composting enterprises are open to visitors, which makes it possible to inform local residents about the benefits and process of composting. As part of the project, 10,000 tons of waste were composted in 2020, and 20,000 tons since the beginning of 2015. This has reduced carbon dioxide emissions by 14,176 tons (UN-Habitat, 2015)

Since 70% of waste is incinerated in the Karaganda region, it would be a good solution to use energy, getting it from the combustion of solid waste, that is, to use waste-to-energy (WTE) technology. One of the successful examples of WTE practice is the construction of the WTE power plant in Wenzhou, China. The local government signed a contract with a local engineering company, which was responsible for the construction of the power plant. After two years of construction, the plant can produce up to 25 million kW of energy per year, converting 320 tons of solid waste per day into electricity (ADB, 2010).

Conclusion

Based on all of the above, we can list the following problems with the situation of solid waste in Karaganda and propose the following measures to solve them. Firstly, the conclusions remain relevant that "the main problem in Kazakhstan is that all garbage can be burned rather than recycled due to its improper sorting ... the country should strengthen measures to solve problems with the processing and disposal of solid household waste" (Baibatshaev, 2021). The

words of the mayor of the city, verified by daily practice, are also relevant: "the problem of timely removal of solid household waste is still not solved. In addition, old broken containers are everywhere and the sanitary area around the tanks is not being cleaned of garbage" (Rabrodova, 2023). Secondly, after analyzing the studies and documents on the implemented practices for solid waste management, it is important to note that before and during the implementation of all practices, local governments and companies paid special attention to informing the public. Since, according to the state environmental inspector for the Karaganda region, Bekzhanov A.M. the fact that a municipal waste management project is currently being developed, as a result of which containers for separate collection of paper, plastic and glass will be installed, it is important to take into account the words of the press service of the VSK recycling company about the lack of awareness of the population on waste separation: "Insufficient awareness of the population on waste separation, often in in mesh containers for recyclables, we find bags with household garbage. We also often encounter a problem when improperly parked cars prevent the emptying of mesh recycling containers that are installed on garbage sites. Based on the response received, public awareness measures should be strengthened.

Assistance in solving the problem should come from both the relevant authorities and the scientific community.

First, it is necessary to update the data of a sociological survey conducted in 2016 to measure changes in the perception of environmental measures by the population: the survey should cover a larger number of people, and from different parts of the city of Karaganda (center, southeast, Maikuduk, etc.). Secondly, to improve environmental education, collaborations between the Department of Ecology and Karaganda urbanists will be useful (see @urban.karaganda on Instagram) due to common interests and the large reach of the Urbanism Center on social networks. Thirdly, in order to understand the ecological footprint of the residents of Karaganda, a separate study should be conducted, similar to the one conducted by a group of scientists, including from Nazarbayev University in 2018-2019 for the city of Astana. Based on data from field collections and literature analysis, they found that "the level of solid waste generation in Nur Sultan is estimated at 1.47 kg per capita per day" (Abylkhani et al., 2020). Such a study would be extremely useful for solving the environmental problems of the city. Fourth, it is necessary to introduce modern MSW management technologies used in countries with many years of management experience, such as Germany, Sweden, etc. For example, the construction of a waste-to-energy plant can solve the problem of solid waste disposal, given the volume of incinerated waste in the Karaganda region. In addition, this solution will create new jobs and produce energy for households. Fifth, small but feasible measures to comply with the MSW management hierarchy will significantly help in improving the efficiency of MSW management. As shown in the MSW management hierarchy, the very first step is waste prevention, which can be achieved by applying educational practices. An educational program should be developed for school students to spread environmental culture among children and adolescents. Among the older segment of the population, information on waste prevention should be disseminated, for example, using social networks. Sixth, it is worth

implementing projects at the regional level, in particular, following the example of the city of Sao Paulo. It is necessary, exploring the experience gained from the implementation of previous MSW management practices in the region, to develop improved solutions. For example, you can create an organic waste composting project similar to the one in Sao Paulo, informing and asking residents to adhere to environmental practices

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Latest Tendencies in Asteroid Mining Industry By Tomiris Muratbek

Introduction

Asteroid mining is a promising field that has the potential to significantly change both the Earth mining industry and the global threat landscape. Asteroids contain a lot of hard-to-find minerals such as nickel, platinum and other rare resources that exist on earth.

Recently, asteroid mining has gained significant interest from both private enterprises and governmental space agencies. According to a research report by Spherical Insights & Consulting, the Global Asteroid Mining Market was valued at USD 1.82 billion in 2023 and is projected to grow to USD 8.40 billion by 2033. Notable companies in this field include Asteroid Mining Company, Bradford, iSpace, Kleos Space S.A, Planetary Resources, SpaceFab.US, Sierra Nevada Corporation, Offworld, Virgin Galactic, and other major players.

However, there are a number of concerns about the future of the asteroid mining field. The problem in the existing literature is that most of them are created by consulting agencies and companies (Lucintel, MordorIntelligence, Fortune Business Insights, Allied Market Research, imarc, etc.).The point is that they primarily focus on the market side of the industry (market size, revenue and other things about money), but not the technologies themselves. In the light of this problem, our research is dedicated to analyze the trends not in the asteroid mining market, but in the asteroid mining industry and technologies. We have conducted an overview of the most prospective asteroid mining companies that have passed through YCombinator Accelerators, took an in-depth interview with the space mining research specialist and analyzed at which stage the asteroid mining technology is currently at according to Gartner's Hype Cycle (see Conclusion).

Asteroid Mining Companies overview

AstroForge

This startup, fresh out of Y Combinator, aims high when it comes to space mining.

It intends to extract the rare and valuable metals from the asteroid, like platinum, and return those metals to Earth. The company has elaborated on how this task could be achieved in excellent detail. They seek a set of asteroids containing their desired minerals and design special small-sized spacecraft specifically for the extraction and processing of those minerals. The largest spacecraft would then be sent to these selected asteroids for mining operations and return the metals extracted to Earth.

However, there are a number of sizable challenges facing the company, too. Technically, the development of required technology that can mine successfully and transport is proving quite challenging. Besides, the space missions involved are extremely costly, with a very doubtful economy over the venture. There are also considerable risks about the whole enterprise, possible technical failures, selecting the wrong asteroid, which can lead to mission failures.

In recent times, AstroForge moved to a bigger headquarters measuring 64,000 square feet in Seal Beach. The new digs boast high-tech labs, offices, and manufacturing to house their work in asteroid mining and spacecraft integration. It accommodates teams working on up to two deep-space missions at any given time for greater collaboration and innovation (Gialich & Acain, 2024). This move reflects the growth and concentration of AstroForge in advancing space mining technologies and building their capability for future missions. In addition, AstroForge has introduced three new mentors to its team in order to further its mission of asteroid mining. Advisors include Dr. Lindy Elkins-Tanton, the world's expert on metal asteroids and lead for NASA's Psyche mission; Justin Chandler, a government relations and aerospace specialist; and Kimberly Crider, former US Space Force CTIO and aerospace visionary.

AstroForge recently added a 3rd mission. AstroForge is preparing for its third asteroid mining mission, scheduled to start in 2025. The mission will be aboard the Intuitive Machines IM-3 moon mission, with the goal of landing a probe on a near-Earth asteroid-a giant leap for private space exploration. The company has raised $40 million to back the mission and has continued refining technologies for the harvesting of precious metals. These are potential missions, which include the 2023 cubesat test and the 2024 flyby mission (Jamasmie, 2024).

Spaceium Inc

This is a startup focused on the development of space technological solutions. The company describes itself as "the world's first service station in space with modular technology."

According to the company, the service stations are modular platforms that carry out refueling, repairs in space, energy transfer, and storage of space debris. Their vision is to pioneer the creation of space infrastructure that will finally allow conducting interplanetary missions without obstacles.

By setting up service stations along a "space superhighway," they envision making available resources-fuel, repairs, and maintenance-that all spacecraft would require. This will prolong flights into space farther and enable space travelers to go farther. With this, they want to extend the frontiers of space travel and to take part in the very long journey of humankind among the stars. Recently, Spaceium became the part of YCombinator S24 batch (Dissanayake, 2024)

Hubble network

Hubble Network is a technology company that deals with the development of a satellite network all over the world and prepares an infrastructure offering communication and IoT services. It wants to develop inexpensive and reliable infrastructure of data transmission for hard-to-reach areas in cases where traditional means of communication, like cell networks or cable connections, are impossible or too expensive to establish.

The Hubble Network envisions a world wherein not only every car, ship, drone, and any industrial machine but, quite literally, all objects will be connectable to a global network anywhere on the planet. Such a network would be able to get the data from objects and transmit it in real time. It would benefit a lot of industries, from logistical and transport to agriculture and environmental protection.

The main problem Hubble Network addresses is that IoT devices lack reliable and global coverage. Basically, most IoT networks have limited ranges and depend on the use of local networks or cellular connections. However, such solutions are so impractical in the most unapproachable regions or when there is a general lack of infrastructure.

Hubble Network deploys a network of small satellites that are able to connect IoT devices basically anywhere on the planet. It will be in low Earth orbit to make sure latency is really low and the reliability of data transmission is really high. This will extend the possibilities of IoT dramatically, connecting even in the most remote areas.

Hubble Network equipment includes small satellites, also known as CubeSats, and ground receivers. These satellites measure approximately 10x10 cm in size, but are very powerful. They fly in low Earth orbit to enable fast transmission of data with minimal delay. These satellites automatically connect themselves with the devices on Earth and transmit data via the ground station.

Receivers can be installed on anything from trucks to weather stations, all of which communicate with the satellites and forward information back through the satellite network to ground stations. As a matter of fact, the entire system is intended to work in the most extreme conditions-be it the hot desert or cold tundra. The equipment is very reliable, using low power, and can maintain contact with any device, irrespective of the location of that device in the world.

Every time such a device with a Hubble receiver collects data, for instance on location or sensors, it sends that back to a CubeSat in low Earth orbit. The signal is then received by the satellite, which relays it on to one of the ground stations or to another satellite, which in turn can radiate the data to where it belongs.

It receives the signal from the satellite at the ground station and relays it to the central control system, which then processes the data and delivers it to the end user. This may be an operator who monitors the movement of cargo or a system tracking conditions within the environment.

Because the satellites are closer to Earth, the entire process of data transmission is very fast and receives minimal delays. Most times it is an automated system and can conveniently deliver communication even in the most unapproachable parts of the world.

Asteroid Mining Corporation

"Rome wasn't built in a day - a big undertaking requires a measured approach", – the company says on its website. Asteroid Mining Corporation (AMC) was founded in 2016 by Mitch Hunter-Scullion and it aims to develop the keystone technologies that can enable the Space Resources Sector to achieve liftoff. From the economic standpoint, their goal is to "become the world's first profitable space resources business"

One of the main technologies of AMC is The Space Capable Asteroid Robotic Explorer (SCAR-E) which is a novel climbing robotic platform developed in collaboration with Tohoku University Space Robotics Lab SCAR-E is engineered for precise sampling and operations in microgravity environments, yet it remains highly effective in Earth-based settings as well. This

versatile robotic platform is suitable for a wide range of applications, including space exploration and industrial inspections. As AMC strives to become the first profitable company in space resource extraction, we are focusing on terrestrial commercialization to complement our development of space exploration technologies.

According to their roadmap published on their web-site, they have three phases of the ignition process: phase 1 is dedicated to succeed in commercialisation, apply their products in industrial scale, and to launch Alchemist I mission of on-orbit technology demonstrator (2022–2026). Phase 2 starts with the SCAR-E deployment to ISS and Lunar Surface (2026–2027) so they will be enabled with the base for future explorations. Finally, Phase 3 aims to establish ground-truth: AEP-1 rendezvous & physical sampling (2027–2033). Ultimately, they plan to start the Asteroid Mining Probe I Commercial mass return mission after the year 2035.

Recently, AMC was marked as a finalist for London's Most Innovative Start Up of the Year at the UK Start Up Awards (Hunter-Scullion, 2024). This fact also makes sense in terms of the asteroid mining expectations. Unlocking Space for Investment is a pilot initiative, backed by the UK Space Agency and executed in partnership with PwC, that aims to catalyze private sector investment to support the growth of the UK space sector.

Origin Space

Origin Space is one among the leading aerospace companies in China that have taken a lead in implementing a host of space-related technologies. The company has manufactured a NEO-X Space Mining Robot, a satellite considered the first in the world designed for mining space resources. NEO-01 has onboard demonstrated technologies relevant not only to asteroid mining but also to low-Earth orbit debris removal, extraterrestrial planet defense, and many others. Origin Space would like to see that in the future, it would be a natural course of affairs to expand human civilization beyond Earth. Its mission is to efficiently make the best use of space resources, cut down on the expenses that come with space, enable a large-scale space-based economy, and reach beyond the limited resources of Earth to further human civilization.

ispace inc.

Ispace.inc. was founded by Takeshi Hakamada in 2010. This company also states it is the "lunar exploration company with a vision to extend human presence into outer space". They believe in the future when, by 2040, the Moon will be inhabited by 1,000 people, and 10,000 people will visit it every year.

The main program of ispace so far has been the HAKUTO-R Program-a multinational commercial lunar exploration program with two missions on Moon landing. This mission, Mission 1 (Lunar Landing), is the first privately-led Japanese mission to land on the surface of the Moon, conducted in the year 2022. The second mission, scheduled for 2024, will carry out a soft landing and deploy a rover for surface exploration and data acquisition at the Moon. Further missions will be launched with the aim to transport customer payloads to the Moon through an increase in the frequency of Lunar landings. According to the company, on September 12, 2024,

the launch of the company's Mission 2 is scheduled to occur no earlier than December 2024 (ispace, 2024)

Astroscale

      Astroscale was founded in 2013 by Mitsunobu Okada and became a leader in on-orbit space services. Among their successes was the launch of the world's first commercial debris removal technology demonstration satellite back in the year 2021. Their job is crucial for maintaining conditions caused by increasing numbers of defunct satellites and other trash that may threaten active space operations.

      Called ELSA-d, this was the 2021 flagship demonstration mission of Astroscale for End-of-Life Services. This mission aims to exercise the capability to capture a defunct satellite via a magnetic docking mechanism and then safely retire it from orbit. Successful demonstrations, such as ELSA-d, form necessary steps in making the removal of debris a regular, affordable service within the space industry.

      Along with the removal of debris, Astroscale is also developing technologies for in-orbit servicing of satellites, such as refueling and repairs. Their global presence, and collaboration with space agencies worldwide like JAXA, proves their dedication to sustainable space use. As the space industry grows, Astroscale's projects are going to be key to a future where space will be secure and safe to operate in.

Planetary Resources

      Planetary Resources was founded in 2009, but whose announcement was made until 2012 and created with the singular vision to expand Earth's natural resource base through asteroid mining technology development. While it had the big idea of extracting materials from asteroids, its opening salvo was to develop a market at the lower end of small space-based telescopes. These were to study near-Earth asteroids. The first prototype, Arkyd-100, was introduced in January 2013; the initial launches were scheduled for 2014. The first Arkyd-3 satellite was lost in a rocket failure in October 2014. A second satellite, Arkyd-3 Reflight, was delivered to the ISS by SpaceX in April 2015 and launched in July.

      In early 2018, Planetary Resources was in financial distress and had to lay off part of its staff. The firm was later acquired, in October 2018, by the blockchain technology firm ConsenSys.

Deep Space Industries

      Deep Space Industries (DSI) was officially established in 2013 with the goal of pursuing asteroid mining. In 2015, the company secured $10 million in funding from Czech-based venture capital firm Metatron Global. At some point, DSI shifted its focus toward building a satellite constellation, and it found some success selling the propulsion units it developed for its small satellites. According to SpaceQ, DSI sold around 34 units, generating approximately $10 million in revenue in 2016. On January 1, 2019, Bradford Space, a company that evolved from a

component manufacturer to a nearly vertically integrated entity within various supplier networks, acquired DSI. DSI's "Comet" propulsion unit now works in conjunction with a system developed by another Bradford subsidiary, ECAPS.

Although DSI is considered a failure for not fulfilling its initial mission of enabling asteroid mining, it did manage to pivot and develop a product with revenue and a customer base. The details of Bradford's acquisition of DSI have not been disclosed.

On the main problems concerning asteroid mining companies

Asteroid mining has remained an as yet unreached dream for any company. While they may have bright ideas and major technological advances, none of them, including AstroForge, Asteroid Mining Corporation, commonly referred to as AMC, and even Origin Space, have mined the valuable materials from asteroids or made it back to Earth. From designing the spacecraft, choosing the asteroid, extracting the resources, and transporting them safely back to Earth, the technological and logistical challenges are huge. These are further compounded by high costs, mission risks, and the very unpredictable nature of space exploration, making asteroid mining still theoretically rather than practically grounded. Many asteroid mining companies have set ambitious roadmaps, but their realization is decades away. For example, AMC's roadmap goes well into the 2030s with an expectation to have its first asteroid mining mission around 2035. What both these timelines bring to the fore is that asteroid mining is a long game-a combination of technology advancements and the sustainability of funding. AstroForge, AMC, and others are working on developing the technology needed, but until then, asteroid mining will remain no more than a theory. The long-term vision often looks beyond the near term to infrastructure that will facilitate commercial asteroid mining decades from now.

But despite these challenges, the asteroid mining companies continue to attract attention and funding as their success in business competitions adds to industry recognition. Entry into the accelerator program Y Combinator by AstroForge and AMC's finish as a finalist at the UK Start Up Awards reflect optimism for such ventures. These are achievements that reinforce investor confidence and keep the hope of asteroid mining alive. The hopes are so alive that it positions the startups to stand at the forefront of a future space economy. Mining remains a hypothesis for the time being, but early achievements are indicative that they are moving in the right direction.

Recent breakthrough in asteroid mining

Recent breakthroughs in asteroid mining are being correlated with technologies currently under development: Optical mining would exploit the Sun's energy to degrade the surface of an asteroid. TransAstra is one such company working on the technology. A second key development emerges with the company AstroForge, from the surface evaporation of metallic asteroids for metal extraction. Both methods are currently under active test and refinement.

Until recently, several firms were addressing the concept of asteroid mining. There was a company named Planetary Resources and another named Deep Space Industries. Planetary Resources sought water and valuable minerals by offering autonomous spacecraft to perform all

tasks: locating the target, intercepting it, and extracting its resources. Deep Space Industries designed and built lightweight, low-cost robots that could prospect and mine small asteroids.

The challenges and scientific community's perspective

Timofey Broslav, research graduate at Colorado School of Mines, states that «it's very difficult to detect small asteroids like 30 feet or around 10 meters, 20 meters in size. Just because they're so small and they're dark, you can't really detect them. You have to use special infrared telescopes. There's companies working on that» (see Appendix 1).

The main challenge in asteroid mining is working in microgravity conditions. Conventional drilling methods that work on Earth are ineffective in space, so new approaches are needed. Additionally, some asteroids are just loose rubble piles, making landing difficult—spacecraft could sink into their surface. Another issue is space dust, which can damage equipment. One solution is optical mining, where extraction is done without direct contact with the asteroid's surface.

Regarding the scientific community, particularly at the Colorado School of Mines, interest in asteroid mining is growing. Although there's currently more focus on lunar exploration, asteroids are also being studied to better understand their composition and structure. Methods are also being developed to detect small asteroids that could be valuable for mining, but there can be difficulties with this, because small asteroids are difficult to detect and capture.

Conclusion (What stage asteroid mining technology experiences today?)

The Hype Cycle outlines the five key phases of a technology's life cycle. It begins with the Innovation Trigger, where a breakthrough sparks early interest and publicity, but usable products are rare, and commercial viability is uncertain. This leads to the Peak of Inflated Expectations, where media hype results in some success stories but also many failures, with only a few companies acting on the potential.

Next is the Trough of Disillusionment, where enthusiasm fades as early implementations underperform, and many producers fail. Only the most resilient providers push forward, improving their offerings. During the Slope of Enlightenment, the technology's benefits become clearer, and more businesses begin to explore its potential, though cautious companies may hold back (Fenn & Linden, 2003). Finally, in the Plateau of Productivity, mainstream adoption takes off, with clear standards for provider viability and widespread recognition of the technology's value (see Picture 1).
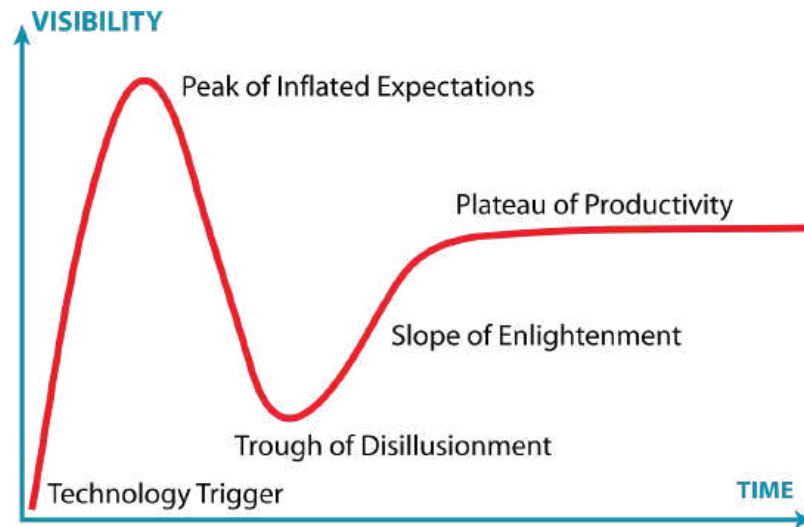
Picture 1. Gartner Hype Cycle

From all of the information above, we can conclude that today's asteroid mining industry is on the peak of the expectations society yields to it. Along with the fact that there is no successful asteroid mining mission complete and that they are planned to be complete in the next decades, the companies get huge investments, the forecasts of the market tell about growth perspective, the enterprises receive numerous regalia, the scientific community shares hopes for the asteroid mining industry, the accelerator programs support asteroid mining projects. Moreover, although some companies (DSI, Planetary Resources) already stopped their life at trough of disillusionment (for the financial reasons), other enterprises do not recognize these risks.

Although we differ our research from the market analysis performed by consulting companies, we shall say that the work that we start by our research should be continued. This topic needs more in-depth interviews with the specialists of the companies mentioned, as well as the general historical overview of how asteroid mining technologies were born and developed, and how they were implemented successfully (or not). Moreover, the future research should include criticism (positive and negative) towards the consulting companies' research so there will be a consistent picture of how the market is explored.

Time will reveal the truth behind the expectations and show the success or failure of asteroid mining enterprises in the nearest decades. However, we believe in its success due to the technological breakthrough in this field, e.g. in optical mining.

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The Role of Religion in a Secular World By Anfissa Pruitt

For most people, the concept of a secular world invokes a visceral response that implies a philosophy of a world completely void of religion. According to the Merriam Webster dictionary, secular means "of or relating to the worldly or temporal" and "not overtly or specifically religious" ("secular," def. 1a,1b). However, the most popular definition, accepted by the general public, is that of secularism, "indifference to or rejection or exclusion of religion and religious considerations" ("secularism," def. 1). Thus, it is implied that it is representative of tangible and austere activities involving industrialization and science and negates intangible pursuits that evoke emotions, faith, and salvation. The concept of secular only becomes understandable in and through contrast to the religious, comparable to the concept of yin and yang. History illustrates that there has been a metaphorical pendulum with a bob that is incapable of holding its position for an extended period of time at either end of its swing and never centering between secular and religion. It swings freely back and forth under the influencing forces of society and the philosophers each seeking to explain the complexities of the human experience. To mentally process our modern dilemma of why religion is still a force in a secular world we need to understand our collective past and explore why neither side of this equation has been able to gain enough momentum to overtake the other or why the pendulum's bob never rests at a point of equilibrium.

Over the millennia there have been several instances of societies shifting between "mythos" and "logos".According to Shawn Manaher, "Logos is a Greek word that means 'word,' 'reason,' or 'logic.' Mythos, on the other hand, refers to the stories and myths that shape our understanding of the world". In ancient Greece Homer and Hesiod were poets that documented Greek mythology which provided tales from which people gleaned moral lessons and explanations for human behavior. Many of the stories were conveyed orally over hundreds, and perhaps thousands, of years which allowed them to remain contemporary according to the social norms and expectations of the audience. This polytheistic system offered extraordinary and supernatural answers to the basic questions about human existence that every human asks. Like every great system that is established and accepted, it worked fine until it was scrutinized. The system of mythology was questioned by three Greek philosophers, Plato, Socrates, and Aristotle. Socrates was put to death due to the questions that he raised which caused the youth of Athens to doubt the traditional gods. Plato and Aristotle, perhaps taking note of this, embraced the existence of a monotheistic creator as an Unmoved Mover and a supreme "Good" force. Both of these concepts served as precursors to the Christian God. Though Plato and Aristotle didn't make public announcements that challenged the societal belief systems, their philosophical questions and methods of teaching set in motion the transition from superstition and mythology without proof or challenge "mythos" to a form of secularism that favors scientific reasoning "logos". This "new" form of rationalism fundamentally weakened the system of mythology by introducing the basis of scientific thought and techniques of logic, observation, inquiry and

demonstration. The Greek philosophers had introduced a secular approach to exploring their world and helped facilitate the acceptance of alternative ideologies.

Monotheistic Christianity, which began as a sect of Judaism in the Roman Empire, diverged from Judaism, replaced the majority of polytheistic Greek mythology, paganism, and Helenists that existed fairly quickly and spread across Europe in the first century of the Christian era. With Constantine's edict of Milan in 313 AD, a "proclamation that permanently established religious toleration for Christianity within the Roman Empire", Christianity became the hegemonic religion for the Western Roman Empire (Encyclopaedia Britannica). The monarchies throughout Europe adopted Roman Catholic and Byzantine theological systems that established the Great Chain of Being. The wave of Christianity that swept across Europe swayed the masses from "logos" to "mythos". The majority of the European monarchs claimed absolute autocratic power that was justified by a theological divine right. Religion was absolutely intertwined with the political structure.

The pendulum swings and transitions from "mythos" to "logos" with the age of Enlightenment, a shift towards a secular political divergence. The concept of rational thought, free of superstition and belief without proof, that challenged the very foundations of religious ideals. New ideas and belief systems formed, such as Deism, which were driving forces in stifling the political power of organized religion. Two of the most influential thinkers of Enlightenment, John Locke and Voltaire, challenged the dominance of the Church, promoted religious tolerance, advocated freedom of speech, and espoused the secular political concept of separation of church and state. Their philosophies were influential in the development of constitutionally secular world governments. Neither of these men denied the existence of a "higher power" or God. Locke wrote, "[Humans know] also that nothing cannot produce a being; therefore something must have existed from eternity" (Locke and Pennsylvania State University). Locke's ideals and actions illustrate a paradigm shift where religion retains relevance alongside secular ideologies. The secular tenants of Locke and Voltaire would serve as part of the groundwork for countries to form constitutionally secular governments.

There has been significant debate that towards the end of the Enlightenment period there was a religious revival in the American colonies called the First and Second Great Awakening which relied on each individual's personal connection with God. New denominations grew as did the number of churches. The movement led to several colleges, mission societies and represented a renewed Christian faith. The new Declaration of Independence announced to the world that the United States had been made official as a truly secular form of government.

During the last two centuries many countries besides the United States have declared secular forms of government including France, Turkey, Mexico, India, Russia, and South Korea. Thus, in its purest sense, the world has become predominantly secular. However, this is inconsistent with how many sociologists and other scholars define the word secularism. Peter Berger, a sociologist of religion, defined secularism as the "process that removes institutionalized religion's domination over a culture, and a situation where more and more people make sense of their lives without traditional religious interpretations." However, the issue with secularism is

that it substitutes science, logic, and reason for some of the most primitive aspects of what it means to be human and does not offer answers to the questions that are consistent across every culture, society, and each individual person. No matter how secular a society may be politically, socio-economically, or philosophically only religion can answer the question of the meaning of life and there is no way to dispute the answer. True or not, it all ends with faith. Why are we born? Why do we exist? What happens to us when we die? The violent swing from religion to secular thought and back centers around these primary questions. Religion's enduring impact in our secular world is deeply rooted in its ability to provide emotional support during times of uncertainty, suffering, or joy. Religion serves such a function of soul-sheltering that allows the soul to find peace and power in times of adversity. There is an ongoing process of secularization in our societies, but biblical and historical religious dogma will always attract the people who are looking for meaning, communion, and emotional protection beyond the material world.

Religion remains a formidable force in our secular world primarily because it fulfills a profound human need for meaning, purpose, and belonging. Over time, religious practices have served as the bedrock within which people and communities attempt to find their own place in the world and make sense of it. For example, Buddhism relies on the Four Noble Truths and the Eightfold Path to unfold the mysteries of suffering and reach enlightenment, enabling followers to know their purpose and direction. The Five Pillars of Islam are the basic practices and doctrines that form the foundation of the lives of all Muslims. This generates a sense of belongingness to the ummah – a global community of believers. The Christian message of love, forgiveness, and atonement brings them solace as well as guidance. From handling existential concerns and offering moral and ethical guidance, religion fulfills the most fundamental human needs of coherence and connectedness, as well as salvation and survival in a secular world.

In the 19th century European thinkers, including Max Weber and Emile Durkheim, suggested that increasing scientific knowledge would replace supernatural explanations in industrializing societies. Though there is no specific or established documentation to support this speculative concept, it has the implication of being an inverse religious equivalent to Moore's Law. In the 2021 Gallup poll survey performed in the United States, for the first time ever, fewer than half of Americans—47%—were members of a church, synagogue or mosque (Gallup, Inc.). Yet another crucial measure of institutional religion in the U.S, the percentage of people identifying as religious, is also at a low: about 1 in 5 adults now say they have no religious affiliation, a staggering increase from 1 in 50 in 1960 (Gallup, Inc.). However, unlike a prognostication of the decline of religion, the role of religion as the formation of personal thinking, social norms, and cultural customs is still powerful. Secularism is spreading, and it is still an important matter of religion for those who search for meaning, belonging, and direction in spiritual fields.

The most important factor for a religion to survive amidst secularism is the multitude of interconnected characteristics that allow it to be dynamic, relevant, and effective. By looking at the ways religion can satisfy the basic emotional needs of people, influence social norms, and maintain hope for the future it is much easier to understand why people grasp and hold on to the

intangible promises of religion. There are some legitimate arguments that explain why religion remains vital in the context of the contemporary world's ever-increasing complexity. There will always be a significant portion of society that wants and needs to believe that there is an answer for all of their questions where science leaves a void. People want to believe that when they die it is possible that they may continue to exist in some realm or conscious space.

Today, secularization and religious conviction can no longer be addressed and discussed as alternatives that exclude each other. There are, indeed, many good and theological arguments for them being understood together instead. (Butler et al).To reiterate, the concepts of religion and secularization make up two sides of one and the same taxonomy; secular only becomes understandable when in contrast to religion and vice versa. It is with this understanding that, perhaps, it is necessary to recalibrate our pendulum to simply oscillate with a mild arc such that violent swings between secular and religious thought are muted such that the two may coexist relatively harmoniously. In essence, accept that perhaps we are living in a new era. Some scholars describe a "return to religion" and "new visibility of religion" over the last few decades and has been referred to as post-secular. In other words, the post-secular is not situated after secularization. If anything, we seem to be living in a time characterized by "the return of religion"—at the same time as the secularization process progresses and proceeds (*PARSE*). Though ambiguous, one thing remains certain, our secular world shall retain religion as a powerful force

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Civilizations, How They are Born and Why They Die By Anfissa Pruitt

Using genetic analysis researchers have determined that a common ancestor of modern humans and Neanderthals lived sometime between 550,000 and 775,000 years ago (Handwerk 2021). Archeological researchers place anatomically modern humans on this planet for only 300,000 years (May 2012). Yet, the earliest known evidence of civilizations emerged in Mesopotamia in approximately 4,000 B.C., ancient India in 3,300 B.C., and ancient Egypt in 3,100 B.C. These facts raise two questions - Why did the progression from hunter-gatherer to recognizable civilizations take over 275,000 years and why do these civilizations not exist today? The basic explanation that all civilizations rise and collapse is incorrect. A civilization is not like a souffle where, with the correct preparation and conditions it has a predictable, controllable, and explainable rise and potential collapse when its delicate balance is disturbed. They are intricate structures composed of interdependent and subordinate elements whose relations and properties are largely determined by their function in the whole, which is also the definition of an organism according to the Merriam-Webster dictionary (May 2012). The concept of civilization is fluid and subjectively complex. Thus, instead of discussing the rise and collapse of civilizations, we should be exploring the life and death of civilizations in terms of a living organism whose success is dependent upon multifactorial external pressures and events, as well as the internal systems that must remain in balance to ensure the success of its existence.

The complexity demonstrated by civilizations requires basic building blocks much like the DNA molecule, comprised of only four bases: adenine, cytosine, guanine, and thymine, connected by a chemical bond and aligned in strands with millions of variations ("Deoxyribonucleic Acid (DNA)" 2024). From the oldest civilizations to the most modern, there are commonalities in the essential building blocks. Maslow's hierarchy of needs illustrates the five stages of human physiological and psychological needs to progress from a foundation of subsistence to complex interpersonal requirements where each level needs to be fulfilled to provide stability ("Deoxyribonucleic Acid (DNA)" 2024). The construction of a hierarchy for the needs of a successful civilization would be built on much the same foundation of fulfilling physiological needs. According to NASA, the most fundamental physiological needs that must be satisfied for human survival are air, water, food, and shelter (Polk and NASA 2022). These foundational elements are the most basic and important part of a civilization's hierarchy that must be present and provided for all humans to survive.

We can assume that early humans lived in social groups. The net benefit of this living arrangement is that each member contributes to the survival and overall well-being of the other individuals within the group. The group establishes a collaborative alignment of rules, ideologies, practices, customs, and spiritual practices that are unique to their group which becomes a unique culture. As members of the group were found to be more efficient than others at certain tasks, the members of the group specialized. Perhaps some members were proficient hunters, while others were better at foraging. This efficiency provides the groundwork for a division of labor and a transition into a society. When the group discovers agricultural

developments that allow them to stop relying on subsistence farming they can exchange the excess food and establish a barter and trade economy. This is perhaps the most important accomplishment that is at the heart of a society and is at the foundation of every viable civilization. With the alleviation of the stresses involved in subsisting as a hunter/gatherer society, the excesses provide one asset that is required for innovation - time and people can turn their attention to tasks beyond the vital need to acquire food. Agricultural inventions and revelations for greater production resulted in the surplus required to spur population growth and urbanization as villages were developed in surrounding areas (Popedadmin 2022). A division of labor arises as goods and services become tradable assets for food and the society can specialize and organize its members to develop technologies for better shelter, survival techniques, and weaponry. It becomes necessary for a form of government to establish and enforce rules to protect the economy and the well-being of the people. This newly established government takes responsibility for organizing resource management, security, and conquest. If the society has developed and fulfilled these prerequisites it has reached a point of viability and a new civilization has been born.

It took millennia of social evolution for people to form a civilization. The one thing that must be considered is the idea that early humans started from "zero" and had to invent everything they needed. Unfortunately, development is a long and slow process, and given that social and technological innovation is heavily reliant on building upon available systems and population size, growth in these sectors would inevitably be significantly protracted (Popedadmin 2022). The social evolution that must take place to realize the birth of civilization could take several 100,000 years to develop when human resources and developments must begin with sharp stones and monosyllabic guttural utterances. To put things in perspective, it has only been approximately 5,000 years since humans developed a form of reading and writing for communication (Futrell 2022).

Civilizations "collapse" and die from what I would call "Top Down Deterioration" resulting in a downward spiral driven by multiple factors leading to social decay and ultimate failure. The inability to support the basic human needs, the foundation of society, marks the end of a civilization. Factors that can produce rifts in the hierarchy are introduced as a combination of internal pressures such as political instability caused by corruption, ineffective leadership, and struggles for power damage the people's trust in the government. Extreme gaps in social and economic inequality between the rich and poor result in civil unrest. These two elements are followed closely by social fragmentation and cultural decay. As the gap in socioeconomic status grows, resources can become strained, driving a wedge deeper between the classes and resulting in a devaluation of trading currency and available resources. Thus, the problems that initially started at the uppermost levels of the civilization hierarchy are weakened, and stress fractures are created in the social structure eventually extending to the foundation of the civilization. Granted, there are many instances of civilizations that are affected by environmental factors that directly chip away at the foundation as essential resources become scarce.

For example, the Roman Empire was born out of the Roman Republic, a polity that expanded from the third century BC from a small city-state in central Italy to dominate the Mediterranean world by the time Rome's first emperor, Caesar Augustus, ascended to the throne in 27 BC ("Rome's Transition From Republic to Empire" n.d.). For the next two centuries, Rome went through its most prosperous period. Its people lived in a wealth and material progress that would not be seen again until the 18th century, and peace largely prevailed from Portugal in the west to Iraq in the east and from Britain south to the Sahara Desert.

In the late second century AD and the decades that followed a full-blown crisis developed, with the empire facing incursions by foreign people and internal instability. The reasons for this 'Crisis of the Third Century' varied. Firstly, the people of the empire simply became used to peace and prosperity and less warlike, while the Germanic and Asiatic people who began breaking through the border defenses and raiding the empire from the mid-third century AD onwards found Rome a much easier target of riches than it had been in the past. Secondly, there were internal problems. The empire also had an economic crisis centuries in the making, caused by the devaluation of their currency as successive emperors watered down the silver content until the silver content was just 5%, confidence in the currency collapsed and the prices of everyday goods skyrocketed ("NGC Ancients: The Decline of Roman Silver Coinage, Part I | NGC" n.d.). These issues, civil war, foreign invasion, and social crisis began in the third century and eventually culminated in the empire splitting into two halves. The Western Roman Empire was overrun by various Germanic tribes that established kingdoms and ended in 476 AD when the last emperor of Rome was deposed. The Eastern Roman Empire survived for another millennium as the Byzantine Empire.

A modern example is the decline of the British Empire in the twentieth century which mirrored the fall of Rome in some tangible ways. For instance, when the end came to the Western Roman Empire in the fifth century AD, it happened very quickly. When the end came in 476 AD there was little Western Roman Empire to speak of left, with most of it long having been carved up by foreign invaders (Wasson and Netchev 2023).

Similarly, the fall of the British Empire progressed quickly through the 1940s, 1950s, and 1960s. First, the British Raj was granted independence in 1947 as the new states of India and Pakistan were formed. Ghana became the first major British colony in Africa to acquire independence in 1957. A deluge of grants of independence to places like Nigeria, Uganda, and Kenya followed in the late 1950s and early 1960s. By 1965 there was little of the British Empire left, just small enclaves like Hong Kong and some islands in the Caribbean that have remained British Overseas Territories to this day. Yet while the collapse of the British Empire might appear to have been swift and sudden, the problems that underlay it were long in the making.

Both Rome and Britain grew powerful on the back of resource extraction from conquered or colonized territories. In the eighteenth and nineteenth centuries, Britain became rich off of sugarcane production in the Caribbean, the sale of tea and opium from India, and the extraction of petroleum and rubber from places like Burma and Borneo. Rome had simply asset-stripped the wealthy kingdoms and states of the Mediterranean after it conquered them. These riches

allowed both powers to maintain great armies and navies and to become immensely powerful states for centuries. But eventually, they ran out of territories to strip assets from, and when they did they began to decline compared to the vast numbers of people they were trying to rule over. As this occurred, both powers entered into a period of comparatively rapid decline, though there were differences. Rome's collapse was more elongated, beginning in the third century, climaxing in the fifth and in some ways continuing through to the fifteenth when the Byzantine Empire came to an end. Britain's played out over just a few decades, a development which clearly marks the decline of the two powers as being different in substantial ways.

Several questions confront the UK that may lead to societal stress or diminution if not solved. Concerns with the economic outlook and stability, influenced by the recent volatility caused by various factors like Brexit, the COVID-19 outbreak, and the shifting global economy, remain challenging (Du, Satoglu, and Shepotylo 2023). Concerns such as the worrying trend of rising levels of income disparities, geographical disparities in the economy, and general concerns that call for efforts to diversify the economy and modernize it are also delicate issues(Cairney et al. 2022). Brexit, in particular, revealed major schisms within British society, whose effects on social and political stability are yet to be seen. Despite these risks, it would be inaccurate to suggest that the UK is doomed for collapse. The way forward will depend on the UK's capability to handle problems, enhance unity in British society, and navigate the shifts in global issues and conditions. Finally, as it often happens with any society, the future of British civilization will depend on its capability to identify and rectify its weaknesses and threats, to sustain its stability in social and political realms, to successfully manage the process of adaptation to the new conditions, and be mindful of the issues that can generate the environment for "top down deterioration".

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A Study on Video Thumbnails Design Attributes and Their Influence to the Outcome of the Video By Abhitha Madhav Kumar

Abstract

In the evolving landscape of user-generated content (UGC) platforms, where videos have become a preferred mode of entertainment and information consumption, the importance of thumbnails in attracting viewers cannot be overstated. This study delves into the intricate relationship between thumbnail design and video success, focusing on the Chinese UGC platform RED. Specifically, the research examines the thumbnails of @Amber Lulu, a vlogger with a consistent style of video and thumbnails. Analyzing a data sample of 30 videos within the "day in my life vlog" category, the study categorizes thumbnails based on three design elements: emphasis on one person vs. a group, two lines of title vs. one line, and a close vs. far background. The results reveal significant correlations between thumbnail design and video metrics, notably emphasizing the positive impact of a distant background, an emphasis on one person, and the use of two lines of heading. Drawing from communication theories such as visual hierarchy, cognitive load theory, and the effect of image characteristics, the study provides valuable insights for content creators seeking to optimize their thumbnails for increased engagement. This research contributes to a nuanced understanding of the role thumbnails play in viewer engagement on UGC platforms, offering practical advice for content creators to design more visually appealing thumbnails for their videos.

Introduction

In recent years, watching videos on user generated content (UGC) platforms has become the preferred choice for much of the population; people like to go to YouTube or TikTok to receive information or to get entertained instead of traditional forms of media. More demand creates more supply. In 2019, 500 hours of videos were uploaded per minute on YouTube [1]. However, according to research by Chowdhury and Markaroff, in a sample of 2528 videos posted under YouTube's entertainment category, only 0.12% of the videos were able to receive more than 100,000 views; 74.7% of the videos obtained less than or equal to 100 views. The skewed distribution demonstrates the competitiveness in the field — it is becoming harder to stand out. Amongst most video-based social media apps, the thumbnail, or the cover of the video, is the first thing that users see before immersing themselves in the video, which is why they are so important [2]. Using it as a tool to understand the video content, the users decide whether they want to watch the video based on the thumbnail [3]. A good thumbnail needs to tell the users what they will see in the video while making it sound appealing so the users want to click on it. Therefore, a well-designed thumbnail is crucial to the success of a video.

This study focuses on the thumbnails of one vlogger on the Chinese UGC platform RED. RED is a social media app based in China with over 2 billion users, and a million of them are active daily users [4]. Its initial target users are young, urban females who want to share their experience with fashion and luxury shopping [5], while now it has also expanded to other

categories, such as living abroad. When a user logs in to their account, they first land on their "for you page," which features photos or the thumbnails and titles for 4-5 videos, and they decide whichever one they want to access. The study will look at the vlogs uploaded by the user @Amber Lulu, comparing her similar videos under the same category and analyzing the influence of the thumbnail on the viewership and likes of the video. The purpose of this study is to better understand the relationship between thumbnail designs and their influence on the video to allow content creators to make better thumbnails for their videos.

Method

        The study used primary sources and chose one vlogger as the subject of study to be more consistent with the data, taking a data sample of 30 videos uploaded by the vlogger @Amber Lulu. This vlogger has around 63,000 followers, specializing in making vlogs about her daily life as a high school student in America, making the data less influenced by topic selection. All the chosen videos were uploaded within a year, under the category of "day in my life vlog" to minimize other potential influences upon the likes and views of the videos. The study then looks at the different number of likes and views yielded by each vlog, comparing the data to the design of each video's thumbnail. The design of the thumbnails is categorized into three different sections: emphasis on one person vs. no emphasis, two lines of title vs. one line, and whether the people in the photo are far away from the audience. For each category of thumbnails, there are ten videos chosen based on the most fitting of the category. All the data collected for each category has no other obvious differences except for what they are being compared to.

Results

Table 1, Different Thumbnail Designs & Video Feedback

		A Group Thumbnail vs. Emphasis on one pers Thumbnail	2 lines of heading vs. 1 line of heading	Close vs. far
Like	Average	1335.5 vs. 1638.8	2045.1 vs. 1418.3	1606.9 vs. 3472.6
Views	Average	20326.1 vs. 32470.6	29987.1 vs. 23447.0	29252.0 vs. 46056.2

        As Table 1 shows, in the comparison between a group thumbnail vs. emphasis on one person thumbnail, the group thumbnails averaged roughly 37.4% lower than the emphasis on one person thumbnail for views and was also 18.6% lower on likes. While previous research has suggested that users have a bias toward thumbnails with human faces over other subjects, the

result seems to say that it is not the more, the better [3]. This can be due to the Cognitive Load Theory. The theory indicates that an excessive amount of information can lead the audience to develop frustration or detachment over the message. While a group photo on the thumbnail can result in information overload, emphasizing one specific person by putting an outline on them can help the audience filter information by creating a visual hierarchy. Instead of an influx of information, the audience can process the information step by step. According to the Fluency Theory, the human brain finds it more enjoyable when the information can be processed easily [6]. It is possible that adding a focus to the thumbnail makes it more appealing to viewers because it is easier to process.

An even larger discrepancy can be seen in thumbnails with different lines of titles. According to Table 1, the average likes of videos with two-line titled thumbnails are 44.2% higher than that of 1-line titled thumbnails. While the number of people in the thumbnail is part of the way that the thumbnail conveys information, the heading is the other way in which information is transferred through text [7]. Since headlines on thumbnails are given a comparatively smaller space budget, there has always been debates of the perfect amount of information being conveyed in the thumbnail headline. While some researchers are proponents of visual embellishments, suggesting that making the thumbnail more aesthetically pleasing can also attract viewers, others are "minimalists" when it comes to thumbnail designs [8]. Like Edward Tufte, who supports the maximization of the "data-ink ratio." In this case, headlines are considered as part of the "data-ink" portion. Its ratio to the rest of the non-data-ink is considered the data-ink ratio. Though thumbnails with a single headline are more succinct and may be more visually appealing, it may need to condense the information and, therefore, reduce the data-ink ratio. On the other hand, thumbnails with two lines of heading have more data-ink ratio and are better than the prior, according to Tufte's theory. According to the theory, the more data ink the better. So, it is even possible that three or more lines of heading may result in even more views and likes than two lines of heading. However, it is still worth noting the importance of visual hierarchy in adding headlines to the thumbnail.

There is also a stark contrast between a close and far background. The average liking of a far thumbnail is 53.73% higher than a close thumbnail, while the views are 36.49% higher. According to the "image characteristics effect" [9], the image content in a thumbnail can provide additional attraction to the video through informational and aesthetical value independent from the text message. Unlike textual information, the image suggests visual elements, enhancing the viewer's ability to remember and relate to the conveyed concepts [10]. When a thumbnail features a far-photo perspective, it often presents a broader visual context, allowing viewers to quickly grasp the structural and integrated concepts within the image. On the other hand, a thumbnail with a closer-shot photo may be unable to explain to the viewer the context of the photo as much as a far photo since it contains less background information. Furthermore, a close-shot photo often comes with larger human figures due to scale. For example, faces that normally would have been a small portion in the center of the thumbnail may be enlarged to cover half of the thumbnail. While this is not necessarily a bad thing, it may result in a loss of

visual hierarchy compared to a far-shot photo. In far-shot photos, the subject is more often in the middle and is obviously the center of attention. In contrast, when the photo is closely shot, the subject often gets stretched out and takes a much bigger portion on the picture. It is better if the background can contrast the content of the thumbnail, so the latter pops out from the backdrop [11]. This relates to the fluency theory that was previously discussed, which conveys that thumbnails work better with a clearer focus.

Discussion

Based on the results, there seems to be a strong correlation between thumbnail design and video results. The clicking habits of platform users should be respected, but good content deserves to be given enough opportunity by the platform as well. It would be better if the algorithm could not only rate a video based on its likes and viewership, as they are both heavily related to the thumbnail but also evaluate the video on its content. On the other hand, content creators should put certain efforts into making their thumbnails if they aim for better video feedback. For example, having an emphasis on one person, having two lines of heading instead of one, and having a far background are all elements worth consideration, as proven previously. However, it is important to note the difference between an appealing thumbnail and clickbait thumbnails. Clickbait thumbnails are thumbnails that do not align with the video content but often draw the viewers in through exaggerated and misleading thumbnails [12]. While such thumbnails can give the content creator more clicks, the inconsistency between what was advertised and what the viewer watched can make the viewer feel unsatisfied, annoyed, and betrayed [12]. Furthermore, clickbait headlines may not be a good idea in the long run. Clickbait news often has less information to be perceived by the audience than news with traditional headlines, which decreases the chance of the news to be shared by the reader and, therefore, lowers the publicity of the video [13]. Therefore, content creators should focus on creating thumbnails that align with their video content.

Conclusions

Using 30 videos with a similar topic but different style of thumbnail designs, the paper finds that there is a strong relationship between thumbnail design and the likes and views of the video. More specifically, the subject of focus, the number of headlines, and the distance of the background all hold significant influence on the feedback of the video.

First of all, the comparison between group thumbnails and emphasis on one-person thumbnails highlighted a substantial preference for the latter. Group thumbnails faced a 37.4% lower average in views and an 18.6% decrease in likes. Contrary to the common belief that more faces in thumbnails lead to higher engagement, the cognitive load theory suggests that an excess of information can overwhelm viewers. Emphasizing one person in the thumbnail, creating a visual hierarchy, enables a more enjoyable and easily processed experience, aligning with the Fluency Theory.

The study also delved into the impact of different lines of titles in thumbnails. Thumbnails with two-line titles outperformed those with one-line titles, boasting a 44.2% higher average in likes. This finding resonates with the concept of the "data-ink ratio," proposed by Edward Tufte. While debates persist on the optimal amount of information in a thumbnail headline, the study suggests that a balance is crucial. Thumbnails with two lines of heading, maximizing the data-ink ratio, demonstrated better performance, potentially indicating that even more lines could yield higher views and likes.

Moreover, the study highlighted the significance of background distance in thumbnails. Thumbnails with a far background received a significantly higher average of likes (53.73%) and views (36.49%) compared to close background thumbnails. This aligns with the "image characteristics effect," emphasizing the additional attraction provided by visual and aesthetic elements in an image. A far-photo perspective offers a broader visual context, aiding viewer comprehension. The study also connected this preference to the fluency theory, suggesting that thumbnails with a clearer focus, often achieved through a far-shot perspective, tend to perform better.

In summary, the research provides valuable insights for content creators on the Chinese UGC platform, emphasizing the importance of visual hierarchy, balanced data-ink ratios in titles, and the strategic use of background distance for optimal viewer engagement. Nonetheless, with research conducted under the samples from a single vlogger, the small sample size limits the research results. Though this decision was made to limit other factors influencing the feedback of the video, future studies should expand on other types of content creators to better understand thumbnail designs.

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Determining the Relationship of the Size of the Meteor Crater by Dropping Various Masses Over Different Heights By Anya Dublish

Introduction

Asteroids, meteors and other space rocks are rarely spoken about. However, these masses are what led to the extinction of the last superpowers of Earth. Apart from that, the remains of the impact craters help geologists develop a deeper understanding of the past and present of our solar system.

If we were to protect ourselves from such rocks that the dinosaurs could not, how can we? Can we establish a relationship between the dimensions of the crater formed and the mass and height from which the rock is coming? These findings can enhance our understanding of past impact events and inform models predicting the effects of future impacts, contributing valuable data to the field of planetary science.

Since we cannot experiment with such large masses, we can create a simulation or model of the sand as the earth's surface and simple rocks found on the surface as the space rocks. Thus, we can observe and measure the resulting craters. This simple model allows us to draw parallels with real-world asteroid impacts, providing insights into the dynamics of crater formation. RQ: Determining the relationship of the size of the meteor crater by dropping various masses over sand over different heights.

Background Information

1. **What are meteors, why study impact?** [1]
A meteor is a streak of light in the sky caused by a meteoroid crashing through Earth's atmosphere. Meteoroids are lumps of rock or iron that orbit the sun. Most meteoroids are small fragments of rock created by asteroid collisions. Comets also create meteoroids as they orbit the sun and shed dust and debris. When a meteoroid enters Earth's upper atmosphere, it heats up due to friction from the air. The heat causes gasses around the meteoroid to glow brightly, and a meteor appears. Meteors are often referred to as shooting stars or falling stars because of the bright tail of light they create as they pass through the sky. Most meteors occur in Earth's mesosphere, about 50-80 kilometers (31-50 miles) above Earth's surface.[2]

However, before jumping in, there are several other objects found in our solar system that we confuse Meteors with.

2. **Difference between various space rocks**

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[1] [1]W. Gov, "Meteors and Meteorites," Jul. 2013. Available:
https://www.nasa.gov/wp-content/uploads/2009/12/Meteors_Meteorites_Lithograph.pdf?emrc=375a9a
[2] Ibid.

Meteors are streaks of light in the sky caused by a meteoroid passing through Earth's atmosphere.[3] Whereas **meteorites** are a solid piece of debris from an object, such as a comet, asteroid, or meteoroid, that originates in outer space and survives its passage through the atmosphere to reach the surface of a planet or moon.[4] On the other hand, **asteroids are** small, rocky objects that orbit the Sun.[5] Moreover, **comets** are large objects made of dust and ice that orbit the Sun[6] and **meteoroids are** lumps of rock that orbit the Sun. Many particles called micrometeoroids are extremely common throughout the solar system.[7]

3. **Which are the craters that we know? And their ecological importance**

Firstly, the **Chicxulub Crater (Mexico)** is in the Yucatán Peninsula, Mexico and is approximately 66 million years old. The crater has a diameter of ~150 kilometers (93 miles)[8]. Its Ecological Importance is that the impact that created this crater is widely believed to have caused the mass extinction event that wiped out the dinosaurs and many other species, leading to significant changes in Earth's biodiversity and the subsequent evolution of mammals and other life forms[9]. Secondly, the **Barringer Crater (Meteor Crater, USA)**[10] located in Arizona, USA is ~50,000 years old with a diameter of ~1.2 kilometers (0.75 miles)[11]. Its Ecological Importance is that it is one of the best-preserved impact craters on Earth, Barringer Crater provides valuable insights into impact processes and serves as a natural laboratory for studying meteorite impacts. It also supports unique desert ecosystems around the crater.[12] Thirdly, the **Vredefort Crater (South Africa)**[13] is in Free State, South Africa and is ~2 billion years old. Its diameter is ~300 kilometers (186 miles). Its Ecological Importance is that it is the largest verified impact crater on

[3] [2]J. Evers, "meteor | National Geographic Society," education.nationalgeographic.org, Oct. 19, 2023. Available: https://education.nationalgeographic.org/resource/meteor/

[4] [3]NASA, "ARES | Meteorite Falls | What are Meteorites?," Nasa.gov, 2018. Available: https://ares.jsc.nasa.gov/meteorite-falls/what-are-meteorites/

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[6] [5]NASA, "What Is a Comet? | NASA Space Place – NASA Science for Kids," spaceplace.nasa.gov, Dec. 20, 2021. Available: https://spaceplace.nasa.gov/comets/en/

[7] [6]"Meteoroid," education.nationalgeographic.org. Available: https://education.nationalgeographic.org/resource/meteoroid/#

[8] [7]C. to, "prehistoric impact crater buried underneath the Yucatán Peninsula in Mexico," Wikipedia.org, Oct. 04, 2009. Available: https://simple.wikipedia.org/wiki/Chicxulub_crater

[9] [8]E. Hand, "Updated: Drilling of dinosaur-killing impact crater explains buried circular hills," www.science.org, Nov. 17, 2016. Available: https://www.science.org/content/article/updated-drilling-dinosaur-killing-impact-crater-explains-buried-circular-hills

[10] [9]"Meteor Crater, Arizona, USA - NASA Science," science.nasa.gov. Available: https://science.nasa.gov/resource/meteor-crater-arizona-usa/

[11] [10]Wikipedia Contributors, "Meteor Crater," Wikipedia, Oct. 25, 2019. Available: https://en.wikipedia.org/wiki/Meteor_Crater

[12] [11]D. A. Kring and Jake. Bailey, "Barringer Meteor Crater and Its Environmental Effects," www.lpi.usra.edu. Available: https://www.lpi.usra.edu/science/kring/epo_web/impact_cratering/enviropages/Barringer/barringerstartpage.html

[13] [12]U. W. H. Centre, "Vredefort Dome," UNESCO World Heritage Centre. Available: https://whc.unesco.org/en/list/1162/

Earth. It has influenced the geology and landscape of the region, contributing to the distribution of mineral resources. The area around the crater is also rich in biodiversity and serves as a habitat for various plant and animal species.[14]

4. Why are craters formed?

a. Physics

A crater is a bowl-shaped depression, or hollowed-out area, produced by the impact of a meteorite, volcanic activity, or an explosion. Craters produced by the collision of a meteorite with Earth (or another planet or moon) are called impact craters. The high-speed impact of a large meteorite compresses, or forces downward, a wide area of rock. The pressure pulverises the rock. Almost immediately after the strike, however, the pulverized rock rebounds. Enormous amounts of shattered material jet upward, while a wide, circular crater forms where the rock once lay. Most of the material falls around the rim of the newly formed crater. Cratering is a rare occurrence in the solar system today. Planets, moons, comets, and other celestial bodies have stable orbits that do not interact with each other. Meteors do collide with planets—including Earth—every day. However, most of these meteors are the size of a speck of dust and do not cause any cratering. Most meteors burn up in the atmosphere as "shooting stars" before ever colliding with the surface of Earth.

b. Impact

When an impactor strikes the solid surface of a planet, a shock wave spreads out from the site of the impact. The shock wave fractures the rock and excavates a large cavity (much larger than the impactor). The impact sprays material — ejecta — out in all directions. The impactor is shattered into small pieces and may melt or vaporize. Sometimes the force of the impact is great enough to melt some of the local rock. If an impactor is large enough, some of the material pushed toward the edges of the crater will slump back toward the centre and the rock beneath the crater will rebound, or push back up, creating a central peak in the crater. The edges of these larger craters also may slump, creating terraces that step down into the crater.[15]

c. Three-stage process of crater formation:
   i. Initial contact, excavation of a transient cavity,
   ii. Collapse.
   iii. Information needed for energy calculations

In this research paper, I will be making a relationship between the size of the crater and the mean diameter of the impact, by a simple model experiment.

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[14][13]K. Hansen, "Vredefort Crater," earthobservatory.nasa.gov, Sep. 01, 2018. Available: https://earthobservatory.nasa.gov/images/92689/vredefort-crater
[15][14]Lunar and Planetary Institute, "Explore Space Science Activities," Usra.edu, 2018. Available: https://www.lpi.usra.edu/education/explore/shaping_the_planets/impact-cratering/

Hypothesis

I hypothesize a positive linear relationship between the distance from the ground and the size of the crater. Secondly, I hypothesize a positive linear relationship between the mass of the rocks and the size of the craters. Based on the Background information and Equation, I hypothesise that both parameters: mass of the rock and distance from the ground are directly proportional to the size of the crater. This research paper will help establish this relationship.

Methodology

Variables

Independent Variables

This investigation explores two things:

1. The relationship between the distance at which the rock is thrown and the size of the crater.
2. The relationship between the rock's mass and the crater's size.

Thus, the independent variable used is the mass of the rock and the distance from where it has been thrown from. The rocks are common rocks found in our backyards and without any definite shape, like the asteroids about to impact the earth's surface.

I have made increments of 5 grams, with a range of 5 to 25cm. I have taken this range as there was overlapping data and very small changes in the values with smaller increments and a lower range. If increased, with the equipment available, the crater formed would have intersected the edge of the container and hence could not use anything bigger than 25g.

Dependent Variables

This experiment and the dependent variable aim to estimate the size of the asteroid crater by dropping various masses over sand.

The dependent variable is the size of the crater which is measured by the mean diameter of the crater in the sand. This has been done by levelling the sand, throwing the rock, removing the rock from the sand carefully to ensure the sand is not disturbed, and measuring using a ruler. Once measured, the mean diameter is found to form the relationship. To improve the precision, we need to minimize parallax (random) error by using a measuring tape as the edge of the tool digs into the sand and aligns it to the edge of the crater formed. I have 5 trials for each of the independent variable values.

Controlled Variable

Firstly, the shape and material of the rocks must be kept in control because the different shapes and materials can alter the way energy is transferred upon impact. For example, a spherical mass will create a different crater compared to an irregularly shaped mass of the same

weight due to differences in how the impact force is distributed. This is controlled by using masses of the same shape (e.g., spherical or cylindrical) and material for all drops. We verify the shape using calipers and material consistency through density tests.

Secondly, the sand properties have variations that can influence how the energy is absorbed and dispersed upon impact, which would affect the crater size. Consistent sand properties ensure that the only variable affecting the crater size is the mass of the dropped object. Thus, we should ensure that the sand has the same grain size, moisture content, and compaction for each trial. Grain size can be measured using a sieve analysis, moisture content with a moisture meter, and compaction with a standard proctor test.

Thirdly, the magnitude of force applied when releasing the socks must also be controlled. It can be controlled by dropping it from the same height with the same consistency. This is done because we need to ensure the crater is formed accurately under the influence of gravity.

Fourthly, to control each increment of height as needed to place it at an accurate position, we should use a ruler or a measuring tape to ensure the height is consistent for each drop. This can also be done by holding the masses at the same height. This is done because the impact energy depends on the height from which the mass is dropped due to gravitational potential energy (E = mgh). Variations in height would result in different impact energies, affecting the crater size independently of the mass dropped.

Fifthly, the drop method must be controlled by using a consistent method for releasing the masses, such as a drop mechanism or electromagnet, to ensure that they fall straight down without initial velocity in any direction. Variations in the drop method can cause the mass to hit the sand at different angles or with different velocities, leading to inconsistent crater sizes.

Sixthly, ensuring ambient conditions, which is possible by using a thermometer and hygrometer to monitor and control the temperature and humidity of the environment. Changes in temperature and humidity can affect the properties of the sand (e.g., moisture content) and the material of the masses, influencing the results.

Seventhly, an uneven surface can lead to inconsistent impact conditions, where some drops might encounter more resistance than others, affecting the crater size. Therefore, ensure the sand surface is leveled before each drop using a spirit level or a flat edge.

Eighthly, the mass drop location is integral because dropping the masses in different locations could result in varying sand conditions (compaction, previous craters), affecting the size of the new crater. We can control this by dropping the mass in the same location within the sandbox for each trial and by using a marker or a fixed frame to guide the drops.

Apparatus

S.No	Apparatus
1	5 different rocks
2	Weighing scale
3	Measuring tape/ ruler (2)
4	Sieved sand
5	Tongs
6	Mug/Bucket - container

Schematic Diagram

Experiment

SETUP
1. Get a bucket of sand, as pure as possible and ensure there's minimal moisture in it.
2. Sieve the sand to remove any big rocks that may affect the results

3. Use a bucket or a mug and pour the sand into it until the 8cm mark.
4. Place it on the ground and pin up a meter-measuring tape from the ground
5. Place a ruler inside the sand to ensure the sand remains at the 8cm mark throughout.
6. Make increments of 10cm from the ground on the measuring tape.

Experiment 1
1. Using a plank place the 5 grams rock on it. For the first reading at 10cm, take off the plank ensuring the height is unchanged and there was no external force applied to it.
2. Once fallen into the mug, carefully remove the rock using tongs and place it away.
3. Using the measuring tape/ ruler measure the diameter of the crater formed - vertically and horizontally.
4. Repeat with different heights (10cm, 20cm, 30cm, 40cm, 50cm)
5. Do each of these heights 5 times

Experiment 2

Once done for 5 grams, do the same with 10g, 15g, 20g, 25g.
1. This must include all 5 increments of heights.
2. Repeat for each mass 5 times.

Safety, Environmental and Ethical Considerations

Safety

1. Heavy Objects:
   ○ If the rocks and stones are very heavy, they may injure the scientist.
   ○ Reduce: use tongs to handle the masses, and protective gear (gloves & safety goggles).
2. Falling Objects:
   ○ When dropped from a higher height, they may fall and injure someone.
   ○ Reduce: Make sure the bystanders have distance, or reduce heights to conduct it inside without any possibility of hurting someone.
3. Sand Particles:
   ○ Sand particles may cause respiratory issues if inhaled. Sand particles may also go into the eyes and mouth.
   ○ Reduce: make sure the environment is a well-ventilated area and wear a dust mask to prevent inhalation of sand particles. Wear safety goggles to prevent any eye damage.

Ethical Issues

1. Use of Materials

○ Sand may not be sustainably sourced, and taking huge amounts of sand may cause habitat destruction for animals who live in them.

Environmental Issues

1. Disposal of Sand
   ○ Should dispose of sand in an environmentally friendly manner. Careless disposal may lead to pollution. We must reuse it or place it back where we got it.

Interpretation

Processed Data

Table: Distance from the ground/cm versus the dimensions of the crater/cm for each mass of a rock

Distance from ground/cm	Mass of the rocks/g				
	5.00	10.00	15.00	20.00	25.00
25.40	3.30	3.17	3.76	4.15	4.41
50.80	4.03	4.21	5.23	5.01	5.19
76.20	4.49	4.46	5.33	5.55	5.73
101.60	4.91	5.17	5.84	6.26	6.49
127.00	5.30	5.47	6.81	7.22	7.53

Figure: Graph of distance from the ground/cm on the x-axis versus the dimensions of the crater/cm on the y-axis

Distance from the ground/cm - dimensions of the crater/cm

- 5g
- 0.0192x + 2.94
- 10g
- 0.0219*x + 2.83
- 15g
- 0.0264*x + 3.38
- 20g
- 0.0291*x + 3.42
- 25g
- 0.0297*x + 3.6
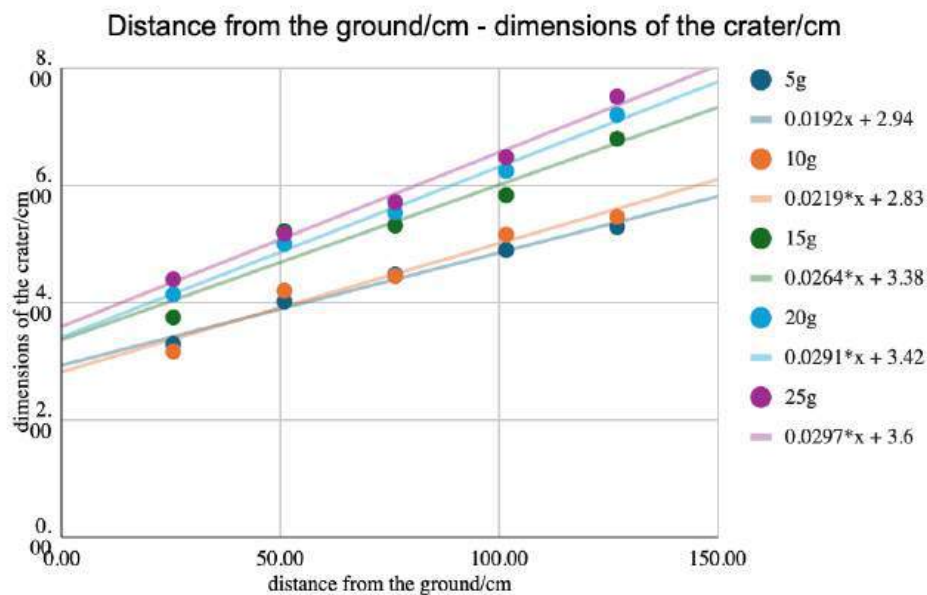
Table: Mass of the rock/g versus the dimensions of the crater/cm for each distance from the ground/cm

Mass of the rock/g	Distance from the ground/cm				
	25.40	50.80	76.20	101.60	127.00
5.00	3.30	4.03	4.49	4.91	5.30
10.00	3.17	4.21	4.46	5.17	5.47
15.00	3.76	5.23	5.33	5.84	6.81
20.00	4.15	5.01	5.55	6.26	7.22
25.00	4.41	5.19	5.73	6.49	7.53

Figure: Graph of mass of the rock/g on the x-axis versus the dimensions of the crater/cm on the y-axis

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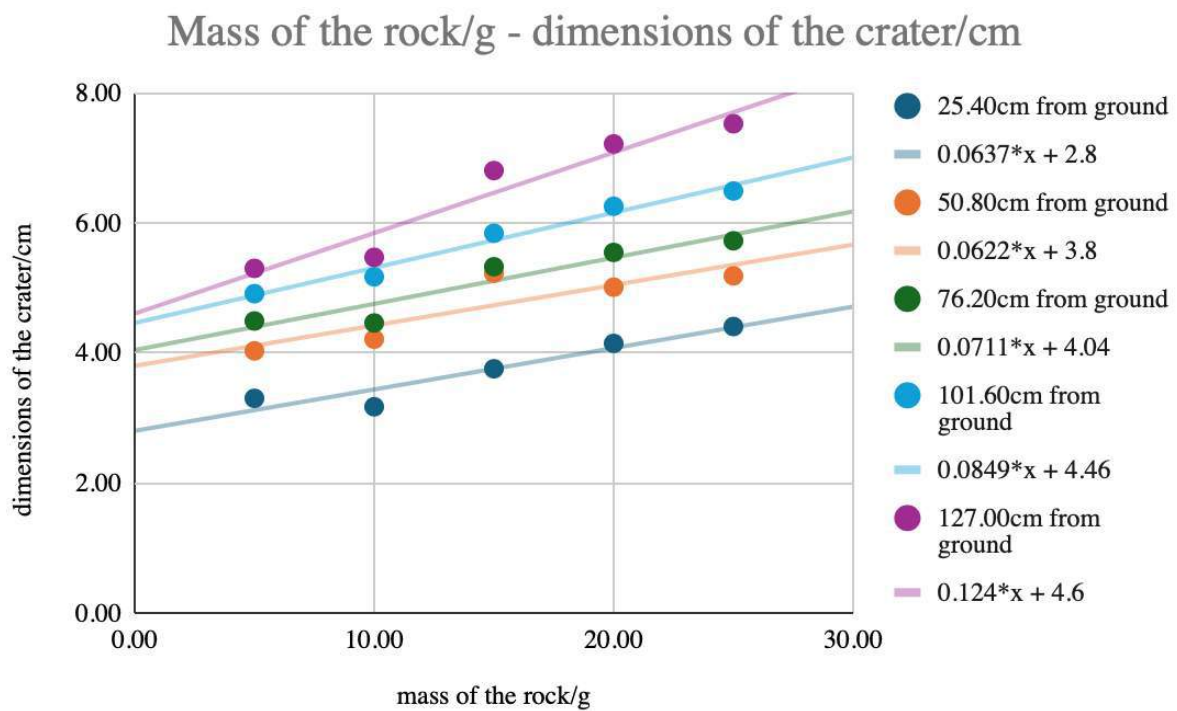
ANALYSIS

In Graph 1, we can see the linear trends of the increase in mass of the rock/g with the mean dimensions of the crater/cm.

-

distance from the ground - dimensions of the crater			
	Equation of the line	Mean slope	Mean R^2
25.40cm	0.0637x + 2.8	0.0637	0.903
50.80cm	0.0622x + 3.8	0.0622	0.749
76.20cm	0.0711x + 4.04	0.0711	0.89
101.60cm	0.0849x + 4.46	0.0849	0.973
127.00cm	0.124x + 4.6	0.124	0.925
mean		**0.08118**	0.888

In graph 2, we can see the linear trends of the increase in distance from the ground/cm with the mean dimensions of the crater/cm.

-

mass of the rock - dimensions of the crater			
	Equation of the line	Mean slope	Mean R^2
5g	0.0192x + 2.94	0.0192	0.983
10g	0.0219x + 2.83	0.0219	0.953
15g	0.0264x + 3.38	0.0264	0.918
20g	0.0291x + 3.42	0.0291	0.992
25g	0.0297x + 3.6	0.0297	0.988
mean		**0.02526**	**0.9668**

My initial hypothesis of a positive linear relationship between the distance from the ground and the size of the crater is therefore correct. My second hypothesis between the mass of the rocks and the size of the craters has also been proven to be correct. This is seen by the positive mean slope in Graph 1 of 0.0212, with little standard deviation from the original slopes with a minimum of 0.0622 and a maximum of 0.1240 increasing the precision. Likewise, in the second graph, the mean slope is 0.025, with little standard deviation in the original slopes with a minimum of 0.0192 and a maximum of 0.0297, increasing the precision. The high mean R^2 values as seen in graph 1 of 0.888 show how there is a high accuracy, however, since there were high uncertainties it was not as close to the mean R^2 value of graph 2 of 0.967, closer to 1. 1 is the perfect value of R^2 that helps determine how close it is to the perfect values.

Further Scope

      We could consider calculating the impact on the crater using energy calculations and find methods to connect it back to the actual impact of meteors on the earth's surface with more sufficient data on the topic.

Appendix:

ROCK 1

Distance from ground/ inch	Distance from ground/ cm	mass/g	t1 D1	t1 D2	t2 D1	t2 D2	t3 D1	t3 D2	t4 D1	t4 D2	t5 D1	t5 D2	Mean D1	Mean D2	Mean (D1,D2) [c]	Rock D1	Rock D2	Rock D mean
10.00	25.40	5.00	3.20	3.40	3.20	3.50	3.10	3.40	3.15	3.50	3.14	3.40	3.16	3.44	3.30	1.90	2.15	2.03
20.00	50.80	5.00	4.00	4.20	3.90	4.10	3.90	4.00	3.85	4.00	4.10	4.20	3.95	4.10	4.03	1.90	2.15	2.03
30.00	76.20	5.00	4.50	4.70	4.40	4.50	4.40	4.50	4.35	4.50	4.40	4.60	4.41	4.56	4.49	1.90	2.15	2.03
40.00	101.60	5.00	4.90	5.00	4.80	5.10	4.70	5.00	4.80	4.90	4.85	5.00	4.81	5.00	4.91	1.90	2.15	2.03
50.00	127.00	5.00	5.20	5.30	5.20	5.30	5.30	5.40	5.20	5.40	5.30	5.40	5.24	5.36	5.30	1.90	2.15	2.03

ROCK 2

Distance from ground/inch	Distance from ground/ cm	mass/g	t1 D1	t1 D2	t2 D1	t2 D2	t3 D1	t3 D2	t4 D1	t4 D2	t5 D1	t5 D2	Mean D1	Mean D2	Mean (D1,D2) [c]	Rock D1	Rock D2	Rock D mean
10.00	25.40	10.00	3.40	3.50	3.00	3.20	2.10	4.00	3.00	3.40	2.60	3.50	2.82	3.52	3.17	2.70	2.80	2.75
20.00	50.80	10.00	4.00	4.30	4.20	4.20	4.20	4.20	4.10	4.30	4.20	4.40	4.14	4.28	4.21	2.70	2.80	2.75
30.00	76.20	10.00	4.50	4.70	4.30	4.60	4.70	4.70	3.20	4.80	4.40	4.70	4.22	4.70	4.46	2.70	2.80	2.75
40.00	101.60	10.00	5.00	5.10	5.20	5.30	5.10	5.20	5.10	5.20	5.20	5.30	5.12	5.22	5.17	2.70	2.80	2.75
50.00	127.00	10.00	5.30	5.40	5.30	5.40	5.40	5.60	5.50	5.70	5.40	5.70	5.38	5.56	5.47	2.70	2.80	2.75

ROCK 3

Distance from ground/ inch	Distance from ground/ cm	mass/g	t1 D2	t2 D1	t2 D2	t3 D1	t3 D2	t4 D1	t4 D2	t5 D1	t5 D2	Mean D1	Mean D2	Mean (D1,D2) [c]	Rock D1	Rock D2	Rock D mean
10.00	25.40	15.00	3.90	3.70	3.80	3.65	3.70	3.70	3.80	3.70	3.80	3.71	3.80	3.76	2.80	3.40	3.10
20.00	50.80	15.00	4.80	6.90	7.10	4.55	4.85	4.70	4.90	4.85	5.00	5.12	5.33	5.23	2.80	3.40	3.10
30.00	76.20	15.00	5.30	5.25	5.40	5.20	5.50	5.30	5.50	5.30	5.40	5.23	5.42	5.33	2.80	3.40	3.10
40.00	101.60	15.00	5.90	5.70	6.10	5.80	6.10	5.70	5.90	5.70	5.90	5.70	5.98	5.84	2.80	3.40	3.10
50.00	127.00	15.00	6.85	6.70	6.80	6.80	6.90	6.80	6.90	6.80	6.80	6.76	6.85	6.81	2.80	3.40	3.10

ROCK 4

Distance from ground/inch	Distance from ground/ cm	mass/g	t1	t1	t2	t2 D2	t3	t3 D2	t4	t4 D2	t5	t5 D2	Mean D1	Mean D2	Mean (D1,D2) [c]	Rock D1	Rock D2	Rock D mean
10.00	25.40	20.00	4.10	4.25	4.20	4.00	4.05	4.20	4.10	4.20	4.10	4.25	4.11	4.18	4.15	3.10	3.70	3.40
20.00	50.80	20.00	5.00	5.10	4.90	5.00	4.95	5.10	4.90	5.15	4.90	5.10	4.93	5.09	5.01	3.10	3.70	3.40
30.00	76.20	20.00	5.45	5.60	5.50	5.60	5.45	5.60	5.50	5.65	5.45	5.65	5.47	5.62	5.55	3.10	3.70	3.40
40.00	101.60	20.00	6.00	6.30	6.20	6.30	6.10	6.40	6.20	6.40	6.20	6.45	6.14	6.37	6.26	3.10	3.70	3.40
50.00	127.00	20.00	7.00	7.20	7.00	7.30	7.15	7.25	7.25	7.30	7.30	7.40	7.14	7.29	7.22	3.10	3.70	3.40

ROCK 5

Distance from ground/inch	Distance from ground/ cm	mass/g	t1 D1	t1 D2	t2 D1	t2 D2	t3 D1	t3 D2	t4 D1	t4 D2	t5 D1	t5 D2	Mean D1	Mean D2	Mean (D1,D2) [c]	Rock D1	Rock D2	Rock D
10.00	25.40	25.00	4.15	4.50	4.30	4.50	4.20	4.65	4.05	4.70	4.40	4.60	4.22	4.59	4.41	3.90	4.00	3.95
20.00	50.80	25.00	4.90	5.10	5.20	5.20	5.20	5.40	5.20	5.30	5.10	5.25	5.12	5.25	5.19	3.90	4.00	3.95
30.00	76.20	25.00	5.70	5.80	5.75	5.80	5.60	5.90	5.60	5.80	5.60	5.70	5.65	5.80	5.73	3.90	4.00	3.95
40.00	101.60	25.00	6.50	6.60	6.30	6.50	6.40	6.60	6.40	6.60	6.40	6.60	6.40	6.58	6.49	3.90	4.00	3.95
50.00	127.00	25.00	7.30	7.50	7.45	7.60	7.45	7.70	7.50	7.60	7.50	7.65	7.44	7.61	7.53	3.90	4.00	3.95

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What Is the Point of Unenforced Laws By Andrew Ye

Abstract

This paper explores the expressive powers of the law. It's guided by the question "What is the point of unenforced laws?" Traditional views on laws are often around the deterrence of the punishment i.e. prison time for robbing a bank. However, there are laws in society that aren't heavily enforced, such as minor speeding violations. This paper examines the law's expressive powers, legitimacy, and deterrence. In doing so, this paper will detail how these expressive functions of the law shape social norms, influence behavior, and reflect societal values, even without punitive action. This paper argues that unenforced laws, such as minor speeding violations or jaywalking, are more than symbolic; they provide a framework for potential future enforcement, influencing collective attitudes, and contributing to the legitimacy of the legal system. Thus, these unenforced laws play an essential role in society today, even if they might not seem useful at face value because of the lack of punishment.

The Use of Unenforced Laws: The Expressive Powers of Law

Laws are typically associated with reinforcement and punishment, serving as guidelines that govern social behavior and ensure safety. Some laws, on the contrary, lack proper enforcement for a majority of violations. This leads to questions about the purpose of these laws. If a law isn't properly enforced or is underenforced, what's the point of having them in the first place? A common example of these laws are speeding laws. Severe violations of these laws, like driving 50 mph over the speed limit in residential areas, are actively policed. However, minor breaches of speeding laws, such as driving 75 mph in a 65 mph zone on a highway which will …, often go unnoticed by law enforcement. This discrepancy raises a significant question: What is the use of these speeding laws?

To understand the purposes of unenforced laws like those regulating minor speeding violations, we need to start with a more general question: what are the functions of the law? To answer the latter question, this paper will first explore various functions of the law, with a focus on deterrence, legitimacy, and expressive powers. While deterrence is a crucial function of many laws, unenforced or enforced, this paper highlights that the law also has other functions, particularly expressive functions, that make them necessary and important. Unenforced laws express societal values as they demonstrate intentions for the future and set a standard for acceptable behavior, even in the absence of enforcement.

Functions of the Law

In legal theory, it's important to recognize that laws serve a multitude of different functions simultaneously, even though some functions may be more salient than others in a particular context. These functions do not have to be mutually exclusive. A singular law can coordinate behavior, convey information, and deter undesirable actions. For example, a law prohibiting theft deters potential offenders and also signals the societal value placed on property

rights. Furthermore, theft laws coordinate social expectations around ownership and possession. Certain laws may prioritize one function over the other, such as criminal laws' emphasis on deterrence, but many laws, as McAdams (2000) and Sunstein (1996) explain, operate on multiple levels, fulfilling distinct roles at the same time.

Deterrence

Deterrence is one fundamental purpose of the law (McAdams, 2015; Levitt & Miles, 2018). It aims to discourage individuals from engaging in illegal behavior by imposing penalties. Deterrence operates on the premise that fear of the punishment will outweigh the desire to commit the violations. Take major violations of the speeding laws as an example. Driving 50% beyond the speed limit is subject to heavy punishments, such as license suspension, hefty fines, or even jail time. These punishments act to deter individuals from violating the law to such a severe degree. Becker (1968) outlines the theory that by increasing the penalties, the perceived cost of commuting a crime increases, therefore incentivizing people to not commit the crime. Poli de Figueiredo et al. (2001), Bjørnskau and Elvik (1992), Wagenaar (2007) all outline the correlation in various countries; the increase in speeding penalties and direct correlation in the decrease in violations, suggests that deterrence is an extremely effective tool when it comes to enforcement of the law.

Legitimacy

Beyond deterrence, laws function as a source of legitimacy. Laws establish a set of rules that society deems morally and ethically appropriate. People often follow the law not just out of fear of the punishment, but because they recognize that laws are legitimate—they exhibit a special type of (moral) authority. As Spencer (1970, p. 126) puts it, "The essence of legitimacy, whether it be of norm or authority, is the sense of duty, obligation, or 'oughtness' toward commands". The law earns people's respect through its legitimacy or authority. This legitimacy is similar to that of parents and children. Parents, most of the time, have authority over their children. Children listen not solely because of the fear of punishment, but because parents are there to guide and care for them. In the case of speeding laws, although they are not perfectly enforced, they're still respected as safe guidelines for driving. We follow the traffic laws not only because of the fear of the punishment, but because we feel like we have the duty or obligation to follow them.

Legitimacy of the law is further reinforced through education. In the case of speeding laws, institutions such as driver's education programs emphasize that every citizen has the duty to follow speeding laws and avoid reckless driving. These lessons are often taught with videos of scenarios or stores in which individuals face the repercussions for speeding. This further solidifies the legitimacy of speeding laws to the younger generation of drivers. Even when people believe that the risk of getting caught for minor infractions is low, the acknowledgment that it is their duty to follow the speed limits contributes to their adherence to these laws.

Expressive Powers

The law also has another special power—its expressive power. As McGinn (2015) and McAdams (2015) explain, the expressive power of a law refers to its ability to shape social norms and communicate values. Laws do not only serve to deter or punish; they can also express societal ideals and set expectations for behavior. McAdams (2015) identifies the two primary expressive functions as coordination and information. Coordination refers to the maintenance of order which involves people aligning their behaviors with the law (e.g., drivers following the rules about stop signs) such that everyone can pursue their individual goals without creating conflicts (e.g., drivers can cross the road safely). Information, on the other hand, refers to the way that laws communicate what is considered "right" or "wrong" by society. For example, speed limits communicate what is considered safe speeds by limiting the speech at which cars can travel at.

The expressive function of speeding laws are evident, though less impactful than in other laws. For instance, there is a prevalent social norm that condones driving slightly over the speed limit. This is especially the case when the flow of traffic dictates a speed that exceeds the speed limit, especially on highways. In fact, it's a bigger risk to drive slower than the flow of traffic than it is to slightly surpass the speed limit. While the law exists, it shows that the social norm greatly outweighs the expressive power of the law. Here, the expressive power of the law is weakened by counteractive social attitudes that trivialize it. In contrast, other unenforced laws, such as those against jaywalking, demonstrate stronger expressive powers. Despite minimal enforcement, the stigma around crossing the street still persists, in part due to the law's main intention of simply establishing expectations for pedestrian behavior. In fact, children are often taught to "look both ways before crossing the road", a saying that derives from the stigma around safely crossing the road.

The Purpose of Unenforced Laws

To understand the purpose of unenforced laws, it is crucial to examine whether the previously discussed functions of law—deterrence, legitimacy, and expressive powers—adequately explain their role. Using the example of speeding laws, we can see that these laws serve more than a simple deterrent function. While speeding laws are technically enforceable, enforcement is inconsistent, and minor infractions often go unpunished. This inconsistency does not render the laws meaningless; rather, it highlights their broader purposes.

One key purpose of unenforced laws is to promote road safety and demonstrate governmental concern for public welfare. Even if the enforcement of minor speeding violations is rare, the existence of speed limits signals that safety is a priority. The absence of any speeding regulations would suggest that road safety is not a concern, which could lead to more reckless driving behavior. Similar patterns have been observed in other areas of public health, such as smoking regulations. In the past, smoking was commonplace, including among teenagers, due to a lack of regulation. However, once the government began implementing age restrictions and public health campaigns, smoking rates declined dramatically. These regulations, even when not

strictly enforced, conveyed a clear message about the dangers of smoking, which influenced behavior over time.

Another purpose of unenforced laws is to set a precedent for future behavior and potential enforcement. By establishing a legal standard, even one that is not rigorously policed, the law lays the groundwork for more stringent enforcement if circumstances change. For example, as technology evolves, new methods of monitoring speeding, such as automated cameras, could increase the enforcement of speed limits. The laws already in place provide a framework for this potential shift, ensuring that the standards are not implemented arbitrarily or without public awareness.

Unenforced laws also serve to influence social norms indirectly. While direct enforcement targets individual behavior, unenforced laws shape collective attitudes and behaviors over time. In the case of speeding, the existence of speed limits, even when not rigorously enforced, contributes to a societal understanding that excessive speeding is undesirable and unsafe. This indirect influence can be seen in the gradual reduction of average speeds in some areas, as drivers internalize the expectation that they should not exceed certain limits, even if the immediate risk of punishment is low.

Laws don't just deter. Laws also shape conduct and set a standard of behavior. Laws, at best, are properly enforced with minimal violations. At worst, laws set standards for behavior. For example, when it comes to speeding laws, while there are minor violations that go unenforced, the law still serves a purpose. Its main purpose, if not enforced, is to create the baseline expectation that speeding is unacceptable. It's impossible to imagine a world where there are no speeding laws, where drivers can go as fast or as slow as they want. Obviously, this would be extremely dangerous and have detrimental effects. The unenforced speeding laws are there to prevent this from happening. It's better to have unenforced speeding laws than no speeding laws at all. Essentially, the presence of the law itself, even when not strictly enforced, still influences behavior by creating a baseline expectation that excessive speeding is unacceptable. This suggests that the deterrent effect of unenforced laws, while indirect, still plays a role in shaping conduct.

Getting Rid of Unenforced Laws?

Despite my above arguments about the functions of unenforced laws, some might still think that maybe we should just get rid of unenforced laws. As The Colombian (2022) outlines, "no law is better than an unenforced one" (see also Depoorter & Tontrup, 2016). They fail to recognize that it's impossible to get rid of an unenforced law. This paper has already established the functions of a law, whether or not the law is enforced. This suggests that an unenforced law is better than nothing. However, even if their argument is true, the application of the process becomes extremely difficult to implement. It's hard to draw the line that outlines the degree to which a law is "unenforced". Does it mean more than 50% of the population is violating the law? Or does it mean more than 50% of violations go unenforced? By attempting to set a standard for

which laws are unforced, it causes more confusion than the supposed benefit compared to unenforced laws.

Another common objection to unenforced laws is the argument that they would be more effective if strictly enforced. If the goal is to promote road safety, for example, why not enforce every single speeding incident? The reality, however, is that the cost of universal enforcement would be prohibitive. Policing every minor speeding violation would require a massive increase in law enforcement resources, potentially causing more disruption to traffic flow and posing logistical challenges. Furthermore, the use of radar cameras, while helpful, does not fully solve the problem, as drivers often find ways to evade detection or ignore fines, especially in areas where ticket enforcement is lax.

Another objection is the idea of implementing universal regulations on speeding to create a consistent standard. In the United States, this approach would conflict with the balance of state versus federal rights, making it legally and politically complex. Even if such regulations were possible, they would not necessarily eliminate speeding. A universal policy does not change the fundamental human behaviors that lead to speeding; it would merely shift the boundaries of the law that are being tested. People would continue to speed, just under a different set of regulations, and enforcement challenges would remain.

Conclusion

The existence of unenforced laws, such as minor speeding violations, serves multiple purposes beyond simple deterrence. These laws act as a statement of societal values, promoting safety and setting standards for acceptable behavior, even when enforcement is inconsistent. They contribute to the legitimacy of the legal system by upholding expectations and providing a framework for future enforcement. While unenforced laws may not have the immediate impact of those that are strictly enforced, their influence on social norms and long-term behavior is significant. Ultimately, the value of these laws lies in their ability to express collective intentions and guide behavior in ways that extend beyond the reach of immediate penalties.

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Authority and Influence: Maneuvering Relationships and Power in a Business' Success
By Quang Tran

Abstract

      Businesses nowadays are adopting psychology into the industry to navigate problems and create solutions as new trends arise and technology becomes more developed. This literature review will focus on utilizing psychology in the business setting and examine the sub-level of an organization which includes employees, power dynamics, and consumers themselves. To further explore an organization, there are factors in control that can contribute to the overall success of an organization. Every employee contributes to a company, so managing relationships and controlling power dynamics is essential in work efficiency. The types of work place relationships are each individually important to an individual's career and being able to utilize power control can help manage social dynamics. How do healthy relationships increase an employee's work quality? Can power dynamics create a stabilized work environment for positive encouragement and improved morality? Finally, how do power and relationships contribute to a business's success?

Introduction

      While looking at an overview of a company, we tend to narrow our perception to the finances, economics, and resources of a company. These factors are definitely important to some extent, but the business industry includes more than what meets the eye. In the workplace, employees are the foundation of a successful company and by diving deeper we can look at the microscope of the actual backbone of an organization. How employees foster and maintain their relationships can determine their well-being and bring more outstanding contributions overall. In terms of managers and CEOs, how they manage their power and utilize it in a healthy way can impact employees to a great extent. The problem is how we can conclude that fostering healthy relationships between employees really leads to a company's success or if a leader exercising his dictatorship is more beneficial towards employees and the business. To take a business to the next level, it is important to understand that internal resources must be organized, especially the workforce of employees that need to be taken care of. Understanding how a company's work environment and employee's mental health is important, it can help distinguish between a normal company and a successful organization. Sometimes, looking inside to reflect on and improve internally is more advantageous than being profit-oriented with no clear plan. Reaching a business' maximum potential will always require risks, but minimizing that risk by setting clear goals, developing a healthy environment, and focusing on employee's well-being. Only then can a business find its path to success and have a clear vision. This research will be split into three different topics. What determines a business's success, the different types of relationships in the workplace, and how power influences the work environment?

Methodology

How does psychology positively impact a business's success? To start off, defining the success of a business sets a foundation for understanding the criteria behind a successful business. Next, it is important to identify the two factors that create the backbone of a company: workplace relationships and power dynamics. By looking into the different types of workplace relationships, we can compare how each type of relationship is needed to create a successful company. To examine overall relationships, power dynamics come into play as they are the stem of connections and authority So I researched the different types of power and how employees/managers can use these powers. Later in the discussion, we can draw conclusions on how relationships and power dynamics can boost the motivation and well-being of employees and steer a company into success.

What defines a company's success?

A successful company comes with many different criteria as different organizations hold different views and criteria. A well-established company will have goals to ensure the motivation of every individual in the organization whether that is the CEO, managers, or employees. By ensuring motivation for the long run, companies look to hold their success and thrive rather than experience short-term satisfaction. According to Harvard Business Review (2019), a business's success can be defined through three different values, "liquidity, growth, or control". Liquidity refers to a company's financial stability and having adequate assets to use for personal needs. Growth is defined as a business's potential and growth over time (Baron, 2019). This can come in the form of finding new goals, introducing talents, increasing profits, and improving innovations. Control is having authority and the power to make decisions (Baron, 2019). Besides these three criteria, individuals can also have perceptions of what they interpret as success. Criteria could also range from a rather simple concept such as team unity, a solid vision, or accurately recording details (Hogarty & Tse, 2021). When companies start up and innovations arise, the most important factor to ensure a long-term successful company is a well-envisioned plan. The plan could be seen as a make-or-break factor but it could also be adjusted along the way. To execute the plan, optimism, and hard work are needed because a plan is nothing if action is not taken. In the process, if the company meets its long-term goals, it will be deemed successful (Cohen, 2017).

Healthy Relationships Determine Quality Work

Positive relationships between employees have been shown to increase performance, employee retention, learning more quickly, and job satisfaction. Overall there are 6 types of relationships in the workplace, "Co-workers, manager, mentor/mentee, work-friends, team members, workspouse" (Maggie, 2022). These relationships are ranked with respect to closeness to the individual. Co-workers are people in the same organization who share the same ideals and goals. Managers are individuals who provide workloads and manage an employee's salary. Mentors help employees navigate around the workplace and answer questions with respect to the

organization's ideals and values. Work friends are people you interact with on a daily basis during lunch or breaks to relieve stress or bond. Since you meet these people, ideally, one-third of your entire life, you're bound to create a connection (Herrity, 2023). This is especially important as employees share a goal for the organization, have similar ideals, and work for the job. Healthy workplace relationships positively correlate with higher-quality work and motivation (Harter, 2022). Employees who experience more positive emotions perform better at work because they have a wide range of meaningful tasks and more autonomy. Behaviors from employees can be seen through offering beneficial incentives, developing personal skills, and protecting the organization (Lyubomirsky,2018). This leads to the question, how do work relationships affect an employee's accomplishment? Positive relationships among employees create a hospitable environment for new employees which helps them adapt to work quicker while talking to fellow co-workers to destress in times of pressure.

Role of Power Dynamics in a Healthy Environment

Some might consider power as something negative, mainly if they are referring to dictatorship. But this is far from the truth as power that is exercised in a healthy way can lead companies to their ultimate goal as it inspires growth, authenticity, and integration (Sconiers, Thomas, 2023). Power can come in many different forms, as there are mainly 8 types of power: Legitimate power, Coercive power, referent power, charismatic power, expert power, reward power, moral power, and connection power(Terry, 2020). Power can be associated with independence, meaning the less powerful party is more dependent than the more powerful party because they need help from the more powerful one. That being said, a power dynamic must always be in play because it builds responsibility, engagement, and the pursuit of shared goals(Williams, Lopiano, Heller, 2022). A lack of this dynamic can bring conflict and disunity as employees can start to rebel and disagreements arise. The same can be agreed upon with too much power, when an individual or a small group is given excess authority, they may use it to gain autonomy or manipulate others. A good balance is needed so that the less powerful party may advocate, while the more powerful party feels satisfied as well (Rose, 2020). As employees, the satisfaction an individual can get is being heard and respected. A positive work environment is shown to boost levels of employee commitment and improve employee work performance (Zhenjing, 2022). In essence, power dynamics can play a huge role in creating safe and healthy environments with powers such as legitimate power and charismatic power. Legitimate power is correlated to managers or higher positions which they could use to create demands, set boundaries, and expect compliance (Terry, 2020). Managers exercise this form of power to make sure employees stay on task and keep them aligned with the company's goals. Charismatic power(i.e. connection power) is utilized to create connections and evoke support from others. Managers who are able to exercise this power in a healthy way can create a cohesive environment for support and motivation (Terry, 2020).

Discussion

   The success of a company is very much dependent on a lot of factors, some are controllable while some depend on external influence. What defines a successful company varies between organizations and the leaders of those companies, but a good rule of thumb follows that a successful company requires two main components. Healthy relationships in the workforce and a positive power dynamic. Healthy relationships are maintained in the workplace for employees to feel supported. Power dynamics determine the balance of authority between different positions. The way this control is balanced ensures a positive work environment for employees to feel secure and respected. The healthier an employee's well-being is, the better their work quality becomes. Employees become more engaged and committed as their work satisfaction increases. This directly correlates to the success of a company as one of the most important components that define a successful company is liquidity. Higher work quality and performance lead to more profit for an organization to thrive and sustain. Control is another quality of a successful business that is highly dependent on power. Control refers to the ability to manage resources, employees, and finances. With the correct power dynamics and authority, control can be sustained and companies can grow further.

Further Directions for Research on Relationship and Power's effect on Business Success

   Relationships go through a cycle of starting and disappearing. An employee can join a job and disappear at any time due to any circumstances. With a longitudinal study on relationships at the lowest and highest points, it is possible to derive insights into relationship sustainability and its effect on a company's success. Power dynamics can also be examined through cross-cultural analysis to analyze a standpoint of different cultural norms and how they can affect the quality of the work environment and the overall success of a business.

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AI Assisted Diagnosis of Mental Health Conditions By Anika Patel

Abstract

Mental health disorders among adolescents are increasingly prevalent, highlighting the need for accurate diagnoses and effective treatments. This study utilized a neural network to analyze symptom overlap in patients with single versus comorbid mental health diagnoses, aiming to improve diagnostic accuracy. It was conducted using Kaggle's Mental Illness Dataset, which includes demographic data, symptoms, and diagnoses from 3,753 patients. The neural network's performance was evaluated, revealing a difference in effectiveness between the original dataset and the single diagnosis subset. Results indicated that the model performed better with the original dataset, which presented distinct patterns of symptom presentation, facilitating more accurate predictions.This distinction emphasizes the importance of considering the complexity of mental health conditions, as symptoms can vary significantly between patients with single and comorbid diagnoses. However, limitations of subsetting patients include oversimplification of symptoms and reduced sample sizes. Future research should focus on larger datasets and changing factors like symptom severity to deeper understand and improve treatment approaches in mental health care.

Introduction

Mental health disorders in adolescents are extremely prevalent today. Found in the results of a study from the WHO World Mental Health International College Student project, the top six most common disorders amongst a college population were: major depression, mania/hypomania, generalized anxiety disorder, panic disorder, alcohol use disorder, and substance use disorder (Auerbach et al.). These results were found to have a moderate correlation to numerous variables: older age, female sex, and unmarried-deceased parents (Auerbach et al.). The findings of this study indicated a higher need for mental health services at several colleges (Auerbach et al.).

The authors claim that psychiatric diagnosis can be an unreliable practice and different measures should be taken (Aboraya et al.). They believe that the diagnosis of these patients should not solely rely on clinician validity, as there are numerous factors that could lead them to the wrong diagnosis (Aboraya et al.). This could be a result of the psychiatrists interviewing skills, or simply the validity of the patient's words (Aboraya et al.). To improve this issue, the authors have proposed an acronym: DR.SED - diagnostic criteria, reference definitions, structuring the interview, clinical experience, and data (Aboraya et al.). To address the unreliability of psychiatric diagnoses, AI models have been developed to improve accuracy by identifying patterns in patient data that clinicians might overlook**,** enhancing both diagnosis and treatment recommendations (Timmons et al.). However, researchers warn that without safeguard to reduce bias, these models could continue social inequities, especially if trained on biased data (Timmons et al.). In my project, I used a neural network to analyze symptom overlap between different mental health diagnoses, aiming to improve diagnostic accuracy. By comparing model

performance on single and comorbid datasets, I'm investigating how diagnosis complexity impacts prediction accuracy.

Method

Dataset

The dataset used for this analysis can be found from the following address: https://www.kaggle.com/datasets/karanbakshi1/mental-illness-dataset This dataset contains patient information, including demographic data, symptoms, and mental illness diagnoses. The key variables include symptoms (like anxiety, mood changes, or suicidal ideation), diagnoses (such as depression, schizophrenia, or bipolar disorder), and comorbid conditions (e.g., substance abuse). The dataset is designed to facilitate understanding of patterns and relationships between various mental health diagnoses and associated symptoms. There were 3753 patients and 53 symptoms that were recorded in the original dataset.

Identification of top symptoms in single-diagnosis patients

To prepare the data for analysis, I first filtered the original dataset ('data_original') to create a subset, 'single_diagnosis', which contains patients with only one mental health diagnosis. There were then 394 patients that were found to have a single diagnosis. The remaining patients, with multiple diagnoses or comorbidities, were kept in the original dataset. This filtering allowed for a clearer comparison between patients with a single diagnosis and those with comorbid conditions. Additionally, relevant variables like symptoms were analyzed across these two groups to facilitate the Venn diagram analysis, which compared symptom overlap. The function generates a bar graph to visualize the top 10 symptoms correlated with a specific mental health diagnosis using phi_k. Phi_k is ideal for categorical data: relationships between symptoms and diagnoses. First, the dataset is filtered to include only patients with a single diagnosis, converting symptom columns to boolean values. The phi_k correlation matrix is then calculated. The top 10 symptoms are identified, ranked, and plotted in reverse, with correlation values displayed on a bar plot. The top variables became the most frequently occurring symptoms in each group, and were used to construct the Venn diagrams.

Neural Network

The neural network starts with an input layer that takes in all the features from the dataset, like symptoms and diagnoses. Then, it has three hidden layers: the first has 128 neurons, the second has 64 neurons, and the third has 32 neurons. These hidden layers help the model find patterns in the data. To make sure it learns the features/patterns, I used the ReLU activation function, which decides when the neurons should pass information forward. At the end, the output layer uses a softmax activation function, which helps the model predict which diagnosis is most likely by turning the results into probabilities.

To assess the performance of the neural network, I used several metrics to check how well the model predicts diagnoses. The metrics include: accuracy, which measures the overall percentage of correct predictions; precision, the ratio of true positive predictions to total predicted positives; hamming loss, the fraction of incorrect labels to total number of labels; jaccard similarity score, gauges the similarity between two sets by comparing their intersection to their union; and exact match ratio, which requires all labels for a sample to be predicted correctly.

Results

Neural network

The performance of the neural network was evaluated on both the original dataset and single diagnosis dataset. For the single diagnosis dataset, the model had a mean Hamming loss of 0.034388, a Jaccard similarity score of 0.904641, and an exact match ratio of 0.896624. In contrast, the original dataset had a mean Hamming loss of 0.018047, a Jaccard similarity score of 0.967325, and an exact match ratio of 0.913360.

Hamming Loss: Mean = 0.034388 (95% CI: [0.032909, 0.035868])
Jaccard Similarity Score: Mean = 0.904641 (95% CI: [0.90, 0.909283])
Exact Match Ratio: Mean = 0.896624 (95% CI: [0.892135, 0.901114])

Anxiety

The Venn diagram comparing the symptoms of patients with a single diagnosis of anxiety versus those with anxiety as part of multiple comorbidities shows overlap (Figure 4). Core symptoms shared by both groups include 6 month duration and sleep disturbance. These symptoms are universally recognized in anxiety disorders, regardless of comorbidity. However, symptoms like irritability and fatigue are more prevalent in patients with multiple comorbid conditions, suggesting that comorbidities may exacerbate or introduce additional symptoms not as commonly seen in isolated anxiety cases.

Depression

For depression, the analysis highlights the overlap of key symptoms such as persistent sadness, loss of interest or pleasure, and fatigue across both patient groups (Figure 3). While these symptoms are common in all forms of depression, the comorbidity group shows a higher incidence of intrusive memories and suicidal ideation, indicating that patients with multiple mental health issues may experience more severe or diverse depressive symptoms. This may suggest that comorbid conditions intensify the manifestation of depressive symptoms.

Bipolar Disorder

The Venn diagram for bipolar disorder shows much overlap similar to depression. Shared symptoms like racing thoughts and inflated self-esteem are found in both the single diagnosis and comorbid groups (Figure 1). However, symptoms such as restlessness and recklessness are more common in the comorbidity group, indicating that these patients might have heightened manic episodes when other disorders are present. This suggests that comorbid conditions may influence the intensity or presentation of mania in bipolar disorder patients.

Schizophrenia

In patients diagnosed with schizophrenia, the analysis highlights core shared symptoms like hallucinations, delusions, and disorganized thinking (Figure 2). These are characteristics of schizophrenia regardless of the presence of comorbid conditions. However, patients with multiple diagnoses exhibited more symptoms of catatonic behavior and diminished emotional expression. This suggests that additional mental health issues could compound the cognitive and emotional challenges faced by individuals with schizophrenia.

Discussion

Top Features in Single vs. Comorbid datasets
Catatonia was found to be an enriched symptom in patients with comorbidity status (Figure 2). According to the National Center for Biotechnology Information (NCBI), treatment of catatonia can occur through several distinct interventions (England et al.). These include: benzodiazepines and electroconvulsive therapy (ECT) (England et al.). Benzodiazepines are a type of medication that enhances the effect of a neurotransmitter called GABA, which calms the nervous system and can help alleviate symptoms of catatonia (England et al.). ECT, on the other hand, involves applying controlled electrical currents to the brain to trigger a brief seizure, which can reset abnormal brain activity associated with catatonia (England et al.).

Hallucinations were found to be an enriched symptom in patients with a single diagnosis of anxiety (Figure 4). According to the National Center for Biotechnology Information (NCBI), hallucinations can occur in anxiety disorders, particularly when anxiety is severe or linked to trauma (Chaudhury). Treatment options for hallucinations associated with anxiety include antipsychotic medications and cognitive behavioral therapy (CBT) (Chaudhury). Antipsychotics work by altering dopamine levels in the brain, which helps reduce or eliminate hallucinations (Chaudhury). CBT helps patients address the underlying anxiety that may trigger hallucinations, teaching them strategies to manage stress and anxiety effectively, which in turn can lessen or prevent hallucinatory experiences (Chaudhury).

One of the unique findings of the current approach, subsetting patients based on diagnosis, is that it reveals significant differences in symptom presentation between patients with a single diagnosis and those with comorbidities. For example, I found that hallucinations were more common in single-diagnosis anxiety patients, while symptoms like catatonia were enriched in those with comorbid conditions. This distinction is important because it shows that

comorbidity status can significantly impact symptom patterns. With this insight, treatments can be tailored more effectively to address the specific needs of each group. Patients with comorbidities might need more complex treatment plans that address a broader range of symptoms, while those with a single diagnosis can be treated with a more focused approach. This ability to identify unique symptom sets based on comorbidity status can improve treatment outcomes by allowing healthcare providers to apply targeted, individualized interventions.

Neural Network performance: Single vs. Comorbid datasets

The results indicate that the model performed significantly better with the original dataset compared to the single diagnosis dataset. The original dataset revealed distinct patterns in symptom presentation and relationships between different mental health conditions, which contributed to accuracy and predictability in diagnosis. For example, the model identified overlapping symptoms common to multiple diagnoses, such as anxiety or fatigue, allowing it to recognize shared characteristics and associations. This increased the model's ability to differentiate between conditions, especially in patients with comorbidities. In contrast, the single diagnosis dataset presented challenges that limited the model's effectiveness. It often highlighted generalized symptoms that could be applied to multiple disorders, making it difficult to draw specific conclusions about individual conditions. The lack of variety in symptom patterns in the single diagnosis group led to less accurate predictions, revealing the complexity of diagnosing mental health disorders when only a single diagnosis is considered.

Limits of subsetting patients

One limitation of subsetting patients based on diagnosis is that it may oversimplify the complexity of mental health conditions. By dividing patients into single diagnosis or comorbidity groups, important variations within each group can be overlooked. Subsetting also reduces the sample size for each group, which may limit the reliability and generalizability of the results. Additionally, the overlap of symptoms in patients with comorbidities can make it difficult to clearly differentiate between conditions, leading to potential errors in classification. This method may also ignore factors like environment or access to care, which can impact symptoms and treatment response. Another limitation is that symptoms might change over time, meaning the initial groupings may not reflect the patient's condition later on. Overall, subsetting gives useful insights but does not fully capture the complexity of mental health disorders. More research is needed to find better ways to account for the complexity of mental health conditions. I would recommend using larger datasets or considering factors that change over time (Ex/ severity of symptoms).

Multi diagnostic   Single diagnosis

- More than one month of disturbance

- Restlessness

- Recklessness

- Increase in goal-directed activity

- Racing thoughts

- Inflated self-esteem

- Distractibility

- Excessive involvement in activities
With high potential for painful
Consequences

- Decreased need for sleep

- More talkative than usual

- Hallucinations

- Delusions

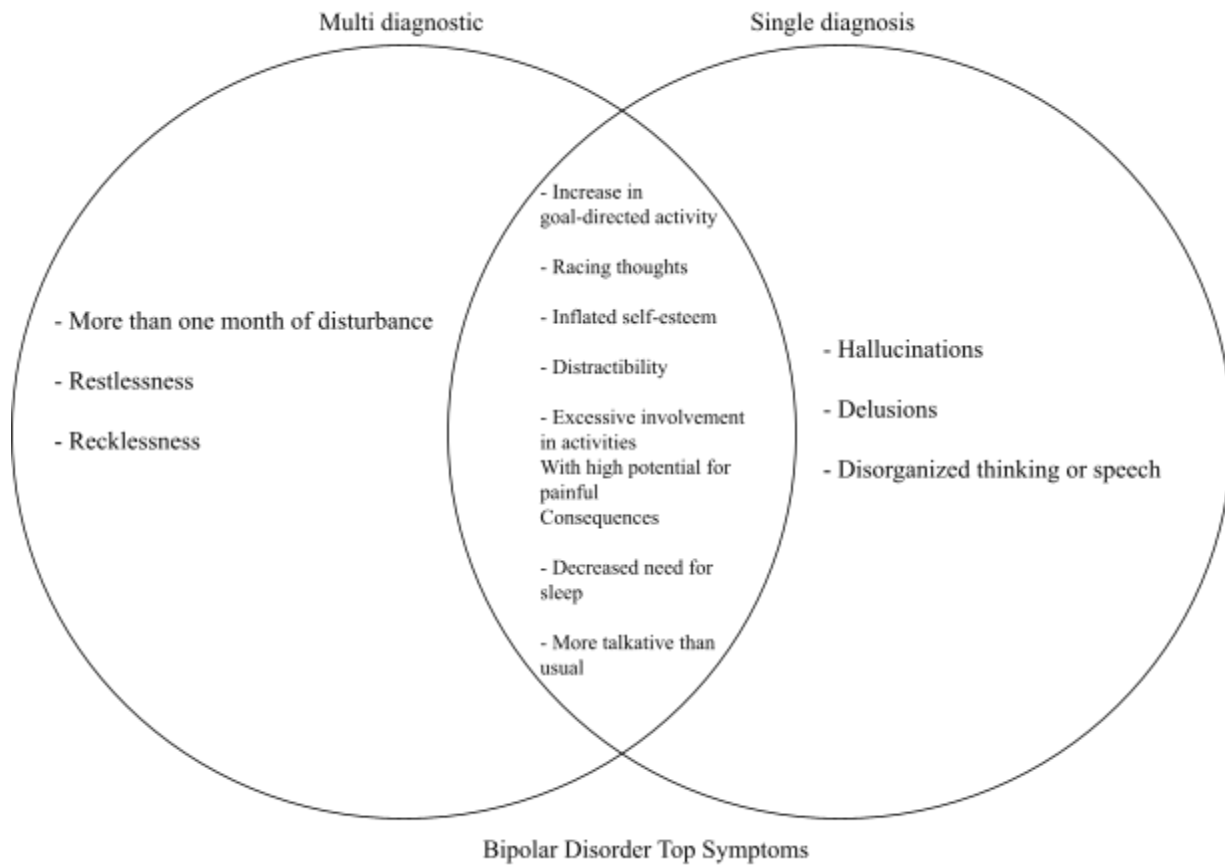- Disorganized thinking or speech

Bipolar Disorder Top Symptoms

Figure 1: This Venn diagram shows the overlap in symptoms between patients with a single diagnosis of Bipolar Disorder and those with multiple comorbidities. The diagram highlights the shared symptoms as well as those that are unique to each group.

Multi diagnostic

- 1 month duration

- intrusive memories or flashbacks

- diminished emotional expression

- catatonic behavior

- more talkative than usual

- recklessness

- the disturbance is not substance induced

Single diagnosis

- increase in goal-directed activity

- excessive involvement in activities with high potential for painful consequences

- racing thoughts

- inflated self-esteem

- distractibility

- decreased need for sleep

- 6 month duration

- delusions

- hallucinations

- disorganized thinking Or speech
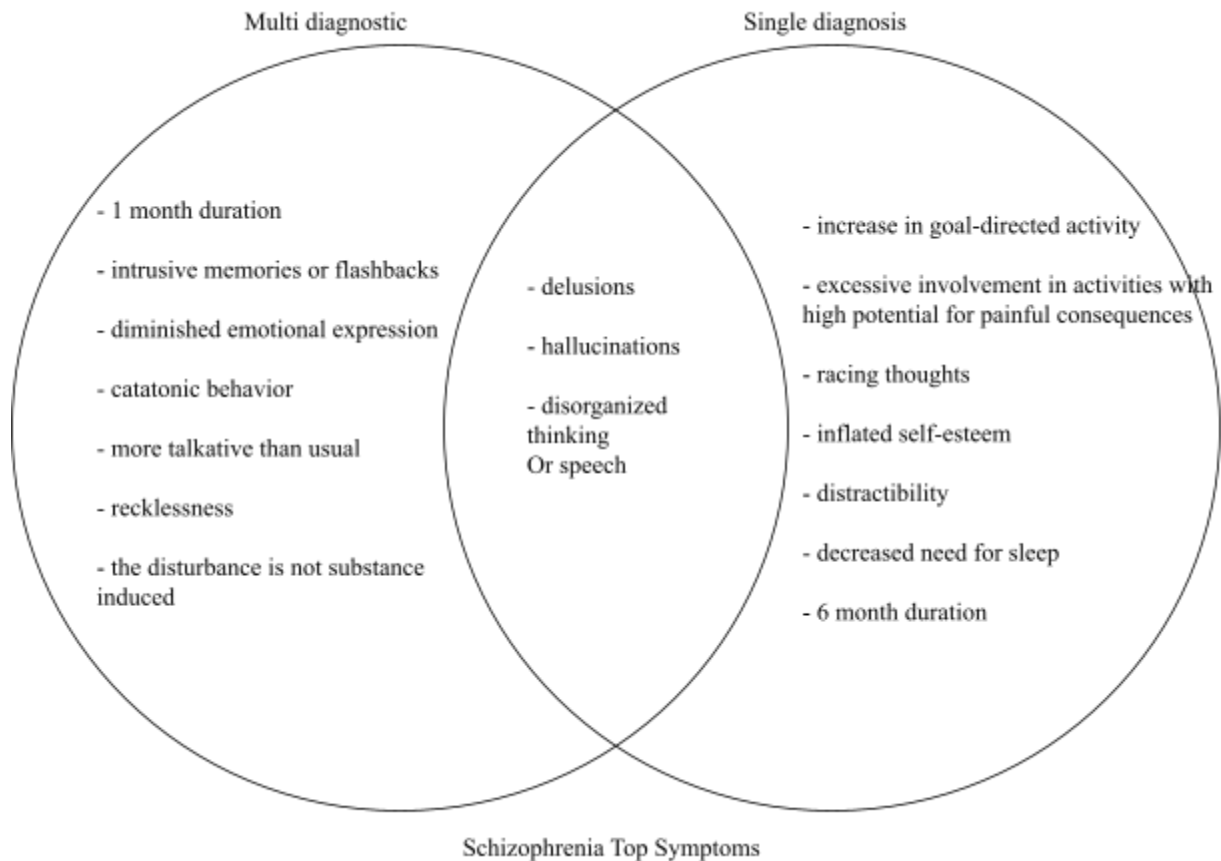
Schizophrenia Top Symptoms

Figure 2: This Venn diagram shows the overlap in symptoms between patients with a single diagnosis of Schizophrenia and those with multiple comorbidities. The diagram highlights the shared symptoms as well as those that are unique to each group.

Multi Diagnostic   Single Diagnosis

- loss of interest or pleasure in activities

- lack of sleep or oversleeping

- fatigue/loss of energy

- depressed mood

- difficulty concentrating or making decisions

- weight loss/gain

- persistent sadness or low mood

- psychomotor agitation

- thoughts of suicide

- intrusive memories or flashback

- disorganized thinking or speech
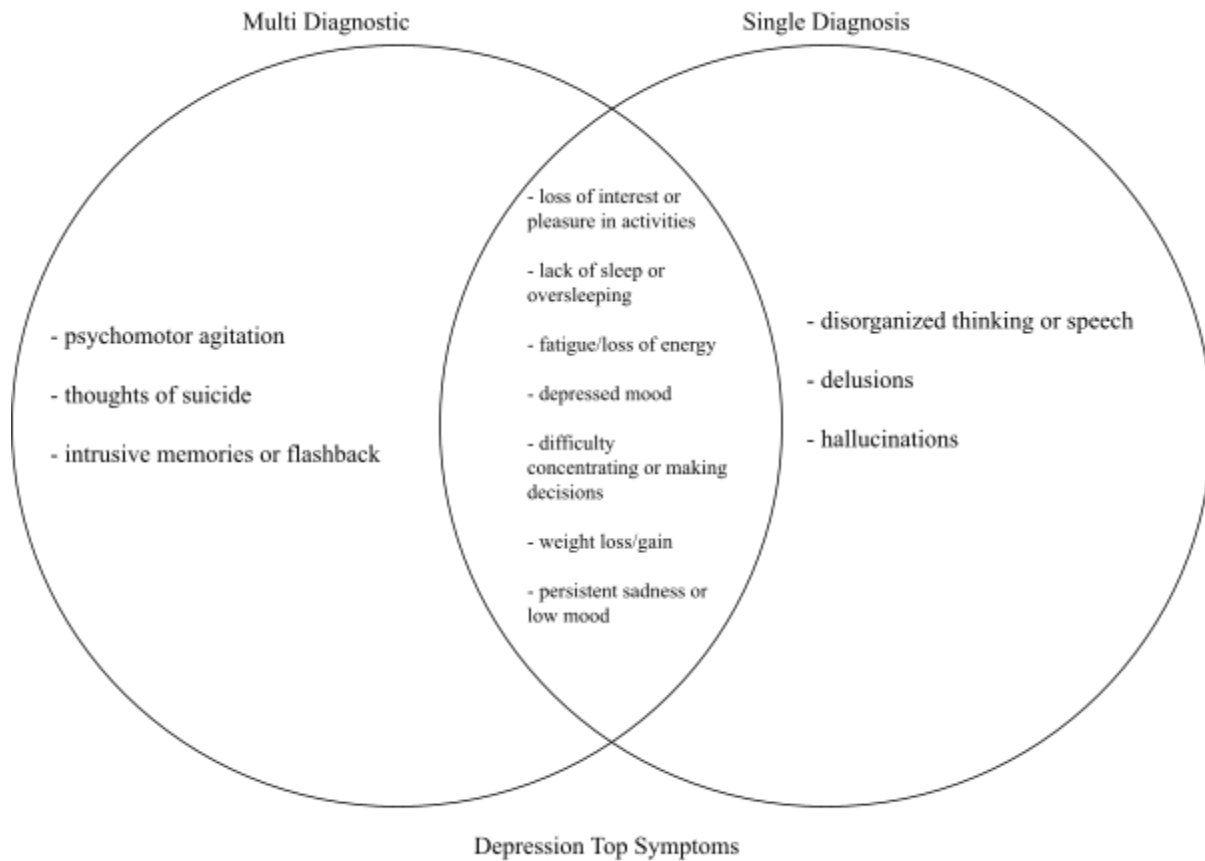
- delusions

- hallucinations

Depression Top Symptoms

Figure 3: This Venn diagram shows the overlap in symptoms between patients with a single diagnosis of Depression and those with multiple comorbidities. The diagram highlights the shared symptoms as well as those that are unique to each group.

Multi Diagnostic

- irritability
- difficulty concentrating
- fatigue
- restlessness
- excessive worry or fear
- dissociative reaction
- depressed mood
- persistent negative emotional state

- 6 month duration
- sleep disturbance

Single Diagnosis

- delusions
- hallucinations
- disorganized thinking or speech
- racing thoughts
- persistent and exaggerated negative belief about oneself or the world
- angry outburst
- intrusive memories or flashbacks
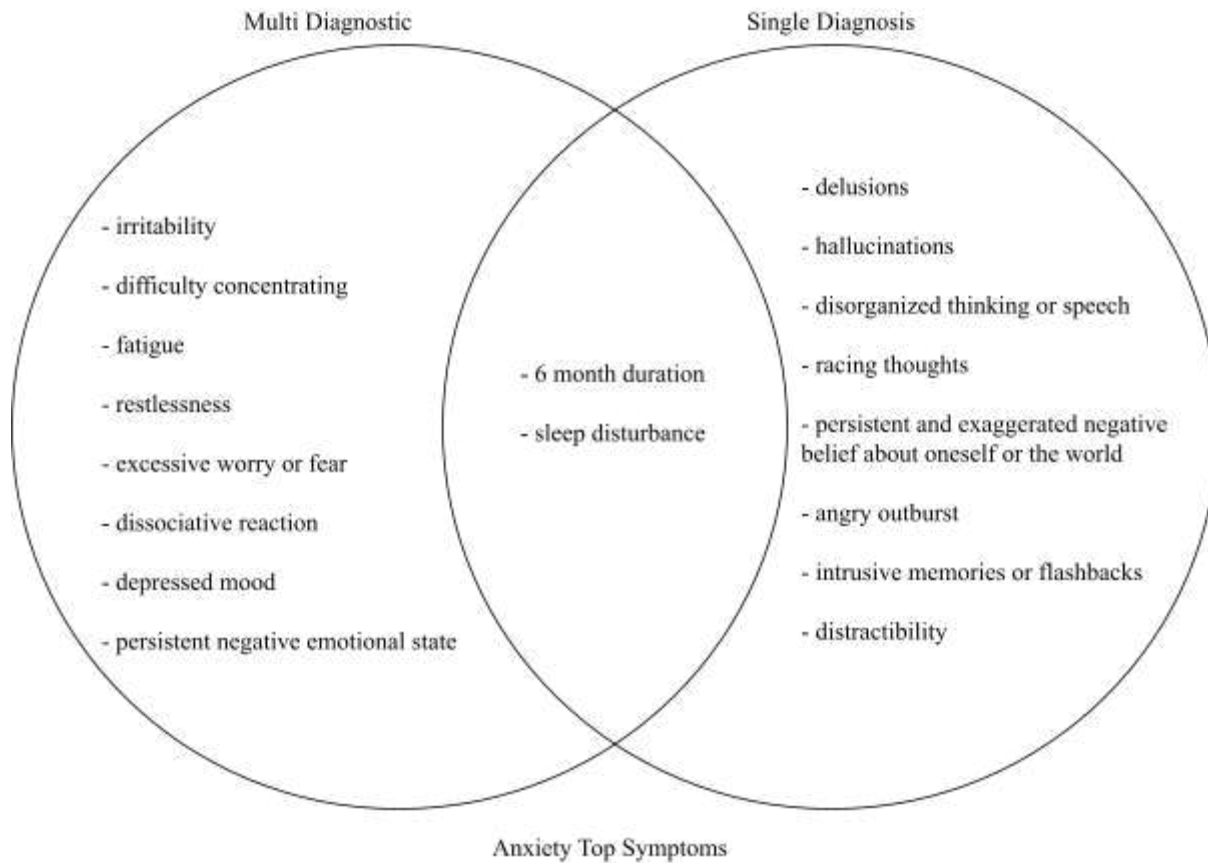- distractibility

Anxiety Top Symptoms

Figure 4: This Venn diagram shows the overlap in symptoms between patients with a single diagnosis of Anxiety and those with multiple comorbidities. The diagram highlights the shared symptoms as well as those that are unique to each group.

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Rising Trends in Makeup Among Generation Alpha: Implications for Psychological Development By Chloe Jung

How have new trends in make-up usage risen among Generation Alpha, and what are their long-term psychological effects?

Abstract

Currently, there has been a huge rise in the use of high-end make-up products among pre-teens. Here I present a literature search investigating this recent trend. Specifically, I identify its initiation in the Covid-19 pandemic with the rise of newer social media platforms like TikTok and careers like "influencing." I elaborate on changes in business strategies as they relate to targeting younger audiences and the impact of this type of marketing on the psychology of young girls, as well as the long-term psychological effects of make-up usage. However, work in this space is limited, so we also highlight suggestions for future research and make relevant suggestions for parents.

Introduction

Societal expectations of women's appearance have been prominent for centuries (ex: Venus, Paris Hilton, Kim Kardashian) and have consistently fluctuated (for example, within a decade expectations changed from a Paris Hilton body type (tall, slim, rectangle figure, comparable to a "classic" supermodel) to a Kim Kardashian body type (average height, slim waist, wide hips, "hourglass" figure, and ultra curvaceous). Given how quickly societal changes occur, the same woman can experience cognitive dissonance (the psychological phenomenon when an individual feels discomfort/stress from another's ideas, beliefs, and values contradicting their own (Joel, 2019)) because across different decades of their lives the societal expectations completely change. This swinging of the pendulum from one expectation to the next is happening more and more frequently now with the advent of social media. This paper aims to discuss how the advent of "Sephora Kids" and changes in make-up use among Generation Alpha (children born from 2010 to 2025) have risen due to social media and changes in marketing, as well as, its potential psychological ramifications and causes.

"Sephora Kids Endemic" described

It is believed that this recent trend of younger kids wearing make-up started as a function of the COVID-19 pandemic. Before the pandemic, many more parents would prevent kids from using apps that were not for the recommended age. However, during the pandemic, kids were deprived of social interactions with one another since they were not going to school. After so many days, months, and years of staying at home, parents became more lenient with the allowance of social media to keep their kids entertained (Jennings & Caplovitz, 2022). Parents allowed children to use apps that would provide entertainment – i.e., TikTok which children began being influenced by.

The earlier use of social media among this new generation led to a shift in the perspective of childhood. Rather than playing and getting active and diverse human interaction in schools, children began to turn to social media for role models. This meant mentally they felt as if they were more mature or older in many aspects. And being away from others, especially kids their age might've contributed to forgetting what kids their age truly act like. Young kids started looking up to 20-year-olds for fashion and more importantly, make-up advice. Here, we suggest that children started to reconstruct themselves in the way they deemed as trendy along with the way they wanted to be perceived (in a way that was not age-appropriate). Constantly being on social media, and looking up to attractive, well-dressed people led young children to drift away from their normal child-like activities and pay more attention to the way they looked. The pandemic also gave rise to the idea of a "glow-up"; the lockdown was a great time to change yourself "for the better" such as learning how to dress, do makeup, hair, nails, and workout. This was not only a fad among adults, but also among young children. Access to social media created a dissociation between their actual "age group" and who kids were acting like. Once you start looking up to people much older, you subconsciously want to act like them or as a peer.

Table 1 below describes how many adults are posting about this 'Sephora Kids' endemic and highlights how it has generally been negative. This will be discussed more below.

Transitions in marketing towards younger children
A recent study (Medley *et al.,* 2023) demonstrated that between 50 and 65% of male and female children are using body products with over 20% using other make-up products (see **Fig. 1** for more detailed information). Specifically, over 20% of young females are using all other types of products including eye and face makeup, etc. They also investigated why these products were being used, finding that 'play' was the most common reason and that kids were most often using these products due to marketing.
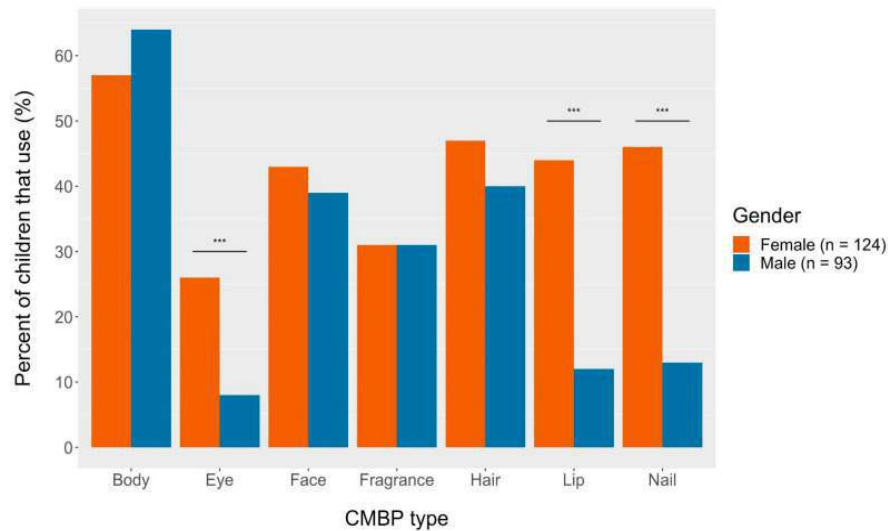
Fig. 1. Figure from Medley *et al.,* (2023) demonstrates the percentage of children using different types of products. Gender identity includes both cis- and transgender children. CBMP stands for children's makeup and body products.

Marketing in social media has changed how it inspires individuals to want to partake in a specific aesthetic. A big part of this is that rather than looking at the traditional My Little Pony or Barbie commercials that millennials grew up looking at, Generation Z (born YEARS 1997-2009) and Alpha children (born YEARS 2010- 2025) are looking at influencers, which are typically much older than they are (~ages 15 - 30). We see many influencers doing YouTube vlogs (video blogs) and "get ready with me"-style videos in which they show off their very attractive lives. Seeing these influencers live a comfortable lifestyle, allows the kids to romanticize the products and associate them with a given aesthetic or lifestyle. Therefore kids are buying products that are much more than they should be able to afford and that past generations allowed their children to have access to.

As a function of this, the target audience for many products at stores like Sephora has changed to be younger and younger. Studies show that consumers decide on purchasing a product within the first 90 seconds (Singh, 2006) and marketing decisions are capitalizing on this and making products appeal to younger audiences. For instance, we see a lot of fun and vibrant colors with childlike scents such as: watermelon, birthday cake, and strawberry in products, notable brands being Glow Recipe [$40] and Drunk Elephant Protini Polypeptide Cream [$69]. Color alone contributes up to 90 percent of the information that forms the decision. This suggests that marketers must understand how the colors they use affect consumers' ability to differentiate products and identify brands (. It is well-demonstrated in more controlled psychological research experiments that individuals prefer streams of information that are congrous as opposed to incongruous (Naefgen *et al.,* 2022; Goller, Kroiss & Ansorge, 2019); people essentially prefer information that is aligned with expectations and conflicts in this, trigger avoidance (Dignath & Eder, 2015). Therefore, brands are choosing and sticking to specific color palettes to make them both more appealing and recognizable. Further, social media marketing now no longer uses

one-long-term video, rather influencers split videos into pieces which makes it more addicting and that repetition increases the likelihood of being influenced (Zhang et. al, 2019):
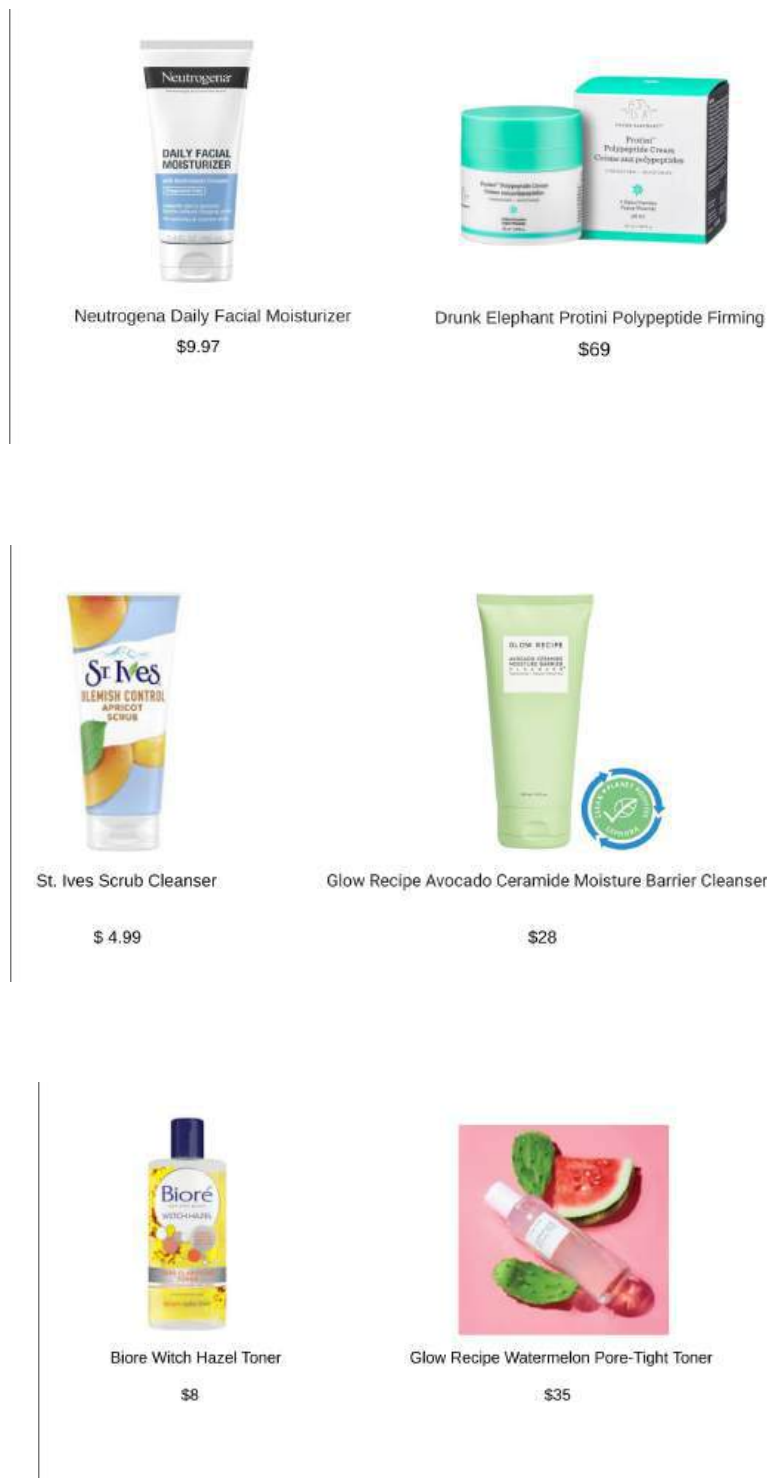

Neutrogena Daily Facial Moisturizer
$9.97

Drunk Elephant Protini Polypeptide Firming
$69

St. Ives Scrub Cleanser
$ 4.99

Glow Recipe Avocado Ceramide Moisture Barrier Cleanser
$28

Biore Witch Hazel Toner
$8

Glow Recipe Watermelon Pore-Tight Toner
$35

Fig 2. Price comparisons indicate how much more expensive current products are (right) than they are in their drugstore counterparts (left).

In addition to kids having more interest in these types of "mature" products (ex: children are buying retinol which are meant to be "anti-aging" products that anyone at their age does not need), we also see changing trends in terms of how parents are responding to their child's interest. Moms are very enthusiastic about their kids getting into beauty and cosmetics. For instance, as written by millennial mom blogger House of Hipsters *I made a pretty big deal about Zoe's first-time visit to Ulta Beauty and Sephora. Shopping for makeup at legit beauty stores as a young girl is a milestone. It's exciting. A step into womanhood if you will*. A big reason for this transition is that moms are now part of the millennial generation.

Millennial moms grew up during the rise of social media and the internet. As they were bombarded with the new phenomenon of teenage skincare and makeup, they bought what was trendy. Years later, dermatologists and other social media influencers are now coming out to say how horrible the quality of those products was. These moms are now starting to see better quality products which happened to be the more expensive ones and want to provide their kids with what they think is best for their skin. The question is are those expensive products truly better for their child's skin and do they know how to use those products and when? [Some notable cosmetic products popular for the millennial generation include baby lips chapstick ($3-5) while nowadays lip balms such as Summer Fridays and Laneige are anywhere between ($22-24)]. Out of 1,000 surveyed parents between the ages of 28-43 (as of 2024), many claimed that they wanted to take a different route from their own parent's parenting style and reach out for advice through social media. Notably, many first or second-generation immigrant kids are now parents who have been raised in a strict and conservative household now wanting to do the opposite for their children and "keep up with the times" to ensure they're being reasonable with their decisions. We also see that millennial moms believe that up their allowance and going to a store to buy something rather more expensive is a way to teach the value of money. They are proud of their children for being confident enough to go to stores filled with older people and the things they want. To better understand how moms nowadays perceive make-up use in young kids, we did our form of data analysis. We looked at the blogs on the Sephora website and searched the term 'Sephora Kids' and then ran a content analysis on what they were saying, as well as a sentiment analysis to get a better sense of their perspectives. Posts ranged from 1/19/2024 to 6/26/2024. Examples of the posts are shown in the Table below along with their data and their sentiment score computed using Vader (Hutto, C.J. & Gilbert, E.E. (2014)). Posts also highlighted that generally, societally, people felt quite negative towards the presence of kids in Sephora (even if moms were supporting it).
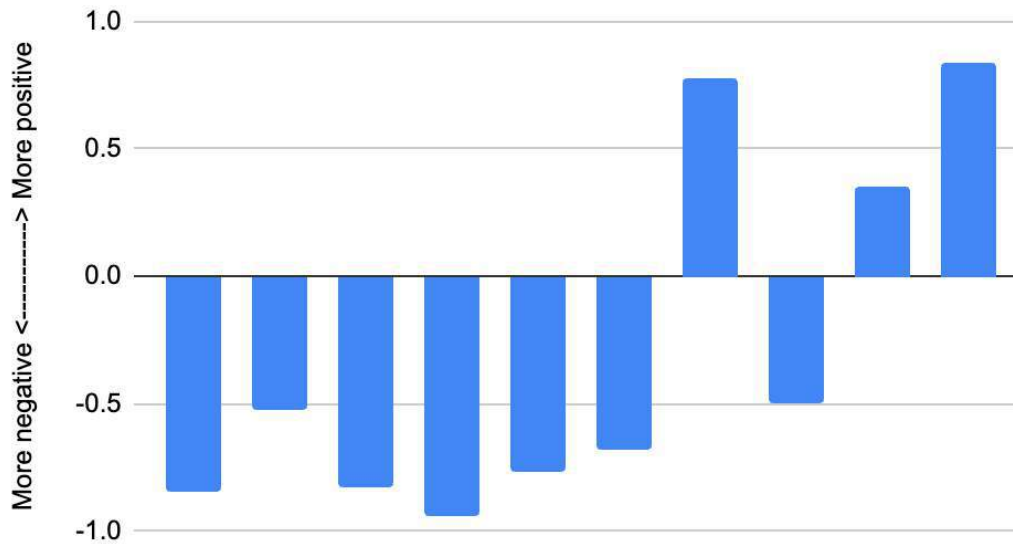
Sentiment score across posts

Fig. 3. depicts a sentiment score of comments left on the Sephora Website revealing predominantly negative sentiment. Key phrases such as "annoying," "harsh," and "do not clean up" frequently appear highlighting the customer's dissatisfaction with sharing the store with the younger generation.

Date	Description	Neg.	Neutral	Pos.	Compound
01-19-2024	Hey I've seen more and more children who are 13 or under going into these stores destroying brands and being disrespectful toward employees. It's very **unfortunate** because when I try to use the used products to try it out, they always look messy or they're put away due to these kids. Not just that but it's all over social media 😖 so if Sephora hasn't done already, they should create an age restriction, so this problem won't happen again."	0.148	0.821	0.031	-0.8467
1-23–2024	"The last time I went in a store the testers were being trashed by little girls and I said excuse me so I can grab my one skincare product I came for, and they said "back off" and tried to push me away. The store was crowded with like seven-year-old girls all in the glow recipe and drunk elephant section! I'm a high schooler and used to love. Going to Sephora anytime but now I dread it! FIX THIS SEPHORA!!"	0.085	0.846	0.068	-0.5216
08-01-2024	" you probably have all been hearing about the support kids typically aged from 7 to 10 year old being obsessed with all of the trending skincare/makeup brands, such as, **drunk, elephant, glow recipe,** MILK, summer Fridays, etc. but skin care brands like drunk elephant have things that are really **harsh and bad** for Jung skin like theirs, but they unfortunately do not understand that when be	0.175	0.691	0.134	-0.8275

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Date	Review				
	very kind Sephora employee tells them that they do NOT need retinol. They also unfortunately make a mess of the testers and make "skin care smoothies" that the employees always result in cleaning up. Due to the behavior, some Sephora had to take weight testers. They are **rude to employees** and for no reason at all! Granted you should not be rude to anyone, but they did not do anything to the customers. Some Sephora kids are surprisingly kind and polite when the employees talk to them whether it is about a product, not being safe for them or just talking to them in general. This is how everyone act when talking to someone in Sephora but generally in life.#bekind #Stopspoiledseohorakids				
6-26-24	"I cannot with the kids at Sephora that are younger than 12 years old. I was sadly a witness of how horribly the employees and customers are treated. The area **drunk elephant** is the worst part of it all. They **do not clean up** after themselves, destroy the testers, and open the new products in its packaging. I think Sephora needs to be a little more aware of what products they're using on their skin. I was at Sephora with my mom and I'll was crying really loudly the whole story I could hear it. The mamas arguing with her about what products she should put in the basket basket. The worst part was that the girl is seven years old and her mom Elephant retinal serum. I think the parents let them buy whatever they want because their kids and they live once; they should let their kids enjoy their time. I think would be to put a kids section in support with popular brands that aren't dangerous to their bases. Sorry for writing a lot just sharing my opinion."	0.15	0.773	0.077	-0.9393
2-24-2024	"Hello! I was at Sephora tonight and I was dumbfounded about the number of young girls in the store. Teens are one thing, but these girls have been in fifth or sixth grade. I typically love shopping at Sephora - such a treat- but tonight I was **horrified and annoyed.** These young girls are running around, running into me, screaming across the store, blocking the isles. I am in my 40s, I have a career, and I can afford to finally shop high-end, so why is it that these KIDS also get to shop there? Yes I know it's their parents money, but these kids are way too **immature** (both physically and mentally) for the store and it's absolutely ruining the experience for women like me or typical Sephora customer. By the way is the same.- full of the minimum 15. Otherwise, I will not be shopping in person anymore at the store. It was too awful."	0.138	0.763	0.099	-0.7705
1-29-2024	"hi! My name is Peyton and I often go to Sephora with my kids! They are five, seven, and 13. My 13-year-old always goes to Sephora with her friends, but has been having many encounters for employees. She was testing a rare beauty blush when employee came up to her and yelled at her for being messy with the products. She was just trying it out, unacceptable. I also went into Sephora wish my five yr and 7 yr. I let my five-year-old run about because she was in the stroller the whole day. She by accident ran into the	0.136	0.749	0.115	-0.6833

	drunk elephant shelf and a moisturizer fell on her head! It had a gross " skin care smoothie" and it was all over her. Then an employee has the audacity to yell at my daughter saying she needs to leave the store because she made a huge mess with the smoothie. Was my daughter, the one who made the smoothie. Another time, my seven-year-old is being filmed by TikTok or while she was testing the anti-aging cream from junk elephant. I screamed at the man filming and my daughter told him to delete the video. He refused and then this Sephora employee back to him up! I was so mad. My new favorite place to shop. There's so much nicer to young kids. Sephora do better."				
4-05-2024	"You're pretty out of line here. Your daughter was running around a luxury cosmetic store (for your and her convenience/ comfort might I add), **destroy** an expensive product and you think YOU deserve an apology? Have some respect, corral your kids and consider letting her run any Bild bear or other kid friendly environment. Would you say the same if she **shattered** a crystal vase? Unbelievable	0.086	0.715	0.2	0.7757
2-11-2024	Kids are kids that's what they do. But you do have to supervise your children… A five year old shouldn't be running around at Sephora and knock out things or mess with samplers…	0.095	0.905	0	-0.5
	OK, I just have to say a couple things. These children's parents have to stop letting the kids being mean or being dirty. They are not the only ones at the store. **Children fighting** over **drunk elephant,** and messing around like they're at home. Parents please be responsible. Also why is this 10-year-old shopping at Sephora and not Claire's? **Ridiculous!**	0.14	0.686	0.174	0.3474
	I just thought I would come on here to see if anyone else is having issues with young teens/children damaging products at their Sephora store? I know that's the forest be we become the new Claire's for kids, and buying **drunk elephant** products that are full of active and retinoids that are **horrible** to kids skin in the latest general Alpha trend, but the testers are getting destroyed. Everything from kids mix, skincare and make up testers together to make "smoothies" to opening new make up packages and seeing a lot of people posting online who are having similar experiences. Either Sephora needs to enforce an age restriction or they need to be supervised and have to pay for products they destroy. Parents please please please supervise your kids. even if you're sending them off thinking they wouldn't do that, you don't actually know unless you see it. This way you can also help them make better decisions about which products are safe for their skin and which ones aren't. I'm **concerned** for the younger generation, they need guidance, but this is also **disrespectful** to everyone else shopping at the four up. Let me know if any of you have been seeing the same thing! Thank you!!!	0.083	0.04	0.113	0.8388

Psychological make-up

While make-up wear is often linked to self-expression, there is also a lot of psychological work that demonstrates its linkage to self-esteem. Surveys of American women showed that 78% spent one hour per day on their appearance (e.g., hair treatments, dressing up, and makeup). Davis and Arnocky [18] argue that makeup may be used as a strategy to enhance social status and Frederick and Reynolds suggest that makeup operates like an "appearance-fixing strategy, being a response to emotions and thoughts related to body image." For instance, there has been a recent rise in relevant products that alter features for social standards such as lip liners and applying contours to faces. A big example of this that relates to social media is the advent of Kylie Jenner's "lip kits". Kylie Jenner, one of the most prominent public figures in 2016-2018 was known for her lavish lifestyle, attractive looks, and particularly her lips. She initially got her fans through her family's reality TV show but they started noticing a huge difference with her lips causing speculations of a cosmetic procedure. Capitalizing on this buzz, she came up with a story about the reason for her insecurity about having small lips and launched her brand of lip kits (containing a lip liner and liquid lipstick). She marketed them as her way of achieving fuller lips with just makeup. However, this sparked many ethical concerns as the younger generation was convinced that they could achieve similar results with just the lip kits not understanding it was a cosmetic procedure with good marketing tactics. This rise in social media contributes to this issue as filters and constant promotion of makeup techniques that alter the perception of one's facial structure can lead to dissociation where an individual struggles to reconcile their real self with the image they present to the world.

Importantly, there is a difference between general self-esteem and social self-esteem; general self-esteem refers to how a person feels about themselves relative to others (GET LINK FROM HERE→[8]) while social self-esteem refers to to how individuals feel about themselves during social interactions with others, and how those interactions affect their social value [9]. Vogel and colleagues [15] found that social comparison negatively affected general self-esteem. This is particularly important given the rise of social media. The increase in digital media usage increased the pressure to look as good as possible because people were increasingly exposed to images and videos of very good-looking individuals [16]. Even though many influencers have been caught editing their photos and getting cosmetic surgeries done, the concept of such unrealistic beauty has already been exposed to the impressionable minds of the younger generation, making it seem somehow attainable or something worth trying to come close to. Prior research has investigated this space. For instance, Mafra *et al.,* and Frisén and Holmqvist's [38] results found that women with higher appearance evaluation, i.e. women who were more satisfied with their appearance, tended to spend less money on makeup.

The social change towards younger and younger children using make-up is therefore potentially concerning. This suggests that kids are experiencing concerns about social self-esteem when younger. As kids are exposed to social media and many older celebrities and influencers, girls feel the need to compare themselves and compete for attention from boys (assuming heteronormativity).

There is also, of course, a link to socioeconomic status where high-end products that are increasingly popular relate to social self-esteem. Kids associate products with a certain aesthetic that they want to portray and activities such as doing make-up with friends exacerbate differences and make certain kids potentially feel better in social settings.

Discussion and Conclusions

a. Suggestions for future research that people should be doing!

To conclude, the goal of this paper was to analyze new trends in make-up usage due to social media among Generation Alpha, and the long-term psychological effects.

. However, work in this space is limited, so we also highlight suggestions for future research and make relevant suggestions for parents. Namely, a lot of the discussions put forth here could use more scientific evidence. While a lot of psychological research was referenced, we suggest that newer work should actively test these psychological processes in the younger generation as to how they relate to specifically social media consumption and makeup. For instance, while influencers have talked about how millennials are more open to splurging a little bit given that they grew up with 'bad products', there aren't official analyses or scientific articles that would support this. However, the research does suggest that there may be major ramifications both in terms of dermatology and psychologically with these new trends, so we also suggest that parents become more aware of them.

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The Ethical Implications Of Infant Formula Marketing: Between The Global North And South By Tehani Nguyen Phuoc Buu-Loc

Abstract

This paper examines the differences in infant formula marketing between the Global North and South, and uses Nestle as a case study; highlighting ethical issues and regulatory discrepancies within this marketing. This study also investigates the baby food industry's marketing practices, and how it persistently markets its products, often through digital channels, which has led to significant public health consequences. This is done through a literature review and an analysis of primary sources. In regions where regulations are weaker, particularly in the Global South, Nestle exploits these regulatory gaps, marketing sugary, substandard products as it capitalises on vulnerable populations, including mothers and infants. In contrast, the Global North consists of stricter regulatory frameworks and consumer protections which slightly limit unethical practices, though aggressive marketing still remains. The paper calls for ethical accountability and stricter oversight in global corporate marketing practices, especially within industries impacting infants and public health.

Introduction

The marketing strategies which are employed by transnational corporations, particularly in the food and beverage industry, vary significantly between regions based on regulations and approach to ethical issues. This research paper investigates Nestlé, as well as the baby food industry's marketing practices, and the discrepancies observed in the Global North as opposed to the Global South. The paper highlights the significant ethical implications and regulatory challenges that characterise each region. I suggest that although the marketing of baby food items is a pervasive issue in both regions, the Global South exhibits a more explicit disdain for morality and legal requirements, resulting in disastrous effects on both mothers and infants.

In this paper, I argue that there are evident differences in Nestlé's approach to marketing and consumer engagement, particularly in terms of ethical and regulatory compliance. These differences are most apparent in the Global South, where weaker consumer protections and regulatory oversight allow Nestlé and other baby food companies to prioritise profit over the health and well-being of the vulnerable populations they target. The conduct observed raises serious ethical concerns for businesses operating in regions with weaker regulatory frameworks. Contrarily, ethical considerations are more prevalent, though not entirely absent, in the Global North, which is defined by stricter rules and a higher level of consumer awareness. This contradiction requires a thorough analysis of the relationship between marketing strategies, corporate objectives, and their impact on consumer health outcomes. I draw on a diverse range of sources, which include newspaper articles, academic papers, and websites.

I hypothesised that there will be regulatory and cultural differences across the Global North and South. The argument was supported by the results of this investigation. Surprisingly, however, regulatory breaches were and are not limited to the Global South. Research shows that

aggressive marketing techniques target women in the Global North in similar ways and to similar extents, revealing an alarming absence of ethics that goes beyond geographical boundaries. Despite the fact that mothers in the Global North may be less affected because of their greater levels of education and understanding, they are nevertheless exposed to marketing strategies that may be detrimental to the health of their newborns.

My investigation begins with a literature review, which provides research and analyses that have looked into Nestlé's controversial marketing strategies. An extensive review of a wide range of articles and sources was conducted for this study, with the findings systematically organised by themes and patterns to present a comprehensive analysis of the subject. The complex aspects of Nestlé's marketing tactics are covered in more detail in the discussion section. I will examine the ways in which these tactics vary in the Global South and North, highlighting more general concerns, such as the targeting of vulnerable populations and the ethical challenges that face corporations. The study will include a comparative analysis of various marketing strategies and their impact on consumer health, with a particular emphasis on mothers and infants. Furthermore, the difficulties presented by digital marketing will be investigated, including social media and online advertising, as these means of communication have a growing impact on the attitudes and actions of consumers.

This paper highlights the urgent need for moral and ethical accountability in corporate marketing strategies, especially in industries that have a direct impact on lives, which in this case are those of mothers and young children. The research adds to the ongoing discussions about corporate accountability and responsible advertising in the global marketplace.

Literature Review

This review examines previous studies of the Nestle scandal and the Infant formula industry as a whole, and exposes the multifaceted nature of them. The analysis and synthesis of this literature is crucial for understanding the complexity of Nestlé's involvement in the infant formula industry and its presence in the Global North and South, particularly given how those contexts differ substantially in ethical practices.

Most studies, such as those that are mentioned throughout this literature review, agree that Nestlé's marketing of infant formula in the Global South is controversial and has significant public health implications, including impacts on infant mortality rates. However, there is a divergence in focus between studies that address public health ramifications (Sasson) (Anttila et al.) (Muller) and those that adopt a more corporate-centric view (Baker) (Boyd) (Hastings et al.)

An example of this is one of the first pieces of literature published on this topic, written by James C. Baker in 1985. 'The International Infant Formula Controversy: A Dilemma in Corporate Social Responsibility' explores the ethics of Infant Formula marketing, particularly in Less Developed Countries, with a particular focus on Nestle. Key concepts of the paper include corporate social responsibility, marketing ethics, the Nestle boycott and public health concerns.

Baker analyses transnational corporations in vulnerable markets, using a business ethics framework. He describes the results of Nestle's behaviour., which led to an international boycott

and new international codes, causing major corporate strategy shifts. Baker's work contributes to the literature on business ethics, and confirms corporate legitimacy along with responsibility.

Despite a strong ethical analysis, Baker's study has limitations. It focuses narrowly on Nestle, neglecting broader cases in other industries or countries, and limits the reader's comprehension of general corporate social responsibility. Its business-centric approach prioritises corporate impacts over the harm to infants and mothers, limiting insight into the complexity of the issue.

Baker's work is not the only paper with a more corporate-focused approach. Colin Boyd in 2012 similarly wrote 'The Nestlé Infant Formula Controversy and a Strange Web of Subsequent Business Scandals', which links Nestle's involvement to other scandals, exploring corporate ethics, scandal networks, insider trading and corporate culture. Boyd suggests that Nestle's behaviour is a part of a broader pattern of corporate misconduct, tied to particular individuals who are named and revealed. Boyd's work innovatively reveals interconnected scandals through personal and corporate networks. While his analysis is detailed, the discussion on corporate reform could be more extensive.

Later papers shift the focus from corporate strategy to marketing practices, still addressing public health implications.
A prime example of this is the paper 'Milking the Third World? Humanitarianism, Capitalism, and the Moral Economy of the Nestlé Boycott', written by Tehila Sasson in 2016. Sasson explores Western transnational corporations' role in contributing to malnutrition through infant formula marketing. Key concepts include malnutrition, ethics and corporate responsibility, critiquing capitalism's effects on the 'Third World' and highlighting the tension between profit-driven systems and ethics.

The use of the Nestle boycott case study enables Sasson to reveal how corporations engage in humanitarian narratives whilst exploiting the 'third world'. The boycott exposed contradictions between public relations efforts and harmful practices in vulnerable communities. The paper fits into the broader critiques of globalisation and capitalism, and contributes to the discussion about how effective consumer-driven ethical movements are in creating real change.

One of the strengths of this paper is its thorough analysis of activism against transnational corporations such as Nestle, detailing how consumer activism influences corporate behaviour and public perception. However, the paper lacks a clear alternative framework, leaving the reader to question whether the current system can be transformed beyond consumer activism, which is proving to have limited effectiveness.

This discussion connects with Jesse K. Anttila-Hughes et al. 's 2019 paper 'Mortality from Nestlé's marketing of infant formula in low and middle-income countries'.
This study addresses how Nestle's marketing relates to infant mortality in low income countries, particularly due to unclean water. Using a difference-in-differences model, the paper shows that its formula introduction increased infant mortality by 19.4 deaths per thousand births in households without clean water.

The strengths of this paper are its robust data and large sample size. However, one

weakness of this paper is its inability to isolate Nestle's impact from other formula companies. Nonetheless, it provides essential quantitative evidence of the severe public health consequences of formula marketing.

Together, both these papers provide a comprehensive view of the interplay between corporate practices, as well as their profound impacts on public health and ethical considerations.

'Selling second best: how infant formula marketing works', written by Gerard Hastings, Kathryn Angus, Douglas Eadie and Kate Hunt in 2021 focuses on how infant formula, inferior to breast milk, is sold using emotional and manipulative techniques. The core concept of the paper is the "commercial determinants of ill-health," where formula is marketed despite being less beneficial than breast milk.

This paper introduces emotional marketing tactics: strategies that aim to connect with consumers on a psychological or emotional level to influence their purchasing decisions. It draws on theories from marketing and public health, emphasising how companies create faux relationships with consumers. The study uses a combination of qualitative interviews with marketing experts and analysis of marketing documents to reveal formula industry tactics.

The findings suggest formula marketing exploits mother's concerns, promoting formula despite breastfeeding being healthier. In relation to previous studies, it confirms that corporate marketing, similar to that in tobacco and processed foods, harms public health. The study includes qualitative insights from industry insiders. However, it has a limited geographic focus (UK and Western markets), which may not effectively capture global variations of this marketing.

Among the most influential works, Mike Muller's 2009 paper "The Baby Killer", links the company's aggressive marketing of its formula to soaring infant mortality rates, particularly in regions where the sanitary conditions were unsuitable for formula feeding. However, the work's strength is placed more in its heavy ethical critique and less in statistical rigour. Muller's work brought global attention to the issue and led to the establishment of rules in regards to Infant formula marketing, however, it lacked quantitative data to support its claims entirely. This piece deviates from those previously mentioned, by setting the foundations for the ethical discussions regarding Nestle's actions. Its title says it all, Nestle's formula is a 'baby killer'.

In light of the extensive background provided by the reviewed literature, it is evident that whilst significant insights have been gained into Nestlé's marketing practices and their impacts, certain areas remain underexplored. Despite the wealth of research which focuses on various impacts of this scandal, there is a notable gap in comparative analyses of the marketing strategies employed in disparate contexts. This gap highlights a pressing opportunity for further investigation.

Given the diverse findings and perspectives presented, there is a clear need for a more subtle and sophisticated analysis. A comparative analysis could potentially offer valuable insights into how different marketing strategies affect outcomes in varying environments, such as the Global North and South.

In conclusion, whilst existing literature does provide a strong and rich foundation, the

proposed comparative analysis is crucial for advancing our understanding of how varying strategies lead to different outcomes, especially in populations around the world. It promises a deeper and more refined perspective, which could potentially guide future research and policy development in regards to this area.

Historical Controversies and Health Impacts of Infant Formula Marketing

Infant formula, first developed in Germany in 1865 ("How formula milk shaped the modern workplace"), became popular as more women entered the workforce , and its use peaked after World War II (Brady). However, in higher-income countries, sales eventually declined due to lower birth rates and rising awareness of breastfeeding benefits. In response, companies like Nestlé turned to developing nations in the 1960s and 70s. (Brady) By the mid-1970s, public health activists raised concerns about formula-related infant deaths in low- and middle-income countries, blaming companies for promoting formula in areas with limited access to clean water and health knowledge. Nestlé, the largest supplier, faced criticism for unethical marketing practices in these regions (Muller and Jewett). Public health literature highlights the risk of bacterial infection and diarrheal disease, which increase infant mortality due to illness and dehydration (Mebrahtom et al.), when infant formula is mixed with dirty water. Poor water quality is strongly associated with negative infant health outcomes, especially in low- and middle-income countries (LMICs). Low literacy among caregivers can worsen these risks, as they may struggle to follow instructions on formula labels, further endangering infants' lives ("The deadly toll of marketing infant formula in low- and middle-income countries"). Research indicates that after Nestlé entered the formula market in low- and middle-income countries, infant mortality rose significantly, particularly in homes with dirty water. The risk of mortality increased by 19.35 per 1,000 live births in the five years following Nestlé's entry, a 27% rise from the baseline in areas with unclean water ("The deadly toll of marketing infant formula in low- and middle-income countries"). On July 4, 1977, a boycott was launched in the United States against Nestlé in Minneapolis, USA, by the Infant Formula Action Coalition (INFACT). This boycott soon spread to Australia, Canada, New Zealand, and Europe as a result of worries over Nestlé's strong marketing of infant formulae (Brabeck). As a response, a strong regulation of advertising prohibiting the promotion of baby milk products as being any kind of substitute for breastmilk was adopted by the World Health Organisation in 1981. The code is followed, according to Nestle, "as implemented by national governments" (Neslen). The controversy did not stop there however. The analysis below identifies several significant issues, including misleading marketing claims, unethical use of ingredients, exploitation of weak regulatory frameworks, geographic disparities in product formulation, and the targeting of vulnerable populations. These concerns will be explored in the following discussion.

In recent years, misleading marketing claims have become an issue, gaining attention in newspapers following the controversy. Nestlé was accused of misleading consumers about the nutritional content of their infant formulae (Neslen) and breaking moral marketing guidelines (Meese and Angst). According to a recent report by the Changing Markets Foundation, Nestlé

promoted their infant milk formulas as "closest to," "inspired by," and "following the example of" human breast milk in several countries, despite a UN World Health Organisation (WHO) ban ("Based on science? Revisiting Nestlé's infant milk products and claims • Changing Markets"). The study, which examined more than 70 Nestlé infant formula brands across 40 nations, also discovered that Nestlé frequently disregarded its own dietary recommendations in its marketing ("Based on science? Revisiting Nestlé's infant milk products and claims • Changing Markets"). The company advertised its Brazilian and Hong Kong formulas as being free of sugar "for baby's good health," yet in South Africa, it used sucrose in infant milk formulae (Neslen). The company advertised that its baby milk powders in Hong Kong were healthier due to their lack of vanilla flavourings, despite selling other vanilla-flavoured formulae in the region (Neslen).

      However, the misleading marketing described here is not the primary issue. The larger concern is Nestlé's unethical use of ingredients in its products and its inconsistencies across markets.

Global South vs Global North: A comparative analysis
      Among Nestlé's best-selling infant food brands in low- and middle-income nations are Cerelac and Nido (Syed). Their sales value in this category exceeded $2.5 billion ("Nestle faces backlash from social media, non-profit group – Asia Food Beverages"). In Brazil, the second-largest market globally, projected sales were approximately $150 million in 2022, while India's sales were expected to reach $250 million ("How Nestlé gets children hooked on sugar in lower-income countries"). The majority of Cerelac and Nido products sold in low-income nations do, in fact, include added sugar—often in large amounts (Jeong). Public Eye, a Swiss-based, independent NGO focused on sustainability and development. It advocates for Swiss politics and businesses to uphold human rights and environmental standards in impoverished countries, examined 114 goods offered in Nestlé's main markets in Latin America, Asia, and Africa, and found that 93% of them contained additional sugar. Their research yielded an average of about 4 grams, or roughly one sugar cube, per serving for 66 of the products they studied ("How Nestlé gets children hooked on sugar in lower-income countries"). In the Philippines, Cerelac Rice Cereal marketed to six-month-old infants had the highest sugar content, with 7.3 grams per serving (Jeong). In India (Cerelac Wheat Cereal), every Cerelac infant cereal contains added sugar—roughly 3 grams on average per serving ("Nestlé's sugary baby food in developing nations expose double standards"). In South Africa, the largest market on the African continent, each serving of Cerelac Mixed Vegetable Cereal contains 4 grams or more of added sugar (Brederode and Cronje). In Brazil, around three-quarters of Cerelac baby cereals (known as Mucilon in the country) contain added sugar, with an average of three grams per serving ("How Nestlé gets children hooked on sugar in lower-income countries").
      However, there are stark geographical differences in the sugar content of Nestlé products ("Nestlé Under Scrutiny for Sugar Addition in Infant Products Sold in Developing Countries"). In the Global North, Nestlé tends to market products with a stricter adherence to health standards, particularly regarding sugar content. Nestlé advertises that their biscuit-flavoured

cereals for infants as young as six months old have "no added sugar" in Switzerland , yet Cerelac's biscuit-flavoured cereals in Senegal and South Africa contain six grams of added sugar per serving (Prasad). Similarly, in Germany, France, and the UK, none of Nestlé's infant formula for children aged 12 to 36 months (such as Nestlé NAN Formula) contains added sugar ("How Nestlé gets children hooked on sugar in lower-income countries"). While infant cereals for babies under six months old do not include added sugar, certain infant cereals for young children over a year old do. For example, Nestlé's wheat-based Cerelac baby cereal for six-month-olds sold in Germany and the UK contains no added sugar, but in Ethiopia and Thailand, the same product has almost five grams of sugar per serving ("How Nestlé gets children hooked on sugar in lower-income countries").

Nestle's use of sugar is particularly harmful to infant health in the context of rising obesity rates in low and middle income nations. Since 2000, there has been a nearly 23% increase in the number of overweight children under five in Africa. The rate of overweight children in South Africa is 13%, twice the global average of 6.1% (Goldstein). Sugar that isn't needed is a contributing factor to obesity ("The sweet danger of sugar"), which has serious health consequences like high blood pressure, diabetes, and other cardiovascular diseases (Pakhare). The World Health Organisation has demanded that items intended for infants and young children under three years old not contain added sugar (Ridao). Before turning two, kids shouldn't consume any added sugar ("A ban on sugar for toddlers? New guidance urges vigilance - UW Medicine | Newsroom"). According to studies, including sugar in any kind of food that is given to infants or young children increases their risk of developing a 'sweet tooth'. They begin to favour sweets over other foods,which negatively impacts their diets for the remainder of their lives (Goldstein). Sugar offers flavour and, some would argue, addictive qualities to the food item (Hatanaka). Throughout our lives, these ingredients are detrimental to our health; nevertheless, babies are particularly vulnerable given that their bodies are still developing (Goldstein). At this age, children consume little amounts of food. The food they consume therefore needs to be rich in nutrients to guarantee proper nourishment (Goldstein).

Exploitation of Maternal Anxieties: Global Marketing Tactics in the Formula Industry

The targeting of vulnerable mothers, both in the Global North and South, is also a prevailing issue. Whilst infant formula was developed for valid reasons, such as the fact that some women are unable to breastfeed, its use has expanded beyond this necessity. There are a variety of legitimate reasons as to why infant formula exists. However, the problem arises when formula manufacturers exploit mothers' common concerns, particularly those around insufficient milk production (Pérez-Escamilla et al.). Research published in the *Lancet* suggests that formula companies have not only capitalised on these common anxieties but may also be contributing to the creation of that very fear. By promoting infant formula as an easier or even superior alternative to breastmilk, they encourage mothers to use it when they may be better off breastfeeding (Pérez-Escamilla et al.). This marketing strategy plays on the emotional vulnerabilities of mothers, diverting them from breastfeeding, even when they are physically

capable of doing so (Pérez-Escamilla et al.). Unethical infant formula marketing is therefore not confined solely to the Global South, as previously mentioned, but is also prevalent in the Global North. Large infant formula corporations exploit the aforesaid anxieties of mothers to drive formula sales. They employ a variety of tactics, including targeted digital marketing, to manipulate these concerns for profit. In the following section, we shall explore how these corporations leverage both traditional and digital platforms to influence mothers' feeding decisions.

A report by WHO highlights how formula companies exploit the anxieties of young mothers through sophisticated and contemporary digital marketing strategies. These companies utilise algorithms to track and respond to daily online behaviour, specifically targeting new mothers with crafted advertisements ("WHO reveals shocking extent of exploitative formula milk marketing"). In today's digital age, our online presence, or what we call our 'digital footprint', has significant implications. Our footprint includes everything from social media posts about newborns, to websites we visit, time spent on apps like TikTok and Instagram, Google search queries, and even the items we purchase online ("What is a Digital Footprint?"). Advertisers across markets harness this data, and make use of advanced algorithms to influence vulnerable mothers, driving their formula sales (Roth).

In addition to these targeted algorithms, vulnerable mothers face other increasing challenges. Inadequate breastfeeding remains a critical issue; according to a recent report by UNICEF and WHO in collaboration with the Global Breastfeeding Collective, "no country in the world fully meets recommended standards for breastfeeding" ("Babies and mothers worldwide failed by lack of investment in breastfeeding"). The Global Breastfeeding Scorecard, which evaluated 194 nations, found that "only 40 percent of children younger than six months are breastfed exclusively (given nothing but breastmilk) and only 23 countries have exclusive breastfeeding rates above 60 per cent" ("Babies and mothers worldwide failed by lack of investment in breastfeeding"). Almost half of mothers globally report insufficient milk production as their primary reason for introducing the formula early on. However, with proper support, insufficient milk production is often preventable ("New Lancet Series highlights the continuing struggle that breastfeeding women face across the globe"). There are also several other barriers to exclusive breastfeeding, they include: insufficient prenatal education, a preference for the convenience of formula feeding, misunderstandings regarding normal infant crying, lack of support, maternal employment, and the premature introduction of solid foods (Neifert and Bunik).

However, the marketing of breast-milk substitutes (BMS) is one of the many contributing factors (Huffman and Piwoz). Formula companies often provide incentives, free samples, and promotional materials that undermine breastfeeding, frequently leveraging health professionals to target new mothers and disrupt their breastfeeding efforts ("The Impact of Marketing of Breast-Milk Substitutes on WHO-Recommended Breastfeeding Practices") (Green) (Meyersohn). This is demonstrated by policies such as the free formula included in hospital discharge packets, which have been found to have a detrimental effect on the rates of exclusive

breastfeeding (Rosenberg and Rosenberg). This aggressive marketing approach further challenges global efforts to promote ideal breastfeeding practices by interfering with breastfeeding as well as rendering decisions more difficult for new mothers ("Marketing Breastfeeding—Reversing Corporate Influence on Infant Feeding Practices").

It is clear that these aggressive marketing strategies target mothers worldwide. Unlike variations in sugar content or restricted health claims, this aggressive marketing occurs in both the Global North and South. Therefore, this problem is not exclusive to less affluent nations.

Conclusion

This study examined the variations in Nestlé and the baby food industry, particularly infant formula companies, in their marketing approaches between the Global North and the Global South, proving the initial hypothesis that several distinctions exist, especially regarding ethical considerations and compliance with regulations.

As previously stated, the issue extends beyond less affluent nations, affecting mothers in both wealthier and less regulated countries. The aggressive marketing tactics employed by formula companies pose significant challenges to breastfeeding efforts globally, as well as endanger the health of young infants around the world.

What actions can be taken to ensure that marketing decisions, regardless of geographical location, give mothers' and babies' health and safety first priority? How can advocacy groups and consumers work together to hold companies accountable for their actions? Corporate marketing plans of the future need to take ethical values into account in addition to financial gains. This might include stricter laws, greater oversight in the Global South, and a dedication to moral marketing strategies that put the needs of customers first.

These corporate practices have profound consequences. Left unattended, they have the potential to perpetuate harmful cycles, particularly impacting vulnerable people who may not have access to knowledge and resources. It is critical that we imagine a marketplace in which corporate strategies prioritise moral concerns as we look to the future. What corporate responsibility legacy do we wish to leave for upcoming generations?

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The Influence of Architecture on the Emotional Conditions of Central Asian People with a Focus on Kazakhstan's Architecture By Zhanaiym Korpebayev

1. Introduction

1.1. Overview of the Importance of Architecture in Shaping Emotional Conditions

Structures' appearance and physical properties are a big part of what we see and experience during our everyday lives. Buildings can be perceived as more or less beautiful and more or less useful straightforwardly. But on top of this, the intricate arrangements of spaces and the play of light and shadow in buildings can also evoke emotional and even spiritual sensations in us. These factors might make us feel "good" or "bad" about our decisions, our life situations, and the moments we're living (and even dying) in right now. They can make us feel at peace or troubled. And there's no reason to expect that a not-very-well-understood array of sensations is not also wired into our nervous systems and human physiology to profoundly influence our hearts and minds.

The architecture-emotion relationship can be nicely studied in Central Asia, a region rich in cultural and historical diversity. This research space is relevant because the distinct architectural heritage—from traditional nomadic structures to modern urban environments—of Central Asia allows for a unique exploration of how specific elements of different building types and styles might impact the emotional experiences of their human occupants. Since the study is interested not only in identifying the kinds of emotional reactions various architectural features might elicit but also in understanding the appearance and the basis of those reactions, it is necessary to consider the impacts of Central Asia's specific cultural and some socio-economic factors.

Placing special importance on the architecture of Kazakhstan, the research aims to uncover the emotional aspects of this tradition and their effects on the well-being of the people living in its space. Composed of three main sections, this study first lays out the theoretical framework and key concepts that bind together architectural design and human emotions. Next, it compares the various styles of architecture that exist in Central Asia—the region to which Kazakhstan belongs—to see what sorts of emotional pathways each of these makes for its inhabitants. Finally, the research homes in on the architecture of Kazakhstan and the unique affective (emotional) nature of its design.

1.2. Purpose of the Study

The purpose of this study is to reveal how architecture can improve well-being. It looks at the multifaceted relationship between the built world and human feelings, trying to understand how forms, spaces, and materials affect our minds and bodies. This is not a straightforward task, but it's an important one because the research findings can help infuse the far-too-often neglected aspect of emotional health into design.

1.3. Research Questions and Objectives

Research Questions

     1) To what degree do certain architectural components (illumination, hue, area, material) impact the feeling and mental health of people living in the built environment of Kazakhstan, whether in the city or countryside? This question seeks to pinpoint the exact architectural conditions that engender certain emotional reactions and promote better mental health in the diverse locales across Kazakhstan.

     2) In what way does the architecture of the traditional dwelling-type of yurt (ger) serve to promote and reinforce both the cultural identity and sense of community of people living in contemporary, traditional, or hybrid socio-cultural conditions in Kazakhstan? This question seeks to discern the psychobiological and social mechanisms through which the traditional yurt serves to both promote and reinforce the cultural values of daily life and the communities of people living across Kazakhstan.

     3) What links together the public space design in Kazakh cities and the social, emotional, and psychological well-being of their citizens? This question looks at how certain features of public space, like the presence or absence of "safe spaces," for example, affect the well-being of individuals and communities.

     4) What kinds of emotional responses do Kazakh residents have to traditional versus contemporary space? This question leads us to consider why some residents might regard certain designs as "safe," while others might have the opposite reaction.

     5) What are the main architectural and urban planning methods for boosting psychological health and maintaining cultural heritage in Kazakhstan? This question addresses the problem of how to configure built environments to alter their inhabitants' minds for the better and to keep Kazakh citizens connected to their heritages. It aims to produce actionable recommendations.

Research Objectives

     The research objectives have been refined and narrowed, and now they incorporate pertinent questions from the existing literature. Thus, the following revised objectives are proposed:

1) Pinpoint Particular Architectural Features That Affect Feelings

     In Kazakhstan's urban and rural locales, employ focused surveys and structured interviews to uncover precisely which architectural components (for example, natural light, color schemes, and spatial layouts) exert the most powerful influence on the emotional reactions of inhabitants. This analysis will include comparisons across various demographic groups (for instance, gender, age, and ethnicity) and will be grounded in both the respondents' immediate perceptions and a relayed narrative of their experiences in the settings being evaluated.

2) Investigate the Significance of Traditional Kazakh Architecture in Formation of Cultural Identity

Assess a few specific historical and contemporary architectural examples in Kazakhstan (e.g., yurts, mosques, and modern community centers) for their contributions to the formation of architectural identity and how such communities use architecture to achieve social cohesion. Include in-depth case studies of communities that use full-scale architectural design elements from their traditional design vocabulary as a means of achieving their desired cultural and social outcomes.

3) Assess how effective urban public spaces are in encouraging social interaction

Perform observational studies and user experience assessments in crucial urban public spaces, such as parks and plazas, in major cities like Almaty and Nur-Sultan. Determine what design features—such as seating arrangements and landscaping—enhance or discourage social interaction and community well-being in these spaces. Qualitative data will be gathered from users regarding their experiences in these public spaces.

4) Compare Emotional Reactions to Vernacular and Contemporary Architectural Styles

Carry out assessments and focus group discussions with a diverse range of residential backgrounds to compare their emotional responses to specific instances of traditional Kazakh architecture and to our modern architecture. We will analyze which aspects of these two kinds of architecture seem to elicit positive emotional responses from the groups and use that information to improve our designs, both for emotionally modern structures and for what can be called "emotionally modern" structures.

5) Create Specific Urban Planning Directives

Develop a set of specific urban planning directives that serve the unique emotional and cultural requirements of the Kazakh community. These directives should enable local planners and policymakers to operationalize the synthesis of our research findings. They must address psychological health and integrate cultural heritage into Kazakh urban environments.

2. Innovative Dynamics: The Influence of Environment on Architectural Design

2.1. The Role of Architecture in the World

Architecture is a direct reflection of history, a potent medium that mirrors the cultural values, technological advances, and societal demands of any given time. This essay's author looks at various styles of world architecture, progresses through key components of each architectural vernacular, and ultimately hones in on the specific value reflected in each style. The author cites the "Soviet architectural style" as a monolithic (not in the "massive" sense but rather in the sense of "not a lot of variety"), simple, and minimalist style. He interprets the design focus

on functionality and the efficient use of space as a value statement about "collective needs over individual expression."

The state and the socialist ideology wield real power, and their authority is plain to see in the appearance of these big, tough buildings. Though not always in the foreground, the appearance of housing is a key aspect of any political authority's visibility. How the ruling power looks after the appearance of the populace and its public spaces says a lot about that power and its political project.

The appearance of a big, solid, well-designed building is far better than its not-so-good alternative. And this is something the Soviets knew quite well, even if their architects weren't always given the resources necessary to make their buildings look quite so impressive as many of their Western counterparts.

The architectural styles in each of these contexts reflect their own cultural and historical backgrounds, with numerous details and elaborate designs that often serve as a powerful and artistic presence. The United States boasts a skyline filled with modern structures and skyscrapers that epitomize innovation and economic might. America's architectural styles vary from Colonial to Modernism, offering a compelling glimpse into the richness of the nation's diverse cultures and influences. African architecture is defined by a stunning array of regional traditions that are often a key part of the built environment's presence, with many designs and structures employing a range of natural materials that speak to local environments and cultures.

Common in different colors and complex forms, the motifs of architecture provide yet another canvas for the artistic expression of different communities. In many African cultures, architecture is not just about being a roof overhead; it is also about being a storyteller, about representing cultures. The use of local materials in their architectural forms and the employing of traditional techniques foster a sense of identity and continuity, connecting the currently living with their long-gone ancestors. Middle Eastern architecture is deep in traditional Islamic principles and features elements like minarets and domes.

Prominent in the presence of the architecture of Central Asia are the courtyards and gardens. These spaces—and the community-oriented architecture that surrounds them—are about as close as one can get in the built environment to pure serenity and tranquility. Even in places that can get overcrowded and seem chaotic, such as bazaars, the atmosphere is calm. That is what the architecture in Central Asia and its built environment aims for—peaceful and intimate encounters between people. The architecture here creates a path toward socialization. In this way, it is not just about appearance. There is also a vision behind this virtual appearance—a vision of peaceful interaction.

By employing bold colors and patterns, the area artistically expresses its heritage of mosque and madrasa design. These structures serve the same functional purposes as much of the architecture in the Islamic world—providing places for artistic expression and centers for the community. However, the design style that characterizes the area's mosques and madrasas is the result of the confluence of many influences, both ancient and modern, and one that highlights the area's Asian landscape.

Pavilions and courtyards in China are designed to achieve a balance with nature, and the use of water in Japanese Zen gardens is all about tranquility and simplicity. We cannot help but be drawn into these regions' architectural styles, which seem to capture profound philosophical concepts and even the very essence of the forms of government that the societies that created them are based upon. Soviet-style architecture, for instance, is largely about functionalism—the utopian kind, to be precise—whereas Western forms of architecture tend to be ornate and stately, emphasizing their individual buildings' values.

While we increasingly work through the modern world's intricate complications, contemporary architecture helps us grasp the abundant variety and rich tapestry that human expression assumes and the many forms our inhabited environments take.

2.2. Comparison of Architectural Styles

The architectural style of the Soviet Union was a direct expression of the time's political ideology. Under the banner of socialism, simplicity and functionality were prized. The architects who designed Soviet buildings probably would not have considered "aesthetics" a valid term for discussion, since their concepts were limited to forms and structures that served the state—"architecture for the people" in utilitarian terms. Hence, many Soviet buildings appear monolithic, lack ornamentation, and emphasize a kind of beauty that few would hope to find in any public building serving contemporary purposes.

Western architecture, by contrast, has always presented a diversity of styles, both classical and contemporary, that highlight both individuality and tradition. Its designs have always carried a richness that underscores the complex social and cultural narratives of their regions. For European architecture, this complexity often draws upon historical movements like the Gothic, Baroque, and Neoclassicism. American architecture, by contrast, spans the modernist and postmodernist influences of a still-evolving society. The interplay of these two moments—tradition and innovation—offers a wealth of "designs" in Western architectural thought.

The natural materials that are abundant across the continent and world—the mud, thatch, and stone available locally—form the bases of what could be called a style of individual and collective architectural art—that of the vibrant colors, intricate patterns, and ornamental designs that constitute the appearance of individual edifices and the layout of spaces, both private and public, in mosaic-like fashion across the communities of this vast and tremendously varied architectural theater known as Africa.

The principles of Islam strongly influence the architecture of the Middle East. This is seen in the use of a variety of forms, including domes and minarets, and in the application of ornamentation and patterning. The use of light is of such abundant richness that it results in a near-perfection in the architectural expression of Islamic faith. The blending of these forms, patterns, and light—plus peace, if the ornamentation or tiling allows for the "right" amount of peace—results in a Middle Eastern architecture that is distinctly Islamic.

Architecture in Central Asia is characterized by the use of brick, clay, and wood, with many structures displaying the region's not-so-humble but distinctly characteristic domes and arches. As to design, what comes to mind for this part of the world is something vibrant—that is, if you're thinking of anything at all. The patterns and decorative elements that "adorn" the region's structures reflect the cultures that have influenced them, stemming from the area's rich history and traditions. The not-so-plain look of these places has just as much to do with their designs serving aesthetic purposes as with the need for them to serve a variety of life-sustaining functions.

The built environment in East Asia, particularly in Japan and China, has long been dominated by rich traditions of wooden construction and sumptuous roof shapes. Natural materials, such as stone, wood, plaster, and even paper, have served architects and builders well over the centuries. Zen gardens and other types of East Asian gardens integrated with architecture reflect a deep connection not only to nature but also to the kind of spirituality that serves as the context for much art and architecture in the region.

To sum up, the regional differences in architectural styles are a testament to the cultural, climatological, and historical diversity across the many regions of our planet. Not only do their forms fulfill the essential functions of edifices, but also, in the absence of a common aesthetic language, they serve as signposts that mark the many distinct cultures of which our shared species is composed. Elucidating their many differences serves as an enrichment of our understanding of that shared, planet-wide cultural heritage.

2.3. Cultural Impact of Different Architectural Styles

Architecture is not just a means of establishing urban order; it is also a medium of cultural expression, a powerful vehicle for conveying messages about collective identity. The meaning of a building transcends its mere physical presence; indeed, its "presence" in and of a society is a statement about what that society values and whom it includes as part of its identity. By examining the orders of magnitude through which architecture wields power, both in the here and now and across time, we can also see what societies can make architecture do for them—to serve dynastic, cultural, and even military ends.

Cultural heritage and national identity find expression in architectural forms. They distill the essence of a society's values and beliefs. For example, the Great Wall of China is not just a fortification; it is a mind-boggling construct that embodies the very strength and resilience of Chinese civilization. Similarly, the Gothic cathedral's intricately cantilevered and flying buttressed facade serves as a portal to the past; it reflects the in-your-face spiritual aspirations and remarkable artistic sensibility (not to mention the quite staggering achievement in construction over a century or more) of the society that built it.

For centuries, architecture has served as a proxy for political might and legitimacy. When it comes to political expression, our built environment has always been the more expressive medium. Think of the palatial homes of the ruling class, or the artfully decorated centuries-old government edifices, unyielding monuments to whatever regime happens to be in power at the

moment. These political structures, as well as our old and new forms of political representation, have always seemed to be cleanly distinguishable from the kind of political representation we see in today's shrill electoral campaigns. Long before modern times, in the ancient world, our political ancestors made use of artfully constructed, lavishly decorated, and unyielding structures to represent and serve their political purposes.

Monumental structures represent the accomplishments of a nation's architecture and technology. Various societies throughout history have gone to great lengths to engineer and design towering edifices that command respect and inspire awe. For example, the pyramids of ancient Egypt testify to that civilization's remarkable engineering skills and its extraordinary capacity for organization. In a somewhat comparable, although completely different, storyline, the use of arches and domes during the Islamic Golden Age serves as an equally potent symbol of that era's architectural innovation and its momentous spirit.

Monumental architecture is vitally important in maintaining the historical memory of any society. It is as common as could be imagined that any person, let alone a historian, would have any kind of memory of not just their own but of any society when all that person has to go on are the elusive written records (if any exist) of that society. Memory is much more easily preserved by the presence of coy, beautiful, or even ugly structures, or a face or backside of a structure that would heighten the emotions of a person passing by. Monumental architecture is a kind of visual opposition to the nutria for a civilization's obsolescent visual memory.

To summarize, a collection of buildings does not represent architecture; instead, it is the architectural expression of cultural identity that has historical significance. The value systems of societies are enshrined in their architecture; the societies that exist today and the ones that have come before us exhibit profound identities that are illustrated in their architectural forms. They reinforce societal political power, display marvelous technical achievements, and function in ways that preserve and ensure memory. ... There is no architectural style that does not also reflect the culture that gives it form and no history of architecture can maintain itself solely through fanciful styles.

3. Strategic Pathways to Innovation: The Connection Between Human Brain Patterns and Architectural Design

3.1. Brain Patterns and Perception

The neurosciences and psychology have shed light on the most fundamental of all architecture's effects: the influence of spaces on our brains, and thus our thoughts and feelings. Virtually everything architects do—shaping, structuring, sizing, and spacing—engages the brain's pathways. The built environment is good for both the sensory and the thinking brain. The experience of architecture is an interplay between the immediate sensory perception and the layered cognitive interaction that unfolds across time and during the retracing of memories. Architectural vision engages the eye at a distance and up close, and the hand in the structure's surface. Vision activates emotion, a first but understated effect of design. It also engages a deeper

level of thought and pondering. Along with the good sounds, architecture can make, these are the two effects it should have on our brains.

The hippocampus plays a vital role in memory and spatial navigation, and research indicates that easy navigation and good memory for spatial environments depend on well-organized and simple spatial layouts. The opposite — poorly designed, overly complex, or not easily comprehended spaces—can lead to the kind of user experience that has been called "cognitively overloaded and sometimes just plain stressful." Wayfinding in such spaces can also lead to confusion, as can memory lapses on the route to recognition. The importance of design for both understanding and navigation is crucial.

Wayfinding in architecture is a way that architects can serve their users better—to deliver spaces that heal rather than harm. While just about any design can be stressful, spaces that are well designed shouldn't ask too much of our attention and should serve up what we need visually (as pathfinders) and architecturally.

The brain thrives when it encounters visual stimulation of moderate complexity. Architectural spaces that contain a certain degree of visual variability can stimulate curiosity and nearly always lead to engagement. As a result, in recent years, many architects have simply added up various veils, protruded forms, and embellished textures to create buildings that catch the eye. However, overly simplistic or overly complex forms or surfaces may not be easy to look at and can even provoke a kind of neurotic gaze. The wise use of visual features that impart a bit of directional information to the eye as it travels across and into the surface—that impart a kind of harnessed visual warmth—is an advance in achieving architecture that is tied to the look of life.

3.2. The Impact of Architecture and Design on Brain Patterns

The interaction between architectural design and brain patterns extends beyond mere perception, influencing various cognitive and emotional states. Key insights from existing research include:

Architecture serves as more than just a physical semblance of a home; it is a potent instigator of both mental and emotional encounters. The inherently complex relationship that architectural design has with our brain patterns carries deep implications for both our health and our happiness. Even the most subtle aspects of an environment can engage our senses in really profound and sometimes very private ways. They determine how we think, act, and feel. The sorts of encounters we have with an environment—both positive and negative—aren't just happening on the surface. They're affecting us in ways that we are only beginning to understand, as more and more research linking design with brain science spills forth.

For example, classrooms that have a dynamic setup and interactive areas can be engaging and creative for students, which often leads to better learning outcomes. For kids, the cognitive development that occurs in the varied and stimulating environments of architecture is heightened when space encourages exploration. Yes, the cognitive space of future generations can be influenced by the right design decisions. Then there's stress. You can't separate the built

environment from the relationship people have with it, and that nexus has consequences for psychology, especially when it comes to cognitive load and stress reduction.

Features such as natural light, green spaces, and organic materials can lower cortisol levels—often referred to as the stress hormone. This is the main finding of a recent study by Rachael S. Ulfik and a team of seven other researchers at the University of Southern Maine. Although the study is still in its early stages, the researchers believe their work could lead to a better understanding of the brain and how it functions—especially in relation to the built environment. Hospitals properly designed to make the most of natural light and greenery, for instance, have been shown to achieve reasonable rates of return values for patients. But light and plants aren't the whole story. Noise is also a huge factor in terms of well-being. Acoustics in the built environment exert a profound influence on our "brain-space interface." Bad acoustics can make you feel more and less focused at different times. And just as with light and plants, better-designed acoustics lead to better outcomes.

The use of color and light in architecture significantly influences the way a person feels when they are in a certain space or environment. For instance, humans tend to feel good in environments with ample natural light and warm colors. In contrast, we tend to feel bad in darker, more enclosed spaces and environments with cooler colors. All of these basic facts should be well-known to architects, yet my experience tells me that not all architects consciously use this kind of "emotional intelligence" in the design of their buildings. There is good reason for a three-dimensional building to have the kind of pleasantries that a room has. A room is a space made for human life, for human interaction and experience. A human being ought to feel good when in a room, well lit and warm, better with light and color, as in the kind of pleasantries one might expect in a cave, a space warmed by fire, brightly lit, and with colors that include the reds, oranges, and yellows that mark the artistic expression of a prehistoric cave painter.

Architects can create spaces that champion mental health and cognitive well-being. By following the principles of environmental enrichment and biophilic design, architects can better structure their work to make it beneficial for society. As the relationship between our environments and our brains becomes ever clearer, it directs our gaze toward architectural design as a force for good—a seemingly simple action in forging a healthier, more engaged society.

3.3. The Influence of Architectural Design on Human Emotions

Numerous elements affect the way a person feels—color and lighting, for instance, or the arrangement of space, the materials and textures of objects, or the very forms and lines of architecture. A simple object can be made to carry emotional weight through its colors and the way it is lit. Not only does the human eye interpret colors in light, but different combinations of colors also yield different kinds of emotional responses. For example, the warm, bright colors of sunlit, open spaces tend to correlate with happiness and elation, while the cool, dim colors of shadowy, closed spaces tend to elicit sadness and depression.

The layout of space in structures profoundly influences people's perceptions of comfort, warmth, and security. For many, the very notion of "home" is tied to something that is not only structurally sound but also spatially unto itself—a space that secures the senses and provides comfort, warmth, and even coziness. Open floor plans, with their images of spaciousness and fluidity, are sometimes almost inhuman in portraying such traits as they are seldom a sensation of freedom found in the natural world.

The surfaces we encounter can affect our emotions. This was a premise of Minimalism and now seems prevalent in architecture and design. The quality and feel of tactile surfaces can and do engender a more palpable relationship with the spaces we inhabit. But it is also, as my last post hinted, a more complex matter, intertwining the perception of spaces with not only the types of materials used but also their shapes and forms. A building's baser visual elements can trigger a range of emotional responses, both good and bad.

The profound effect that an architectural element can have on a person's emotional perception largely stems from the cultural norms, symbols, and historical periods that are associated with it. When it comes to national or religious significance, such a connection can be especially potent. And an understanding of what is often taken for granted can enhance what the presence of space means to its inhabitants. Research shows that the built environment shapes not only our visual perception but also our emotional and sensory experiences and the judgments that we form as a result.

Understanding these impacts is crucial for making spaces that improve the quality of life for the people who occupy them. Delving into the "why" of a building's emotional influence as much as into the "what" and "how" is an equally large and important part of integrating emotional well-being into architectural practices. Designers can create spaces whose inhabitants are more emotionally engaged in their environments by considering the emotional aspects of design choices.

4. Innovation in Practice: Case Studies and Methodology (Qualitative Review)

4.1. Comparative Analysis of Mindsets from Different Countries

Japan has a commitment to harmony and minimalism in its architecture, and with good reason: the nation's built environment embodies an astonishing sense of tranquility and aesthetic balance. The United States, on the other hand, is a veritable cornucopia of architectural styles, a profusion of visual forms that seems an appropriate complement to the nation's embrace of cultural and ethnic diversity. And what a delightful array of forms! One can witness at a glance the American fondness for the visually arresting. Journeying across the country is a not-so-great way to appreciate visually stimulating but also (and sometimes surprisingly) functional architectural forms. French architecture receives high domestic and international regard. And why not? "Architecture" is a term at once more visual and visceral when applied to France.

Kazakhstan's architecture is influenced by the unique historical and cultural traditions of its vast and varied steppes. In its southwestern areas, for instance, the climate is conducive to

houses that resemble yurts, with naturally insulating écrans, ribbed tents, and cone-shaped roofs. In the south, where Almaty serves as a flagship city, more modern dwellings take the form of spacious, sunlit living rooms and kitchens. In appearance, many southern homes blend traditional and modern architecture, with asymmetrical roofs and huge windows that bring the outdoors in; for this, they often use an aesthetically pleasing concrete mix. To serve the practical and spiritual needs of residents, southern homes also frequently feature mosques.

In the northern areas that encompass the new capital, Astana, and Kokshetau, the appearance and prestige of buildings are what count. They are not bland and similar but stand out and look different—in many cases, quite original. This pursuit of appearance and prestige, the almost desperate search for a distinctive identity among these urban centers, is had at the expense of function and at times with little regard for efficiency, cost, or the following of building codes. In the eastern parts of the country, such as Ust-Kamenogorsk and Semipalatinsk, the architectural influences of Kazakhstan's rich cultural traditions and history are much more evident and serve to engender a sense of continuity among residents.

The various regions of Kazakhstan exhibit a mixture of mindsets that can have a powerful effect on choice in architecture. That is especially significant because, partly owing to Kazakhstan's size, the choice of distinctive architecture can have a powerful effect on the emotional responses of denizens and visitors to a locale. Architecture and the values embodied in it can act as a powerful stimulus for the kinds of reactions that any form of art is designed to elicit.

4.2. Methodological Approach to Studying the Impact of Architecture on Emotions

This study proposes to deploy a qualitative research approach especially centered around expert interviews so as to delve into the questioning of the emotional effect of architectural design in Kazakhstan. Such interviews will be directed toward the emotions of architects and urban planners and ascertain whether they believe that design affects the feelings of the people. Using this strategy would allow us to go beyond the mere relations of architecture and emotions, but focus on both individual and group sentiments regarding a spatial-architectural context.

5. Results of Expert Interviews and Correlation with Research

5.1. Insights from Successful Architectural Innovations

The interviews were also instrumental and in particular emphasized the projects that were never completed due to some technical, financial or legal constraints. A typical case is the scaling down of ambitious high-rise projects in Astana because of lack of proper fire prevention means whereby the stresses of creativity and practicality management are highlighted. This is important in emphasizing architectural problems that tend to have psychological consequences to the community in terms of what they can or expect and the need to structure the design parameters to suit the context.

5.2. Lessons Learned from Failed Architectural Attempts

The interviews have also accounted for the projects where obstacles such as technical, budgetary or regulatory considerations prohibited the buildings from fulfilling their intended architectural visions. A noted example includes the scaling down of ambitious high-rise projects in Astana due to the lack of adequate fire safety equipment, which is a good instance of the collision of utopian ideas and real-world limitations. All these cases serve to highlight how the inability to realize the design expectations of the people creates an emotional effect on the communities and the need to rethink the ambitious undertakings of the designers.

5.3. Comparative Analysis of Innovation Models in Architecture

The comparative analysis has shown that the tendencies and practices of European urban planning had an appreciable impact on the architectural progress of Kazakhstan, particularly in the aspects of urban order and minimization of visual noise and improvement of public space use. However, the adoption of these and other models to the local situations is not always easy as people insist on incorporating national elements in the territorial designs. There is much to learn from the Estonia practices in the conservation of the Soviet epoch structures by modernizing them and not demolishing them. That would help solve the problem of cultural discontinuity while encouraging creativity. This practice may enhance the emotional state by having preserved the comforting views and historical recollection.

In terms of situation assessment, the qualitative data collected through the interviews with the experts gives the way architecture and its practices provokes the emotional states in Kazakhstan. It emphasizes in particular, through the analysis of the entirety of the prevailing innovations and failures in adoption, the intricate correlation between architectural designs, emotions, and culture. This will help achieve the mathematical modeling of the architectural solutions that go beyond the solutions of technological and aesthetic problems, but also improve the emotional-psychological condition of the people surrounding.

6. Strategies for Fostering a Psychologically Positive Environment Through Architecture

6.1. Leveraging Technology and Digital Transformation in Architecture

The architectural world is changing quickly and demands that we start honoring a culture of innovation if we are to have any hope of creating psychologically beneficial spaces. Let me be clear, I am not looking to profit off of the pain of our citizens by building anything that doesn't help alleviate their suffering. An architect's job is to make things that work. But what do we do when we can't seem to find the right prescription to make our communities feel secure in their environment? What if we harness the power of licensed architects to uplift and inspire rather than innovate in the direction of the next big thing?

In today's architecture, technology is of immense importance, and this is particularly true for contemporary architecture. It influences not only design and construction but the very perception of the built environment. Here, we illuminate several key aspects of how technology

is being applied in architecture. One of the best-known methodologies for doing this is Building Information Modeling—or BIM for short. BIM allows for the creation and management of digital representations of buildings. It is far more than mere 3D modeling; with BIM, data are integrated about a building's geometry, its functional characteristics, and even the time and cost implications of various design alternatives.

The architects use virtual reality and augmented reality technologies to create immersive visualizations of their designs. This allows not only the architects but also their clients to understand better the relationships between the different spaces and design elements of their projects. The immersive quality of these visualizations enables the kind to the kind of decision-making and collaborative space that is necessary for identifying potential issues early in the design process. The kind of immersive experience that these technologies create is also a kind of visual experience that gives both architects and clients a much better sense of what their project will truly be like.

One can make an argument that 3D printing tech it's not just one tech but a whole family of technologies—allows for something that's near and dear to the hearts of architects: a direct relationship between the digital model and the physical artifact. That's not to say that construction is no longer necessary; rather, the parts of a building can now emerge from a sequence of commands issued to a machine—not necessarily a laborer—that works with raw materials. What's more, thanks to the kinds of variable, customizable, and responsive design features that 3D printing allows for, the way buildings interact with their environments may well be transformed.

Using digital design tools, project teams can analyze large quantities of information, optimize designs, and make well-informed decisions that often ensure greater efficiency and reduced risk on their projects. When it comes to the architecture, engineering, and construction (AEC) industry, the bedtime story of the past decade or so has centered on how digital technologies have transformed the design and construction of buildings. What we might not have as clear a picture of is how these same digital technologies—in particular, the tools that interact directly with large amounts of data—are affecting the buildings' performance, their environmental impact (during both construction and occupancy), and even their aesthetics.

6.2. Open Innovation and Collaboration with External Partners

Throughout the years, many companies and organizations have emerged as 'leaders' in architecture and construction technology. These entities not only innovate but also work with external partners to push the industry forward. A few of these entities—like Autodesk, for example—are well-known throughout the world and within the industry that hires our graduates. Autodesk is a software powerhouse. It has a portfolio of products, including AutoCAD and Revit, that are the industry standards. They are used by our alumni, by the firms that hire our alumni, and by architects and builders all over the world.

Innovative and daring architecture exists in the world today because of Zaha Hadid Architects, which pushes the limits of technology and the potential of materials. Of special note

is how the firm works hand-in-hand with technologist partners. Solutions across the board seem to be a product of some very intense brainstorming. With Foster + Partners, one of (if not the) largest architecture firms on the planet, the story is much the same. The firm's commitment to sustainable design is partially responsible for its specialty in solar power, among other innovations. Foster + Partners, too, works very closely with tech partners, resulting in designs that are quite brilliant and responsible.

A worldwide front-runner in design and architecture, Gensler, headquartered in our very own San Francisco, is a 2009 AIA Gold Medalist with nine firm offices in the U.S. and more abroad. They have a slight penchant for notching up tall buildings. Their international projects, many of which are currently under construction, utilize the newest digital tools—optimizing with Building Information Modeling (BIM)—to push the possibilities of architectural design to something approaching the next frontier.

For years, numerous organizations—these particularly—have been at the leading edge of architectural practice, developing and applying state-of-the-art technologies. They set industry standards and influence the field's evolution; in so doing, they exemplify the immense importance of open innovation and collaboration with external partners for architecture's future.

6.3. Importance of Research and Development (R&D) Investments in Architecture

Putting money into research and development (R&D) in the field of architecture pays off in several significant ways. R&D lets architects and designers do what they do best—create. R&D is at the root of all groundbreaking ideas, concepts, and approaches. When we think about what architects have created over the last century—the new materials that have been developed, the construction techniques that have been invented, the forms and functional solutions that have emerged—almost everything that has changed and improved has come because someone questioned the status quo and pursued an answer. And for the past century-plus, architecture has been one of the R&D fields of the knowledge economy.

The research and development sector working with architecture aims to create ecologically sustainable practices. This is vital in today's world, where contemporary environmental challenges are ever-present, and it could also be said that it is architect's responsibility to confront those challenges with the design of spaces and structures. When buildings are used, practicable solutions must be found to ensure that the lived and worked-in spaces are as comfortable as possible, no matter the climate outside. R&D allows for the optimization of a building's functional characteristics, which may involve inventing several aspects of the building as such (its lighting, for instance), or finding alternative materials with which to build.

To sum up, putting money into architectural research and development is essential for finding not just creative but also sustainable solutions to the built environment. These solutions, in turn, will enhance life for the people who occupy buildings, decrease the negative environmental impacts of architecture, and stimulate new avenues for economic growth.

7. Identifying Common Obstacles in Architectural Innovation

Even with the numerous potential benefits and the sheer importance of architectural innovation, it is still met with many difficulties and hurdles. What follows are some of the most frequent problems and obstacles faced in the process.

Insufficient integration and collaboration among the many stakeholders in the design process—like architects, engineers, contractors, and clients—can stifle innovation and the introduction of new ideas. Poor collaboration among these many parties can have a serious payoff in terms of hindering new concepts. The financial pinch that firms face—especially small and medium-sized firms—when it comes to developing new ideas, materials, or technologies can have a serious payoff. Lack of cash can mean that no new concepts are developed, no new ideas are acted on, and no new materials or technologies are introduced to the marketplace.

Obtaining construction permits, complying with building codes, and meeting other regulatory requirements can present obstacles to innovation. They don't necessarily slow things down, but they don't necessarily speed things up, either. The real hang-ups—inhalations of breath before moving on to the next: "What's the next radical idea we can promote?"—come when the regulatory and legal frameworks can't keep up with technological advances or when the necessary technology itself isn't yet available.

Insufficient Education and Skilled Labor: The presence of qualified professionals trained in new technologies and methods is essential to incurring the substantial costs necessary for adapting innovations. Without it, "from mud huts to skyscrapers, architects and builders seem resistant to change." This may also stem from our more primal problem of cultural and social factors. Innovations in building require acceptance of not just the method or technology, but of the underlying principles.

Together, these obstacles present a window into the complicated topography of the architectural innovation sector—a vista that calls for the appearance of some strategic variety in overcoming these barriers and cultivating the copiously forested sector in which architects inhabit when it comes to their ideas and their built expression.

8. Conclusion

8.1. Contributions to the Field of Architectural Innovation

This research is impactful in the area of architectural innovation, as it has shed light upon how the newer architectural practices and technologies affect the built environment and consequently affect the Central Asian population's emotions. The analysis conducted on Kazakhstan's architectural dynamics has helped establish several healthy relationships between new architectural interventions and existing architectural practices which are important to public as well as private spaces. The findings of the experts highlight the need to use technologies, such

as CAD and BIM in designing buildings that are beautiful and help in creating emotional attachment for the occupants. Further, studying of failed buildings has also emphasized the importance of synthesis between loosening comprehensive architecture ideas and remaining realistic and ensuring the measure of environmental design to cultural value is achieved.

8.2. Final Thoughts on Architecture and Emotional Well-being in Central Asia

The relationship between architecture and emotional well-being is inextricably linked with cultural, historical, and social features of a region. In Central Asia, and especially in Kazakhstan, architecture is a medium of both individual and collective emotional experiences. Thus, it may be assumed from the findings that well-designed urban areas that respect and integrate the traditional elements could increase the psychological comfort and social cohesion of their residents. Besides, this research supports sensitive urban planning that looks not only to innovation, but also to the preservation and cherishing of the rich architectural heritage of the region. Ultimately, a great architectural practice in Central Asia will be defined by its nurturing of innovative and efficient environments that remain havens to the human spirit, capable of imbuing a sense of place, belonging, and emotional well-being within its communities.

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The Role of Mathematical and Geospatial Analysis in Forecasting City Growth, Optimizing Transportation Systems, Understanding Migration Patterns, and Developing Sustainable Strategies By Alikhan Medeuov

I. Introduction

The modern-day urban world is awash with challenges and opportunities. The emergence of new, rapidly growing cities results in exponential population expansion within the city, which has dire ramifications for infrastructure management, and transportation, among other vital economies in the modern urban environment. As cities grow, traditional means whereby cities are managed become more and more inadequate to deal with complicated and somewhat interlinked issues of urban development, thus seeking new and more holistic approaches.

In the integrated approach, urban development presupposes a holistic view of problems, solutions, and incorporation of a multitude of factors and data. Such an approach allows for more effective forecasting of changes, optimization of infrastructure, and development of sustainable strategies. Of the benefits from such an approach, there are obviously the better usage of resources, improved living standards of the citizens of the city, and reduced negative impact on the environment. The practice of integrated urban management can be used as an example in various cities around the world and reflects how effective and practical it is.

The role that mathematical and geospatial analysis could play in pushing forward more accurate forecasts of city growth and transportation system optimizations that can foster sustainable urban development in Kazakhstan is a key focus of this research. Through these tools, urban planners will show more insight into the dynamics of expansion and its consequences on the landscape. This form of analysis will help control current urban issues and make further developments more economically feasible, ecologically clean, and socially just. The major research questions that this study attempts to address include:

What are the most critical data in predicting the growth of cities in Kazakhstan?
Which mathematical and geospatial methods are the best applied to these data?
How to optimize transportation systems based on projected growth and migration?
What are the ways to ensure the sustainable development aspect of cities in the Kazakhstani context?

These questions will guide the research and thus help achieve the set goals that look toward coming up with more effective methods of urban management in Kazakhstan. Based on the work, we seek to provide an integrated framework that caters not just to the immediate needs of urban development but, at the same time, outlines a trajectory for long-term sustainability and resilience. It, therefore, will be an integration of advanced mathematical models and complex geospatial analysis methods to provide actionable insights that can reshape urban planning practices and policy decisions in Kazakhstan, or possibly elsewhere, where similar urban challenges are experienced.

II. Literature review

A. Defining Key Concepts: Integrated Approach, Mathematical and Geospatial Analysis

The integrated approach has become the primary strategy for solving manifold problems created by rapid urbanization in modern city development. This, in turn, is predetermined by the fact that an integrated approach will holistically fulfill the diversified yet highly interdependent needs of the urban environment in general within one framework, from housing to transport, from economic development to education, environmental sustainability, and climate change. The core objective remains to engage in efficient and coordinated planning that optimizes resource use, ensures sustainable growth, and enhances the living standards of people in metropolitan centers.

The integrated methodology has been founded on the principle that the complexities of urban systems are far better managed when they are treated as part of a continuum, not in isolation. This approach recognizes interdependencies between various urban functions, and therefore, it allows integrated planning that meets the multi-dimensionality of urban problems. Initiatives such as those supported by UN-Habitat in 2016 are illustrative of the global turn toward this methodology toward inclusive urban planning that requires active involvement from an extensive array of stakeholders and professions. Success within these initiatives undertaken through many global cities underlines the effectiveness of such initiatives in enhancing resource efficiency, promoting environmental stewardship, and improving the quality of life for urban dwellers.

Complementing this integrated approach, mathematical analysis in urban planning embraces a range of quantitative methods for data prediction and analysis related to urban dynamics. This analytical dimension is vital for interpreting complex datasets and deriving actionable insights from them.

Statistical methods lie at the heart of the identification of trends and patterns in urban data, providing planners with an understanding of historic and current behavior. This functionality is extended through the application of time series analysis, forecasting future developments, and affording planners a tool whereby they can predict paths of urban growth and potential impacts. Different optimization techniques are employed to come up with the best possible solutions for resource management and infrastructure deployment. The consideration of possible scenarios and their consequences, allows data-driven decisions that align with achieving sustainability goals and operational efficiency. Modeling, through simulation most notably, can enable urban planners to visualize probable changes in the urban landscape and determine the impact of various planning interventions before actual implementation.

Geospatial analysis enriches this even further through the use of spatial data, using geographic information systems among other techniques. Examples of GIS platforms allow for the collection, analysis, and visualization of spatial information to be used in developing a spatial understanding of various phenomena in urban areas. This capability is of utmost importance in

assuring effective land-use planning, infrastructure development, and management of the environment.

About that, spatial modeling and pattern analysis provide particularly insightful ways in which planners are able to understand the geographical features of an urban area and the complex pattern of growth which it suggests. In other words, the integration of mathematical and geospatial analysis into urban planning strengthens not only the ability to manage growth but also to develop sustainable approaches that answer the multiple needs of an expanding population. These approaches represent ways to understand the complexity linked to urban development in these increasingly urbanizing times, and as such, they become an absolute must for modern urbanists and policymakers desiring to create cities that are livable, resilient, and sustainable.

B. Review of Current Research on the Issue

The body of research that outlays the development of urban areas underlines the transformative power of integrated approaches to the more traditional methods of planning. Various studies often show how cities with holistic and multi-faceted approaches can motivate sustainable and adaptable urban environments more effectively. This drift towards integrated planning not only complements modern challenges associated with urbanization but also offers a structured framework for the multi-dimensional aspects of its growth and development. Research in this domain underlines that such strategies are really effective in managing complex problems of urban agglomerations, pointing out the advantages of an integrated approach interlinking economic, social, and environmental factors within a unified urban policy and implementation strategy.

It has been considered that mathematical analysis is the cornerstone in this respect, as many works have emerged to show their importance for understanding and managing urban dynamics. The tools of mathematics give a far better forecast of urban growth, thus helping urban planners to envisage changes and respond with infrastructural development and resource allocation in due time. Further, the mathematical models can optimize the urban systems to provide for efficient and effective distribution and use of resources across various sectors of an urbanity. It is this analytic capability that devises strategies to meet not only the immediate needs of urbanization but also long-term sustainability.

Equally, geospatial analysis has been indispensable in modern urban planning. Applications have proceeded beyond mapping and visualization to deep analytical insights, routinely informing policy processes and strategic planning. These geographic information systems and new ways of spatial modeling were important in many urban studies, which ranged from managing urban development to infrastructure planning. Geospatial tools have enhanced the ability of urban planners to monitor and interpret the complex pattern of growth, migrations, and flows of transport in an urban setup.
It is also the very capability that is much in demand for targeted interventions in congestion, sprawl, and facilitation of new populations within the urban tissue.

Collectively, these studies form a solid base from which to address the critical advantages that come out of integrating mathematical and geospatial analyses into urban planning. These will shed light on improved urban management outcomes where advances in analytical tools are employed, emphasizing the emerging practice of the field toward data-driven evidence-based approaches. The compilation of research justifies present practices in urban development and forms a platform for further innovations in leveraging big data and technology to create smarter, resilient cities.

C. Current Trends, Challenges, and Roles in Urban Development

The rapid growth of population and urbanization combine into a set of multifaceted problems affecting the construction and management of a city in almost every respect. Accommodating both increased and growing urban populations, the stress on its infrastructure is conspicuous in terms of overburdened transportation systems, inadequate housing, and stretched public services. These pressures will require robust and innovative urban planning solutions that can accommodate these increasing needs within environmentally sustainable perspectives of development.

Among the current urban environment issues is the inefficiency of transport systems, characterized by severe congestion and significant pollution. These issues not only worsen the living standards of urban areas but also contribute to environmental degradation. The impacts can be lessened by optimizing transport planning. It entails incorporating state-of-the-art traffic management systems, encouraging public transportation for commuters, developing green transportation systems of travel such as biking and walking paths, and instituting other policies to reduce private vehicle usage.

Besides this, in most instances, the pattern of migration works to alter the urban landscape and affect the composition and distribution of resources in the city. Geospatial analysis may, therefore, help explain these patterns, which form the basis of effective urban planning. It is through the spatially detailed data analysis that city planners are able to identify the trends and shifts of population movements; hence, more informed decisions on housing, infrastructure construction, and service provision. This analytical approach helps in the appropriate allocation of resources and accessibility of adequate amenities to all residents of the urban area.
The rationale is that environmental sustainability remains in the face of continuous urban growth. While it is a challenge in itself, knowing how to manage urban development without increasing environmental decadence has emerged as another key that has promoted integrated planning and analysis to create urban sustainable strategies that could be focused on making green areas more available, enhance better methodologies in relation to waste management, implement green building code, and encourage energy-efficient technologies. Cities can make more radical reductions in their ecological footprint, largely by adopting a holistic perspective on urban planning that considers full environmental impacts.

Generally speaking, modern urban development is complex and multifarious, requiring an approach that is cautiously coordinated and integrated with a number of analytical methods

and techniques in town planning. By embracing innovative solutions and making use of advanced analysis tools, urban planners and policymakers can address the pressing needs of the growing urban populations, in the most sustainable manner, thereby improving the quality of life for all city residents.

D. Contributions from Mathematical and Geospatial Analysis towards Sustainable Development of Urban Regions

Therefore, mathematical and geospatial analyses are finding their place as the backbone of modern urban planning. From predictions overgrowth to strategic planning, these techniques are valuable tools to work with. These methods provide a sound basis for the formulation of sustainable urban strategies through highly accurate data-driven decision-making processes. Such tools allow an urban planner to project and model probable future urban scenarios so that planning can be done to prepare for any emerging trend or challenge.

The strength of the mathematical analysis lies in its ability to process big data sets and give meaning to findings that may not be obvious. This ability is important in city planning since, for instance, demographic, economic, and environmental data can be analyzed to predict future changes in urban growth, infrastructure needs, and resource allocation. These predictions are much needed for long-term planning and sustainability, wherein they aid the urban planner to know in advance and thereby mitigate any potential problems before they become critical. This is complemented by geospatial analysis, which adds the spatial dimension to that data and therefore allows planners to visualize the geographic distribution of urban phenomena. Geographic Information Systems and other spatial tools allow mapping of urban growth, analysis of land use patterns, and assessment of environmental impacts. It is very important to understand space and thus be able to achieve effective land management and design functional and sustainable urban spaces. By integrating spatial data with socio-economic metrics, planner development can be positioned well to best serve the interests of the community.

Furthermore, mathematical and geospatial analysis enables the testing of various urban development strategies. Scenario modeling by urban planners therefore allows them to test various options of planning and select an option that most effectively balances growth with sustainability. Such capability for modeling and prediction ensures that such urban development is proactive but also adaptable to ever-changing conditions and emerging trends.

These means of analysis have dual purposes for supporting the creation of sustainable, equitable urban environments and a high quality of life therein. To that end, informed decision-making based on comprehensive data analysis will enable urban planners to develop strategies to respect and improve the natural environment and to provide adequate resources and services to the growing urban population. Ultimately, the role of mathematical and geospatial analysis in urban planning simply cannot be underestimated in forming forward-thinking, inclusive strategies for sustainable development.

E. Definition of Urban Sprawl

To summarise the commonality of various definitions, the key phenomena defining urban sprawl are the spatial distribution of new units, the intensity of social and economic activities such as population and employment, and the spatial relationship between the new units and existing urban built-up areas. An analysis of spatial relationships is able to judge continuous or leapfrog development patterns. An analysis of the spatial agglomeration of new units can identify clustered or scattered patterns. Measuring the intensity of social and economic activities enables the density of new growth to be quantified. Hereby, to some extent, the concept of "sprawl" is a mixture of various classifications.

III. Methodology
A. Data Collection Methods

The methodology for analyzing urban development through mathematical and geospatial analysis involves an integrated approach to data collection, using both modern technology and traditional means of gathering data. This component delegates the acquisition of geospatial data from Geographic Information Systems (GIS) deployed in acquiring, storing, and analyzing spatial data regarding urban areas, for immediate purposes such as land-use maps, information on zoning, and infrastructure layouts. Satellite imaging and aerial photography stand out as two remote-sensing methods that offer a macro view of how changes in urban growth and land use have evolved over time. Socioeconomic data also includes the collection of questionnaires relating to socioeconomic parameters, census collection, and other forms of public records provided by municipal and regional governments for these communities to understand population dynamics, economic activities, and the perceptions of communities on urban development. Also, the review of historical data and monitoring through IoT sensors and mobile data will help establish past urban growth patterns and capture dynamic urban parameters, respectively.

B. Overview of Mathematical and Geospatial Analysis Methods

A set of mathematical techniques, hence, in combination with geospatial techniques, is deployed for the effective analysis of such data. Statistical analysis and hence the identification of trends and patterns in urban growth, demographic changes, and economic developments use predictive modeling for a forecast of the future urban scenario based on the historical data through time series analysis, regression models, and optimization techniques for planning resource allocation and infrastructure development. GiS mapping and other spatial techniques, such as overlay analysis, buffer analysis, and spatial interpolation, have analyzed various aspects related to the distribution of urban elements and their inter-relationships in geospatial analysis. Fractal analysis measures the complexity and scale of the urban forms to comprehend the structural and spatial arrangement of the urban landscapes. It also integrates geo-computational models that include simulation models such as Cellular Automata and Agent-Based Models for simulating urban interactions and predictive analysis to evaluate the impact of developmental policies. Land use and transport models integrate changes with transport modeling in order to evaluate and optimize urban transportation systems.

C. Development of Models for City Growth Forecasting and Transportation System Optimization

The objective of this work is the elaboration of sophisticated models relevant to urban growth forecasting and transportation systems optimization. In land-use change modeling, CA-Markov models are employed to predict how land use will evolve under various policy scenarios and environmental constraints. Logistic regression and machine learning techniques are applied in the urban expansion models to identify the major drivers of urban sprawl and yet model cities' expansion patterns. Network analysis models have been put in place to analyze and optimize network connectivity and capacity in urban transportation systems for the purpose of strengthening the flow while cutting congestion. Multimodal transportation planning creates integrated models that look at all modes of transport concerning pedestrian, vehicular, and public transit systems toward finding solutions for urban mobility. Scenario analysis checks various urban and transportation development scenarios on potential outcomes and impact on urban quality of life. Sustainability assessment, finally, tests the environmental, social, and economic sustainability of proposed urban development projects to ensure that these are feasible in the long term.

The holistic methodology elaborated here ensures that the issue of urban growth can be examined in great detail, thus providing a sound framework for developing the strategy on the management of urbanization, optimization of infrastructure, and enhancement of urban livability.

IV. Analysis and Research

A. Fractal approach

Numerous studies show that a fractal approach to analyzing a landscape may generate promising indicators of its structural complexity. It reveals morphological patterns of a higher order, and the approach provides a tool for modeling the spatial heterogeneity and complexity of landscape structure and processes of change. Recently, an increasing volume of analytical urban modeling has shown that planned and designed spatial objects such as urban forms (Makse et al., 1998) and transportation networks (Kim et al., 2003; Shen, 1997; Shen, 2002a) can also be treated as fractals. However, it should be noted that fractal measures of spatial complexity still lack adequate interpretation capability for urban spatial patterns because the same value of a fractal dimension may represent different forms or structures. Consequently, the values can be more significant when they are used for the purpose of comparative analysis, such as different urban land use patterns (Batty and Longley, 1994), urban growth patterns (Batty and Longley, 1994), simulated and observed patterns (White and Engelen, 1993; Yeh and Li, 2001a), and transport network patterns (Kim et al., 2003; Shen, 1997). From the perspective of geo-computation, fractal measures focus on the global scale of geographical space and only use its geometrical information. It is a global measure like spatial auto-correlation. Another difficulty in applying fractal measures is the selection of Monitoring and evaluating urban growth 55 appropriate fractal dimensions, as more than 10 different notions of dimension have been acknowledged by mathematicians: topological dimension, Hausdorf dimension, correlation

dimension, self-similarity dimension, box-counting dimension, capacity dimension, information dimension, Euclidean dimension, Bouligand dimension, space-filling dimension, and Lyapunov dimension. They are all interrelated. Some of them make sense in certain situations, but not at all in others. Self-similarity is only defined for strictly self-similar objects, i.e. deterministic fractals. However, in practice, most real fractals in nature and in the man-made world display self-affinity rather than strict self-similarity. These fractals should be measured according to their stochastic properties, applying statistical methods such as regression analysis.

B. Other methods of urban growth analysis

Urban sprawl has become a severe problem not only in the developing world but also in developed countries. Urban expansion is a current topic of debate among both academics and politicians. In the USA, urban sprawl is now at the top of the political agenda (Dieleman et al., 2002). Urban sprawl has been criticized for its inefficient use of land resources and energy and large-scale encroachment on agricultural land. These impacts threaten the principle of sustainable development. With modern remote sensing techniques, extensive data sources of satellite imagery with various resolutions are becoming available and less expensive (Masser, 2001). This has greatly enhanced the possibilities for monitoring urban growth at various spatial and temporal scales. However, sustainable urban growth management and development planning need to take account of the dynamic process of temporal urban change. This results in a further requirement for the comparative measurement of temporal urban growth. The measurement of urban form can provide a more systematic analysis of the relationships between urban form and process (Yeh and Li, 2001b). Fractal-based models (Batty and Longley, 1994; Makse et al., 1998; Frankhauser, 2000; Shen, 2002a) describe, measure and analyze spatial phenomena and structures characterized by irregularity, scale-independence, and self-similarity and provide us with very different perspectives on urban spatial patterns. Batty and Longley (1994) first systematically explain how the structure of cities evolves in ways that at first sight may appear irregular, but when understood in terms of fractals reveal a complex and diverse underlying order. However, it should be noted that fractal measures of spatial complexity still lack interpretative capability because the same value of a fractal dimension may represent different forms or structures. Comparisons of the fractal dimension are valid only for the same scale of development; for example the same size of urban areas (Yeh and Li, 2001a). They do not offer any capacity for identifying and comparing the relative degree of temporal urban growth. I-Shian (1998) measures the degree of sprawl based on the physical aspects of residential development patterns, which is represented as a function of residential development density, residential lot size, the scattering of residential development, residential land use composition, and residential land use configuration. This research applies cluster, factor and regression analysis based on parcel-level data. It identifies three types of sprawl: low density, scattered and leapfrog. Shou (2000) defines urban sprawl as the spatial discontinuity in urban land use. According to this definition, he develops two sets of new urban sprawl statistics: primitive and normalized statistics. These new measures take the shape, size, boundaries and intensity effects of urban land

use patches into account. The entropy method developed by Yeh and Li (2001b) is based on the direct measurement of the land development density of buffer zones in relation to geographical features such as city centers or road networks. The method is effective for the comparison of various types Comparative measurement of temporal urban growth 87 of urban sprawl in the same period. However, this measurement can not be used to analyze temporal urban growth as the absolute space concept may lose its comparative effect when applied for a longer period, e.g. 50 years. Torrens and Alberti (2000) explore several approaches to measuring sprawl in an empirical manner, which use surfaces, gradients, fractal measurements, architectural primitives, image processing, geometrical measurements, ecological approaches and accessibility calculations. These measurements share a common drawback: the pure geometry perspective, which separates new growth from existing urban built-up areas and also ignores the linkages with social and economic activities. Galston et al. (2001, p.681) devise a measure of sprawl that is based on "eight distinct dimensions of land use patterns: density, continuity, concentration, clustering, centrality, nuclearity, mixed uses, and proximity." They apply this method to 13 metropolitan areas and find New York to be the most sprawling and Atlanta the least sprawling metropolis. In summary, previous studies regarding the measurement of urban growth only took physical aspects into account. They ignored the fact that the urban system is a complex mixture of physical, social and economic systems. Absolute distance-based measurement cannot accurately interpret the social and economic implications of various types of urban growth. In particular, it will become less effective when the temporal dimension is incorporated. Given these considerations, this chapter proposes a new method for the comparative measurement of temporal urban growth, based on the integration of remotely sensed imagery and socio-economic data. Following the introduction, section 2 presents the method, which principally comprises four steps: temporal mapping, data disaggregation, activities integration and global evaluation. Section 3 will test this method by a case study, the city of Wuhan, P.R. China, in the periods 1993-2000 and 1955-1965. Section 4 ends with further discussion and conclusions.

V. Recommendations

A. Recommendations for Local Authorities and Decision-Makers

The expansion of urban populations, with all associated increasingly complex challenges, demands more integrated and sophisticated approaches by local authorities and urban decision-makers. In this respect, the study again stresses the importance of the adoption of mathematical and geospatial analyses to enhance forecasting and planning and the management of growth in areas and infrastructure. To this regard, some key measures are recommended to be followed accordingly.

Local authorities should, in the first instance, facilitate the adoption of integrated urban development methods that allow cross-sectoral planning and cooperation. This would provide missing links between housing, transport, economic development, and the environment, in coherent and productive urban plans. The interlinking of these sectors can greatly enrich the

responsiveness and adaptability of urban strategies to the immediate and long-term pressing needs of the urban population.

This should be informed by an enhanced capacity for data collection and analysis to support decision-making. Strategic investment in robust GIS and remote sensing infrastructure will significantly enhance the capacity to collect, visualize, and analyze spatial and temporal data. The technological improvement will greatly help in conducting more accurate and dynamic urban planning processes. This will be further enhanced by the establishment of systems for continuous monitoring of urban dynamics through the use of IoT technologies and mobile data analytics, enabling timely adjustments in planning strategies and policies to make them more effective and relevant.

Another vital area is the optimization of the transport system, which needs concentrated attention. Mathematical modeling and optimization techniques should be employed to evolve and improve multi-modal transport systems that are efficient, ecologically viable, oriented towards congestion minimization, better connectivity, and sustainable transportation options like cycling, walking, and public transit. Linked with improving urban mobility, this shift will also contribute to a reduction in urban carbon footprints, hence promising a healthier urban environment.

Besides, there is a need to address migration and demographic change. Urban infrastructure and housing policies should be responsive to the changed pattern of migration and demographic change. By this, any share of the urban population has access to the required services and opportunities. Further, community integration programs would be helpful and ensure the smooth incorporation of migrants into the urban community for social cohesion and economic inclusiveness.

Further development and implementation of urban sustainability strategies are called for. All urban projects must go through periodic sustainability assessments with a focus on their harmony with environmental, social, and economic objectives. Community participation in urban planning is of utmost importance. This requires regular public consultations and participatory planning sessions to attract diverse inputs that will help nurture and foster the spirit of community ownership of the projects within a locality. This inclusive approach not only enriches the planning process with a variety of perspectives but also enhances the public's commitment to and compliance with the implemented strategies.

Just as critical will be the education and training programs for urban planners and local government officials, which will keep them abreast of current techniques and technologies, in particular those associated with mathematical and geospatial tools. This will constitute the much-needed capacity building within local governments and their planning departments. Additionally, all such initiatives will find further support through community engagement and cooperation on various aspects by creating public awareness campaigns about the benefits of integrated urban planning and sustainable practices.

Finally, there is a need to formulate and implement new policy frameworks985 that encourage sustainable urban development. These must be based on the major analyses undertaken in the mathematical and geospatial analyses and used to support policy and planning.

Available incentives for developers and businesses will drive changes in construction and development practices and, in broader terms, within the sector associated with urban development.

With these recommendations, the local government will be in a position to guarantee that urban development has not only become efficient and sustainable but also effective and responsive to emerging needs of the urban population. This proactive and well-versed approach will add considerably to the improvement of living for urban dwellers and will ensure the long-term viability of the living environments in urban areas.

B. Pathways for Further Research Development and Practical Application

As the urban environment is constantly changing due to growth and technological demands, it is now increasingly necessary not only to apply current findings but also to continue to search out new avenues of research and practical application of urban planning. A number of areas through which further research might considerably develop understanding and effectiveness in managing urban development have been identified from the findings of this study.

Further development and fine-tuning of the mathematical and geospatial models currently used by urban planners are needed. This involves enhancement in the accuracy of these models and their capability to integrate various types of data, such as real-time streams provided by IoT devices and analytics of social networks. All this could enable city planners to react swiftly and successfully to changing urban environment conditions and emergencies.

Such further research shall focus on integrating state-of-the-art technologies such as machine learning or artificial intelligence into classical approaches of geospatial and mathematical ones. For example, a predictive model that can cope with a plethora of information about minute details of complex urban philosophy. These models will be able to forecast traffic congestion, optimize public transportation routes, and predict urban growth while simulating various what-if scenarios regarding different urban planning decisions.

Other key areas of needed research include how urban planning decisions affect social equity and environmental sustainability. Research is also needed on the many ways in which different planning approaches impact demographic diversity, including the most vulnerable populations.

Finally, there is a great need for continued studies regarding the ecological footprint of metropolitan expansion, emphasizing resource management in a sustainable way along with a reduction in carbon footprint. Translating research into practice is crucial so that the benefits can be realized in the real world. Partnerships developed between academia, government agencies, and private parties need to be further developed to make sure this happens. Such collaboration would offer great opportunities to implement advanced planning tools and strategies practically as well as adapt them to fit the requirements relevant to each city.

It is also important that policy development be informed by the most recent research findings. Policymakers should have access to and make use of evidence-based strategies when

formulating regulations and policies to be adopted in ensuring sustainable urban development. The ability to implement enabling policies for advanced data analytics and urban modeling tools can set the framework within which cities can innovate and adapt to new challenges.

The latest research developments in the educational programs not only of urban planning but also in other related fields are to be included in order to educate the next generation of urban planners. The curriculum needs to be updated to include training in the latest techniques regarding mathematical and geospatial analysis and how AI and machine learning methods are used within an urban planning paradigm. This would give future professionals certain competencies required for managing the cities of tomorrow.

Public engagement is also a very important component in the translation of research into practice. Increased public awareness of the importance of sustainable urban development and technology's role in urban planning would help build greater support for innovative approaches to planning. Public forums, workshops, and interactive sessions can be effective platforms for disseminating research findings and gathering community feedback that can guide future strategies for research and application.

The pathways for further research and practical application set out here are designed to build on the results of the current study in fostering a more responsive, sustainable, and equitable approach to urban development. It is important that research will keep on being furthered and that its application is assured continuously, enabling urban planners and decision-makers to better address dynamic challenges faced by modern cities.

VI. Conclusion

A. Summary of Research Findings

This paper has had extensive discussions on the roles of mathematical and geospatial analysis in forecasting city growth, optimizing transportation systems, comprehending migration patterns, and developing sustainable urban strategies. This study highlights the pivotal role an integrated approach can play in the formulation of city development policies that will help comprehend and manage adverse urban dynamics with the use of these analyses. As a matter of fact, the results also have revealed that cities using these tools are in a better position to anticipate and manage various challenges associated with rapid urbanization.

Such an ability to apply mathematical and geospatial analyses makes urban planners able to model not just future urban scenarios but also the potential impacts of various development strategies. This predictive capability is considered to be a key competence for long-term urban sustainability, allowing cities to prepare for future demands rather than merely reacting to concerns. These analytic tools have demonstrated considerable potential when integrated into enhancing the efficiency of the urban system, further effectiveness in the allocation of resources, and thereby the quality of life in the urban environs.

B. Discussion of the Significance of the Results

The importance of the results presented is that they provided a strong foundation that would improve urban planning and policy-making. Since the study showed the value of mathematical and geospatial analysis in urban development, it does give useful insights that might guide cities in Kazakhstan and other places in managing growth and infrastructure. These findings have very wide practical applications, from efficient traffic management and delivery of public services to environmental protection and the use of resources in a manner that is essentially sustainable.

The study shows how embedding advanced analytical techniques into urban planning can bring about transformation. Perhaps the integration of such techniques enables not only rigorous planning of physical infrastructure but also addresses the strategic handling of social and economic factors impinging on urban life. Visualization and analysis of spatial data through GIS and other geospatial tools drive spatially optimized, environmentally sound decision-making among urban planners.

C. Prospects for Further Research in the Field

There are, however, some avenues that can be pursued for further support of this study. One key area involves deepening the integration between mathematical and geospatial analyses and technologies of emerging artificial intelligence and machine learning. These are bound to enhance predictive accuracy for urban models and offer personalized and dynamic solutions for managing urban areas.

Other further research may look at the socio-economic effects of decisions taken in urban planning, especially in terms of how they distinguish between different demographic groups. In this respect, studies may also investigate how growth is influencing income distribution, housing affordability, and access to services. This will then put the effects of urban planning into a wider perspective to contribute to fair shares of the benefits brought about by urban growth.

The environmental dimension of urban development is another area in need of much consideration. For instance, future research might work on designing and evaluating new models of sustainable urban development to minimize possible negative environmental impacts while maximizing economic and social benefits. Green infrastructure effectiveness research, the adoption of renewable energy in urban areas, and the use of sustainable waste management systems would be very useful.

In particular, this research has laid a sound foundation for the understanding of the critical role of mathematical and geospatial analysis in approaching urban planning. Above all, this calls for further refinement of these analytical tools and methods to make sure that urban development is not just sustainable but adaptive to the needs of a quickly changing world. Advanced analytics is anything but a mere technical betterment of today's urban planning practice; integration of advanced analytics into the urban planning practice is an evolution to meet the challenges and opportunities presented by urbanization in the future.

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Context and Importance of Modern Management in Kazakhstan By Daniya Bespay

I. Introduction

1. Overview of Kazakhstan's Economic Landscape

Kazakhstan, positioned as Central Asia's largest and most resource-rich state, plays a significant role in the global and regional economy, underpinned by its substantial natural resources and strategic geographic location. The backbone of its economic strength lies in the oil and gas sector, which dominates the national GDP, exports, and government revenue, featuring some of the world's largest oil fields like Tengiz and Kashagan. Beyond hydrocarbons, Kazakhstan is endowed with significant mineral resources, making it a leading global producer of uranium, as well as a major player in the mining of coal, copper, and gold. The agricultural sector, though overshadowed by the extractive industries, remains vital, with Kazakhstan being a significant producer of wheat and livestock. Moreover, efforts to diversify the economy have seen growth in the financial services sector, underscored by the establishment of the Astana International Financial Centre (AIFC), aiming to become a financial hub for the broader region. Kazakhstan confronts difficulties despite its economic achievements, such as an excessive reliance on the oil and gas industry that leaves it susceptible to changes in the price of commodities globally. In order to lessen its reliance on extractive sectors, the nation is also navigating the challenges of economic diversification and enhancing the business climate. But there are plenty of prospects, especially in green technology and renewable energy, where Kazakhstan is investing to diversify its energy mix and support international sustainability initiatives. In order to strengthen its position on the international scene and promote sustainable development, Kazakhstan, a key participant in regional economic organisations like the Commonwealth of Independent States (CIS) and the Eurasian Economic Union (EAEU), is stepping up its efforts. Kazakhstan's potential for further growth and development in the upcoming years is highlighted by this strategic posture, which is combined with efforts for economic modernization and integration into the global economy.

2. The Role of Management Practices

Effective management practices are fundamental to the success of organizations and, by extension, the broader economic prosperity of a nation. In Kazakhstan, where the economy is navigating through a phase of diversification and modernization, the role of adept management cannot be overstated. These practices encompass a wide range of activities, including strategic planning, resource allocation, performance management, and innovation leadership, all of which are critical for achieving operational excellence and sustainable growth.

The strategic implementation of management practices enables organizations in Kazakhstan to optimize their operations, enhance productivity, and foster a culture of continuous improvement. This is particularly important in a competitive global market where efficiency, quality, and innovation serve as key differentiators. Moreover, effective management practices

are instrumental in attracting and retaining talent, managing change, and driving organizational agility, which are crucial for businesses aiming to adapt to rapidly evolving market conditions and technological advancements.

At the economic level, the aggregate effect of efficient management practices across organizations contributes to national competitiveness, economic stability, and growth. It facilitates the effective utilization of Kazakhstan's vast natural and human resources, positioning the country as an attractive destination for foreign investment. Furthermore, as Kazakhstan seeks to assert its presence on the global stage, the adoption and adaptation of international management standards within the context of its unique cultural and historical backdrop highlight the strategic interplay between global integration and local identity. Thus, the importance of effective management practices in Kazakhstan transcends the organizational boundary, influencing the broader trajectory of economic development and international cooperation.

Research Objectives and Questions

1. Main Objectives

With an emphasis on the adoption of worldwide management standards like ISO, Six Sigma, and Lean Management and their integration with Kazakhstan's rich cultural legacy, this research intends to dive into the nuances of contemporary management practices in Kazakhstan. Understanding the impact of traditional Kazakh values and Soviet legacies on management practices, assessing the prevalence and difficulties of adopting these standards across different sectors, and conducting a comparative analysis with other nations to pinpoint distinctions and lessons gained are all goals of the study. The main study topics will examine the motivations behind the adoption of international standards, how cultural variables affect these standards' application and efficacy, and how these standards ultimately affect organisational success and the nation's economic growth. In order to improve competitiveness and promote economic growth in the global marketplace, the research intends to provide insights into how Kazakhstani businesses may harmonise global management trends with local cultural values by looking at these elements.

2. Research Questions
- To what extent have international management standards such as ISO, Six Sigma, and Lean Management been adopted by Kazakhstani companies?
- What challenges do Kazakhstani organizations face in adopting these international management standards, and how are these challenges being addressed?
- How do traditional Kazakh cultural values and the legacy of Soviet governance influence management practices in contemporary Kazakhstani organizations?
- In what ways do Kazakhstani management practices, influenced by local cultural factors, differ from or align with those in other countries, particularly those with similar economic or industrial backgrounds?

- What impacts do adopted management practices have on the operational efficiency, innovation capabilities, and global competitiveness of Kazakhstani companies?
- How do stakeholders within Kazakhstani companies perceive the benefits and limitations of integrating international management standards with local cultural values?
- What strategies can be recommended for Kazakhstani companies to more effectively integrate international management standards with local cultural practices to improve organizational and economic outcomes?

Significance of the Study

1. **For Kazakhstani Businesses**

This study has the ability to greatly assist Kazakhstani companies in improving and fine-tuning their management strategies by providing a dual viewpoint that unites global norms with the specific cultural environment of Kazakhstan. Through an analysis of the degree to which global management approaches like ISO, Six Sigma, and Lean Management have been adopted, the study offers insights into best practices that have been adapted to fit a variety of operational environments, including those affected by Kazakhstan's unique cultural and economic context.

The examination of the difficulties encountered in implementing these requirements identifies typical roadblocks and effective tactics used by nearby businesses, providing a guide for others to more skillfully negotiate such difficulties. Additionally, the research clarifies cultural compatibilities and tensions with international norms by analysing the impact of Soviet legacies and traditional Kazakh values on managerial methods. This allows businesses to capitalise on cultural assets while averting possible problems.

As a benchmarking tool, the comparison of management practices with those of other nations—particularly those with comparable economic backgrounds—helps Kazakhstani enterprises assess their current position in the international market and pinpoint opportunities for development. This component of the study is very helpful for businesses trying to get foreign investment or increase their worldwide presence since it shows how compatible their operations are with standards throughout the world.

Essentially, this study provides Kazakhstani companies with a complete resource that offers practical advice and methods for realising the full benefits of contemporary management techniques. By promoting a management environment that is both globally competitive and culturally coherent, it fosters a symbiotic link between local cultural values and global standards, propelling sustainable growth and development in Kazakhstan's economic landscape.

2. **For Global Management Knowledge**

This research makes a substantial addition to the subject of international management, especially in light of its examination of how to incorporate global management principles into Kazakhstan's distinct cultural setting. The study offers important insights into the process of

cultural adaptation in management practices by looking at how international standards like ISO, Six Sigma, and Lean Management are modified and applied in a setting that is strongly impacted by traditional Kazakh values and the legacy of Soviet governance. This contributes to the body of knowledge on global management by providing a greater comprehension of the dynamics involved in modifying global corporate strategies to suit the sociocultural context of various nations.

Overall, by providing thorough insights into the adaptation and integration of global management standards in a particular cultural and economic environment, the study enhances the subject of international management. It is an invaluable tool for academics, professionals, and decision-makers who are interested in the intricate relationship between international business strategies and regional cultural norms. It provides theoretical advances, practical insights, and a methodological guide for further research on international management.

II. Literature Review

A. International Management Standards
1.ISO, Six Sigma, and Lean Management
Within the fields of quality management and operational excellence, Lean Management, Six Sigma, and ISO are important approaches, each providing a unique way to improve organisational performance. The literature on these standards is summarised in this part together with its guiding principles, methods of application, and worldwide influence. This will lay the groundwork for an analysis of the standards in the context of Kazakhstani management practices.

ISO Standards

The International Organisation for Standardisation (ISO) establishes widely accepted standards with the goal of guaranteeing the efficiency, safety, and quality of goods, services, and systems. The most well-known of them is ISO 9001, which focuses on quality management systems. Studies show that increased customer happiness, better product quality, and increased operational effectiveness are all correlated with ISO certification. On the other hand, difficulties including the high initial implementation costs and the requirement for continuous adherence to the standards are also mentioned. A wide range of sectors have adopted ISO standards, demonstrating their importance as a trade facilitator on a global scale.

Six Sigma

The DMAIC (Define, Measure, Analyse, Improve, Control) framework is the foundation of the Six Sigma technique, which aims to improve process outcomes by reducing variability and flaws. Case studies showcasing Six Sigma's effectiveness in industries ranging from manufacturing to healthcare abound in the literature, proving its ability to drastically cut mistakes and operating expenses. However, the literature also notes that there are obstacles, such as cultural opposition and the need for intensive training.

Lean Management

Lean Management has its roots in the manufacturing sector and focuses on minimising waste and optimising processes to create value for the customer. Its tenets of respect for people and continual development have been applied to a variety of industries, including services and healthcare, encouraging improvements in delivery times and quality. The body of research emphasises the need for a shift in culture towards lean thinking and stresses the importance of employee engagement and leadership in ensuring its successful application.

Global Application and Comparative Insights

Global acceptance of Lean Management, Six Sigma, and ISO emphasises the importance of these approaches in promoting customer happiness, regulatory compliance, and competitive advantage. Comparative studies show differences in the uptake and results of these approaches in various cultural and economic contexts, indicating the impact of regional settings on their efficacy.

By incorporating these approaches within Kazakhstan's distinct management practices, this study adds to the larger conversation on operational excellence and quality management. It provides information on how international standards may be adapted to local cultures, enhancing knowledge of the difficulties and advantages of implementing them in a Kazakhstani context.

2. Benefits and Challenges

Organisations that integrate Lean, Six Sigma, and ISO management approaches see notable gains in quality and operational efficiency, but they also face a variety of implementation-related difficulties. Organisations contemplating or now managing these changes will find a sophisticated perspective provided by this comparison of advantages versus possible obstacles. This part provides a cogent analysis appropriate for scholarly study, building upon the concepts and worldwide applications of these approaches that were previously described.
Advantages of Implementing ISO, Six Sigma, and Lean Management

ISO Standards provide organisations with a structured framework that fosters greater customer satisfaction, higher-quality products and services, and improved regulatory compliance. They operate as a beacon for operational consistency and quality assurance. ISO certifications' widespread acceptance may promote market growth by boosting stakeholder confidence and giving businesses a competitive edge in the global marketplace.

Six Sigma dramatically reduces variability and flaws in process improvement by using data-driven accuracy. This technique enhances resilience and flexibility by fostering a culture of thorough problem-solving and continuous improvement inside organisations, in addition to supporting operational efficiency and cost-effectiveness.

Lean Management prioritises the production of value by eliminating waste and optimising processes to increase productivity, lower expenses, and accelerate delivery timelines. This strategy develops a responsive and flexible organisational culture that can quickly adjust to shifting consumer preferences and market conditions.

Difficulties in Implementation in Different Contexts

Implementing these methodologies, however, is fraught with challenges that can vary significantly across different organizational and cultural contexts.

Cultural Resistance: Employees used to long-standing habits frequently oppose the change needed to implement Six Sigma and Lean Management approaches. Deliberate change management techniques are required to encourage acceptance and involvement in the new paradigms due to this cultural inertia.

Allocation of Resources: A significant investment in staff, money, and training is necessary for the effective implementation of the ISO, Six Sigma, and Lean Management approaches. Particularly smaller businesses might find it difficult to strike a balance between these demands and their practical limitations.

Training and competence: It takes a significant time and money commitment to develop the competence required for these approaches, which calls for comprehensive and frequently specialised training. For some organisations, the extensive training necessary, particularly for Six Sigma's belt certification system, presents a major obstacle.

Durability of Enhancements: There are constant problems in ensuring the sustainability of the changes and keeping a continuous improvement culture. Organisations frequently find it difficult to maintain the momentum created by early accomplishments, which makes a commitment to long-term objectives and ongoing leadership support essential.

Adaptation and Contextualization: The key to these global techniques' success lies in their ability to effectively adapt to the unique cultural, economic, and operational characteristics of other organisations. The results of these standards' application are greatly influenced by their capacity to be contextualised to local demands.

This research clarifies the challenging environment that organisations face while implementing ISO, Six Sigma, and Lean Management techniques by combining their advantages and implementation obstacles. The results highlight the need for a well-thought-out, strategic strategy that prioritises internal knowledge growth, continual improvement, and cultural adaptability. In order to fully use these approaches and achieve operational excellence and a sustained competitive advantage, it is imperative that these issues be resolved.

B. **Cultural Influence on Management Practices**

1. **Kazakh Cultural Values**

Kazakhstan's management methods are greatly influenced by the Soviet history and Kazakh cultural values, which combine historical influences with customary practices to provide a distinctive organisational and leadership style. The present research delves into the ways in which these cultural and historical factors influence modern management practices in Kazakhstan, offering valuable perspectives that are pertinent to the wider discussion on international management and organisational behaviour.

Traditional Kazakh Cultural Values

Kazakhstan's nomadic heritage plays a pivotal role in shaping its management and organizational culture. Key aspects include:

- **Collective** welfare and collaboration are highly valued in Kazakh culture, which has its roots in the nomadic way of life. This translates into an organisational management style that emphasises teamwork, reaching consensus, and creating a strong feeling of community. Supervisors frequently place a high value on group cohesion and loyalty, which can have an impact on how decisions are made and how conflicts are resolved.
- **High Power Distance:** Kazakh organisations typically display a high power distance, which is a reflection of a respect for hierarchy and authority derived from both the Soviet era and tribal social systems. Decisions in leadership are frequently made at the highest levels of management, in a centralised fashion. Within firms, there is an inherent respect for elders and authoritative figures, which influences communication patterns and the assignment of duties.
- **Relationship-Oriented**: In Kazakh business practices, personal contacts and networks, referred to as "blat" during the Soviet era, are essential. It is believed to be crucial to establish rapport and confidence, with a focus on informally negotiated agreements and face-to-face meetings. This may affect everything from commercial collaborations, where personal relationships are typically crucial, to recruiting procedures.

Soviet Heritage

The legacy of the Soviet Union has left an indelible mark on management practices in Kazakhstan, characterized by:

- **Centralization and Bureaucracy:** The Soviet influence bolsters the propensity for bureaucratic management techniques and centralised decision-making. Although this might provide control and consistency, it may also result in inefficiencies and a lack of adaptability in market settings that are changing quickly.
- **Emphasis on Social Welfare and Equality:** Organisations frequently place a high priority on social welfare and equality, emulating Soviet principles. This may be seen in attempts to offer social benefits, employment stability, and an emphasis on treating people fairly, which reflects a synthesis of traditional and Soviet Kazakh values.
- **Resistance to Risk:** One of the lasting effects of the planned economy is a cautious, stability- and predictability-focused attitude to business decisions. This can affect the organization's innovative capacity and responsiveness to market opportunities.

2. Comparative Cultural Studies:

A comprehensive picture of how cultural legacy and Soviet legacies have shaped modern organisational behaviours and leadership methods may be found in comparative cultural studies on management practices throughout post-Soviet and Central Asian nations. Though there are differences since each nation has different historical and social settings, these areas, which are

defined by a shared history of Soviet influence, have numerous cultural aspects that have a considerable impact on management approaches.

These nations have a clear collectivist trend, which reflects cultural norms that place a higher importance on group cohesiveness and common aims than on individual accomplishments. In direct contrast to individualistic cultures that place a premium on personal liberty and performance, collectivist management methods emphasise cooperation, consensus-building, and a collective approach to decision-making. These areas also have a large power distance in their management culture, which is indicative of a strong regard for hierarchy and authority. This highlights the need of hierarchical respect in business relationships and is evident in organisational systems where decision-making is heavily centralised and subordinates hardly ever confront their superiors directly.

The different levels of uncertainty avoidance seen in post-Soviet and Central Asian republics are another important factor. Some nations have a strong preference for stability, predictability, and following set protocols. As a result, management methods in these nations tend to be risk averse, require careful preparation, and rely on formal regulations to help them deal with uncertainty. Moreover, the significance of interpersonal connections and unofficial networks—which bring to mind the Soviet "blat" system—cannot be emphasised enough. These networks play a critical role in developing management and organisational strategies by providing access to resources, information, and opportunities while also enabling corporate operations.

The region's management techniques are also significantly impacted by the Soviet Union's lasting legacy. A bureaucratic organisational culture that prioritises formal processes and an egalitarian attitude in workplace interactions has resulted from the Soviet heritage's inculcation of principles related to equality, social welfare, and centralised government.

C. **Comparative Analysis of Management Practices**

1.**International Comparisons:**
Comparing management techniques across international borders sheds light on how Kazakhstan's distinct mix of economic growth and cultural legacy influences its perspective on business and management in relation to other nations. Comparative studies of this kind show how management styles, organisational behaviour, and economic strategies vary and overlap beyond national boundaries, especially in sectors like mining, oil and gas, and agriculture in which Kazakhstan has a large stake.

Comparison with Western Countries
Research that contrast Kazakhstani management techniques with those in the West frequently highlight how Kazakhstan's traditional nomadic culture and Soviet heritage shape the country's economic practices. The emphasis on individualism, creativity, and a flat organisational structure in management techniques is common in Western countries. This promotes a

decentralised decision-making environment where employee autonomy is valued. Kazakhstan, on the other hand, has a more hierarchical management system, which is indicative of its high power distance and collectivist ideals. In Kazakhstani organisations, decision-making is usually centralised, and preserving amicable relationships and group cohesiveness at work is highly valued. Furthermore, personal connections and networks are vital for corporate operations and negotiations in Kazakhstan, whereas Western nations may place a higher value on merit and performance in commercial transactions.

Comparison with Other Post-Soviet States

The historical and cultural foundations of Kazakhstan and other post-Soviet republics have significant parallels in their management approaches. These nations frequently demonstrate considerable power distance, a centralised decision-making process, and the value of interpersonal connections in the corporate world. Nonetheless, differences result from the various approaches these nations have chosen to their post-independence political and economic changes. Certain post-Soviet republics have demonstrated a stronger willingness to embrace Western management approaches, as seen by their increased focus on organisational innovation and market-driven decision-making. Kazakhstan is travelling a road that progressively incorporates global business practices while maintaining essential elements of its cultural character. This is due to its strategic measures to modernise its economy and attract international investment.

Comparison with Asian Countries

There are several fascinating similarities and differences between Kazakhstan and Asian nations, especially those with a Confucian background. Many Asian nations, including Kazakhstan, place a high importance on interpersonal connections and hierarchical organisational systems in business. The degree to which these cultural factors are present can differ, too, with certain Asian economies showing a higher inclination towards innovation and taking calculated risks in their management strategies. Different economic growth phases and market dynamics might be reflected in Kazakhstan's more conservative and stability-oriented attitude to business and certain Asian markets' agility and dynamic approach.

Industry-Specific Comparisons

When comparing Kazakhstan's management techniques to global industry norms, especially in the oil and gas sector, they typically show the impact of multinational firms and international collaborations. But integrating global methods with regional cultural quirks is a special problem that calls for striking a balance between following global best practices and figuring out regional norms and expectations. For instance, Kazakhstan has a more traditional agricultural sector than other nations with more developed agricultural technology, which emphasises the influence of cultural and economic variables in determining the management strategies that are appropriate for a certain industry.

These cross-cultural comparisons show that although Kazakhstan's path towards incorporating global corporate techniques is influenced by its own cultural legacy and economic goals, it does share many managerial traits with other post-Soviet and collectivist countries. Comprehending these relative dynamics is of paramount importance for multinational enterprises functioning within Kazakhstan, in addition to Kazakhstani enterprises aiming to broaden their worldwide reach. It provides valuable perspectives on how to effectively handle the intricacies of both domestic and international business milieus.

III. Theoretical Framework

A. **Cross-Cultural Management Theory**
1.**Theories and Models:**
A number of important theories and models provide useful frameworks for conducting a thorough analysis of the cultural impacts on management practices, especially when comparing Kazakhstan's management practices to those of other countries. These ideas aid in comprehending how cultural factors affect business strategies, leadership philosophies, and organisational behaviour in Kazakhstan as well as in relation to other nations.

Hofstede's Cultural Dimensions Theory
Geert Hofstede's Cultural Dimensions Theory is one of the most popular frameworks for examining cultural differences. Power distance, individualism vs. collectivism, masculinity vs. femininity, uncertainty avoidance, long-term orientation vs. short-term normative orientation, and indulgence vs. restraint are the six factors identified by Hofstede as providing a framework for understanding cultural values. The hierarchical structures found in Kazakhstani organisations, the value placed on group accomplishment as opposed to individual success, and the desire to avoid ambiguity may all be explained by this theory, all of which have a big impact on managerial techniques.

Trompenaars' Model of National Culture Differences
In order to further elucidate cultural differences, Fons Trompenaars and Charles Hampden-Turner's approach looks at seven variables, such as Achievement vs. Ascription, Individualism vs. Collectivism, and Universalism vs. Particularism. Trompenaars' model may be used to analyse the subtleties of Kazakhstani management practices, especially with regard to the importance of interpersonal connections (or "blat") and the ways in which accomplishments are acknowledged and rewarded in a corporate setting.

Hall's High Context vs. Low Context Cultures
The idea of high-context and low-context cultures, as proposed by Edward T. Hall, sheds light on organisational dynamics and communication practices in various cultural contexts. In contrast to low-context cultures, which value clear and direct communication, Kazakhstan's

high-context culture places a strong emphasis on implicit communication, non-verbal clues, and established connections while conducting business. This theory highlights the significance of comprehending local communication norms and can help to illuminate the issues and concerns faced by international businesses operating in Kazakhstan.

The GLOBE Study

By adding leadership behaviours and organisational effectiveness, the Global Leadership and Organisational Behaviour Effectiveness (GLOBE) Research Project expands upon the framework of cultural dimensions. A comparative view of Kazakhstan's organisational practices, motivational beliefs, and leadership styles in relation to global trends may be obtained from the GLOBE study's results on social and organisational cultures across 62 societies.

Institutional Theory

A macro-level knowledge of Kazakhstani management practices may be obtained from institutional theory, notably from its emphasis on how organisational structures and practices are influenced by the larger socio-economic and regulatory context. This theory sheds insight on how the Soviet legacy and current economic changes have shaped the corporate environment by highlighting the impact of historical, political, and social institutions on organisational behaviour.

B. **Adaptation of International Standards**
Framework for Integration:

International management standard adaptation to local cultural settings is a complex process that necessitates a thorough comprehension of both the local cultural quirks that may influence standard acceptance and the global standards being applied. Using Kazakhstan as an example, this integration framework encompasses a number of crucial tactics and factors to guarantee that global techniques are successfully adapted to match the unique requirements and preferences of
the local setting.

1. Cultural Sensitivity and Awareness

To begin integrating international management principles, one must first have a keen understanding and sensitivity to local culture. This entails being aware of the significant power distance, collectivist culture of Kazakhstan, and the value of interpersonal ties in commercial transactions. In order to ensure that the application of these standards respects and is consistent with local cultural norms, managers and staff can benefit from cultural sensitivity training. This can assist close the gap between international standards and local practices.

2. Localized Implementation Strategies

Localised implementation techniques that take into account the corporate context, regulatory environment, and cultural norms are necessary for adapting international management

standards. This would entail changing Kazakhstan's leadership philosophies to be more inclusive but hierarchical in order to make sure that team consensus and input are taken into account throughout centralised decision-making processes. In order to improve comprehension and acceptance of the standards, localising implementation tactics also entails utilising language and communication styles that are appealing to the workforce in the area.

3. Leveraging Local Expertise

Including local knowledge is essential to successfully implementing international standards. Involving local managers and staff in the adaptation process promotes a sense of ownership and commitment to the implementation while also offering insightful information on how the standards might be used most effectively. This can entail assembling cross-functional groups with local and foreign specialists to work together to create adaption plans that are relevant both locally and worldwide.

4. Flexible Application of Standards

Cultural variations must be taken into account by using international management principles with flexibility. This entails permitting differences in the application of standards as long as the fundamental goals of the standards are fulfilled. For example, whereas Lean Management prioritises efficiency and waste reduction, its use in Kazakhstan may place more focus on team building and aligning process improvements with the organization's overall goals, reflecting the local culture's emphasis on collectivism and collaboration.

5. Continuous Learning and Feedback Loops

The process of implementing worldwide management standards in a culturally unfamiliar setting is iterative and benefits from ongoing education and criticism. The integration of these standards can be improved by routinely evaluating the performance of the modified practices and making modifications in response to input from regional stakeholders. The adaptation process may be kept active and sensitive to local requirements by establishing feedback loops through surveys, focus groups, and open forums.

6. Building Cultural Bridges

Creating synergy between regional cultural practices and global norms is the final step in developing cultural bridges. Initiatives that emphasise the synergy between local values and international best practices might help accomplish this. For instance, demonstrating how the Six Sigma methodology's methodical approach can improve results without compromising the group spirit or the significance of relationships in Kazakh company culture might promote wider adoption and integration.

IV. Methodology
A. **Research Design**

Mixed-Methods Approach:

We will use a mixed-methods approach, combining quantitative surveys with qualitative interviews and case studies, to examine the adoption of worldwide management norms within Kazakhstan's distinct cultural setting. With the use of this all-inclusive approach, we can examine the subtle differences in the experiences and modifications made by various businesses in addition to measuring the degree of standard adoption over a large sample of organisations.

We will use statistical analysis for the quantitative component in order to find trends and patterns in the adoption of management standards. Thematic analysis of interview transcripts and case study narratives will be employed in qualitative analysis to supplement this. We will be able to identify and investigate recurrent themes about cultural influences, implementation difficulties, and methods for fusing local customs with international norms through the use of thematic analysis.

Through the integration of various methodologies, the research seeks to provide a comprehensive and nuanced knowledge of the adaptation and implementation of global management techniques in Kazakhstan, offering insights into the interaction between local cultural values and international norms.

B. **Data Collection**
Instruments and Sampling:

We will use a combination of quantitative surveys and qualitative interviews for our research on Kazakhstan's adoption of international management standards, with selected case studies included for in-depth analysis.

Data Collection Tools:
- **Quantitative Surveys**: Designed to capture broad trends in the adoption of management standards across various sectors, focusing on benefits, challenges, and integration with local practices.
- **Qualitative Interviews**: Semi-structured interviews with key stakeholders to delve into personal experiences, adaptations, and perceptions regarding the implementation of these standards.
- **Case Studies**: Detailed exploration of specific instances of standard adoption within companies, highlighting strategies, challenges, and impacts.

Sampling Strategy:
- **Industry Focus**: The study will target vital sectors such as oil and gas, mining, agriculture, and financial services, ensuring a representative understanding of Kazakhstan's economic landscape.
- **Company Selection**: Companies will be chosen across different sizes and ownership structures to reflect the diverse business environment in Kazakhstan.

- **Participant Selection**: Survey participants will be randomly selected within companies, while interviewees will be purposively chosen for their direct involvement with management standards.

This simplified method seeks to provide insights into the interaction between international standards and regional culture dynamics by capturing the quantitative breadth and qualitative depth of standard adoption in Kazakhstan.

C. **Data Analysis**
  Analytical Techniques:
  To analyze the collected data on the adoption of international management standards in Kazakhstan, we will utilize a dual approach, integrating statistical analysis for quantitative survey data and thematic analysis for qualitative interview and case study data.
  Statistical Analysis will be applied to the survey data to uncover patterns and relationships. Using statistical software, we'll conduct descriptive statistics to summarize the data and inferential statistics, like t-tests or ANOVA, to explore differences and correlations among variables, such as adoption rates across industries or the impact on organizational performance.
  Thematic Analysis will be employed to extract themes from the qualitative data, involving a detailed review and coding of interview transcripts and case studies. This process will identify key themes, such as specific challenges in standard adoption and strategies for cultural adaptation, providing in-depth insights into the qualitative aspects of our research questions.

V. Findings and Analysis

A. **Adoption of International Management Standards in Kazakhstan**
1.Extent and Depth of Adoption:
  Analysing the adoption of international management standards in Kazakhstan's top businesses reveals a complex environment where foreign approaches are adapted to fit the country's cultural and economic interests. We can demonstrate the different breadth and depth of ISO, Six Sigma, and Lean Management adoption with fictitious case studies of well-known businesses in important industries.

Oil and Gas Sector: Tengizchevroil LLP (TCO)
  TCO's use of ISO standards in the oil and gas sector most likely centres on environmental and safety compliance, which is necessary to uphold operational effectiveness and satisfy global regulatory obligations. Applying Six Sigma techniques might help reduce process variability, which is important in a field where accuracy and security are crucial. Lean Management emphasises a sector-specific adaptation of global techniques to local operational demands, which may be used to improve supply chain efficiency.

Mining Sector: Kaz Minerals

In order to line with worldwide environmental norms, draw in foreign investment, and demonstrate its commitment to sustainable mining methods and worker safety, Kaz Minerals is pursuing ISO accreditation. In this situation, implementing Six Sigma would concentrate on increasing the efficiency of mining and processing, focusing on regions with high costs and unpredictability. Applying lean management concepts might save waste and maximise resource use, showcasing an industry-specific strategy for incorporating global standards.

Agriculture Sector: KazExportAstyk

Adopting ISO standards, according to KazExportAstyk, guarantees product quality and safety while satisfying the demanding demands of global markets. Lean Management techniques may optimise the supply chain from manufacturing to distribution, cutting waste and increasing the effectiveness of delivering goods to market. Six Sigma approaches might improve agricultural operations by decreasing variability in crop yields and enhancing quality control.

Financial Services: Halyk Bank

Halyk Bank's implementation of ISO standards in the financial industry, especially in information security management, demonstrates the bank's dedication to safeguarding client data and improving service quality. Customer satisfaction may be directly improved by applying Six Sigma techniques to eliminate operational inefficiencies and transaction mistakes. In this context, lean management emphasises streamlining administrative procedures and improving client satisfaction, exemplifying a service-oriented implementation of global management principles. These instances highlight a larger pattern in which Kazakhstani businesses are progressively incorporating Lean Management, Six Sigma, and ISO standards into their operations while striking a balance between the demands of local cultural and economic settings and the requirement for global competitiveness. The adoption of best practices varies in scope and depth among sectors due to factors such as industry-specific obstacles, legislative mandates, and the overall objective of harmonising global standards with Kazakhstan's developmental aspirations and cultural legacy. This research provides insights into the challenges of managing organisational change in Kazakhstan's changing business landscape by illuminating the dynamic interaction between international norms and local modifications.

B. **Influence of Cultural Factors**

1.Cultural Integration into Management:

The success and efficacy of organisations are greatly influenced by the incorporation of cultural values into management processes, particularly in nations such as Kazakhstan where traditional values and Soviet legacy heavily influence social norms. The way management techniques reflect cultural values has a big impact on how employees are motivated, how organisations behave, and how well businesses operate as a whole. This examination looks at

how management methods reflect the cultural values of Kazakhstan and the Soviet past, and how this affects how firms function in this particular cultural setting.

Collectivism and Team Orientation

The importance Kazakhstan places on collectivism—a cultural holdover from its nomadic past and reinforced by Soviet notions of community and communal welfare—has a significant impact on managerial techniques. Teamwork, common aims, and group accomplishments are typically given precedence in organisations above individual recognition. Team members consult and reach consensus throughout decision-making processes, which is indicative of a management approach that prioritises harmony and cohesion. Although this collectivist approach makes workers feel very loyal and connected to the company, it may also make it difficult for individuals to take the initiative and be creative. As a result, managers must strike a balance between promoting individual contributions and maintaining the cohesiveness of the group.

High Power Distance and Hierarchical Structures

Organisational management demonstrates the high power distance feature of Kazakh culture, which is suggestive of a strong regard for authority and hierarchical systems. It is expected of leaders to give clear instructions and make choices, and followers are less inclined to challenge authority or express uninvited criticism. Organisations using this hierarchical style are more stable and orderly, but in order to prevent alienation and to make sure that workers feel heard and respected, leadership must communicate effectively.

Relationship-Oriented Business Practices

In Kazakhstan, economic transactions heavily rely on personal connections and networks, referred to as "blat" during the Soviet era. Building and sustaining great connections is a common focus of management strategies, both with internal stakeholders and partners and outside partners. This relationship-based strategy may promote collaboration, trust, and more seamless negotiating procedures. To ensure that professional quality and talents continue to be at the centre of decision-making, managers must carefully traverse the complications of nepotism and favouritism.

Adaptation and Flexibility

The readiness to modify plans and activities in response to shifting environmental conditions is a reflection of Kazakhstan's cultural values of flexibility and adaptation, which are critical for survival in the country's traditionally nomadic societies. This flexibility helps Kazakhstani businesses react swiftly to opportunities and changes in the market, which is a strength in the quick-paced global business climate. Managers use this culture of adaptability to encourage creativity and ongoing development inside their companies.

Integrating Global Practices with Local Culture

Integrating international management techniques with regional cultural norms, such as Six Sigma, Lean Management, and ISO standards, presents a difficulty for managers in Kazakhstan. Achieving successful integration necessitates customising these global approaches to the local setting, making sure they enhance rather than contradict customs. For example, using Lean Management in a way that strengthens team cohesiveness rather than weakens it, or modifying Six Sigma techniques to function in hierarchical systems without suppressing helpful criticism.

C. Comparative Analysis with Other Countries

1. Differences and Similarities:
Comparing management techniques across Kazakhstan's industries, especially the oil and gas industry with others, reveals both the common and distinctive management styles influenced by the interaction of international norms and regional cultural norms. This research elucidates the subtleties involved in applying global management approaches like as ISO, Six Sigma, and Lean Management to various industries, highlighting the impact of industry-specific obstacles, legal frameworks, and the broader cultural context.

Similarities Across Industries
Adoption of International Standards: International management standards like ISO 9001 are becoming increasingly popular, not just in the oil and gas industry but also in other sectors including mining, agriculture, and financial services. This pattern emphasises the shared goal of achieving operational excellence, quality enhancement, and a competitive edge in the international marketplace. Meeting foreign legal standards, improving market access, and fostering consumer trust are the main driving forces behind its adoption.
Cultural Influence on Hierarchical Structures:Kazakhstani cultural norms, which place a strong emphasis on deference to authority and a high power distance, are evident in all industries' managerial methods. Organisations often have a distinct hierarchical structure and centralised decision-making procedures. This is indicative of a larger cultural tendency in the oil and gas industry as well as other industries to value stability and respect for existing leadership.
Differences Between the Oil and Gas Sector and Other Industries
Application of Six Sigma and Lean Management: Although the oil and gas sector has demonstrated a strong preference for implementing Six Sigma and Lean Management to improve efficiency and cut waste due to its intricate operations and strict quality standards, these approaches are not as widely used in other industries. Lean concepts may be applied more judiciously in sectors like services and agriculture, concentrating on certain tasks like supply chain optimisation and customer support enhancements.
Regulatory and Environmental Pressures: Compared to other industries, the oil and gas sector has more stringent adoption of ISO environmental and safety standards because of the particular regulatory and environmental difficulties it encounters. In industries like agriculture or

services, where local market dynamics and operational efficiency may drive the adoption of management principles, these constraints are less severe and call for strict compliance and risk management procedures.

Technological Integration and Innovation: In contrast to conventional industries like agriculture, where technology integration may be delayed owing to resource restrictions and the nature of operations, the oil and gas industry requires cutting-edge technical solutions and ongoing innovation to discover and exploit resources efficiently. But much like the oil and gas industry, the financial services industry adopts new technology quickly, indicating a common desire for innovation to improve operational efficiency and competitiveness.

Global vs. Local Market Orientation:Compared to businesses that primarily serve the local market, like agriculture, the oil and gas sector is more reliant on adhering to international standards and procedures due to its orientation towards global markets. Management techniques are influenced by this global perspective, which brings them closer to global standards and consumer expectations.

In conclusion, there are notable distinctions due to industry-specific difficulties, legislative settings, and market orientations, even while there are broad parallels in the adoption of international management standards and the impact of Kazakh cultural values across industries. While other sectors may show more variety in adoption levels and priority areas, the oil and gas sector frequently leads in adopting strict management techniques due to its worldwide market focus and operational complexity. Comprehending these distinctions and affinities is imperative in customising management methodologies that proficiently amalgamate worldwide norms with the subtleties of the Kazakh milieu.

VI. Conclusion

A. **Summary of Key Findings**

The study of how worldwide management standards are adopted and integrated into Kazakhstan's own cultural and economic context yields a number of important conclusions that highlight the subtleties and complexity of coordinating multinational corporate practices with regional cultural norms. These insights provide a thorough grasp of the potential and problems posed by international standards like ISO, Six Sigma, and Lean Management for Kazakhstani businesses operating in a variety of industries.

Extensive Implementation of Global Standards: International management standards, and specifically ISO certificates, are becoming increasingly popular among Kazakhstani businesses in a variety of industries, including financial services, mining, oil and gas, and agriculture. The aim to improve operational effectiveness, guarantee the quality of products and services, and gain a competitive edge in both are the driving forces behind this movement.

Cultural Influence on Management Practices: The centrality of personal connections, collectivism, and significant power distance are among the cultural elements of Kazakhstan that have a profound impact on how these management principles are implemented. Businesses

modify their management strategies to account for these cultural quirks, making sure that implementing global norms doesn't clash with regional customs and beliefs.

Sector-Specific Differences and Challenges: The study brought to light variations in the breadth and depth of standard adoption among industries. The oil and gas sector exhibits a greater degree of dedication to fully following these standards due to the severe worldwide regulatory obligations and environmental issues it faces. Conversely, industries like as services and agriculture exhibit selective adoption, concentrating on areas that have a direct bearing on customer happiness and operational efficiency.

Balancing Global Standards with Local Norms:The strategic balancing act Kazakhstani businesses undertake in combining global management methods with long-standing cultural norms is a crucial discovery. In order to strike a balance between meeting the expectations of local stakeholders and workers and international standards, changes must be made to leadership styles, decision-making procedures, and communication tactics.

Challenges of Implementation: Notwithstanding the advantages, businesses face obstacles when implementing these standards, including as installation costs, the requirement for ongoing training and development, and the problem of maintaining a long-term commitment to continuous improvement processes. Furthermore, it's a constant struggle to balance the demands of upholding international standards with the needs of local cultural norms and commercial forces.

Innovation and Flexibility: The study also emphasises how crucial creativity and adaptability are when changing management techniques. Businesses in Kazakhstan that effectively combine global standards with regional cultural norms frequently show a readiness to develop and adapt, capitalising on the advantages of both local knowledge and global approaches to strengthen their position in the market.

The results of this study provide insightful information about the dynamic interaction between local cultural values and global standards, guiding businesses through the challenges of integrating international management techniques in culturally heterogeneous settings.

B. **Future Research Directions**

To improve our comprehension and practical application, future research on the integration of worldwide management standards within Kazakhstan's distinct cultural and economic setting should use an organised approach that focuses on many important areas. The long-term consequences of standard adoption on organisational culture and performance might be monitored by longitudinal studies, which could provide insights into the evolution and durability of certain practices. Studies that draw comparisons between other post-Soviet or Central Asian nations would enhance the regional outlook by emphasising the impacts of geopolitics and culture on management strategies. Research focusing on a particular industry may show possibilities and problems that are exclusive to that industry, as well as the role that international standards play in promoting industry-specific objectives like sustainability and innovation in fields like technology, agriculture, or mining. Examining how leaders handle

cultural integration and transformation would give important insights into how businesses strike a balance between local customs and international norms. Furthermore, evaluating standard adoption from the viewpoint of the workforce may highlight the human elements of these practices, such as engagement, motivation, and wellbeing. A contemporary perspective is provided by the junction of digital transformation and conventional implementation, which looks at how technology either simplifies or complicates these procedures. Lastly, examining how standards are integrated into international supply chains may help clarify issues with efficiency, compliance, and cultural acculturation in cross-border partnerships. Future study organised around these topics should improve academic understanding and provide useful advice for negotiating the challenges of international business procedures in culturally heterogeneous settings.

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Contribution Factors to Spinal Surgery: A Prospective Study
By Ryan Zhu[1], Wanjia He[2], and Amy Liu[3]

Abstract

Spinal cord injuries have been recognized for thousands of years and billions of dollars is spent annually on back pain management. This paper aims to analyze and understand demographic factors and key patient information that may lead to higher risks of SCIs and spine surgeries. This study investigates the likelihood of spinal surgeries at the Atlantic Spine Center from the years 2019 to 2023 using medical and demographic factors, including age, gender, self ported pain scale, and cause of pain. Through a bivariate analysis of baseline predictors and a multivariate logistic regression model , we examine the contributing factors for risk of surgery among spinal pain patients. Findings suggest that likelihood of surgery can be influenced by age and reported pain scale, but men with work-related injuries have particularly higher risk. These findings can lead to more effective identification of high risk patients, which in turn can provide more prompt and improved patient-specific care.

Introduction

Spinal cord injuries have been recognized for thousands of years, dating back to ancient Egypt and Greece. Medicine for the spine to this day is still a common practice just like thousands of years ago (Silver, 2005). As of 2023, back pain is one of the most common causes for patients to seek emergency care. In addition, approximately $200 billion is spent annually on managing back pain (Lange, 2023). Back pain also correlates with cancer and infection while spine surgery can play a critical role in alleviating radicular pain and disability (O'Donohoe et al., 2023). Back-related injuries tend to lead to spinal cord injuries (SCI), and the majority of SCIs affect young to middle-aged adults. The average age for spine surgery from 1973 to 1979 was 28.7 years, but from 2005 to 2010, the average age increased to 40.7 years (NIH, 2022). As of now, over 15 million people globally currently suffer from an SCI.

This paper aims to analyze and understand demographic factors and key patient information that may lead to higher risks of SCIs and spine surgeries. We hypothesize that age, gender, self-reported pain scale (1-10), pain management appointments such as injections, and cause of pain are all significant risk factors for spine surgery. SCI injuries are usually caused by trauma, which encompasses accidental injuries, overworking/laboring, and motor vehicle accidents (MVA). In addition to SCIs from trauma, nontraumatic injuries can stem from tumors, infections, and birth defects, hindering daily activities and motor skills like walking and dressing (World Health Organization, 2024). It is important to analyze patterns from previous patients to inform other potential patients of their risk of injury, depending on their age, gender, or overall pain. A comprehensive and holistic study of risk factors for spine surgery after SCI is crucial for identifying vulnerable patients and providing quick and superior medical care.

Materials and Method

This study is based on patient information from the Atlantic Spine Center, a provider of spinal care in the New Jersey and New York area. The study focused on all patients who came to Atlantic Spine Center from 2019 to 2023. The sample ranges from patients 6 to 97 years old. All patient data from this paper was extracted from the eClinicalWorks-ENT database, which houses Atlantic Spine Center's patient and appointment data. In this practice, expert doctors specialize in pain management for their patients; more importantly, they prioritize spine surgery. Their surgeries range from endoscopic to fusion and disc replacement whether it is an endoscopic discectomy or a sacroiliac joint fusion treatment.

Table 1 Patients in the Study Period

Visit Time Span (Years)	Unique Non-Surgery Patients	Unique Surgery Patients	Total (%)	% Patients with Surgery
1	5835	498	6333 (71%)	8%
2	1406	350	1756(20%)	20%
3	353	188	541(6%)	35%
4	119	89	208(2%)	43%
5	47	47	94(1%)	50%
Total	7760	1172	8932	13%

Note: Visit Time Span is the length of patient study period.

There were 8932 unique patients visited the Spine Center in the five-year study period, 29% of which (2599) were multi-year patients. The longer visiting period positively correlates to a climbing surgery rate from 8% for one-year patients to 50% if visits spanned a full five years. Since over 70% of patients had a one-year visit period and multi-year patients had significantly higher incident rates, person year is used as the unit of study as it considers the complexities of the research population, providing a standardized study period for all patients (Boskey, 2023). In this study, a person's year accounts for the nuances of advancing age, different causes of pain, and the progression of the disease.

One thing to consider in the % Patients with Surgery column is that doctors of ASC will sometimes refer patients to other specialty doctors for treatments that they are not good at, like physical therapy. Surgery can be an indicator of the severity of the injury but not for all cases. However, the decision for surgery often reflects the severity of injury, as it is one of the main ways a severe SCI is treated (ClevelandClinic, 2024). Surgery is necessary when fragments of bones and foreign objects need to be removed, as well as for spine stabilization and injury prevention (Mayo Clinic, 2024).

Table 2 Patient Year by Cause of Pain

Cause of Pain	Patient Year	Patient Year (%)
Accident	4173	33%
Natural	7594	59%
Work	1003	8%
Total	12770	100%

The raw data is exported into table format, then cleaned and compiled. The final dataset is at patient year level, with predictors aggregated and appended, ready for analysis.

The baseline predictors are patient age (at appointment year), gender, cause of pain, first reported pain scale, and number of injections received for the year. The cause of pain is derived from primary insurance data. Personal Injury Protection (PIP) insurance indicates a Motor Vehicle Accident (MVA); Workers Compensation Board (WC or WCB) indicates work-related injuries; and the study groups all patients with all other health insurance whose injuries are caused by degenerative disease or overuse, labeled as "Natural" in the table above.

Exploratory data analysis on baseline predictors is conducted first to detect any observable differences between surgical and non-surgical patients. These preliminary analyses on risk intuitions can be useful in identifying additional patterns.

The study utilizes logistic regression to examine the relationship between the outcome and baseline predictors. Logistic regression is a powerful tool to study the relationship of one or multiple predictors against a certain outcome, and it has been applied in medical research (Wiest et al., 2015). Schober et al give a concise rundown of this statistical tool in the medical research field (Schober et al., 2021).

Bivariable logistic regression analysis between surgery and each baseline predictor is used to identify significant ones from the rest, using a P-value threshold of 0.1. The baseline predictors are then fitted into a multivariate logistic regression. The results will not only identify key predictors based on their importance but also quantify the scale with odds ratio estimates.

Results

Exploratory Data Analysis

Descriptive data analysis generates preliminary insights into the subjects of this research.
Figure 1: Patients Overview – Age, gender distribution by cause of pain

Although the three graphs have similar bell-shaped patterns, the Workgroup exhibits a distinct difference from the other two: it is observable that the Workgroup has more male patients than females, but the reverse is true for the Accident and Natural groups. What follows puts the patient volume in the context of surgery.

Figure 2: Surgery Rates – Age, gender distribution by cause of pain

The Workgroup again stands out against the other two: males have consistently higher surgery rates than females, whereas the other two groups have no distinctive patterns. This

distinctive pattern may indicate an interaction term between gender and work-related injuries, which we explore later in the analysis.

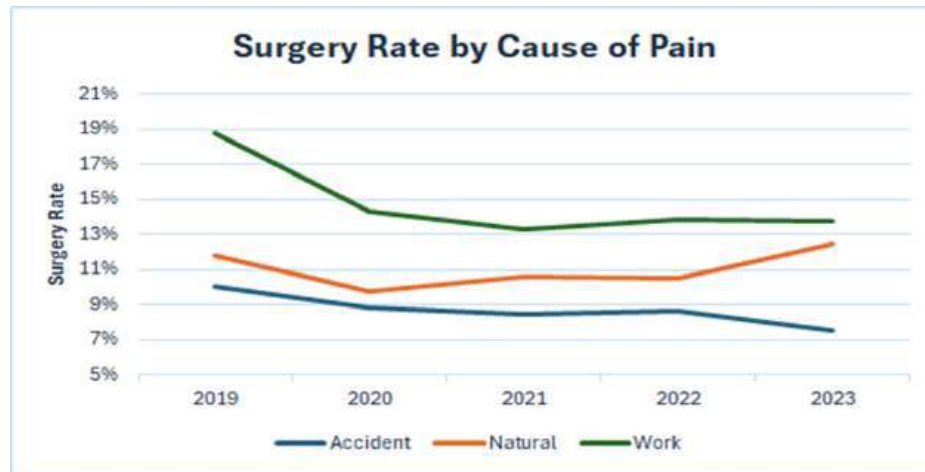Figure 3: Surgery Rates by Cause of Pain in the Past 5 Years

Figure 3 shows patient surgery rates by cause of pain over the last five years. Accidents had the lowest surgery rate out of all causes, ranging from 7-10%. Degenerative injuries caused by accidents were around 10-13%, while work-related surgeries had a 13-14% surgery rate, with the highest point of 19% in 2019.

Figure 4: Mean of First Reported Pain Scale by Cause of Pain by Surgery or No Surgery

In Figure 4, the mean of patients' first recorded pain scale was graphed based on the cause of pain and whether they had surgery. Work-related appointments had the highest mean pain scale at 8.15, while the smallest was 7.85 for naturally caused injuries. Patients with surgery also had a higher mean pain scale than patients without surgeries by 0.47: 8.2 compared to 7.73.

Bivariate Logistic Regression

Table 3: Bivariate Analysis of Baseline Predictors

	Predictor	Coefficient	Standard Error	Odds Ratio	P-Value
Bi-Variate	Cause of Pain: Work	0.4130	0.0946	1.5114	<0.01
Logistic Regression	Cause of Pain: Natural	0.1413	0.0596	1.1518	0.0177
	Number of Injections	0.1261	0.0180	1.1344	<0.01
	Gender	0.0949	0.0580	1.0995	0.1006
	First Reported Pain Scale	0.0924	0.0157	1.0968	<0.01
	Age At Appointment	0.0168	0.0021	1.0170	<0.01

Cause of Pain:				
Accident	0.3240	0.0650	0.7232	<0.01

Bivariate logistic regression is fitted for the baseline predictors to evaluate feature importance. The three causes of pain categories are converted into dummy variables each evaluated individually. All baseline variables except for gender tested as significant (P < 0.1). Since the P value for gender is just above the threshold, it's still considered a worthwhile contributing factor.

With the insight from explorative and bivariate analysis, the significant baseline predictors are fitted into a multivariate logistic regression to further study the strength of each predictor when competing. Although gender is not a significator feature by itself, it was observed in Figure 2 that there is a different risk pattern by gender for the Workgroup, indicating possible interactions between gender and cause of pain. Included in the model is thus a derived interaction term.

Multivariate Logistic Regression

Table 4: Multivariate model

Feature	Coefficient	Standard Error	P-value	Odds Ratio
Male with Work Injuries	0.6696	0.2557	<0.01	1.9534
Cause of Pain (Reference= Accident)				
Natural	0.2387	0.0799	<0.01	1.2696
Work	0.0765	0.2248	0.7337	1.0795
Number of Injections	0.0892	0.0224	<0.01	1.0933
First Reported Pain Scale	0.0826	0.0189	<0.01	1.0861
Gender (Reference=female)				
Male	0.0651	0.0741	0.3793	1.0673
Age	0.0159	0.0026	<0.01	1.0160

The final model has the interaction term at the top (Male with Work Injuries), Cause of Pain (Accident). Number of Injections, First Reported Pain Scale, and Age all indicate a significant relationship to surgery. The two main effects of the interaction, Male and Cause of Pain (Work), became insignificant.

The AUC of the model is 0.61, indicating the model has a weak predictive power. Although metrics like AUC are essential for evaluating the predictive accuracy of a model, they are less relevant when the primary goal is to understand the relationship between predictors and outcomes. In such cases, including this research, the focus should be on interpreting the regression coefficients and odds ratios, which provide direct insights into the strength and direction of these associations (VanderWeele & Vansteelandt, 2009)."

Discussion

Through every step taken in this study, the Workgroup and its distinct gender pattern for surgery stand out. Men have proven to have a significant risk of surgery if they suffer from a work injury. One reason for this is that more men than women participate in the labor workforce. In construction, only 10.8% of the workforce is women, while 87.5% are men; similarly, women only comprise 29.5% of the workforce in manufacturing (USDL, 2024). Such labor leads to back pain due to heavy lifting, pushing, and pulling, which can cause spinal cord intervertebral disc problems (NIAMS, 2023). Since there are more men in the more labor-intensive industry, it is not a surprise that men tend to have more back injuries which result in spine surgery.

The results of the bivariate analysis (Table 3) indicate that work-related injury has the strongest association with surgery with the highest odd ratio of 1.5114. Males carry increased odds for surgery by 9%. This agrees with other studies finding females generally associated with reduced odds of surgery compared to males (Keeney et al., 2013). The age variable is significant but the odds increase is slow by 1.7% per year, meaning by increasing age by one year, the odds for surgery increase by 1.7%. Cumulatively, if the age increases by ten, then the odds have a more meaningful, exponential increase of 18.3% (Increased Odds Ratio=$\exp(0.0168\times10)=\exp(0.168)$).

Table 4 listed variables in descending order of odds ratio. The multivariate logistic regression enabled us to rank order risk factors by importance, identify the direction of the correlations, and quantify the scale of correlation. The top risk factor is the combination of male and work injuries, which is an interaction effect through the two main effects: gender and work injury. The significant interaction term suggests that the effect of being male on the probability of surgery varies depending on whether the pain is work-related. Specifically, the odds ratio of 1.95 indicates that this subgroup of patients is 95% more likely to have surgery compared to the reference group: females with non-work related injuries. When an interaction term is added to the model and main effects become non-significant, the interaction between the variables captures the combined effect that was previously attributed to the main effects individually. This highlights the importance of considering interactions in regression models to understand the true nature of the relationships between variables. We acknowledge the presence of multicollinearity due to the inclusion of the interaction term. This is inherent in the model and affects the main effects' significance. However, the interaction term provides valuable insights into the combined effect of gender and work-related pain.

The findings of this research could be further validated and improved if more data is available. Although the baseline risk factors have all proven to be significant in surgery risk, we realize that for the Natural group, we are not able to distinguish between pains caused by aging, degenerative disease and general overuse against traumatic events such as a fall. Other potential contributing factors for back pain and surgery such as Body Mass Index are not available (Lucha-Lopez et al., 2020).

Simple Conclusion

Injuries because of degeneration such as aging and overuse resulted in the highest number of spine surgeries because they accounted for close to 60% of the patient population; however, patients with work-related injuries have the highest incident rate. Surgery rates do not differ significantly by gender; however, adding a cause of pain along with gender leads to interesting findings. More women had surgeries because of accidents or degenerative causes, while more men needed surgeries because of work-related injuries. The data also illustrates differences between males and females on the reported pain scale. Women had higher average first-reported pain scales than men, either because of differences in injury severity, or pain perception/threshold. In terms of age, as the patient gets older, they are more likely to need surgery. Peak age is around the 48 to mid-50s range, and from there, spine surgeries plummet. Combining all the baseline factors enumerated above in a logistic regression model, the data indicates males who suffer work-related injuries have the highest surgery rate.

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From NFTs to New Frontiers: CounterTEN's Journey in Startup Financing
By Benjamin Spiwak

Abstract

This study explores the most effective funding strategies for startups at various stages of growth and their impact on financial sustainability. It aims to bridge existing data with practical applications, using CounterTEN as a case study. A literature review was conducted to identify key themes in startup financing, followed by a structured interview with CounterTEN's founder, Steve Shulman. The findings reveal alignment between theoretical frameworks and CounterTEN's experiences, emphasizing the importance of strategic investor selection and financial management. CounterTEN's journey illustrates the need for adaptable strategies in startup financing, due to the risks and opportunities inherent in different funding strategies.

Keywords: Startup financing, venture capital, angel investors, financial sustainability, growth stages, CounterTEN, digital ownership, blockchain technology

1. Introduction

In recent years, startup financing has garnered significant attention due to its crucial role in driving economic growth and innovation. Startups are pivotal in fostering new technologies, creating jobs, and stimulating competitive markets. According to recent statistics (Teare, 2022), global venture capital investments reached an all-time high of over $600 billion in 2021, underscoring the growing relevance and scale of startup financing. As these young companies navigate the complex path from inception to maturity, effective funding strategies become paramount for their financial sustainability and growth potential.

This paper seeks to address the research question: What are the most effective funding strategies for startups at various stages of growth, and how do these strategies impact their financial sustainability and growth potential? Recent academic literature indicates that both venture capital (VC) and angel financing play critical roles at different stages of startup development.

Venture

capital is highly effective for scaling and professionalizing startups, while angel financing provides essential early-stage support and mentorship. This paper reviews the existing literature on startup financing strategies and presents qualitative data from an interview with Steve Shulman, founder of CounterTEN. CounterTEN, founded in 2022, is a startup that aims to revolutionize digital ownership through blockchain technology, with a focus on applications like digital ticketing, fundraising, and event management. A significant contribution of this paper is its examination of how CounterTEN's strategic shift from NFTs to broader applications

highlights the importance of adaptability in real-world startup financing. This shift not only addresses challenges in the market but also provides a richer understanding of how theoretical concepts apply in dynamic, evolving business environments.

The remainder of the paper is as follows: Section 2 provides a comprehensive literature review exploring different funding strategies and their effectiveness at different stages of growth. Section 3 outlines the methodology used in conducting the interview with CounterTEN's founder, linking it to the themes identified in the literature. Section 4 presents the results of the interview, offering a descriptive account of CounterTEN's journey. Finally, Section 5 engages in a case study discussion, connecting the interview insights with the literature to analyze the implications of startup financing strategies.

2. Basics of Startup Financing

2.1. Overview of Startup Financing

Startup financing options are diverse, and their accessibility, conditions, and impact on success rates vary significantly. The main options include bootstrapping, angel investors, venture capital, crowdfunding, and bank loans.

● **Bootstrapping**: This method involves using personal savings or revenues generated by the business. It's accessible to almost any entrepreneur but limits the scale and speed of growth due to limited funds (Gompers and Lerner, 2001).

● **Angel Investors**: Angel investors provide early-stage funding, often in exchange for equity. They offer flexible terms and mentorship, significantly increasing survival rates and initial growth (Wong, Bhatia, and Freeman, 2009). Angel investors typically invest their own money and are more personally involved in the startups they support.Nevertheless, angel investors may demand a significant equity stake, potentially diluting the founder's control over the company. This can sometimes conflict with the founder's vision or slow down decision-making processes. Additionally, the limited financial capacity of angel investors compared to venture capitalists might restrict the available funds for scaling the business (Ibrahim, 2010).

● **Venture Capital**: VC firms invest in startups with high growth potential, usually in exchange for significant equity and control. They provide substantial funds and strategic guidance, crucial for scaling, but require rigorous conditions and due diligence (Kaplan and Stromberg, 2003). Venture capitalists manage pooled funds from various investors and focus on high-growth opportunities. They bring in professional management practices, governance structures, and strategic oversight that help startups scale efficiently (Davila, Foster, and Gupta, 2003).

● **Crowdfunding**: This method involves raising small amounts of money from a large number of people, typically via online platforms. It's accessible and can validate a business idea but may not provide enough capital for substantial growth (Haddad and Hornuf, 2019).

● **Bank Loans**: Traditional loans require repayment with interest and may require collateral. This option typically becomes viable when a startup has demonstrated consistent revenue streams and is seen as lower risk to lenders. Bank loans are often used when a startup wants to avoid equity dilution. However, they require regular repayments with interest and may require collateral, which can be a burden for a company with little revenue streams. They provide no dilution of ownership but can be difficult to obtain without a proven track record or significant assets. While bank loans allow founders to retain full ownership, the repayment obligations can strain cash flow, especially in the early stages when revenue may still be volatile (Phillippon, 2016).

Venture capitalists are needed because startups often face significant uncertainties and require more than just financial investment—they need strategic guidance, mentorship, and access to networks that VCs provide (Gompers and Lerner, 2001). Startup financing is different from other companies because of the high risk and uncertainty involved, necessitating specialized investment mechanisms that align incentives and manage risks effectively (Kaplan and Stromberg, 2003).

2.2. Stages of Startup Financing

Financing needs and options vary significantly across different stages of a startup's lifecycle. The early stages of a startup are characterized by different challenges and funding requirements compared to later stages.

● **Seed Stage**: At this early stage, startups are primarily focused on product development and market research. Funding is typically sourced from personal savings, family, friends, and angel investors. The amounts are relatively small, and the emphasis is on proving the concept and achieving initial milestones. The accessibility of funds is higher, but the amounts are limited, and the impact on success rates is significant due to the mentorship and network access provided by angel investors. Success in the seed stage depends on validating the product in markets and managing resources. Failure often occurs when startups cannot secure enough funding to move forward or when their product fails to gain traction in the market (Ibrahim, 2010).

● **Early Stage**: Once a startup gains initial traction, it may attract seed funding from angel investors or early-stage VCs. The focus remains on product development and market entry, but there is a greater need for funds to support initial scaling efforts. Early-stage VCs provide not only capital but also strategic guidance, helping startups refine their business models and prepare for more extensive market penetration. The risk of failure remains high, particularly if the product

does not meet market needs or if the company struggles with scaling its operations. Success is determined by the ability to attract customers and generate revenue while managing growing operations (Kerr, Lerner, and Schoar, 2011).

● **Growth Stage**: As the startup grows, it seeks larger rounds of funding from venture capital firms to scale operations, expand market reach, and enhance product offerings. At this stage, the funding amounts are significantly larger, and the conditions become more stringent. VCs play a crucial role in professionalizing the startup, introducing best practices in management, and ensuring operational efficiency. However, failure can occur if the startup grows too quickly without proper infrastructure, leading to operational breakdowns, or if it cannot sustain the rapid pace of growth due to market saturation or increased competition. The growth stage is characterized by a higher level of scrutiny and due diligence from investors, who seek to ensure that the startup can sustain rapid growth and generate substantial returns (Davila, Foster, and Gupta, 2003).

● **Expansion Stage**: Mature startups looking to dominate their market or enter new markets require substantial capital. Venture capital continues to play a key role, along with potential late-stage investors and private equity. The focus at this stage is on large-scale operations, market expansion, and potentially preparing for an exit event. Success in the expansion stage depends on the startup's ability to replicate its business model in new markets and maintain operational efficiency. However, failure can occur if the startup overextends itself, faces unexpected market challenges, or fails to maintain the quality and consistency of its offerings. Additionally, external factors such as economic downturns or regulatory changes can impact the success of expansion efforts. The funding conditions are the most stringent, with a significant emphasis on performance metrics, market position, and strategic alignment with investor goals (Hellmann and Puri, 2002).

● **Exit Stage**: Finally, the focus shifts to liquidity events such as IPOs, mergers, or acquisitions. Venture capitalists and other investors aim to realize returns on their investments. The exit stage involves complex financial transactions and requires extensive preparation and strategic planning to maximize valuation and ensure a successful exit. Success at this stage is often determined by the startup's ability to achieve a strong market position, profitability, and sustained growth. However, failure at the exit stage can occur if the market conditions are unfavorable, the startup's financials are weak, or if there is a lack of interest from potential buyers or public investors. A poorly executed exit can result in a lower valuation or even the collapse of the deal, leading to significant financial losses for all parties involved (Gompers et al., 2020).

2.3. Financial Planning and Management Practices

Effective financial planning and management are crucial for a startup's success. Best practices include:

● **Rigorous Financial Monitoring**: Implementing detailed financial tracking and forecasting helps startups manage cash flow, control costs, and make informed decisions. Venture capitalists often require such practices to ensure transparency and accountability (Chemmanur, Krishnan, and Nandy, 2011).

● **Professional Management Structures**: Establishing professional management teams and formal business practices early on can lead to improved operational efficiency and scalability. This professionalization is often driven by venture capital involvement (Hellmann and Puri (2002), Chemmanur, Krishnan, and Nandy (2011)).

● **Strategic Financial Contracting**: Using well-structured financial contracts that align incentives between entrepreneurs and investors helps mitigate risks and promote sustainable growth (Kaplan and Stromberg, 2003).

● **Mentorship and Networking**: Engaging with experienced investors and advisors who provide strategic guidance and industry connections significantly enhances a startup's growth potential and financial health (Wong, Bhatia, and Freeman, 2009).

3. Methodology

3.1. Interview Structure
The primary methodology for this study involves a structured interview with Steve Shulman, the founder of the startup CounterTEN. I want to compare and contrast the story of CounterTEN with the findings in the literature because doing so will provide practical insights into how theoretical concepts are applied – or challenged – in the real world. CounterTEN's journey, especially in a niche like digital ownership on the blockchain, offers a tangible example of how startups navigate financing challenges. Examining this specific case, will enrich the understanding of financing dynamics on a much closer level. The interview will be divided into five main sections: General Background, Funding History, Venture Capital and Angel Investors, Financial Planning and Management, and Lessons Learned.

3.2. Relationship to Literature Review
The structure of the interview is designed to align with the themes identified in the literature review. By segmenting the interview into focused sections, we can compare the real-world experiences of CounterTEN with the theoretical insights and empirical findings from the reviewed studies.

Interview Sections and Questions

1.   General Background
○   Can you provide a brief overview of your startup and its mission?
○   Where does it innovate? What is its niche it's exploring?
○   What stage of growth is your startup currently in?
2.   Funding History
○   What types of financing have you used at different stages of your startup's growth?
○   How did you decide which type of financing to pursue at each stage?
3.   Venture Capital and Angel Investors
○   Have you received funding from venture capitalists or angel investors? If so, what was the process like?
○   How did you pitch the idea?
○   What criteria did they use to evaluate your startup?
○   How has their involvement impacted your startup's growth and strategy (the influence that the investors have on the strategy of the company)?

4. Results of Interview

4.1. Background of CounterTEN

CounterTEN was founded in 2022 by Steve Shulman, with the mission of revolutionizing digital ownership using blockchain technology. Initially focusing on the inefficiencies and fraudulent nature of NFTs, CounterTEN aimed to streamline the concept of digital ownership, making it accessible and secure. As the NFT market faced challenges, the company pivoted to explore other use cases, such as digital ticketing and event management. This pivot aimed to leverage blockchain technology to allow ticket owners to resell tickets while earning royalties, a feature not widely available in the market. The startup is still in its very early stages, described as the "Conception Stage" and "Proof of Concept Stage," where they are developing their platform and seeking business partnerships for growth.

4.2. Funding History

CounterTEN's initial funding came from Steve Shulman's personal savings, which helped launch the company and develop a prototype. Recognizing the need for additional capital, Shulman raised $360,000 in a pre-seed funding round from friends and family. This funding was crucial for building a prototype and demonstrating the concept. As the company neared the depletion of these funds, Shulman sought out angel investors to secure further financing. He successfully obtained a term sheet from an angel investor in June of the previous year, which outlined an investment of approximately $12.5 million for a 35% equity stake in the company. However, the deal fell

as the investors failed to provide the agreed funds, resulting in a significant setback and requiring Shulman to take on debt to continue operations.

Venture Capital and Angel Investors

CounterTEN's experience with angel investors highlighted both opportunities and challenges in securing startup funding. The negotiations involved detailed financial documentation, including anti-money laundering clauses and ownership structures. Shulman noted that pitching to investors required tailoring the presentation to align with their interests, focusing on the versatility and potential of CounterTEN's product. However, the investors expressed concerns about the broad scope of the company's ambitions, suggesting a more focused approach might be more appealing to them.

The angel investors' criteria for evaluating CounterTEN centered on the potential synergy with their existing portfolios and the market entry strategy of the startup. Despite the initial interest, the failure to secure funding led to a reassessment of CounterTEN's financing strategy, emphasizing the importance of finding reliable and experienced investors, particularly those familiar with technology investments.

Financial Planning and Management

CounterTEN had implemented financial planning practices in anticipation of the significant investment from the angel investors. These plans included revenue projections, hiring strategies, and detailed budgeting for various operational needs, such as development and sales. The expectation of a $12.5 million investment led to ambitious plans, including the hiring of 8-10 new staff members and a focus on expanding into new markets. However, the collapse of the investment deal required a reevaluation of these plans, emphasizing the importance of prudent financial management and the risks associated with overreliance on uncertain funding.

Lessons Learned

The experience with the angel investors highlighted the complexities and potential pitfalls of startup financing. Shulman noted the importance of carefully vetting investors to ensure alignment with the company's vision and values. He also emphasized the need for startups to demonstrate market viability through revenue generation before seeking substantial external funding. Shulman advised against relying heavily on equity deals early in the company's life cycle, as they can dilute ownership and control. Instead, he recommended focusing on organic growth and building a sustainable business model before engaging in significant fundraising Efforts.

CounterTEN's journey underscores the importance of cautious and strategic financial planning, the need for alignment between investors and the company, and the challenges of navigating the startup financing landscape. The company's pivot and ongoing efforts to secure reliable funding reflect the dynamic nature of the startup environment and the critical role of

effective leadership in steering the company through uncertain times.

5. Case Study: Comparing Literature Review Findings with Insights from CounterTEN

5.1. Overview of Startup Financing
5.1.1 Similarities and Differences

The literature review identified several primary financing options for startups: bootstrapping, angel investors, venture capital, crowdfunding, and bank loans. CounterTEN's funding journey began with bootstrapping, using personal savings, which aligns with the literature's depiction of initial financing methods (Gompers and Lerner, 2001). This method is often accessible but limits growth due to constrained resources.

CounterTEN's subsequent move to raise a friends and family round, securing $360,000, reflects a common strategy in early-stage startups to gather initial capital while maintaining control (Wong, Bhatia, and Freeman, 2009). This approach is consistent with the literature, which suggests that such funding is crucial for building prototypes and validating concepts.

The involvement of an angel investor in CounterTEN's funding history highlights a key finding from the literature: angel investors often provide critical early-stage funding along with mentorship and network access (Ibrahim, 2010). However, Shulman's experience diverges from the typical narrative; despite a promising term sheet, the failure to secure the promised funds underscores the risks associated with angel investments, particularly the importance of investor reliability.

The literature on venture capital emphasizes the provision of substantial funds, strategic guidance, and the implementation of professional management practices (Kaplan and Stromberg, 2003; Davila, Foster, and Gupta, 2003). Although CounterTEN did not successfully secure venture capital funding, the discussions with potential investors reflected common themes in the literature, such as the emphasis on alignment with investor portfolios and the need for clear, strategic focus (Kerr, Lerner, and Schoar, 2011).

5.2. Stages of Startup Financing

5.2.1. Seed and Early Stages

CounterTEN's initial stages of growth align with the literature's description of the seed and early stages, where startups focus on product development and market research, often funded through personal savings and early investments from family and friends (Ibrahim, 2010). The literature suggests that these stages are crucial for proving the concept and achieving initial milestones, which CounterTEN aimed to accomplish through its prototype development funded by the friends and family round.

The attempt to secure angel investment during the early stage is consistent with literature findings that highlight angel investors as critical for scaling and providing strategic input (Wong,

Bhatia, and Freeman, 2009). However, the failure to finalize the angel investment due to financial and strategic misalignment reveals the complexities of navigating early-stage financing, which is less frequently addressed in depth in theoretical discussions.

5.2.2. Growth and Expansion Stages

During the growth and expansion stages, CounterTEN faced the challenge of pivoting its business model to explore new markets beyond its original focus on NFTs. This shift involved expanding the company's scope to include digital ticketing and event management, which required not only strategic adjustments but also the ability to innovate within a rapidly evolving industry. This aspect of pivoting and expanding into new markets is not extensively discussed in the existing literature on startup financing, which often assumes a more linear growth path. One of the main contributions of this paper is highlighting how real-world startups like CounterTEN deal with these challenges, offering a better understanding of the growth and expansion stages.

CounterTEN's experience illustrates a critical point in the growth and expansion stages: the challenge of securing substantial capital to scale operations and enter new markets. The literature notes that venture capitalists play a pivotal role during these stages by introducing best practices and governance structures (Hellmann and Puri, 2002). The lack of a cohesive strategy and the perception that CounterTEN was spreading itself too thin ultimately led to investors turning away, fearing that the company might struggle to achieve sustainable growth in the long run (Kaplan and Stromberg, 2003).

This situation mirrors the findings of Wong, Bhatia, and Freeman (2009), who emphasize the role of angel investors in offering strategic guidance. CounterTEN's challenges in securing funding for expansion underscore the difficulties startups face in aligning their strategic vision with investor expectations, a theme recurrent in the literature.

5.3 Financial Planning and Management Practices

Financial Oversight and Professionalization

Both the literature and the interview with Shulman emphasize the importance of rigorous financial planning and management. The literature highlights the role of venture capitalists in enforcing detailed financial monitoring and accountability practices (Chemmanur, Krishnan, and Nandy, 2011). CounterTEN's experience with planning for a significant investment, despite it not materializing, demonstrates an understanding of these principles. The startup had outlined detailed plans for hiring, revenue projections, and operational budgeting, aligning with best practices suggested in the literature.

6. Conclusion

CounterTEN's setbacks in securing reliable funding emphasize a critical lesson echoed in the literature: the importance of selecting investors who are not only financially capable but also strategically aligned with the startup's vision (Gompers and Lerner, 2001). Shulman's advice to

other founders—to be cautious in choosing investors and to prioritize building a market-ready product before seeking large-scale investment—is consistent with prudent strategies in entrepreneurial finance literature.

Furthermore, CounterTEN's strategic pivot from NFTs to broader applications like digital ticketing and event management underscores the need for adaptability in business strategy. This pivot, driven by market realities, allowed the company to tap into new opportunities, demonstrating that flexibility is as crucial as securing the right funding. However, pivoting to different markets when seeking funding also presents challenges. One significant drawback is the potential loss of focus, where shifting attention from the original market might dilute the company's core vision and value proposition, making it less attractive to investors who prefer a clear and consistent strategy. Additionally, frequent pivots can signal instability or a lack of confidence in the original business model, which might deter potential investors who value predictability and a clear growth trajectory. Despite these risks, CounterTEN's pivot was successful, illustrating the unpredictability and complexity of securing funding in the real world. The case study of CounterTEN reveals both alignments and divergences between theoretical frameworks and practical experiences in startup financing. While the theoretical literature provides a structured approach to understanding different financing stages and the roles of various investors, CounterTEN's journey highlights the unpredictability and complexity of securing and managing funding in the real world.

CounterTEN's experience serves as a valuable example of the challenges and opportunities inherent in the startup ecosystem, offering lessons for both entrepreneurs and investors in navigating the intricate landscape of startup financing. As CounterTEN continues to evolve, its story will provide further insights into the practical applications of theoretical concepts, particularly in the dynamic environment of startup growth and development where market-driven pivots are often necessary.

Future research could build on the findings of this paper by exploring the impact of market pivots on investor perceptions and startup valuations more extensively. Scholars could conduct studies to quantify how shifts affect funding rounds, especially regarding investor confidence and commitment in financing stages. Additionally, further investigation into the long-term outcomes of startups that frequently pivot would provide insights into the sustainability of such strategies. Research could also examine sector-specific responses to market pivots, illustrating which industries are more forgiving of changes. This could help startups tailor their strategies based on industry norms and investor expectations, potentially leading to more successful financing outcomes.

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Tracking Macronutrients Using Neural Networks, Object Recognition, and APIs
By Nathan Aguiar

Abstract

This paper discusses an analytic method of monitoring nutrients and caloric intake from food groups using Artificial Intelligence (AI). The specific kind of AI was an object recognition program, which processed the images of foods by recognizing patterns. With the inclusion of the "Food 101" dataset by TensorFlow, this study employed convolutional neural networks to identify specific food groups. The algorithm is then fed to an Application Programming Interface (API) to present nutritional and caloric information. The information that has been collected could prove useful when provided to dietitians, nutritional analysts, and consumers.

1. Introduction

The idea of tracking macronutrients using AI is currently a growing field. Tracking nutritional information has grown in popularity throughout the last few decades and is useful to help improve health (Bond et. al. 2023). Nutrition is important in daily life and helps with functions to survive. Being mindful of caloric intake allows for longevity and minimal health complications. Given this, Dietitians and Nutritional Analysts are constantly working on optimizing meal plans to allow for a more productive lifestyle. Currently, the average consumer will not track their calories on a day-to-day basis, which can lead to improper nutrition, causing problems such as diabetes and cancer (National Research Council (US) Committee on Diet and Health, 1989). With flaws in nutrition tracking, an increase in innovation and attention will ensure that younger generations maintain a healthier lifestyle in the future.

Currently, most macronutrient trackers require multiple inputs, such as typing out the food or scanning barcodes (not available on homemade dishes), which is inconvenient, making it difficult for consumers to account for their intake (What are convolutional neural networks?. IBM, 2021). Some of the best current options need to be revised, which is a problem that can be improved, but not solved as it is impossible to create a 100% accurate program (Bond et. al. 2023). The current methods of using artificial intelligence to help dietitians track macronutrients are difficult to access. The current problem is that the available tools do not provide the service needed to significantly help the professionals who create nutritious diets. Observing clinical nutrition and how there is always a difference in diets and recipes adds complexity when attempting to track these macronutrients using AI.

This study aims to solve a culmination of problems, which vary from how Artificial Intelligence can be improved to help dietitians greatly to exploring how macronutrients can be tracked in an easy-to-operate manner comprehensible to the public. Being able to track macronutrients easily will help dietitians help their clients who are aiming for an improvement in their health (Ravindra, 2022). Object recognition plays a role in achieving this as it allows tracking to occur while using minimal effort. This improvement often leads to psychological benefits in addition to physical, which help improve the lifespan of consumers. Using APIs,

Convolutional Neural Networks, and an object recognition algorithm, macronutrients can be tracked with ease in a comprehensible manner, which is generally more comfortable for an average consumer. Monitoring caloric intake is important as humans have limits that may vary, but optimizing a consumer's intake to maximize good nutrients solves multiple problems and creates an optimal scenario for both the consumer and their nutritionist.

2. Results

The algorithm found that 10 layers with 30-100 nodes (artificial neurons) per layer, resulted in the best accuracy at just under 91 percent of correctly processing and identifying the images of food groups (Craig & Awati, 2024). These results are based on the testing results that came with running the convolutional neural network. Using the data given from the dataset, images that had some background disturbance were still able to be recognized. Training the algorithm took longer than expected as it took 26 hours to run the algorithm the first time. The training accuracy improved notably over each epoch, often improving its accuracy by 5-10 percent.

3. Discussion

Certain aspects of this algorithm shine such as its recognition accuracy, but there are limitations when it comes to the accuracy of the actual macronutrients as every recipe differs and it would be near impossible to create a perfectly accurate model. There is still much room to improve as there still needs to be a developed user interface and the algorithm can be run faster. In addition, the accuracy could be improved if a larger dataset was used and since the training was not perfect, there will be room for a slight increase in accuracy. This study was based on the use of AI in tracking macronutrients and how it will help professionals. Professional dietitians and consumers can continue to track and recognize foods with options that do not utilize AI, but as some algorithms start to process images more accurately and quickly, consumers will start to recognize the extreme benefits and added convenience (Uribe & Patterson, 2023).

This study has real-world applicability, but some aspects should be improved upon such as the efficiency of this model and how an interface would be created. Tracking macronutrients helps professional nutritionists in their field by providing more information, which allows their patients to reap the physical and mental benefits of this research. Many variables should be considered that vary greatly such as a person's weight, sex, and age. These are manual inputs, that can drastically change the information that is needed for a healthy diet, but it is still essential to track macronutrients (Counting macros: What they are, benefits, how to count them, 2023). It can be taken away that AI can process information faster than humans in some ways, but in comparison to other fields, tracking macronutrients lacks the efficiency that AI aims to provide. This study was based on real-world results and available resources, which proves that the current work is developing at a rapid rate and shows a promising future. The results presented from the algorithm are an improvement on a few current applications and it could still be improved. AI is helping the field of tracking macronutrients and promoting health improvement (Zhu & Wang, 2023).

4. Methodology

The Dataset being used in this project is named 'Food 101' from Tensorflow and contains many images of different dishes. More explicitly, it contains 101,000 images which are amassed from different dishes such as pizza, pasta, and salads. Each dish has 1000 images and these images are split up into 750 training images and 250 testing images. The data collected was representative of commonly consumed foods which increased the likelihood that this would be used in real-world scenarios.

While building an object recognition program, neural networks were involved. A neural network is a machine learning program that operates like the human brain, by using neurons (What is a neural network, 2021). Neural networks have certain parameters, such as neurons, layers, epochs, and more. Epochs refer to iterations of each combination of neurons and layers. In this study, the algorithm contained epochs of ten, meaning that every combination of neurons and layers was run 10 times to increase the accuracy. When training the model, different amounts of layers and neurons per layer can drastically change the accuracy of the model when recognizing food groups.

There are multiple kinds of neural networks and the one used in this study is called a convolutional neural network. Convolutional Neural Networks (CNNs), also called CNNs, use three-dimensional data shaped by the algorithm. Then, the network pools the images and later softmaxes (making the image readable for the computer) the photos, which gives a fully trained output[11]. In this study, the images measured 224 x 224 x 3 pixels. The images have 3 layers, which makes them three-dimensional. There are 3 layers to start with because there are 3 base colors: red, green, and blue. Pooling helps decrease the size of the image. There is a grid of a certain amount of pixels and each pixel has a numerical value depending on its color features. Then, there is an output given by pooling, which reduces the size of the image. In this study, max-pooling is used, so the highest numerical values for pixels in the grid are the output that the max-pooling produces. Softmaxing is how the convolutional neural network recognizes patterns in certain foods and in turn, predicts what that image could be. In this study, the images were of 101 food groups.
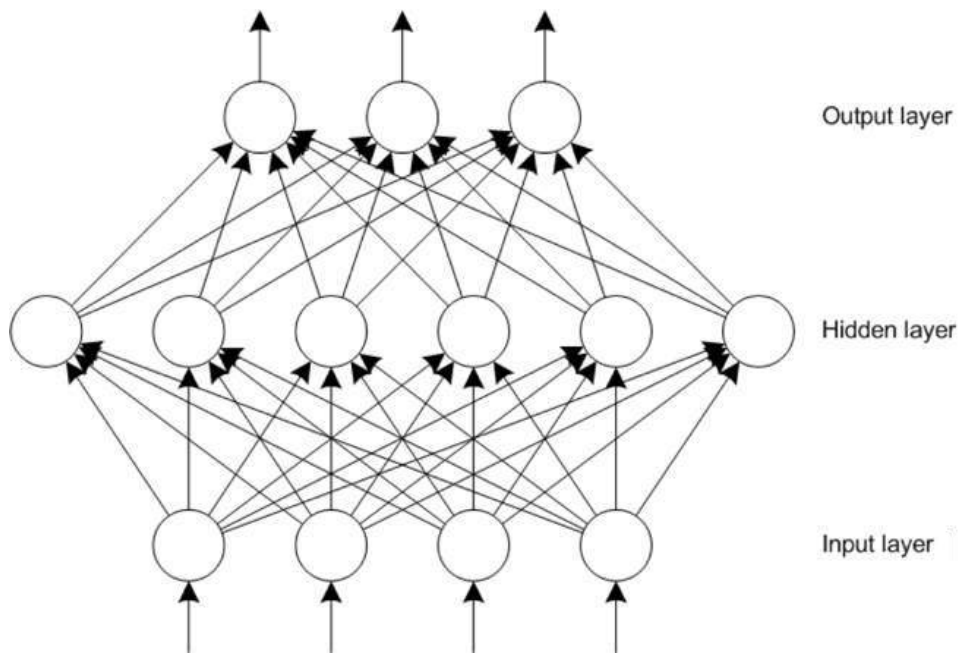
Figure 1: How Neural Network really works (Jones, 2017)

The second part of the algorithm is an API that allows two different software to interact. In other words, an API is a messenger that will convey information by taking input from one software and running its output as input in another program (Frye, 2024). Since this project is based on clinical nutrition, the API used is the Fatsecret API. The Fatsecret API is an application programming interface that is used for connecting information and labels to nutrition facts. This API is needed for this study as it contains information about thousands of dishes, which allows the algorithm to be given a common input.

Conclusion

When one considers the benefits of tracking macronutrients using artificial intelligence, it is clear that the construction of new algorithms greatly improves upon the efficiency and accuracy of current alternatives. The benefits of accurately tracking caloric intake is crucial as it is one of the few controllable aspects of a consumer's life when it comes to health. Throughout this study, it has been proven that AI can process images with a high accuracy rate, while still being efficient and convenient. As a result of this, new technologies are being developed as there appears to be a future for this information. Finally, the algorithm built from this study has proven that there are more efficient options when tracking macronutrients, which could also provide helpful information to nutritionists and consumers who take an interest in this technology

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What Are the Causes and Consequences of Low Fertility Rates in Advanced Economies, and How Can We Combat Them? By Rebecca Rong

Demographic decline: Using progressive policy to combat low fertility rates

Declining fertility rates have been a decades-long major concern for advanced economies, posing challenges and opportunities. These 41 economies, classified by the International Monetary Fund (IMF), and the world overall, are all experiencing their lowest fertility rates in history, measured in total fertility rate (TFR). A TFR of 2.1–the "replacement rate"–is required for a population to be stable. While global TFR was a high 4.5-7 in the pre-modern era, it is now 2.3 and decreasing; for advanced economies, it is even lower, well below replacement ("Global Fertility"). Thus this issue is a worldwide concern, bearing economic and social implications for society such as labor shortages, economic slowdowns, and weakening welfare systems (Ferguson). This essay contends that the causes of low fertility rates–rising costs of raising children and women's empowerment–drive a rapidly aging population. It concludes that nations can address these demographic shifts through progressive social policy and relying on external labor sources, without reversing societal progress.

Causes

The first major driver of low fertility rates is the economic cost of raising children. Economist Gary Becker argues that fertility rates correlate to the demand for children–their "price"–measured by direct and indirect costs (Becker; Roser). Direct costs, such as childcare and education fees, weigh heavily on families' finances. Indirect costs are even more significant, including the opportunity costs when parents–especially women–step away from the workforce during a parental leave period. They can miss out on work experience, skill training and advancement opportunities during this time, which directly impacts their long-term careers and ability to earn more in the future (Roser; Hoem). Contemporary parents may choose smaller families to provide their children with a higher quality of life, reflecting a "quantity vs. quality" tradeoff. In a technology-driven economy, with less child labor, children are considered economic liabilities (Roser). These issues thus highlight a need for policies that support women with financial relief without compromising their career development.

The second factor is the empowerment of women. Research shows an inverse correlation between women's education levels and birth rates in a population. As women gain more freedom, they often choose to have fewer children. More women are now educated on the use of contraceptives; combined with increased access, unintended and teen pregnancies have dropped substantially (Bytyci; Doepke; Ferguson). Chicoine and Bailey emphasize this impact, noting the decrease in unintended births contributed to a nearly one-third decline in US fertility between 2007 and 2016 (Ferguson). Though a contributing factor to declining overall birth rates, this is reflective of fundamental social progress, and something policy responses should continue to support.

A third factor is evolving social norms ("Global Fertility"). Society has shifted to become more accepting of women with fewer or no children (Roser). Lutz et al. argue that as societies develop from fundamental needs to self-actualization, pursuing individual goals, such as furthering careers, tends to take priority over starting families. Other cultural shifts intensify

this shift in priorities. Declining sexual activity–caused by sexual conservatism, online entertainment, and widespread mood disorders among young adults–contribute to lower fertility (Ferguson). Many advanced economies have been gradually shedding religious values that have traditionally been pro-natalist, and overall religiosity has been measured as declining (Roser). These three factors reflect evolving norms that lead to diminishing fertility rates.

Consequences

The long-term decline in fertility rates in advanced economies has significant consequences, impacting their economies, social systems, and environments. As the number of working age people relative to retirees decrease, these systems receive fewer contributions, requiring tax hikes or benefit cuts to sustain them (Alvarez; Doepke; "Global Fertility"). This can cause other problems such as delayed retirement, lower real returns for savers, heightened healthcare demands, and other fiscal crises. Assessing economic and social consequences illustrates the need for careful approaches to combat young labor shortages greatly burdening working generations.

Counterargument

It should be acknowledged that lower fertility rates in advanced economies can benefit the environment by reducing total emissions. A 2017 study found that having one fewer child per family in high-income countries could reduce 58.6 metric tons of emissions annually. Since overconsumption in wealthy areas causes disproportionately high emissions and exacerbates climate damage (i.e. in the U.S.), this demographic shift should be paired with sustainable policies that regulate these negative patterns (Keulen). Addressing low fertility rates requires a holistic approach that balances population concerns with environmental sustainability.

Possible Solution: Social Policies (France)

France's approach to combating low fertility, by providing work-related benefits to families that raise children, is a good example of how countries use progressive social policies to address these challenges. This case study highlights France's approach to combating low fertility rates, a model successfully implemented in other regions like Scandinavia (Hoem; Olivetti). France's TFR dropped sharply during the early 1960s to 1.8, prompting a response on multiple fronts: the introduction of social and work policies, increased public spending, allowances, and supportive services. France has one of the highest public spending as a portion of national wealth, offering allowance to households with two or more children. Compensated parental leave for up to three years helps parents, particularly women, remain in the workforce. To alleviate the monetary and temporal costs of childcare, France provides free preschool education and affordable schooling onwards (Influence; Olivetti. These incentives have made an obvious impact; although still under the replacement rate of 2.1, France's 1.9 TFR is one of the highest among advanced economies, topping countries like Italy and Japan ("Country Comparisons;" "Global Fertility"). The significant discrepancies among the TFRs of advanced economies reveal the importance of such policy. For example, countries like Italy and Japan have extremely low

TFRs of 1.26 and 1.4 children per woman, due to a societal lack of attention on childcare (Doepke). By contrast, France and Sweden are higher, at 1.9, and 1.67 due to supportive family policies that help parents balance childbearing with careers ("Country Comparisons;" Ferguson; Olivetti). Thus, undoubtedly, adopting pronatalist policies and developing these areas can greatly improve the TFR of advanced economies while preserving progress towards gender equity.

Possible Solution: Immigration and Technology

The robust current labor demand in advanced economies, aggravated by low TFRs, can be addressed with increased immigration and AI innovation. AI automation can enhance efficiency and productivity, reduce cost, and alleviate the strain on a smaller workforce, including elderly care (Andriole; "Global Fertility"). Meanwhile, immigration, especially of highly skilled individuals, promotes innovation, economic growth, and a sustainable age structure. It also lowers the age dependency ratio, as seen in recent progress in the U.S.. Immigrants, typically younger and with higher fertility, make positive fiscal contributions. Despite its benefits, immigration often faces opposition from aging populations who fear the cultural, economic, and social shifts migrants bring. Older generations may feel that migrants threaten national identity or displace them in the workforce. These fears have perpetuated anti-immigrant sentiment, reflected in pushes for stricter policies controlling immigration and stark divisions. Thus, immigration alone cannot solve demographic issues without forward-looking strategies (Peri).

Low fertility rates in advanced economies result from various economic, social, and cultural factors, significantly impacting economic growth, societal structures, and environmental sustainability. While these changes reflect progress, particularly for women, addressing low fertility requires a balanced approach that reflects individual choice and mitigates consequences. Policy makers must adopt comprehensive strategies to ensure a sustainable population and improve quality of life without reversing positive societal shifts towards women's empowerment.

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Nutritional Interventions for Bipolar Disorder: A Narrative Literature Review
By Kiren Mahadevia, Dan Li

Abstract

Bipolar disorder (BD) is a disorder characterized by extreme mood and energy variability. The goal of this project is to find ways in which people experiencing BD can improve their conditions through nutritional and dietary changes. The basis of this idea stems from the theory of the gut-brain axis: a connection between dietary intake and mental pathways. We conducted a systematic review of the literature to identify promising dietary interventions for this population. The review aims to identify strength of evidence around dietary changes and outcomes among bipolar patients with the ultimate goal of providing practice informing information to psychiatrists and other health-related professionals.

Introduction

Bipolar disorder (BD) can be defined as a disorder in which individuals oscillate between depressive and manic states. Depressive states are characterized by extreme sadness, low energy and motivation, and thoughts of death. Manic states are opposite of depressive states and are characterized by intense happiness, high energy, and impulsive decision-making. Neither of these states are beneficial or pleasant as they do not promote healthy actions or feelings. Individuals with BD struggle with maintaining healthy relationships, lifestyles and jobs (SAMHSA, 2023). There are two types of BD: type I and type II. Type I BD is when an individual has at least one major manic episode and no history of major depressive episodes. Alternatively, type II BD is when an individual has at least one major depressive episode and one hypomanic episode, a less severe form of a manic episode (Datto, 2016). Many current treatments of BD include prescription drugs that can lead to side effects and have not been completely effective. The goal of this project is to find natural and effective treatments by changing the diets of adults with BD.

One potential issue with this approach is the biological differences in different individuals. According to William J. Walsh, an expert in healing patients through nutrients as opposed to drugs, "Each of us has innate biochemical factors that influence traits such as personality, behavior, mental health, immune function, and allergic tendencies…each human has unique biochemistry, resulting in quite diverse nutritional needs" (Walsh, 2014). Walsh explains that biological differences will result in different results depending on the individual, meaning that certain treatments will work well for some individuals but not for others. Therefore, this paper will adapt and explain how treatments may differ based on biology, and it will attempt to disclose which treatments are best for each type of individual.

The gut-brain axis, the connection between the gut microbiome and the mental and neurological connections, has become a prominent way of treating patients in the last 15 years. The gut microbiome has been proved to change the physiological state of the body such as the nervous system, immune system, and blood flow. However, recently, research shows that the gut is responsible for the secretion of many hormones, neurotransmitters and metabolites which affect

brain functionality greatly (Mayer, 2022). Based on these developments, it is likely that nutrient intake is related to neurological disorders, and optimizing the gut microbiome may result in positive changes in the conditions of patients with BD. The first section of this paper will establish how biological, psychological and environmental factors all influence the development of BD, showing that changes in environment such as food and sleep can result in changes in the severity of BD symptoms. The second section of this paper will review effects of the ketogenic diet on BD. The following section will address specific dietary nutrients and the effects they have on the manic or depressive state of BD. Finally, the last section of the paper will go over how biological differences may impact treatment from patient to patient.

Methodology

Research Question Overview

Original research question: **What nutritional changes are most effective for the treatment of BD in adults?**

This research will be focused on nutrition and how nutrition affects the brain and body of patients with BD.

PubMed Search Strategy

All searches contained the term "bipolar disorder". In combination with "bipolar disorder", there were searches for "nutrient intake", "dietary intake", or "supplement".

Screening Protocol

The screening protocol included two rounds. The first round examined the title and abstract, and the second round examined the entire text as a whole.

Inclusion Criteria

Population - Adults with BD
Concept - Nutritional changes/diets/specific supplements and their effects on BD
Context - There will be no restrictions to specific geographical locations
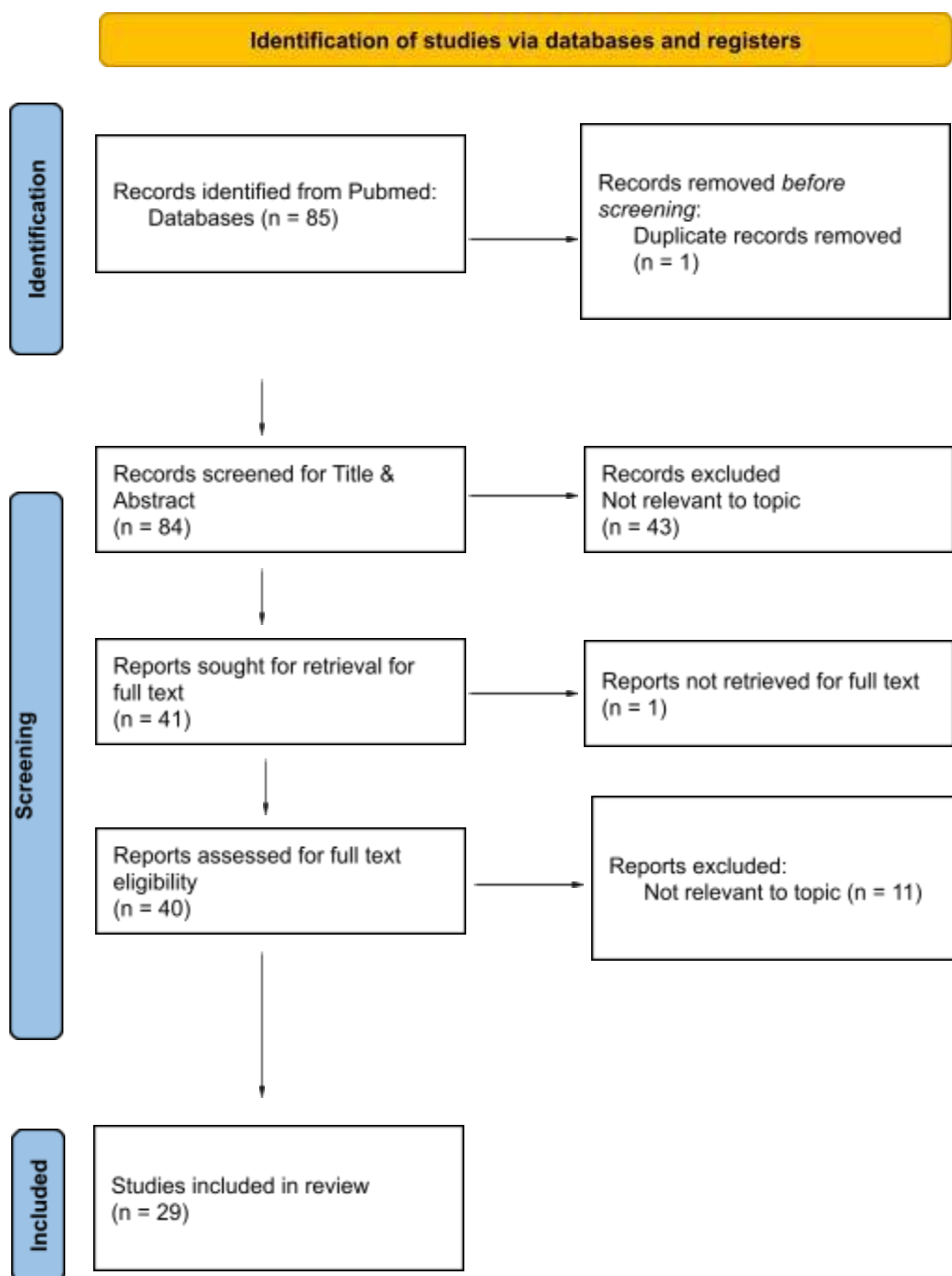Source of Evidence: Pubmed

Flow Chart and Data Extraction

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow chart was used to look at numerical results retrieved from scoping reviews and the inclusion decision process. The flow chart clearly shows the process for finding studies, removing duplicates, selecting the right research, retrieving the full article from the library and presenting the final analysis. A charting template was utilized as it makes extracting data easier and more efficient.

Results
PRISMA Flow Diagram

Identification of studies via databases and registers

Identification

Records identified from Pubmed: Databases (n = 85)

Records removed *before screening*:
 Duplicate records removed (n = 1)

Screening

Records screened for Title & Abstract (n = 84)

Records excluded
Not relevant to topic (n = 43)

Reports sought for retrieval for full text (n = 41)

Reports not retrieved for full text (n = 1)

Reports assessed for full text eligibility (n = 40)

Reports excluded:
 Not relevant to topic (n = 11)

Included

Studies included in review (n = 29)

The PRISMA Chart shows that the majority of papers excluded were from the initial Title & Abstract screening. Many papers were unavailable for the complete text and were excluded. Finally, the final text screening revealed that some papers were not relevant to the topic. In total, 22 studies will be included in the review. *From:* Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n71

Biological influences on BD

Although a singular cause for BD cannot be identified, research has shown that a combination of biology, psychology, and environment all contribute to BD. In biological theory, genetics that create predispositions to neuroinflammation, poor myelination of neurons, and less serotonin being released in the brain are all potential contributors to BD. In addition, it has been observed that patients in a depressive episode of BD have significantly lower levels of the neurotransmitters serotonin, GABA, and norepinephrine which deal with increases in mood and arousal. The manic state has an overflow of these neurotransmitters. Many antidepressants work to block the reuptake of these neurotransmitters in order to allow more norepinephrine and serotonin to flow through the neurons in the brain (Bernal-Vega, 2023). This paper by Bernal-Vega et al. mainly researches the impact of sphingolipid metabolism and its effects on psychiatric disorders. It concludes that the gut-microbiome impacts metabolism, and a healthy metabolism can result in less neuroinflammation and more release of beneficially neurotransmitters, improving brain chemistry. Research also shows that the circadian rhythm influences the gut-microbiome which has been proven to have an impact on brain chemistry and the secretion of hormones and neurotransmitters. A paper by Wagner-Skacel et al. (2020) accurately describes this phenomenon, "the gut microbiota is directly involved in the production of a variety of neurotransmitters, cytokines and metabolites such as 5-HT, dopamine, gamma-aminobutyric acid (GABA), SCFA and melatonin" (Wagner-Skacel, 2020). Eating disorders have also been shown to negatively affect the gut microbiome, causing neurological issues. For example, a study done by Koning and Vorstman et al. (2020) focuses on this relationship. High appetite eating disorders can lead to depressive BD episodes, while low appetite eating disorders can lead to manic and hypomanic episodes (Koning and Vorstman, 2020). Finally, studies pertaining to the comparison of the gut microbiota of patients with BD to those without BD show key differences. This is seen when Ortega et al. write, "Gut microbiota composition of BD patients is different from healthy individuals" (Ortega, 2023). Because of these findings, it can be concluded that the gut microbiome, along with other health factors such as eating and sleeping which affect the gut microbiome, plays an important role in the restriction of BD, creating possibilities for patients who can manipulate their gut microbiome to treat symptoms of BD.

Possibilities of the ketogenic diet on BD patients

The ketogenic diet (KD) is a high-fat, low carbohydrate diet that has been utilized commonly over the past 100 years to treat epilepsy as well as obesity, cardiovascular disease and metabolic diseases. Obesity, cardiovascular disease and metabolic disease are all common in BD patients, creating an overlap to address commonly occurring symptoms. Ketogenic diets have a fat to carbohydrate/protein ratio of 4 to 1, meaning that fat makes up over 80% of the diet. Fats are normally consumed through the mediums of lard, butter, tallow, olive and coconut oil and fatty meat and fish. While no larger randomized clinical trials have been completed, small trials have shown improved depressive symptoms of BD while on KD for 3 weeks. The lipid intake during KD has been shown to improve metabolism, thus improving the gut microbiome, leading to less neurodegeneration and improved symptoms of mood disorders such as BD. KD has also been shown to act as an anti-inflammatory, which assists with poor neurological connections and

neurological inflammation which are heavily correlated with BD as almost all patients show these biological signs. (Smolensky, 2023; Chmiel, 2022).

Nutritional changes for the manic state

Lithium

> Lithium's anti-inflammatory characteristic is helpful in reducing the severity of manic episodes. Lithium also has been shown to lower oxidative stress, an imbalance of oxygen within the body that leads to dopamine and mitochondrial dysfunctions (Madireddy, 2022). Lithium is currently the leading mood stabilizer, and is most often used for treatment. Although it is usually used through pharmaceuticals, Lithium can be found in grains, wheats, potatoes, tomatoes, and mineral water.

Vitamin D

> Vitamin D correlates with a decrease in manic and hypomanic symptoms. Like Lithium, Vitamin D also has anti-inflammatory characteristics, further assisting with decreasing the severity of manic episodes (Obi-Azuike, 2023). Vitamin D is found in fish, oranges, milk, and exposure to the sun. Similar to all other vitamins and elements, too much Vitamin D can result in biological imbalances, causing health issues.

PUFAs

> PUFAs, polyunsaturated fats, are known as good fats when compared to saturated fats. Foods like salmon, olives, avocado and canola oil all are examples of PUFAs that can easily be incorporated into a diet. In addition to helping with manic episodes, PUFAs act as an anti-inflammatory agent. The most important use of food high in PUFAs is diminishing the severity of bipolar symptoms. High sugar diets have been shown to create a poor sphingolipid metabolism, causing increased ceramide levels in the brain, which thus leads to defective neurotransmission of important neurotransmitters like serotonin and norepinephrine. This defective transmission is often a symptom of BD. PUFAs, however, can help to prevent this as it improves sphingolipid metabolism, lowering ceramide levels and problems associated with higher ceramide levels (Bozzatello, 2020; Madireddy, 2022).

Nutritional changes for the depressive state

Creatine

> Creatine is an organic compound that can be naturally found in the human body. Creatine is prevalent in meat and fish; however, it is most commonly taken through powder supplements. Creatine's most useful characteristic is its use as an "energy shuttle". It is able to transport energy more efficiently than ATP to muscles and the brain. A study from Allen et al. (2009) shows the effects of creatine on rats. Female rats showed a decrease in depressive behavior while male rats had no change. Additionally, some studies show that people on diets that have low creatine inherently (e.g. vegetarian diets) have higher risk

and severity for depression (Kious, 2019). However, these studies cannot prove causality and conflict due to the complexity of diets and confounding variables such as outside factors not related to food consumption.

Lithium

Lithium has been shown to help cardiovascular issues as well as diabetes. Both cardiovascular disease and diabetes are common in patients with BD, especially bipolar II, due to the unbalanced lifestyle associated with BD (Weiner, 2011). Lithium supplements have been shown to improve patients' cardiovascular condition. While high-dose Lithium supplements have been correlated with a variety of issues, there are very little risks with low-dose Lithium intake. Lithium has also been shown to be anti-inflammatory (Madireddy, 2022). These anti-inflammatory effects have been shown to reduce both manic and depressive episodes.

Vitamin D

Vitamin D has anti-inflammatory characteristics, assisting with decreasing the severity of depressive episodes (Madireddy, 2022). Vitamin D is found in fish, oranges, milk, and exposure to the sun.

Folic Acid/Folate

Folic Acid has been proven to be helpful in treating symptoms of bipolar depression by synthesizing neurotransmitters such as dopamine, norepinephrine and serotonin. An additional key use of folates is assisting antidepressant medication. This is seen when folic acid has been used in combination with antidepressants such as Lithium to help with depressive episodes. This is seen when Folate was combined with Vitamin B and an oral antidepressant, citalopram. A 6.5% risk reduction of major depressive disorder was found (Lam, 2021). Folates also have been shown to greatly treat acute mania episodes. Natural folate levels are significantly lower in patients with BD when compared to healthy controls. A meta-analysis by Hsieh et al. shows this pattern, "folate levels in the patients with BD were significantly lower than those in the controls." (Hsieh, 2019). This shows a need for folate/folic acid in patients with BD. Folic acid can be found in green vegetables such as spinach, brussel sprouts, and asparagus as well as beans, peas and nuts.

Potential changes based on biological differences

As seen in the study on rats by Allen et al. (2009), men and women respond differently to different treatments. Additionally, women are twice as likely to have a mood disorder, indicating that biological differences impact mood disorders between women and men. Changes in neurotransmitters and hormones may affect the effectiveness of some treatments. Unfortunately, very little is known about the specific differences which cause the ineffectiveness of some treatments, and finding the reasons behind the discrepancies between different people is very difficult due to confounding variables associated with the complexity of lifestyles.

Discussion

The results show that many of the treatments for manic episodes apply to depressive episodes and vice versa, leading to the treatments and nutritional changes for bipolar I and bipolar II to be similar. Lithium, the leading treatment for BD, has been observed to be the most common and effective method of treating BD. Treatments such as the ketogenic diet show promise in becoming a new nutrition-based treatment that can be widely effective in suppressing the symptoms of BD. This aligns with previous findings. Not much is known or has been researched on other treatments, creating some limitations when deciding the efficacy of other treatment options. Future work may dig deeper into these other methods of treatment, potentially resulting in a larger variety of treatment options that can be adjusted based on biological differences. Additionally, future research into biological differences that lead to treatment and result discrepancies may benefit those who struggle to find a treatment plan that works for them when treatments such as Lithiu are not effective.

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Earth and Mind: A Comparative Analysis of the Polish and the British Societies in the Context of Climate Change and Mental Health By Konstancja Cegłowska

Abstract

Climate change and its influence on mental health is currently a widely discussed topic due to its profound impact on modern society. A growing body of research has shown alarming results about phenomena such as climate change anxiety as well as other negative climate emotions and mental states. What is highlighted by the researchers is the urgency to examine different societies in that area, as climate change attitudes and mental states can differ due to the unique context of each society's functioning, ways of facing environmental problems, and climate change awareness (Vercammen, Yatirajula, et al., 2023). The research project Earth and Mind is a scientific effort aimed at comparative analysis of the Polish and British societies in the context of their attitudes towards the issue of climate change and its connection to mental health. As part of the project, expert interviews were conducted to explore each country's situation. The research also included the design and dissemination of a research questionnaire in two countries: Poland and the United Kingdom (N = 214, Polish sample = 110, British sample = 104). A wide range of ages (18-65+) as well as the additional variables such as gender, level of education, and current occupation were included. Both questionnaires consisted of exactly the same questions examining the awareness, feelings, beliefs, and climate action of the participants. The findings revealed differences between the countries, but also demographic variables such as age or level of education, which can be further explained by theories and the contextual background described in the paper. Main emotions experienced in both countries included, but were not limited to anxiety and frustration. It can be concluded that the society in the United Kingdom showed a bit more pro-environmental behaviour than the society in Poland. Additionally, it was found out that there is more awareness of mental health in the context of climate change in the United Kingdom than in Poland with denial of anthropological causes of climate change being more prevalent in Poland. Nevertheless, both societies showed a lot of pro-environmental behaviour and many similar emotions in connection to climate change.

* For additional information regarding the project, please visit the earthandmindproject.com website.

Introduction

The recently published data have shown that the year 2023 was the hottest since the global records began in 1850. The ten warmest years in history occurred in the last decade (NOAA National Centers for Environmental Information, 2024). 99.9 percent of scientists agree on the anthropogenic causes of climate change (Lynas et al., 2021). It is a widely discussed topic, due to its profound impact on society with people naming it among other threats, the most serious problem currently faced by the world (European Commission, 2021).

Apart from the physical impacts, one must remember about the societal influence of ongoing climate change: its influence on the global economy, policy, and daily life of every individual. Extreme weather conditions and natural disasters can lead to severe health

consequences, including higher susceptibility to a range of conditions in children (Schapiro et al., 2024) and mental health problems like post-traumatic stress disorder, anxiety, and depression (Lawrance, Thompson, et al., 2022; Morgenstein & Ursano, 2020). However, in places which are not affected by climate change in such severe ways, more indirect exposure to it through media, social campaigns, and observable changes in surroundings can also have adverse effects on mental health (Lawrance, Jennings, et al., 2022; Ogunbode et al., 2021; Clayton et al., 2014). Therefore, what is highlighted by the researchers is the urgency to examine different societies in that area, as climate change attitudes and mental states can differ due to the unique context of each society's functioning, level of direct exposure to negative effects of climate change, climate change awareness and the overall situation in the region (Vercammen, Yatirajula, et al., 2023). Understanding the condition of people can aid implementing effective psychosocial support strategies and equipping specialists with tools needed in their practice to better help individuals suffering.

Moreover, research on climate change attitudes and emotions in relation to mental health can provide useful insight to environmental educators, social scientists, and policy-makers, who need to navigate the process of mobilising the society to take greater action and tackle the problem of climate change and global warming.

Due to the seriousness of the climate change situation and the importance of environmental psychology, this work was created. Its aim is a comparative analysis of the Polish and British societies in the context of their attitudes towards the issue of climate change and its connection to mental health. It included conducting 4 expert interviews and the design and dissemination of exactly the same research questionnaire in two countries: Poland and the United Kingdom (N = 214, Polish sample = 110, British sample = 104). It examined the emotions, beliefs, and opinions of the participants on climate change and mental health. The first sections of this work are dedicated to literature review and background, shaping a contextual framework of the paper, including the climate actions taken in both countries and the current status of research regarding both the presence of different mental states in the countries, as well as the theoretical side of the mechanisms behind them. Afterwards, the methods of the research are highlighted. Finally, analysis of the results is performed and presented as well as discussion of the findings with attention given also to both strengths and weaknesses of the study, potential directions for future explorations, and practical implications.

Literature review and background

Environmental and climate psychology involves a variety of topics dealing with mental health and human responses to nature and climate change. This literature review is aimed at presenting the current state and findings of this research area as well as analysing specific academic endeavours undertaken in the context of two countries compared in the study: Poland and the United Kingdom.

Firstly, what is highlighted by researchers in the context is that humans and nature are in a mutual relationship. Spending time in nature is assessed as an important part of human

well-being and it can positively affect mental health (Dittmer et al., 2023; Chandelkar, 2024; Alavi et al., 2021). Additionally, it was shown that people who spend time in nature are able to care more about the environment, so spending time in natural environments also promotes pro-environmental behaviour (Richardson & Hamlin, 2021).

Therefore, the disturbance of the natural environment can evoke negative feelings in individuals. The concept of eco-anxiety and environmental distress are two among many terms used to describe the negative mental states present in today's societies, due to climate change. Interestingly, daily challenges do not inhibit these reactions. A study conducted by Lawrence, Jennings, et al. revealed that even during the COVID-19 pandemic, climate change induced significantly bigger amounts of distress in young people than the pandemic itself. One of the possible interpretations for this phenomenon is that climate change "represents a more enduring existential threat" (Lawrance, Jennings, et al., 2022, p. 734). As a matter of fact, while people keep being engaged in daily life challenges and problems, eco-anxiety, and environmental distress do not go away as climate change keeps surrounding us continuously. It is important to understand the characteristics of these various climate change mental states and their causes. Reactions to climate change are varied and as it was shown may include all: cognitive, emotional, and behavioural responses (Schwartz et al., 2022). There is a range of mental responses identified in the literature, starting from anxiety, worry, distress, hope, positivity, interest, engagement to guilt, shame, sadness, fear, powerlessness, grief, despair, anger and disgust (Lawrance, Jennings, et al., 2022; Schwartz et al., 2022, Hickman et al., 2021; Clayton et al., 2022).

Unfortunately, if the aforementioned worries, negative emotions, and distress are persistent and quite severe, they can lead to functional impairment, disabling an individual to engage in daily activities. There is a strong negative correlation between climate change and mental health (Ogunbode et al., 2021; Ogunbode et al., 2022; Charlson et al., 2021). Sadly, negative climate-related emotions showed a significant positive correlation with insomnia symptoms (Ogunbode et al., 2021). A study conducted in Germany by Trost et al. revealed that 72% of psychotherapists see patients, who experience climate change-related concerns. It is hypothesised that people who already experience mental health problems can have them exacerbated, due to those concerns. Although the majority of the specialists felt confident with their knowledge, half of them still reported the need to have more information and training on how to deal with such concerns in therapy (Trost et al., 2024), which higlights the urgency to conduct research in the area.

Learning how to deal with mentioned mental states can be very beneficial for both individual wellbeing and the planet. Another array of research deals with finding which mental states and methods can increase the chance of supporting climate change policies and implementing personal action in the context of climate change. It is important to understand the emotional spectrum present in each of the countries and socioeconomic settings, keeping their context in mind as it can help climate change educators and psychologists foster emotions which can lead to more engagement and support for global warming policies and actions. Worry is potentially the strongest predictor. The most worried people were the most likely to support national climate and energy policies. It can be explained by the fact that ecological worry is rather adaptive than deleterious and boosts reflection and critical thinking about the topic. It is

also a state evoked mainly by personal events with people valuing the environment, feeling very worried and personally responsible to tackle the problem. As mentioned in a work by Bouman et al. - "Applied to the context of climate change, worry about climate change signals that an individual is actively and emotionally engaged with the topic of climate change and feels personally bothered by its consequences, making this person seemingly motivated to act upon the issue." (Bouman et al., 2020, p. 2). However, other emotions such as fear, guilt, shame, and sadness can sometimes be counterproductive and we should eliminate them. Due to the abstractness, and scale of the issue of climate change as well as difficulty in understanding it many people might distance themselves from the issue or feel very overwhelmed with what they could do to change the situation, therefore remaining inactive (Bouman et al., 2020, Clayton, et. al., 2014). As written by Hayes et al. - "The overarching threats of a changing climate, can also incite despair and hopelessness as actions to address the 'wicked problem' of climate change seem intangible or insignificant in comparison to the scale and magnitude of the threats" (Hayes et al., 2018, p. 2). Being afraid of something which is individually uncontrollable may result in higher levels of anxiety and distancing, being an observed mental response as well. The positive emotions such as interest and hope were found to be strongly associated with greater policy support - "feeling good about doing the right thing can be an important motivator of behaviour change" (Smith & Leiserowitz, 2013, p. 945). This conclusion was repeated in a number of other research articles (Smith & Leiserowitz, 2013; Bouman et al., 2020; Vercammen, Oswald et al., 2023).   While some studies showed that people who were more distressed were also more likely to report greater level of agency, the research was also produced which did not indicate a correlation between climate anxiety measured using scale, and personal engagement (Morganstein & Ursano, 2020). Importantly, recent research published by Vercammen, Oswald et al. suggest that distress is a multidimensional experience, as while it could evoke feelings of guilt, shame, lack of action and agency, at the same time participants with higher levels of distress are more likely to derive fulfilment and wellbeing benefits from climate action (Vercammen, Oswald, et al., 2023). Importantly, only very strong mental responses should be seen as pathological or maladaptive as mentioned before.

Researchers try to investigate potential support strategies for people experiencing climate change concerns. One of the activities that could protect mental health is taking action (Vercammen, Oswald, et al., 2023). According to research in that area, climate activism showed opportunities for protecting mental health and lowering symptoms of both general anxiety disorder and major depression disorder (Schwartz et al., 2022). Interestingly collective action can also lead to constructive hope, which in turn leads to more action and policy support (Smith & Leiserowitz, 2013; Steg, 2023) and creates a circle of positive actions and emotional responses. What is highlighted by many is therefore the urge to emphasise the importance of collective support and framing positive narratives and behaviour to protect mental health and promote climate change action. Social norms are an important aspect indicating that positive role models and the narration in a given society are also important indicators of action (Hickman et al, 2021). Thus, what can be demotivating and negative for mental health to a large

extent is the failure of governments and local organisations to acknowledge and fight against climate change. Positive youth development frameworks and the BUC(k)ET model of core social motives are also objects under investigation (Pereira & Freire, 2021; Brick et al., 2021), which can prove useful in promoting practices that would serve local communities.

Interestingly not every individual responds in the same way, multiple studies revealed that people of younger age, women, and better educated people are more prone to experiencing negative mental states, due to climate change (Searle & Gow, 2010, Vercamen, Oswald, et al., 2023; Watts & Campbell, 2020). In a study by Clayton et al. young women were more likely to report emotions such as: sadness, helplessness, anxiety, fear, anger, guilt, shame, hurt, despair, grief, and powerlessness, whereas men were more likely only to report positivity or indifference (Clayton et al., 2022). Another study revealed that women were also less likely to be climate change deniers (Nartova-Bochaver, 2022). Half of child psychiatrists in the UK say patients have symptoms of environmental anxiety and that it is more common in them than in older and not educated people (Royal College of Psychiatrists, 2020; Watts & Campbell, 2020).

The scientists dedicated themselves to looking at different world's populations and individuals. The studies concerned both countries, gender and age. When it comes to climate change psychology research specifically conducted in countries examined, a big disproportion of amount of research can be found. While in the UK lots of literature is produced in the area, in Poland climate psychology is still a new area without a lot of research and scientific articles, which makes the topic even more important to examine in the Polish context and see whether the conclusions from the studies regarding the UK can be applied to the Polish context and whether there will be significant differences between the countries analysed in the study. In order to establish the context, below is a summary of current research conducted specifically in Poland and the UK.

As already mentioned, in Poland, climate psychology is a very new concept and a developing field with many people still neglecting the issue. However, some articles and scientific work can still be found in the field. In "Climate depression. Critical analysis of the concept" Magdalena Budziszewska and Weronika Kałwak come to their conclusions based on literature review and studies performed. Participants declared depressive symptoms, anxiety, and resignation, some of them even referred to different mental phenomena such as climate change depression. The topic was present in groups of adolescents, students, activists, and psychotherapy patients. However, although the studies can provide valuable insight regarding the topic, as the authors inform "most of them are still in progress" (Budziszewska and Kałwak, 2022, p. 172). Another study found that Polish women are more likely to develop an environmental identity and engage in pro-environmental behaviour than men (Le Hai & Larionow, 2022). A literature review "Climate change and its influence of the chosen sectors in Poland" showed that Polish people were generally less worried about climate change, with more climate deniers being present in the country in comparison to other EU countries, however the review comes from 2017 itself and is based on mainly old studies, which might not reflect the current situation in Poland (Kundzewicz et al., 2017). Fortunately, the most recent report

developed outside of academia gave important insights into the beliefs and emotions of Polish society. The attitudes in the country are divided (UN Global Compact Network Poland et al., 2022). 50 percent of the participants marked climate change and environmental pollution as one of the biggest dangers for the world we live in. On the other hand, there are more people who do not take action in comparison to 2019 thinking that the environmental situation is either not that bad or ecology is a figment. Those people account for almost half of the sample, thus a wide range of responses can be observed. 18 percent of respondents think that human actions do not influence the environment negatively and even help it, which confirms the large percentage of deniers of the anthropogenic causes of the environment present in the country (UN Global Compact Network Poland et al., 2022).

Also, lack of agency and a more negative outlook of the younger generation is observed by the researchers. According to the report, 3 in 10 people think that they are not influential enough to impact the counteraction against climate change. The youngest age group (18 – 25) is twice as likely to think that it is too late to prevent climate change. 23 percent of young people agree with this claim: "Others are responsible for the ecological disaster, and I am not going to do anything about it". (UN Global Compact Network Poland et al., 2022, p. 12) in comparison to 18 percent of people in the whole Polish society (UN Global Compact Network Poland et al., 2022). When it comes to the UK, in one of the studies, sadness, anxiety, and fear were the top three reported emotions (Clayton et al., 2022). Another international comparative analysis revealed that the UK was leaning towards hope (Böhm et al., 2023). Variety of both national and cross-national research including UK as a participating country has been conducted (Lawrance, Jennings, et al., 2022; Verplanken & Roy, 2013; Clayton et al., 2022, Böhm et al., 2023, Ogunbode et al., 2022, Hickman et al., 2021, Vercammen, Oswald, et al., 2023). A study conducted by KCL Policy Institute, showed that 46 percent of Britons think climate change is an important problem with the youngest age group seeing it as even more serious (Ipsos, 2023). The most frightened group were once again the youngest people, who also were more likely to think that climate change is beyond control, representing the same more pessimistic outlook just like young people in Poland (YouGov, 2023). In the study performed by YouGov UK 73 percent of people thought that climate is changing because of human activity (YouGov, 2023), whereas another study, although quite old (from 2010) revealed that 89 percent of Britons believed that human activity played a causal role in climate change (Reser et al., 2012), both of these studies account for a bigger number of people believing in anthropogenic causes of climate change than in Poland (comparing it with the previously mentioned report). A high percentage of dissatisfaction with the government can be seen with 48 percent of respondents being not satisfied with its climate action (YouGov, 2024) and 49 percent think the government is incompetent (PERITIA, 2022b). Once again young people indicated a higher percentage with 68 percent of young people not agreeing that their government is doing enough (YouGov 2024). Similarly, in another study Polish people were very dissatisfied with their government with 6 in 10 people believing that the government is dishonest and incompetent when it comes to dealing with climate change, acts in their own interest and is closed to new ideas when it comes to

dealing with climate change (PERITIA, 2022b). Unfortunately, as mentioned previously, it is argued that failure of governments to adequately reduce climate change is contributing to psychological distress (Hickman et al., 2021).

Relevant to one of the questions I have constructed for this study, 35 percent of young people in the UK found to be dismissed or ignored by others while talking about climate change (Hickman et al., 2021). People in Poland were most likely to say that the central government and businesses should work to prevent environmental catastrophe (UN Global Compact Network Poland, 2022)

A specific type of research is so-called "cross-national" study, where many countries are analysed at once. There are lots of different cross-national studies where the UK (Clayton et al., 2022; Böhm et al., 2023; Ogunbode et al., 2022; Hickman et al., 2021; Vercammen, Oswald, et al., 2023) has been included, and far fewer studies with Polish people being participants.

The only two studies conducted by the same institution found with the UK and Poland together were "Public perceptions on climate change." and "Public perceptions on institutions tackling climate change". The results showed that more Polish people were worried about the impact of climate change on their country, humanity, and for themselves than people in the UK. UK people were also more pessimistic than Polish people with 27 percent agreeing that there is no point in changing their behaviour as it won't make any difference anyway. A strong feeling of lack of agency (already pointed out by previously discussed studies) with 55 percent of Polish people thought it is too difficult for someone like them to do much about climate change is visible (PERITIA, 2022). However, it is still important to acknowledge that the differences observed in this study were based on percentage seen, rather than a statistical test, which would confirm significance of the differences. Moreover, no comparative study which would include only Poland and the UK was found.

Background - country analysis

In order to understand the situation further, this section is dedicated to a deeper analysis of the situation in both countries. In the UK the year 2022 has been the hottest on the record with the temperatures exceeding 40 degrees Celcius for the first time (Department for Energy Security and Net Zero, 2023). Nevertheless, the UK has been considered to be a global leader in action against climate change for a long time. The discussion about climate change in this country has started back in the 20st century with Margaret Thatcher becoming one of the early leaders in the world to mention climate change (Kishinani and Smith, 2020). The majority of British coal mines were shut at the time. Afterwards the Blair government and 2010 coalition have both introduced some positives such as the Tyndall Centre or the Climate Change Levy (Kishinani & Smith, 2020). Moreover, in 2008, the UK became the first country in the world to create a legal commitment, in order to reduce the greenhouse gases emissions (Greenpeace, 2023). The Climate Change Act, included the creation of a special Climate Change Committee, which deals with carbon budgets among other strategies to cope with climate change (Greenpeace, 2023). In 2015 the UK signed the world's largest policy, the Paris agreement on

climate change (Greenpeace, 2023). The country is also the heart of multiple famous climate change activism organisations with the Extinction Rebellion being one of the few. The United Kingdom is also the place of many leading academic institutions, researchers, and specialists dealing with the topic. With all of these actions, the UK has become a "global climate leader" being highly ranked regarding climate actions by various organisations (ClimateTrade, 2023). Recently however, it started losing its title, which can be indicated by falling from the 11th to the 20th position in the "Climate change performance Index" just in one year (Climate Change Performance Index, 2023). It is attributed to the election of a conservative party, which contributed to several policy changes. Many claim that the UK has currently worse environmental laws than the European Union Countries (Pearce, 2023; Niranjan, 2024). The Guardian has found that dozens of chemicals and pesticides are still allowed in the UK, whereas the EU has already banned them. "On the world stage, these policy changes show that the U.K. is turning its back on a global leadership position," wrote Joeri Rogelij, director of research at the Grantham Institute for Climate Change and Environment at Imperial College London, quoted in the recent Guardian article (Pearce, 2023, p. 1). On the other hand, the current government and some UK citizens believe that the UK goes beyond the EU and that nothing in particular has changed (Niranjan, 2024). This recent political tension might be therefore reflected in the answers of the UK participants in the study.

Up to 1989 Poland was a communist country (Polish People's Republic) with a centrally controlled economy. After the change of regime, there was an intensive period of transformation and economic growth including modernization of the energy sector. In 1998 Poland signed the Kyoto Protocol with the goal of decreasing greenhouse gases emission and successfully completed the goal between 2008 and 2012 (Instytut Ochrony Środowiska Państwowy Instytut Badawczy, 2019) Moreover Poland joined the European Union in 2004, which also marked the start of important action against climate change. The country also hosted COP conferences three times (Instytut Ochrony Środowiska Państwowy Instytut Badawczy, 2019). Over the years the overall energy production coming from coal fell from 95 percent to 60 percent with the coal mining industry being still active (Instytut Ochrony Środowiska Państwowy Instytut Badawczy, 2019) contrary to the UK with coal accounting for only one percent of total energy production (Electricity Explained, 2024). The former Polish government, PiS (Law and Justice), did not support many of the EU policies with the leader of the ruling party calling them "madness" (Wilczek, 2021). In 2021 report produced by EU showed that carbon intensity of Poland was the second highest in EU accounting for EU's largest coal deposits (European Parliament, 2021). CCPI ranking noted the domination of coal in Poland's energy mix as well (Poland ranked 55, 35 places worse than the UK) (Climate Change Performance Index, 2023). In comparison to UK with its 112 place, Poland occupying the 74th position has worse air quality (IQAir, 2024). On 10th of January 2024 three Polish cities were in the top 10 polluted in the world according to the World Air Quality Index (Wojajczyk, 2024). However at the same time, renewable energy sources became more popular, with the share of them being doubled between 2005 and 2019

(Instytut Ochrony Środowiska Państwowy Instytut Badawczy). Sadly, the most popular source of renewable energy is biomass contributing to extensive forest harvesting and a conflict of interest in maximising the profits of wood sales and protecting the forests at the same time (Climate Change Performance Index, 2023). Another important aspect is lack of intensive climate change psychology research in the country with only a couple of papers found in the discipline and beginning of the discussion about mental health in the context. On the positive side Poland met EU's 2020 environmental targets and is among the leading countries in terms of heat pump sales (Climate Change Performance Index, 2023). The current new government claims to be more supportive and has ambitions to become "a green player" in Europe (Kurmayer, 2024). However, there are still many people against the EU green deal policy with Polish farmers' strikes against "Green Poison" being one of the most visible (Stezycki, 2024). Thus, once again like in the case of the UK a range of responses can be visible and to tackle climate change effectively a more coherent vision of transformation should be seen in the country. European Union Membership is definitely one of the most important aspects of climate change action and policy in Poland, however, there are still several aspects of climate change action that are needed to be taken care of and range of responses regarding it.

Methodology

The following section is dedicated to the description of methodology. In order to check the hypotheses established and fulfil the aims of this research both qualitative and quantitative methods were chosen. The latter one was exemplified by the development of the online survey. Thanks to it, data about respondents and their views concerning climate change and mental health was gathered. The questions of the survey can be seen in Appendix 1 and Appendix 2. The research concerned two countries - the United Kingdom and Poland and therefore the same survey was distributed in both of them. In order to facilitate the process, the survey distributed in Poland was translated from English to Polish. In the end, the survey was answered by 214 respondents in total (110 respondents from Poland and 104 respondents from the United Kingdom). The selection of the two given countries was influenced by the fact that, as shown in the background section, they are differing in their characteristics, history, trajectory and the current geopolitical affiliation.

The first group of questions of the survey considered the age, gender, education level and employment status to establish the profile of the respondents and later on include demographic variables in analysis of the results. Afterwards, the questions were dedicated to the issues of climate change. Some of them were open-ended questions in order to give respondents more flexibility in their answers. Additionally, to facilitate it even further, the final question was an open-ended one prompting the respondents to share all the thoughts on the topic that the person might have had. For the other questions the respondents could select answers from the provided list (e.g. emotions) or choose their opinion on a 5-level scale. Thanks to choosing the survey as a method and selecting a wide range of questions, a number of topics connected to mental health and climate change were covered and could be researched. Afterwards, the

statistical analysis was performed using the open source GNU PSPP software. Student's t-test and Levene's Test. For Equality of Variances were used. Apart from that, the values will be compared and visually presented. Furthermore, a qualitative method was used in the form of 4 expert interviews (3 video-calls and 1 written exchange) with psychologists, researchers, psychoanalysts, ecologists. These were semi-structured and considered the topics of climate change from the given perspective and in a given country as the interviewees came from a number of backgrounds and both analysed countries (3 from the United Kingdom, 1 from Poland). They were selected based on their profiles and willingness to participate. The interviews provided interesting insights useful for the research and discussion.

Data analysis

Based on the literature review and background analysis, 4 different research questions were developed:

1.Is society in the United Kingdom more ecological and showing more pro-environmental behaviour than the society in Poland?

2. Do more negative emotions prevail in the United Kingdom, in the context of climate change, than in Poland?

3. Is there more awareness of mental health in the context of climate change in the United Kingdom than in Poland?

4. Is there a greater sensitivity of the younger generation to climate change and emotions connected to it?

Connected to that, six null and six research hypotheses were developed:

1.1 There is no significant difference in the amount of pro-environmental attitudes demonstrated in the countries studied.

1.2 There is a statistically significant difference in the amount of pro-environmental attitudes demonstrated in the countries studied.

2.1 There is no significant difference in the type of emotions present in the countries studied.

2.2 There is a statistically significant difference in the type of emotions present in the countries studied.

3.1 There is no significant difference in awareness related to mental health in the context of climate change in the countries studied.

3.2 There is a statistically significant difference in awareness related to mental health in the context of climate change in the countries studied.

4.1 There is no significant difference between age groups

4.2 There is a statistically significant difference between age groups

5.1 There is no significant difference between people with different educational backgrounds

5.2 There is a statistically significant difference between people with different educational backgrounds

6.1 There is no significant difference between genders
6.2 There is a statistically significant difference between genders

In the first question of the survey (apart from the ones dedicated to demographic aspects) the respondents answered the open-ended question about the ways in which they care about the environment. The responses varied and respondents listed plenty of activities, however some trends could be seen when analyzing the answers. In case of the respondents from the UK answers involved "recycling" in 40 cases, transport connected measures were mentioned 24 times, issues connected to diet 18 times, avoiding plastic 16 times, not overconsuming 8 times, saving water 8 times, taking political action/voting for ecologically-friendly parties 8 times, saving energy 7 times. In case of Poland, sorting/segregating waste was by far the most common answer, listed by 78 out of 110 respondents (71%), often as the only activity, saving water was listed 31 times, avoiding plastic or using reusable bags 20 times, saving energy 19 times and actions connected to transport 14 times.

In the next question the participants indicated how they assess the influence of their activities connected with environmental protection. We can see that in both countries the responses were similar with most people (roughly 40%) choosing the middle option.
A question: how do you assess the influence of your activities connected with environmental protection? has been asked. A Student's t-test for independent samples was then used in relation to that question.The difference between the averages in the compared groups was found to be statistically insignificant (t=-0.72; p>0.05).

The Student's t statistic was also used to test the hypothesis of a difference between the inhabitants of Poland and Great Britain in terms of how serious the problem of climate change is. UK residents rate the problem of climate change as more serious than Poles. 62.5% of the British respondents chose the highest level of severity (extremely serious), meanwhile in case of Poland it was only 42.7%. Additionally, 6 respondents from Poland (5.5%) thought that the issue of climate change is not serious at all with only 1 person choosing the same answer in case of the British survey (~1%). Statistical analysis using Student's t method for independent samples confirms the significance of the aforementioned difference. It can therefore be concluded that the British assess the problem of climate change as more serious than the Poles (t=-3.81; p<0.001).

The next question also confirms the more ecological approach of the British respondents, 15.4% of whom always consider the environment when making decisions. Meanwhile, only 5.5% respondents from Poland have chosen this answer.

The relationship between nationality and the degree to which decisions are determined by ecological aspects was then analysed. The largest number of respondents declared that they are very much guided by environmental aspects in their decision-making. In contrast, the fewest admitted that they do not consider these issues at all in their decision-making.
The frequency of different emotions in relation to climate change was also assessed and statistically analysed.

In the case of the UK, frustration was the only emotion chosen by more than 50% of respondents. Interestingly, in the case of Poland frustration was the third most common choice, preceded by helplessness (45.5%) and anxiety (63.6%). In the UK anxiety was selected in 38.5% cases.

Afterwards, the emotions or states were grouped based on their potential to cause mental health issues. It was found out that emotions typically assessed as "positive" being hope, optimism, empowerment, motivation and pride, were chosen 71 times (22.9% of choices) in the case of the United Kingdom and 67 times (20.7% of choices) in the case of Poland. The other category were the emotions typically assessed as "negative" - sadness, anxiety, fear, frustration, anger, regret, helplessness, guilt, uncertainty, worry. These constituted 72.5% choices in the United Kingdom and 71.2% of choices in Poland. The remaining percentage of answers were of "I don't know" or "Indifference" as well as the ones proposed by participants and classified as neutral.

To determine whether there is a statistically significant relationship between nationality and feelings of **frustration** in relation to climate change, a chi-square test of independence was used. The statistically significant result of the chi-square test (χ^2 =12.54; p<0.001) confirms thBased on the results of the chi-square test (χ^2 = 7.4; p > 0.05), we do not have sufficient evidence to conclude that there is a statistically significant relationship between the study variables. This means that the differences between observed and expected frequencies are likely to be the result of random chance rather than a true relationship between the variables. The null hypothesis of no relationship between the variables was not rejected.

Anger was chosen slightly more often by Poles than by UK residents.However, the statistically insignificant result of the chi-square test (χ^2 =0.79; p>0.05; ni.) does not confirm the relationship between nationality and feelings of anger towards climate change.
Poles were also more likely than UK residents to identify **regret** as one of the emotions associated with climate change. Based on the non-statistically significant result of the chi-square test (χ^2 =3.29; p>0.05; ni.), the hypothesis of a relationship between nationality and feelings of regret in relation to climate change can be rejected.

Poles were more likely than the British to indicate **anxiety** as an emotion they feel towards climate change. Based on the statistically significant result of the chi-square test (χ^2 =13.56; p<0.001), it can be concluded that there is a relationship between nationality and feelings of anxiety in the face of climate change.

Feelings of **powerlessness** were more often associated with climate change by Polish than British residents.The statistically significant result of the chi-square test of independence of the two variables (χ^2=8.82; p<0.05) confirms the relationship between nationality and experience and experience of feeling powerless in relation to climate change.

Some respondents indicated positive emotions in relation to climate change. One of these was **hope**, which was indicated by a comparable number of Poles and Britons. Statistical analysis based on the chi-square test confirmed that there was no relationship between nationality and the experience of hope in the face of climate change (χ^2 =0.75; p>0.05; ni.).

Sadness in the context of climate change was indicated more often by Poles than the British.

A statistically significant chi-square test result confirms the relationship between nationality and the experience of sadness in the face of climate change (χ^2 =4.91; p<0.05).

Fear appears to be an emotion that is felt to a comparable degree by Poles and UK residents in the face of climate change. The majority of survey participants did not identify this emotion as accompanying climate change. The non-significant result of the chi-square test (χ^2 =1.45; p>0.05; ni.) confirms the absence of a relationship between nationality and feelings of fear in the face of climate change.

Optimism was slightly more frequently associated with climate change by UK residents than Poles. However, the data presented in the table below shows that this emotion was indicated by a minority of respondents. The result of the chi-square test of independence of the two variables was found to be statistically insignificant (χ^2 =2.69; p>0.05; ni.), which allows us to reject the hypothesis of a relationship between nationality and feelings of optimism towards climate change.

A comparable number of people surveyed from both countries also indicated **motivation** as a state accompanying climate change. The vast majority of survey participants did not associate this emotion with climate change. The result of the chi-square test of independence of the two variables was found to be statistically insignificant (χ^2 =0.04; p>0.05; ni.). On this basis, the hypothesis of a relationship between nationality and feelings of optimism towards climate change can be rejected.

Few of those surveyed indicated a feeling of i**ndifference** in the context of climate change. A comparable number of respondents from both groups associated this emotion with the problem of climate change. The result of the chi-square test of independence of the two variables was found to be statistically insignificant (χ^2 =0.65; p>0.05; ni.). On this basis, the hypothesis of a relationship between nationality and indifference to climate change can be rejected.

The last emotion surveyed in the context of climate change was a feeling of **empowerment.** This feeling was also indicated by a small number of survey participants.The result of the chi-square test of independence of the two variables was found to be statistically insignificant (χ^2 =1.5; p>0.05; ni.). On this basis, the hypothesis of a relationship between nationality and sense of agency towards climate change can be rejected.

Another characteristic of Poles and the British analysed was the extent to which they try to use methods to support their functioning in the face of climate change.Exactly the same number of Polish and British respondents admitted to not introducing any methods. Using such methods sometimes was declared by more Poles, while introducing them "frequently" by more British. Based on the results of the chi-square test (χ^2 = 28.79; p < 0.001), we have sufficient evidence to conclude that there is a statistically significant relationship between nationality and the extent to which people try to use methods to support their functioning in the face of climate change. This means that the differences between observed and expected frequencies are so large that they are unlikely to be the result of random chance. Therefore, the null hypothesis of no relationship between the variables is rejected at the 0.001 significance level. Based on a detailed

count analysis, the likely direction of the relationship can be determined. Poles are more likely to be unsure about using the methods mentioned or to use them rarely. The British, on the other hand, are more likely to declare that they use such methods frequently.

Afterwards, the respondents were asked what methods exactly do they implement, if any. In general, the biggest share of methods was dedicated either to avoiding bad news, concentrating on positive ones or engaging in climate actions. The responses which illustrate the issue are "I try to do everything I can to support/speak up for green issues, I do 'my bit' eg wildlife gardening, recycling, no car etc. I avoid the news, just listen to headlines as this makes me depressed which demotivates me." or "- Stopped viewing everyday media- too conflicting and negative! Want a measured view. Started reading positive news blog. Encourage others and listened to the way friends have adopted change in everyday life. Finding/following positive change activities on my social media channels that give tangible solutions.".

The relationship between nationality and what reactions people face when they share their thoughts on climate change was also analysed. The answer "People say that I overreact" was marked by a minority of survey participants. This group was slightly outnumbered by Polish residents.Based on the results of the chi-square test (χ^2 =2.5; p>0.05; ni.), we do not have sufficient evidence to conclude that there is a statistically significant relationship between the study variables. This means that the differences between the observed and expected frequencies are likely to be the result of random chance rather than a true relationship between the variables. The null hypothesis of no relationship between the variables was not rejected.Respondents responded in a similar way to the sentence 'People make me think that what I feel is not important'. The vast majority of respondents disagreed with this statement. Again, based on the results of the chi-square test (χ^2 =1.26; p>0.05; ni.), there is insufficient evidence to conclude that there is a statistically significant relationship between the study variables. This implies that the differences between observed and expected frequencies may be the result of random chance rather than a true relationship between the variables. The null hypothesis of no relationship between the variables cannot be rejected.

Respondents were more divided on the statement "People share my feelings and thoughts". A slightly higher number of respondents from each group responded positively to this statement. Statistical analysis based on the chi-square test (χ^2 =0.26; p>0.05; ni.), however, did not provide sufficient evidence to conclude that there is a statistically significant relationship between the variables under study. This implies that differences between observed and expected frequencies may be the result of random chance rather than a true relationship between the variables. The null hypothesis of no relationship between the variables cannot be rejected.

The last of the statements that dealt with other people's perceived reactions to opinions on climate change was "People are supportive and empathetic to me". The vast majority of survey participants responded negatively to this statement, with the following among the Poles, the number of people who chose the answer 'no' was higher than among UK residents. The results of the chi-square test (χ^2 =4.27; p<0.05), provide evidence to conclude that there is a statistically significant relationship between the study variables. This means that the differences between the observed and expected frequencies are so large that they are unlikely to be the result of random chance. Therefore, the null hypothesis of no relationship between the variables

is rejected at the 0.05 significance level. It can therefore be assumed that there is a relationship between nationality and the fact that expressing opinions on climate change is met with support and empathy. It is more common for the British to experience this type of response than for residents of Poland.

To the question "Have you ever used forms of support such as articles, organisations, psychological support dealing with mental health in the context of climate change?" the majority of people surveyed answered "No, because I don't need them". In contrast, the least frequent response was "No, but I need them". Based on the results of the chi-square test (χ^2 =12.42; p<0.01), it can be concluded that there is a statistically significant relationship between the study variables. This means that the differences between observed and expected frequencies are so large that they are unlikely to be the result of random chance. The null hypothesis of no relationship between the variables in question can be rejected. A detailed analysis of the number of individual answers given by Poles and the British indicates that residents were slightly more likely to declare having used various forms of support in the context of climate change. Among Poles, on the other hand, the more frequent answer given was "No, as I did not know that such forms existed", which may indicate a lower awareness of the existence of the forms of support referred to in the question.

The next question was an open one - "What emotions does public climate discussion evoke in your country?" Both in the case of Poland and the United Kingdom the responses were similar. The most common responses included frustration and indifference. It is often noted that different groups have different opinions on the topic and therefore there are both dedicated climate activists and climate denialists or those who are sceptics.

When asked about the extent to which there is a discussion on climate change in the respondents' country, the largest number of respondents answered "None/not much" and "Not enough". Slightly less numerous was the group of respondents who declared a lack of knowledge on the subject. A significant minority of respondents gave a positive assessment of the extent to which climate change was discussed in their own country. Based on the results of the chi-square test (χ2=7.11; p>0.05; ni.), we do not have sufficient evidence to conclude that there is a statistically significant relationship between the study variables. This means that the differences between observed and expected frequencies are likely to be the result of random chance rather than a true relationship between the variables. The null hypothesis of no relationship between the variables is not rejected.It can be assumed that in both countries, the level of discussion on climate change is rated as negligible or insufficient. A large proportion of Poles as well as Brits are unable to assess the level of discussion on this topic.

When asked about satisfaction with the government's climate action, the largest number of respondents chose the option "hard to say". Apart from this, both groups were dominated by responses indicating dissatisfaction or strong dissatisfaction. However, in case of Poland the option "hard to say" was by far the most popular - 52.7% compared to 32.7% in case of the United Kingdom. This is visible on figures 9 and 10. Based on the results of the chi-square test (χ^2 =12.41; p<0.05), we have sufficient evidence to conclude that there is a statistically significant relationship between the study variables. This means that the differences between observed and expected frequencies are large enough that they are unlikely to be the result of

random chance. Therefore, the null hypothesis of no relationship between the variables is rejected at the 0.05 significance level.

Based on an analysis of the number of responses, it can be concluded that among Poles, there is a more numerous group of people who avoid explicitly assessing the government's actions on climate change than among the British. At the same time, the latter seem to assess their country's government's actions in this context more harshly. This is evidenced by the clearly higher number of those who are very dissatisfied.

The next two questions were open-ended and asked "What do you think can motivate active people to take greater climate action?" and "What do you think can be done to mobilize passive people to take climate action?". In connection to the former question the responses were diverse, however, an interesting theme could be identified. Many UK respondents pointed out that more evidence of the success of their actions and giving them a bigger platform or stronger associations could motivate already active people to engage even further. One example answer reads as follows: "Making them more aware of the direct impact of every single little action, also encourage to motivate others (through making them realise how much impact they can make as positive role models)". Responses from the Polish participants were similar and also pointed to the aforementioned issues, for example in the comment "Demonstrating the potential of their actions, if possible, to encourage them to continue their activities.". In case of the questions concerning passive people by far the most popular answer in both countries included education. In neither of the two questions major differences in the responses between the countries was reported.

The respondents were also tasked with identifying the cause of climate change. Respondents most often identified human activities and a mix of nature and human activities as factors leading to climate change. Based on the results of the chi-square test ($\chi2=6.69$; p<0.05), it can be concluded that there is a statistically significant relationship between the study variables. This means that the differences between observed and expected frequencies are so large that they are unlikely to be the result of random chance. The null hypothesis of no relationship between the variables in question can be rejected.

It can be concluded that the tendency to link climate change to human activity is more common among Britons. Poles, on the other hand, are more likely than the UK population to believe that these changes are the result of natural factors and human activities.

Responsibility for tackling climate change was most often placed by those surveyed on the government and least often on environmental organisations and associations and local governments. Based on the results of the chi-square test ($\chi^2 =7.91$; p>0.05; ni.), we do not have sufficient evidence to conclude that there is a statistically significant relationship between the study variables. This means that the differences between observed and expected frequencies are likely to be the result of random chance rather than a true relationship between the variables. The null hypothesis of no relationship between the variables is not rejected.

It can be concluded that the British and the Poles do not differ significantly in terms of attributing responsibility for solving climate change problems.

The last question of the survey was an open-ended one - "Would you like to share something relevant to the topic of climate change and the attitudes connected to it?". Some respondents used this occasion to share their various thoughts on the situation. It was visible that while there were also hopeful comments, big corporations and too extreme activists were criticised. Some responses which capture the emotions of the British participants are:

"Understanding that whilst individual choices matter a bit, only significant political action to curb industrial practices will make a difference"

"It is important to make sure that individual people stay motivated to combat climate change. This might be hard as many people might (rather rightfully) believe that their actions are insignificant because Asian countries, celebrities or oil companies are too powerful and too climate polluting to even care."

In case of Poland more comments which can be assessed as sceptical to the issue of climate change were identified such as for example:

"Isn't it the case that East Asia doesn't care anyway and is actually dragging us to the bottom when it comes to the climate?"

"I believe that the topic of climate change is very much abused to introduce irrational laws, to burden people with excessive charges (taxes) and to restrict their freedom."

However pro ecological comments were also present.

As a person of older than 30 years old, I have a lot of optimism and hope, because when I was your age, climate issues, ecology were a total niche and NO ONE of the young people were interested in them, now it is standard and children already in kindergarten learn how to take care of our common home.

I believe that the responsibility for solving the problem of climate change lies with individuals, businesses and corporations, local governments as well as the government. In order to improve the environment, pro-environmental behaviour cannot be ceded to one group of people as it will not be effective and comprehensive. Actions must be integrated and complementary and permeate each other. This ranges from individual, local community awareness to top-down legislation.

Data about demographic variables were also collected and analysed. In the Polish sample significant differences were found in terms of gender regarding two emotions, fear and anxiety and the level of satisfaction in terms of climate change action in the country, with more women being unsure about it. In the British sample it was in terms of frustration and fear as well. The study did not confirm the previous findings with women being more likely to mark almost all emotional states like found in previous research. However, the bigger chance of being anthropological causes of climate deniers confirmed in the Polish sample with 5 out of six people, who claim that climate change is caused by nature being men, but in the British sample one individual marking nature as cause for climate change being a woman.

In terms of level of education there were significant differences found in Poland in terms of anger, anxiety, indifference and optimism. In the UK sample the differences were found in: indifference, sufficiency of discussion in the country and the responsibility for tackling climate change. In terms of age one difference was found in the Polish sample regarding the question about responses when sharing thoughts on climate change with others.

Interviews

In order to gather additional knowledge 4 interviews were performed. Their transcripts are gathered in the Appendix section. The experts who took part were:

Dr Agnieszka Klimska (Doctor of Humanities in the field of philosophy, Assistant Professor at the Polish Institute of Philosophy and the Institute of Pedagogy) - Appendix 3, **Dr Caroline Hickman** (lecturer at the University of Bath in social work and climate psychology) - Appendix 4, **Ben Hart** (Head of Operations at Nattergal, Natural Capital Specialist, ESOS Lead Assessor and Chartered Energy Manager) - Appendix 5, **Anouchka Grose** (psychoanalyst and writer) - Appendix 6

Discussion

This investigation aimed at being a comparative analysis of attitudes, emotions and thoughts of people regarding climate change in two countries: the United Kingdom and Poland. The importance of this research was emphasised, due to lack of comparative analysis of the countries found in literature and little research in the area in Poland in general. Below a summary of findings in relation to currently available literature, both strengths and limitations as well as opportunities and directions for further research can be found.

There was a significant difference regarding the assessed seriousness of climate change with UK participants rating climate change as more serious. Six Polish participants assessed climate change as not serious at all, in comparison to only one UK participant, which in line with the literature analysed earlier, confirms that in Poland, there are quite few people, who do not find the climate situation extremely bad (UN Global Compact Network Poland et al., 2022). Denial of anthropological causes of climate change and ignorance in Poland is further confirmed by 7 people claiming that climate change is the result of nature activity in comparison to just one person in the UK. This finding shows the presence of deniers of the anthropological causes of climate change in Poland.

Fortunately, the majority of people in both countries consider ecological choices when making decisions, however at the same time the majority of participants in both countries assessed the influence of their actions regarding environmental protection at a moderate level. So while many individuals try caring for the environment, they are not very confident with the impact of their actions. Further research should be performed to find potential causes for that phenomenon. One potential explanation could be that, while people do care and do protect the environment on a daily basis, they still are overwhelmed with the issue, presenting itself as an "enduring existential threat" (Lawrance, Jennings, et al., 2022, p. 734) and therefore can potentially be pessimistic about their actions and distance themselves from them. They might not assess their actions as having great impact, feel overwhelmed by the issue and therefore

some can remain inactive (Bouman et al., 2020; Clayton et al., 2014) which is also a topic discussed in the interview with Dr Caroline Hickman and Anouchka Grose. The majority of participants in both countries think that the government and big companies have the greatest responsibility to address the issue of climate change, perhaps people think in this way because of the already mentioned cause: because of feeling overwhelmed and thinking that the actions undertaken by individuals are insignificant. However, according to Caroline Hickman legal action is important in itself and we need to see the collective action take place, so perhaps the participants share the expert's view.

The three most common chosen emotions in the UK were frustration, anxiety and sadness. The commonness of sadness and anxiety can be confirmed by a previously conducted study (Clayton et al., 2022) and the expert interviews. In Poland the most commonly chosen emotions were anxiety, helplessness and frustration, which can be also supported by the expert interview. Sadly as seen in the results negative emotions dominate the positive ones. Giving people chances to act on climate change should be a top priority regarding high levels of these emotions detected as it could potentially evoke more positive emotions and bring constructive hope to the society (Smith & Leiserowitz, 2013; Steg, 2023) and have a positive influence on mental health of the participants. There was a significant difference found between countries in terms of the following emotions: frustration, anxiety, helplessness, sadness. The feelings of helplessness, sadness and anxiety being more frequently pointed out by Polish people.

There is a significant difference between the frequency of using methods, which would support mental health in context of climate change. Poles are more likely to be unsure about using the methods, which would support them mentally in the context of climate change or use them rarely. Moreover, there was a significant difference between the extent to which people seek psychological support in terms of climate change with three in ten Polish people claiming that they did not know something like that even existed. This can be reflected in overall lower awareness and resources in the country with climate psychology being a very new field in Poland. What supports this claim even further is the fact that people in Poland are less likely to share their thoughts on climate change with others, which shows that the topic itself is less frequent in the public debate. Moreover, although not a statistically significant difference was found, Poles were more likely to experience situations in which people said they overreact in comparison to Britons.

The majority of both Poles and Britons think that the discussion about climate change in their country is not sufficient and are not satisfied with the climate change action in their country.There was a statistically significant difference found in that context with Polish people being more undecided (half of the answers) regarding the issue. Failure in addressing the issue and preventing climate change by the organisations and government in the country leads to worsening mental health (Hiickman et al., 2021). Therefore, it is extremely important for mobilising the people, to set good examples in society. Moreover, as found by researchers and confirmed by the study, many people want to care about climate change, but think that society in general doesn't (Steg, 2023). Potentially, having a negative public debate around the issue and presenting it as a controversial political tool rather than a necessity, can lead to

strengthening this misconception and demotivating people even more. There was a statistically significant difference in terms of people who attributed the cause of climate change with more people in Poland claiming it is a mix of both human and nature activity. Almost half Britons and over a half of Poles marked this answer. According to literature, climate change is mainly due to human activity (Lynas et al., 2021). The concerningly high number of answers including nature as the cause shows the need for climate change education. In the "Ziemianie atakują [Earthlings attack]" report the authors showed that on average people rate themselves higher in terms of knowledge than in reality. As mentioned previously deniers of anthropogenic causes of climate change could be also found.

A strong difference in responses regarding caring for the environment was seen with 78 responses in a Polish sample about recycling. What is meant by the participants is dividing trash and throwing them in appropriate boxes. However, still only 40 percent of trash is being recycled in Poland (Vercammen, Oswald et al., 2023). It can be seen that it is commonly taught in schools to recycle, turn off the light while not spending time in the room and turning off the water while brushing teeth, which could suggest why it was such a frequent answer. In reality these actions have a low impact and it could be indicated that in reality Britons are more eco-friendly than Polish people, who often limited themselves to the trivial things mentioned above. It could also point out flaws in the education system,which does not promote more advanced practices.

The study conducted was a pioneering project in the field and the first study which compared the UK and Poland in terms of climate change and mental health, including a statistical analysis. The study's strength was inclusion of a variety of methods, with both quantitative and qualitative methods of research. The open-ended questions gave the opportunity for more in depth answers and real glimpse into thoughts of the participants. However, there were some limitations as well, firstly the sample collected was relatively small and not representative regarding the demographic variables. This could potentially explain the lack of many strong statistically significant differences in terms of age, gender and level of education.

Future research could therefore involve bigger and more stratified quota to delve deeper in differences regarding different demographic variables. Negative emotions should be taken into consideration and examined in terms of their causes, correlation between them and mental health or potential for taking action and potential sociodemographic explanations for these relationships. Further differences could be examined in the context of two countries by looking closely at described mental states and thoughts. Anger in Poland might be a different mental response, requiring different coping strategies than anger in England, although the overall range of emotions felt is similar, the depth and manifestations of them might be different.

Conclusion

To conclude, the research aimed to perform a comparative analysis of the Polish and the British societies in the context of climate change and mental health. In order to fulfil the aims, the literature review was performed which helped in identifying the trends dominating this field of study. In order to gather more information 4 expert interviews with people working in the field

of climate change and psychology were performed. Afterwards, a survey was created which was later filled in by 214 respondents (110 from Poland, 104 from the United Kingdom). The results of the questionnaires were then analysed and discussed. It can be concluded that the society in the United Kingdom showed a bit more pro-environmental behaviour than the society in Poland. Additionally, it was found out that there is more awareness of mental health in the context of climate change in the United Kingdom than in Poland. Nevertheless, both societies showed a lot of pro-environmental behaviour and similar emotions in connection to climate change. The research has provided a lot of insight on the climate, environment, and mental health in the two analysed countries. As the topic of climate change and mental health is relatively new, it should be continuously examined and developed in the future.

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Financial Inclusion and Capital Access for Women-Owned SMEs in Vietnam:
The Role of Microfinance Institutions By Nhu Lam

Abstract

This paper aims to examine the extent of financial inclusion and access to capital for women-owned small and medium-sized enterprises (SMEs) in Vietnam, with a particular emphasis on the impact of microfinance institutions (MFIs). To accomplish this, we triangulate information by reviewing the existing literature, while documenting descriptive statistics focused on capital attainment from the microfinance sector by women entrepreneurs. Relevant themes were explored and presented to draw comprehensive understanding in the field. The following themes emerged from the literature review: (1) the role of microfinance institutions, (2) women's financial access, (3) constraints and facilitators of female entrepreneurship, and (4) the role and relevance of the Sustainable Development Goals with regards to the landscape of financial inclusion. Additionally, from the quantitative information available it was observed a common trend between women-led management in MFIs and microfinancing support for female borrowers and start-ups, highlighting the importance of microfinance and women's leadership in enhancing capital access and fostering a supportive business environment for women-owned SMEs. These observations highlight the importance of targeted financial services in empowering women entrepreneurs to drive economic growth across the country and beyond.

Introduction

In recent years, Vietnam has undergone remarkable economic expansion, establishing itself as one of the most dynamic emerging markets in Southeast Asia. Since the Doi Moi (Reform) policies of 1986 were implemented, heightened international integration and the adoption of a market economy has allowed the nation to achieve substantial growth and socio-economic development (Pham and Talavera). Over the course of the past two decades, its GDP per capita witnessed a significant increase from approximately $395 in 2000 to over $4,100 in 2022 ("World Bank Open Data"). In addition to a thriving economy, the legal system also played a notable role in promoting entrepreneurship with the creation of the Enterprise Law in 2000, thereby setting off a rapid growth in the number and size of small and medium-sized enterprises (Le and Tran). These enterprises account for 98% of all businesses, contribute about 45% of GDP, and have generated about 280,000 new jobs annually over the past decade. As of 2021, there were approximately 700,000 MSMEs that made up the total of 718,000 active enterprises across all industries of Vietnam ("2023 ADB Asia SME Monitor - Region").

According to the 2018 SME Support Law, women-owned SMEs are defined as an SME in which (i) at least 51% of its charter capital is owned by women and (ii) at least one woman is the executive director of this enterprise (National Assembly). Within the private sector, women-owned businesses have been on the rise as a result of increased economic participation. In particular, the trends indicate that women-owned enterprises continue to dominate among the micro- and small-sized enterprises (United Nations Economic and Social Commission for Asia

and the Pacific and Agency for Enterprise Development, Ministry of Planning and Investment, Government of Viet Nam). In September 2019, Vietnam recorded a total of 285,689 women-owned SMEs, accounting for 24% of the total number of SMEs nationwide (Ibid). Among these enterprises, 43% own business capital between the range of VND 1-5 billion while 26% own capital under VND 1 billion (Ibid). Regarding sector distribution, 61.4% of women-owned SMEs are active in the tertiary sector, while 37.6% are in the secondary sector and only 1% are in the primary sector (Mekong Business Initiative (Asian Development Bank) and Hanoi Women's Association of Small and Medium Enterprises). There is an evident concentration of women-owned enterprises in services, which also employ a higher percentage of female workers than SMEs owned by men (Ibid). Though women-owned SMEs have a lower average number of workers compared to men-owned SMEs, 43.4% of workers in women-owned SMEs are female compared with 36% in men-owned SMEs (Ibid).

Women's enterprises have proven their importance in various ways. Not only do they make up a fundamental part of the economy, these businesses also advance Vietnam's progress on gender equality by creating employment opportunities for women to improve their status in society, ultimately driving the nation to achieve its key Sustainable Development Goals (Le and Le). Moreover, an advancement of gender equality could add to Vietnam's GDP an additional $80 billion by 2030 (Delteil et al.). However, the sufficient support and promotion of women's entrepreneurship is yet to be achieved. As previously mentioned, the number of women-owned SMEs in Vietnam in 2019 account for approximately 24% of the total number of SMEs nationwide, making it the highest ratio among Southeast Asian countries (United Nations Economic and Social Commission for Asia and the Pacific and Agency for Enterprise Development, Ministry of Planning and Investment, Government of Viet Nam). However, it still falls significantly below the target set by the National Strategy on Gender Equality 2011-2020, which aimed to achieve a ratio of female entrepreneurs of 30% by 2015 and surpass 35% by 2020 (T. D. Nguyen). This indicates that there still exists a significant gender gap within the enterprise sector, in spite of the growth in the number of women-owned SMEs in the past few years. To explore ways for supporting women entrepreneurs, we examine and review available information to understand the landscape of financial inclusion and capital access for women-owned SMEs in Vietnam with a particular focus on microfinance institutions.

Methods

For this paper, a variety of information available has been triangulated in order to explore and understand the role of microfinance institutions in promoting financial access and inclusion for women-owned SMEs in Vietnam. A review of resources that offer secondary data on relevant information of both quantitative and qualitative nature has been conducted. Additionally, relevant qualitative themes emerge and relevant descriptive data is identified, while both can be used to guide future research.

Literature review

A structured review of data on the support for women-owned SMEs in Vietnam led to

putting an emphasis on the role of the microfinance institutions. The review was carried out by synthesizing varied literature that includes diverse data types (Schick-Makaroff et al.). The content of the review is summarized then organised in a thematic manner to provide an understanding of the emerging themes and their implications in promoting or impeding financial access and inclusion for women-led SMEs in Vietnam.

Quantitative information and initial descriptive observations

Figures and data from 51 microfinance institutions across Vietnam is collected from the MIX Market Database (World Bank) and utilized to document initial quantified descriptive observations (MIX Market). The relevant variables identified are related to women's entrepreneurship and microfinance in the country and are extracted from the aforementioned database and compiled into a primary dataset. The key variables used include: (1) percent of female board members, (2) percent of female managers, (3) percent of female borrowers, (4) percent of financed enterprises that are start-ups (%). Descriptive statistics with measures of center (e.g., mean, median) and spread (e.g., standard deviation, IQR) have been calculated to provide an overview of the startup landscape for women in Vietnam with a focus on capital attainment from the microfinance sector.

Results and Discussion

The role of microfinance institutions in promoting women's entrepreneurship

A key actor in the business sector is the microfinance institutions that play an important role in fostering women's entrepreneurship in Vietnam. To begin with, microfinance is generally understood as financial services delivered to people otherwise excluded from the mainstream financial system due to their low income, lack of education, distance from mainstream providers, or other disadvantages (Bevacqua et al.). As microfinance is defined by the characteristics of the clients rather than the design of the financial products or the organizations offering them, it is a complex system with multiple levels of institutions and considerable overlap. Nonetheless, there are three defined kinds of financial service providers in Vietnam: formal, semi-formal, and informal (Duong and Nghiem).

The major formal microfinance organizations include the Vietnam Bank for Social Policies (VBSP), Vietnam Association of People's Credit Funds (PCFs), several commercial banks, and four licensed microfinance institutions (MFIs) (Bevacqua et al.). Among them, the VBSP is the leader in providing microcredit in Vietnam's microfinance market – especially to poor people and students – with its widespread network across all provinces of the country (Bui). Semi-formal providers, on the other hand, consist of mostly mass organizations (MOs) and non-governmental organizations (NGOs) such as the Vietnam Women's Union, Youth Union,

Farmers' Association, Elderly Association, and Veterans' Association (Duong and Nghiem). In particular, the Vietnam Women's Union has a significant role in facilitating access to microfinance for poor women through their multi-level operational network and a social strategy centered around the empowerment of women (Bui). Lastly, the informal providers consist of moneylenders, relatives, friends, and Rotating Savings and Credit Associations (ROSCAs). Although oftentimes risky and inconsistent, these are major sources of microfinance for people in rural areas as those people are unable to access the formal institutions without proof of sufficient income and allocation from the relevant authority (Hoang and Creedy).

Existing research suggests that microfinance is a crucial tool in fostering the socio-economic empowerment of women in Vietnam (Bui et al.). Due to a longstanding patriarchal society, a woman often has to deal with the burden of domestic chores and unpaid work because she is limited in terms of accessing financial resources and has to depend on her husband, the breadwinner of the household, for provision. The gender pay gap further exacerbated the circumstances, with men earning an average of VND 8.1 million compared to a mere VND 6 million received for women in 2023 (T. H. Nguyen). This means that even if employed, women would remain at a major economic disadvantage compared to their male counterparts. However, microfinance could help mitigate these challenges, particularly by supporting women's entrepreneurship. Access to small loans, savings accounts, and other financial services tailored for female business owners has been shown to boost their economic participation and decision-making power within the household (Ohiomu and Ogbeide-Osaretin). Through their services, many institutions have helped millions of women access the necessary capital to expand their businesses and achieve economic independence. A major financial provider for women, The Vietnamese Women's Union, aims to support women's economic development, capacity building, and empowerment through its Tinh Thuong Microfinance Institution. Until 2023, over 7000 women in Vietnam have become micro-entrepreneurs thanks to the training in financial education, business management and entrepreneurship offered by Tinh Thuong Microfinance Institution (Tinh Thuong Microfinance Institution, "Impact & Coverage"). Another prominent organization within the microfinance sector, the Vietnam Bank for Social Policy, closely coordinates with the Vietnam Women's Union to provide access to preferential loans and financial services for women. In 2011-2020, 10.8 million turns of women have accessed inclusive financial services provided by VBSP with a total loan volume of VND 257 trillion (Vietnam Bank for Social Policy).

Financial access and inclusion for women-owned SMEs in Vietnam

As of 2024, there are 44 active commercial banks operating in Vietnam's banking sector (The State Bank of Vietnam). This expansive network creates a solid foundation for financial access in the enterprise sector, particularly among women-owned SMEs, as commercial banks have been shown to be their most trusted source for capital (Bialus et al.). When in need, 80% of female business owners seek to borrow from a bank (Ibid). This tendency may be attributable to the sense of credibility created by existence of legal frameworks and transparent policies that banks offer where other institutions may not. Having been found to be more prudent and

risk-averse than their male counterparts, women entrepreneurs will therefore be more likely to seek out loans from commercial banks to start their businesses (Do and Tran).

According to a survey of 304 women-owned SMEs by the Asian Development Bank in 2021, 85% have a personal current account, 74% have a business current account, and 65% have both types of accounts (Bialus et al.). Women entrepreneurs utilize various financial products and services such as loans, insurance, letters of credit, and guarantees, and predominantly use mobile banking services for personal transactions (Ibid). Among major state-owned banks, BIDV, Agribank, Vietcombank, and VietinBank are the most widely used by business owners and entrepreneurs – approximately two-thirds of them – for both personal and business transactions (Ibid). Nonetheless, from a macro view of Vietnam's banking sector, few institutions have a specific approach towards women entrepreneurs. Out of the 27 banks surveyed, only 5 (BIDV, SeABank, SHB, TPBank, VPBank) were found to cater to the needs of women-owned SMEs through integrating gender-disaggregated data into their core banking system (Ibid). Most have yet to adopt support policies that target women, either because they fail to recognize the need for a different approach or remain unconvinced of the potential of women-led businesses (Ibid).

In terms of credit usage practices, most surveyed women-owned SMEs prefer borrowing from banks or reinvesting retained earnings to finance their operations (70%) to borrowing from family and friends (20%) or raising equity (10%) (Ibid). Approximately 59% of surveyed business owners (~179 businesses) currently have a loan, suggesting that a significant portion (41%) are not financing their businesses using loans at present (Ibid). Within the 41%, many entrepreneurs indicated that a complicated process, high interest rates, and cumbersome collateral requirements discouraged them from applying for a bank loan (Ibid). Out of these reasons, inadequate collateral has been proven to be the most common reason for failed loan applications and continues to remain a significant financial obstacle for women owners (Goldman Sachs 10,000 Women et al.). As a result of the previously mentioned factors, the financing gap of women-owned enterprises in Vietnam in 2021 was estimated to be $1.2 billion, highlighting the significant shortfall of capital (Asian Development Bank, *Vietnam International Bank Supporting Small and Medium-Sized Enterprises and Improving Living Conditions Project: Report and Recommendation of the President*).

Constraints and facilitators for women entrepreneurs in Vietnam

With regard to financial access and inclusion, women-owned SMEs face several challenges to access credit and loans from banks and from Credit Guarantee Funds. These include not having access to collateral, bad credit history, weak business plans, inability to provide required financial documents or lack of capacity to prepare the required documentation. Moreover, there is no data available on the low usage of credit nor any specific provisions that facilitate credit access for women-owned SMEs (United Nations Economic and Social Commission for Asia and the Pacific and Agency for Enterprise Development, Ministry of Planning and Investment, Government of Viet Nam). In terms of financial literacy and education, women have been found to have significantly lower levels of financial literacy compared to men (D. T. Nguyen). This is accompanied by low education attainment, as only 59.4% of Vietnamese women aged 25 and over had completed at least lower secondary education compared to 71.2%

of men in 2009 (CEIC Data). Several limiting societal and personal factors were also present, with a high percentage of women entrepreneurs mentioning that high pressure from work and family, lack of time, and lack of ability to build social capital – all of which resulted from community attitudes and the large burden of household responsibilities – are constraints for their businesses (Vietnam Women Entrepreneurs Council and Vietnam Chamber of Commerce and Industry). Lastly, though not as prominent, the microfinance sector in Vietnam is undeveloped, with only three organizations of significant size (Bevacqua et al.). This may impede financial access for many women entrepreneurs, as they are faced with complicated loan procedures from commercial banks with few alternative sources for capital (Bialus et al.). Even if they were to borrow from a microfinance institution, certain NGO-ran microcredit programs charge greater interest rates than are legally allowed, frequently in the form of fees rather than a proportion of the loan amount. (Timberg et al.). Therefore, despite the country's socio-economic development, these multifaceted challenges persist and greatly hamper the entrepreneurial potential of women-owned SMEs.

   In spite of the aforementioned constraints, actions have been taken by various stakeholders to promote financial access and inclusion for women-owned SMEs in Vietnam. To begin with, the State Bank of Vietnam (SBV) has issued three directives in 2019 for credit institutions to deploy multiple solutions to remove difficulties for SMEs in accessing bank credit. These include prioritizing capital to support loans for production fields and innovation processes, simplifying loan procedures, and developing credit programs and packages with reasonable interest rates for SMEs (United Nations Economic and Social Commission for Asia and the Pacific and Agency for Enterprise Development, Ministry of Planning and Investment, Government of Viet Nam). In terms of educational opportunities, Vietnam has made significant efforts in enhancing girls' access to education across the country. Projects such as "Lower Secondary Education for the Most Disadvantaged Regions" and the "Gender Equality and Girls' Education Initiative" were met with positive results, with increased enrollment rates and improved capacity development (Asian Development Bank, *Lower Secondary Education for the Most Disadvantaged Regions Project: Project Completion Report*; Ross and Dao). Not only limited to the education sector, social development initiatives like these translate further into entrepreneurship, business, and financial literacy training for women. In June 2017, the Prime Minister of Vietnam issued Decision No. 939/QD-TTg approving the project "Supporting Women in Entrepreneurship in the period of 2017-2025" implemented by the Vietnam Women's Union to support 20,000 women's start-ups and establish 1,200 women-led or women-managed co-operatives across the country (United Nations Economic and Social Commission for Asia and the Pacific and Agency for Enterprise Development, Ministry of Planning and Investment, Government of Viet Nam). In March 2024, another program titled "Accelerate My Business" was launched by the Center for Women and Development with the goal of providing foundational business and financial literacy training to help women-owned SMEs engage fully in the digital economy (Center for Women and Development). Finally, this would not be a complete evaluation without the contribution of microfinance institutions. A leading credit provider in Vietnam, TYM MFI has helped over 300,000 women across various areas, with a

specific emphasis on economic empowerment through its training program (Tinh Thuong Microfinance Institution, "Impact & Coverage". Its lending methodology and repayment models have enabled nearly 100% of women borrowers to repay their loans, protecting them from predatory informal lending and allowing them to build sustainable wealth as they embark on their entrepreneurial ventures (Tinh Thuong Microfinance Institution, *Performance Report 2021*).

The aforementioned constraints and facilitators are summarized and presented in Figure 1:

Figure 1: Constraints and facilitators of women's entrepreneurship in Vietnam

Inclusion and sustainable development impact

From a macroeconomic perspective, financial inclusion is positioned as an instrumental means to catalyze the achievement of the 2030 SDGs (Máxima). In particular, improving women's access to capital and finance can unlock the vast potential of women-owned SMEs in Vietnam and bring positive impacts on its sustainable development. When women entrepreneurs are able to easily access credit, savings, and other financial tools, they will be empowered to start, grow, and scale their businesses to surrounding communities. This will generate higher household incomes, drive production, and enable significant job creation to stimulate economic growth. Since women-owned SMEs need considerably less capital to create a job than SMEs owned by men (only 1.2 billion VND compared with 1.7 billion VND), more opportunities can be brought about at a lower cost to prioritize capital for other developmental aspects, such as management, product enhancement, and market expansion (Mekong Business Initiative (Asian Development Bank) and Hanoi Women's Association of Small and Medium Enterprises). Regarding Vietnam's labor market, there remains a gap in the labor force participation rate between men and women, at 76.7% for the former and 67.9% for the latter in 2023 (International Labour Organization). However, this gap can be addressed by promoting the growth of women-owned SMEs. As these SMEs have been found to have an inclination towards hiring female employees, their expansion will create a favorable labor market for women and contribute to bridging the nation's gender gap in employment. When women's economic engagement is

heightened, productivity, enterprise development, and investment in opportunities for girls are significantly promoted, driving the country towards achieving gender equality (Goldman Sachs 10,000 Women et al.). Therefore, by continuing to prioritize women's financial inclusion, Vietnam can tap into the potential of women entrepreneurs and advance its progress towards the 2030 Sustainable Development Goals.

Concerning all the above, the themes identified for the purpose of this study derive from the review of the literature and are summarized in the figure below (Figure 2). From the review, emphasis was put into the role of the microfinance institutions, hence the study was extended on identifying quantitative relevant information. The identified areas below ought to be considered for any conceptualizations in the field:

- *Microfinance institutions* - Importance of microfinance institutions in fostering the socio-economic empowerment of women in Vietnam through providing access to capital, financial services, and capacity building.
- *Financial access* - Women entrepreneurs' access to banking services, credit, banks' approach to serving women, and the financing gap.
- *Constraints* - Complex loan procedures and collateral requirements, low financial literacy and educational attainment, household work burden, inadequate social capital, and lack of financing options.
- *Facilitators* - State-issued directives to prioritize capital for SMEs, educational initiatives, business and financial literacy training, and the contribution of certain microfinance institutions.
- *SDGs* - Financial inclusion for women entrepreneurs can drive economic growth and advance Vietnam's progress on gender equality
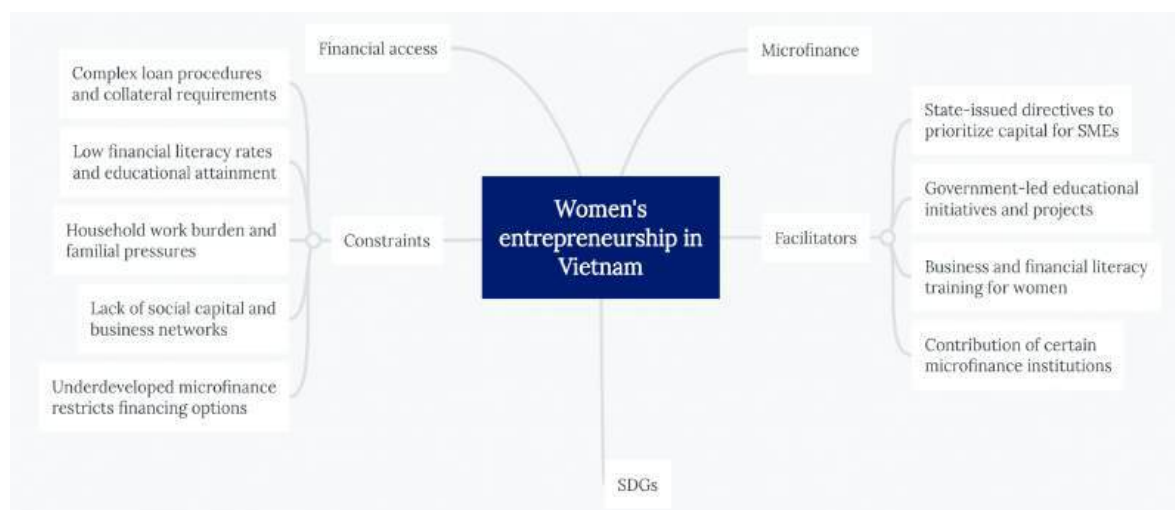

Figure 2: Factors affecting and implications of women's entrepreneurship in Vietnam

Quantitative descriptive observations

Particularly on the topic of microfinance institutions, further research needs to be conducted. To better understand the trends regarding capital provision and clients served in the microfinance sector, in this study we extracted data from MIX Market Vietnam for 51 microfinance institutions across Vietnam between 2010-2018 and looked into four variables: percent of female board members, percent of female managers, percent of female borrowers, and percent of financed enterprises that are startups.

The purpose of this quantitative examination is purely to observe and speculate whether there is any kind of links and relevance between the organizational factors of microfinance institutions, in this case their management composition with regards to gender distribution, and the support they provide to the targeted customer base of female clients and female-owned startups. The table and graph below serve to illustrate and showcase potential trends through the extracted data from MIX Market without any cause-and-effect relationship implied.

Variable	YR2010	YR2011	YR2012	YR2013	YR2014	YR2015	YR2016	YR2017	YR2018
Percent of female board members (%)									
Mean	86,714	75,12588	6,25	72,41	66,12833	68,89917	43,135	33,41167	57,77667
Median	100	100	6,25	80	70,835	73,215	42,5	26,665	40
Minimum (Min)	21,43	0	0	14,29	0	0	0	0	33,33
Maximum (Max)	100	100	12,5	100	100	100	100	100	100
Standard Deviation	24,92443	33,20762	6,25	27,11591	32,31868	31,21338	35,48967	32,82233	29,98032
Q1	89,2825	60	3,125	66,67	50,0025	60	11,605	10,355	36,665
Q3	100	100	9,375	100	100	100	65,0025	38,3325	70
IQR	10,7175	40	6,25	33,33	49,9975	40	53,3975	27,9775	33,335
Percent of female managers (%)									
Mean	86,188	83,80423	78,37174	79,44381	79,36	76,125	48,81833	47,99	70,85
Median	100	100	100	83,33	100	90	45,215	43,88	76,19
Minimum (Min)	45,58	33,33	33,33	33,33	0	25	25,11	23,48	36,36
Maximum (Max)	100	100	100	100	100	100	83,33	82,93	100
Standard Deviation	20,62647	24,91704	28,32628	21,218	26,81211	26,38894	18,97594	19,30032	26,25388
Q1	79,075	54,1675	50	60	57,14	52,4975	36,2425	35,415	56,275
Q3	100	100	100	100	100	100	56,895	56,8525	88,095
IQR	20,925	45,8325	50	40	42,86	47,5025	20,6525	21,4375	31,82
Percent of female borrowers (%)									
Mean	93,55867	94,66655	94,036	91,3885	91,97185	94,11923	87,142	79,1375	82,355
Median	100	99,32	99,31	96,635	97,29	97,91	93,02	83,07	82,355
Minimum (Min)	50,51	64,35	51,41	60,56	60,56	70	70	51,13	72,76
Maximum (Max)	100	100	100	100	100	100	100	99,28	91,95
Standard Deviation	13,67041	9,215538	10,12709	11,41815	10,98158	8,243896	12,84112	18,76224	9,595
Q1	98,32	94,71	92,145	89,15	86,17	91,5825	73,51	67,8325	77,5575
Q3	100	100	100	99,66	99,975	99,99	99,18	94,375	87,1525
IQR	1,68	5,29	7,855	10,51	13,805	8,4075	25,67	26,5425	9,595
Percent of financed enterprises that are start-ups (%)									
Mean		28,59		23,59	20,29	31,59333	17,24	19,11	18,73
Median		28,59		23,59	20,29	20,97	17,24	19,11	18,73
Minimum (Min)		28,59		23,59	20,29	7,14	17,24	19,11	18,73
Maximum (Max)		28,59		23,59	20,29	66,67	17,24	19,11	18,73
Standard Deviation		0		0	0	25,43746	0	0	0
Q1		28,59		23,59	20,29	14,055	17,24	19,11	18,73
Q3		28,59		23,59	20,29	43,82	17,24	19,11	18,73
IQR		0		0	0	29,765	0	0	0

Table 1: Summary of gender representation and entrepreneurship metrics in microfinance (2010-2018)

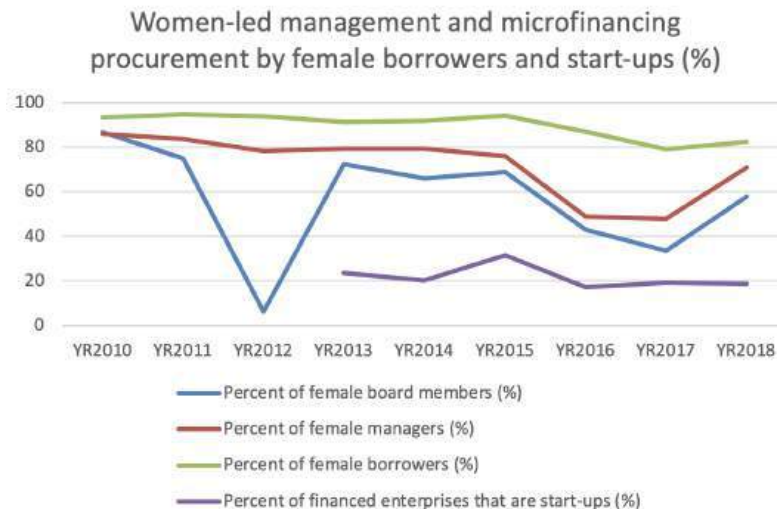After plotting the data in line diagrams, the following line chart is presented (Figure 3):

Figure 3: Women-led management and microfinancing procurement by female borrowers and start-ups among microfinance institutions in Vietnam (%)

In Figure 3, we noticed an overall trend between women-led management in microfinance institutions and microfinancing procurement by female borrowers and start-ups. As the mean percentages of female board members and female managers decrease, so do the average proportions of female borrowers and financed enterprises that are start-ups, and vice versa. However, there can be observed a data anomaly characterized by a sudden drop in the average percent of female board members in 2012. This is due to the unavailability of information from the database with the exception of the following two companies: Capital Aid for Employment of the Poor Microfinance Institution (CEP), which had 12.5% female board members, and The Dariu Foundation, which had 0%.

The irregularity of this occurrence has prompted us to consider expanding our research in researching the external landscape during that point in time. After further research, we found that the crisis in MFIs varied across different geographical regions and over time. Among regions in the world, East Asia and the Pacific has been most prone to financial instability since 2005, with 20% of the region's MFIs being affected in 2008 (Sainz-Fernandez et al.). This is the highest percentage recorded in the region and in the world across the entire duration of the crisis. Although measures have been implemented across East Asia and the Pacific to alleviate this effect, lowering its percent of MFIs affected to 9.1% in 2011, this proportion remains the most significant in comparison to other regions worldwide (Sainz-Fernandez et al.). Therefore, we suspect that the region's susceptibility to crisis may have influenced the economic priorities of its countries, including Vietnam.

Another element identified was Vietnam's economic stagnation due to tightened macroeconomic policies, along with vulnerabilities in the financial sector due to sluggish credit growth in 2012 (International Monetary Fund). Although inflation was significantly reduced during this time, competition and pressure on enterprises to remain in business became much

more intense. Under such unfavorable circumstances, institutions in the country may have chosen to prioritize short-term financial performance over promoting gender diversity and equality in their leadership composition. The amalgamation of crisis vulnerability and economic stagnation likely led companies to lessen their focus on gender diversity and be more reluctant to share data on female board members as a result.

Lastly and most importantly, another aspect to be documented is that out of the various components of these institutions' organizational structures, only data regarding female board members is missing in 2012. As previous research has shown, board gender diversity is a significant driver of the capital structure of microfinance institutions across the globe (Adusei and Obeng). It also reduces the leverage levels of MFIs, which in turn minimizes their risk of bankruptcy. Considering the importance of female board members in decision-making processes, data tracking and clarity regarding their position should have been ensured by these companies to foster a more inclusive and favorable environment for women in executive roles. The unavailability of such data calls forth the need for further research and transparency in data reporting on gender inclusion, women's leadership, and corporate governance in the microfinance sector.

Conclusion

The results of this study acknowledge the significance of microfinance institutions as a crucial tool to enhance capital access and foster economic empowerment for women-owned SMEs in Vietnam. Through a comprehensive review of existing research, we have explored elements of the status quo of financial access for women entrepreneurs and shed light on the contributions of microfinance in promoting such access. In spite of the challenges posed by traditional banking systems, MFIs provide essential support through tailored financial products and services that meet the unique needs of women entrepreneurs. By means of our quantitative observations, women's leadership in MFIs was also observed to be linked with microfinancing provision for female borrowers and start-ups. This emphasizes the value of involving women in executive positions and decision-making processes to promote inclusion in the current business landscape and drive growth in the broader community.

However, further actions need to be taken in order to harness the full potential of Vietnam's microfinance sector and advance women's empowerment. It is crucial for key stakeholders—governments, MFIs, and non-governmental organizations—to collaborate in creating a more conducive and transparent environment for women to launch new ventures. This includes addressing the root causes of barriers to starting businesses such as financial literacy and education, implementing women-targeted policies, and ensuring the transparent collection of gender-disaggregated (gender-specific) data. Such information is crucial to understanding the unique challenges faced by women entrepreneurs for informed decision-making and effective policy design. By cultivating a women-inclusive ecosystem, Vietnam can fully unlock the power of its small and medium-sized enterprises, propelling sustainable economic growth and achieving

gender equality. Subsequent research should delve deeper into the long-term impacts of microfinance on women-owned businesses and investigate innovative models to further bridge the financial gap, creating a more inclusive future for all.

The present study does not come without limitations. We acknowledge that the findings and conclusions derive from the analysis of secondary data, which can inherit relevant biases and impose certain data quantity limits. This means that generalizations cannot be reached at this point. Hence, we propose to explore the identified conceptualizations through primary data, and correlational data analysis, as well as direct in-depth qualitative investigation of the key stakeholders in the field. The above conceptualizations can be explored in various cross-cultural studies.

Acknowledgements

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Advertisements: The Effects of Linguistic Elements on Consumption Behavior
By Quang Tran

Abstract

Advertisements and media have changed societal preferences and human behavior. The manipulation of advertisement language has developed over time, leading to subconscious changes in individual values and decision-making. Advertisers manipulate the rhetoric's subtleness to evoke subconscious desires and appeal to specific needs, thus increasing the probability of long-lasting customers. Although humans can base decisions on impulse and emotions, media sways one's opinions to a particular side by catering to the individual's needs, values, and beliefs. Regarding contemporary standards, how does manipulating an advertisement's narrative pique customer interest? What is the correlation between an advertisement's sentimental value and its performance? Why do certain linguistic elements create an immediate impact on consumers? Examining the differences between language and its influence on consumption behavior is necessary to answer these questions. This study will administer a questionnaire to analyze and compare linguistic approaches with consumers' immediate reactions to four smartphones. Particularly, this research will focus on the descriptive words, the formality of the advertisement, and the narrative of the advertisement. Results show that exaggerated words like "Unlimited" or "Infiniti" strongly influence consumer's perceptions by resonating with their values. Along with hyperboles, the narrative of the advertisement and its emotional appeal also created a lasting impact on readers by evoking a sense of familiarity. Overall, results show that advertisements that appeal to a customer's sense of familiarity, values, and emotions will successfully establish their branding.

Keywords: narrative, advertisement, sentiment, formality, familiarity, values

Introduction

In recent years, with the development of the internet, companies have expanded their use of online promotional means to increase brand exposure and strengthen customer loyalty (Saeed, 2023). Promotional methods include websites, test samples, social media marketing, and sponsorships. However, unlike these new promotion methods, advertisements remain one of the oldest yet one of the most successful. Customers who make purchases without rationalization may blame their emotions or immediate context, yet they fail to realize how advertisements and constant brand exposure influence their subconscious (García-Madariaga et al., 2020). From cinematography to audio processing and even linguistics, advertisements combine multiple elements that harmonize together to create an appealing medium to engage customers. By focusing on the linguistic aspects of advertisements, such as the narrative, formality, descriptive words, and sentimental value, it is possible to find whether manipulating certain linguistic elements can affect consumption behavior and bring this concept to awareness for both consumers and producers. To better understand sentimental value, the subjectivity is quantified into numeric

values and how much emotional impact the reader absorbs. Prior studies of emotional effectiveness in advertisements reveal that the initial impact of an advertisement is due to its emotional strength (Otamendi & Sutil Martín, 2020). Therefore, understanding the appliance of sentiment is essential to understanding how emotions dictate our consumption behaviors and our subconscious. On the other hand, the formality and the narrative depend on how the advertisement is told. The traditional advertisement style typically highlights the product's features, but other advertisement styles may include story-telling, a slice of life, or even fiction (Chen & Lien, 2011). All these factors play a vital role not only in creating an immediate impression but also in creating a long-lasting impact on consumers. Determining how emotions, familiarity, and values are influenced by different linguistic elements will provide businesses with a variety of options for maximizing the marketability of their products. In gauging the degree of consumer reaction, this paper aims to address three research questions as follows:

1. How do brands manipulate advertisement narratives to attract consumer interest?
2. What is the correlation between sentiment in advertisements and product favorability?
3. Why do certain linguistic elements create an immediate impression?

Methodology

Research Questions

   This study aims to dive into the effects of linguistic elements on consumption behavior. In order to quantify consumption behavior, this study will assess the reactions to different smartphone advertisements. To answer the question of how brands manipulate an advertisement's narration to pique customer interest, the study will compare the reactions of four different smartphone advertisements with different approaches in story-telling and their correlation with the subsequent phone's reaction. These reactions refer to the preferability of the phone and the reasons why the respondents chose that particular phone. These responses will then be directed through a natural language processing unit for the sentimental analysis, which helps quantify the average emotional value behind the reader's preference. The purpose of choosing four different advertisements is to compare different approaches of linguistics used in advertisement, which aims to find a pattern of specific linguistic elements that piques the highest customer rating. These linguistic elements can range from formality to descriptive words and narration.

   Next, what is the correlation between the sentiment expressed in advertisements and the reader's favorability of the product? To approach this question, a Python code and a natural language processing program will measure sentimental analysis and judge the degree and magnitude of the perceived emotion. The natural language processing program comprises three libraries: textblob, VaderSentiment, and matplotlib. The textblob library is responsible for processing textual data and providing the polarity score and how subjective the text is. The matplotlib library creates visualizations such as graphs and charts. The vaderSentiment has the same attributes as the textblob library, but it leans more towards promotional/media text input.

Using the help of AI, a code was created that utilizes all three libraries and was then pasted into Jupyter Network (Natural Language Processing software).

Fig 1: Example code for sentimental analysis

The sentimental value scale ranges from -1 to 1. A negative value corresponds to a sentiment that leaves a negative impression, dislike, or an unfavorable preference. One is the opposite: positive impressions and positive emotions. Zero is in between and stands for neutrality or a lack of emotion. Ambiguous and neutral scores are usually rare cases because a series of words that are inputted will inevitably contain some level of subjectivity. The sentiment score will be compared to the reactions from a questionnaire to find a pattern between sentiment and its perceived usefulness. In this case, consumption behavior is quantified as the respondent's rating on a scale of 1-5, with one being "not useful" and five being "useful". Finally, why do certain linguistic elements create an immediate impression on viewers? To quantify impression, the questionnaire will assess the reader's standouts. Specifically, after reading the transcription, which particular words stood out the most and left the most profound impression?

Questionnaire development

The smartphone advertisement will be given as a questionnaire to understand the lexical patterns customers prefer to understand how companies can navigate branding, promotions, and advertising. Prior to data collection, questions on background information will be asked to evaluate patterns that might come from gender, primary phone usage, and age groups. Out of the fifty ads ranging from the creation of smartphones to the current smartphones, four Smartphone advertisement transcriptions will be displayed anonymously. The four smartphones chosen are the OnePlus 5, the iPhone XR, The Samsung Galaxy S8, and the Google Pixel 2A, all of which are models from 2017. The OnePlus 5 was chosen due to its informal story-telling and appeal to young individuals, as its target audience is students. The iPhone XR was chosen for its focus on one specific feature: the Face ID function, which was new at the time. The Samsung Galaxy was

chosen for its overall complexity, while the Google Pixel was directed to a niche of cameras and lenses. All of these advertisements are illustrated through the narrator's perspective. The purpose of the transcription is to avoid video queues and cinematography that might influence the perception of the advertisement rather than the linguistic elements themselves. The anonymity of the advertisement regulates any bias towards specific brands that customers may prefer. Every transcription covers three questions:

1. How would you rate your impression of the advertisement from a not useful to useful scale?
2. What words, if any, stood out to you?
3. Would you like to know more about this product?

Fig 2: Sample Questions

These questions are specifically chosen to study the participant's immediate reaction toward the advertisement to minimize any thought processes and changes in the reaction due to delayed exposure. The first question refers to any words that stood out to understand the immediate impression the advertisement creates on the viewer. The purpose serves to simulate real-life attention span and the instant effect of descriptive words on customers. The second question asks the customer to rate the product from useless to functional to determine what functionality and the underlying sentimental value from the advertisement customers usually prefer. Finally, "Would you like to know more" aims to understand whether the viewer wants to consider the product. Rather than asking if you would like to buy this product, this question better fulfills the purpose of understanding viewer preferences because they do not have to be pressured to answer based on financial constraints, cultural restrictions, or innate biases.

The questionnaire was created through Google Forms and sent out to a sample population of 50 individuals chosen from a nonprofit organization MAX EDUCATION. This population was chosen as a convenience sample. The population mainly includes individuals from Vietnam and individuals in the United States. About 46% of participants are under 18, and the remaining 54%

range from 19 and above. Included on top of the survey are the ethical guidelines for respondent privacy. There are no guidelines on gender, sex, or biological limitations for filling out this questionnaire. The questionnaire was administered live and open for three days. Within those three days, individuals can resume filling it out if they do not exceed the time limit. The resulting data will be put onto the spreadsheet to evaluate common patterns seen through different age groups, whether the primary purpose of one's phone will determine their ad preference, and any outliers present within the data.

Analysis

Population Data

The questionnaire had 29 respondents, of whom 46% were under 18 and 32% were in the age range of 19-25, with the rest compositing the age of 26 and older. The respondents' gender is split in the middle of 50% each. The most used smartphone out of all the respondents is the iPhone, comprising 78% of respondents, while Samsung leads behind at 18%. As for the primary purpose of using phones, work and entertainment lead with each at 42% and 39% respectively.

Questionnaire Data

With the highest average of "most useful" impressions from the respondents, the Google Pixel 2A creates the highest average impression on its readers. Furthermore, 32% of respondents claimed that "Unlimited" was the most impactful phrase when reading the transcription. The second most memorable phrase with 20% of respondents was "16 milliooooooon". However, when examining the other phrases in the Pixel's transcription, another 10% have a similar exaggerated connotation, such as "Ultra Vivid" and "more Whoooooah." The phone with the most highest rated impression was the Samsung Galaxy S8, with 18% of respondents determining that the advertisement was most useful. Similarly, the Samsung Galaxy displays the same pattern, with 34% of respondents claiming that the word "Infiniti" stands out the most.

There is also an emerging pattern within sentimental value and customer satisfaction. When ranking the polarity score of the transcriptions from lowest to highest, the list goes as follows: iPhone X, One Plus 5, Samsung S8, and the Google Pixel 2a. The Google Pixel 2a creates the most positive tone with a polarity score of 0.347, indicating a more positive sentiment than neutral or negative. The same pattern emerges within the questionnaire. The highest average-rated advertisement ranks from Google Pixel 2a, then the Samsung S8, followed by the iPhone X and the One Plus 5.

```
TextBlob Sentiment:
Polarity: 0.3472222222222222
Subjectivity: 0.5244444444444444

VADER Sentiment:
Positive: 0.141
Neutral: 0.828
Negative: 0.031
Compound: 0.8320
```
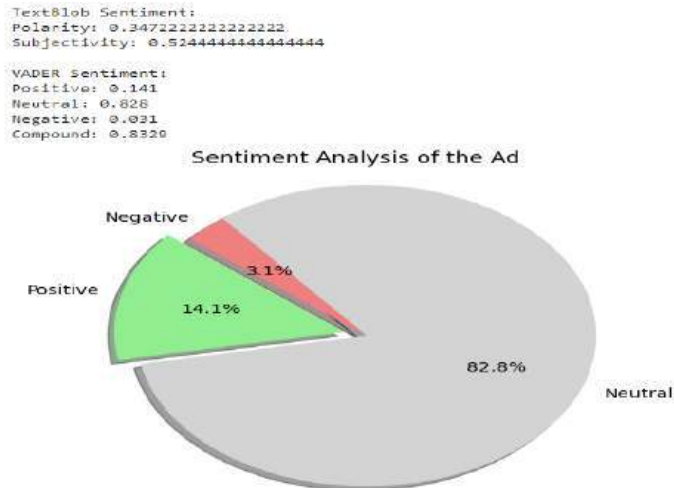
Fig 3: Sentimental analysis score of Google Pixel 2A

However, even though the Google Pixel 2a and the Samsung Galaxy S8 remain the two ads that create the strongest impression, it doesn't necessarily make them the most memorable. Out of all the transcriptions, there is an almost uniform distribution between which advertisement remained the most memorable. Though scoring mainly around the same, the highest number of respondents for the most memorable advertisement was for the One Plus 5 at 31%. Furthermore, 100% of the respondents who claimed the One Plus 5 was the most memorable also agreed that its storyline and narration were the main contributing factors to its strong impression.
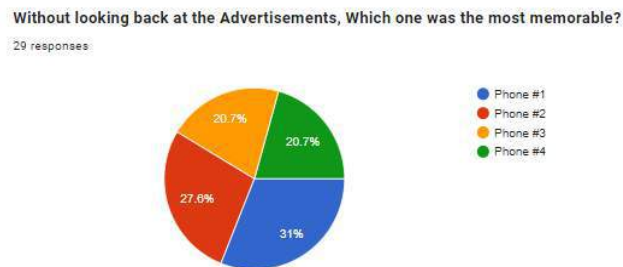
Fig 4: Pie Chart Distribution of most memorable phone

Apart from the patterns mentioned above, we have also observed several outliers, namely the iPhone X. The number of respondents that wanted to know more was the lowest among all advertisements. As expected, the most impactful phrase was the "Face ID" function, which repeats itself 16.4% of the time in the advertisement. 82.2% of respondents agreed that "Face ID" stood out the most to them. Nevertheless, the remaining 17.8% of individuals believed that "The Most Durable Glass ever in a Smartphone" was the most memorable phrase.

Interpretation

To take a closer look at these data, we will first take a look at the phrasing choices in changing consumer perception. The data shows that the Google Pixel 2A received the highest average score in creating the most impression on its readers, with 32% of respondents highlighting the word "Unlimited." The second most impactful phrase was "16 millioooooon". Besides the Google Pixel, the Samsung Galaxy also showed similar patterns, with most respondents choosing the phone as the most impactful and highlighting words such as "Infiniti." Other impactful words have the same connotation, such as "Ultra Vivid" and "more Whooooah." We will then shift our focus to the role sentiment plays in the consumer's favorability. Specifically, how the Google Pixel created the most positive tone with a sentimental score of 0.141(-1 to 1). Last but not least, we will focus on an advertisement's narrative and its effect on memorability. We will delve deeper into the unique story-telling of the One Plus 5, with users claiming that it had the clearest narrative and a good storyline.

However, this raises the question: Why do customers prefer exaggerated words that do not provide an accurate representation of the phone itself while they overlook words that describe the functionality of the phone? Just like the results from the questionnaire that showed clear favors for "Infiniti" or "Ultra Vivid" instead of "The Most Durable Glass ever in a Smartphone." It is evident that "Infiniti" does not portray the quality of the phone screen and hyperbolizes an aspect of a phone that consumers have not even experienced. Overall, why do certain linguistic elements create an immediate impression on viewers while others might find it unnoteworthy? At first glance, it might seem like a matter of preference that developed from repetitive exposure. Individuals who prefer a specific word might follow a particular trend from their age range. For example, Generation Z is exposed to high-tech consumption and slang words, so they might veer towards a familiar sound. Individuals from today, Generation Z, have been inundated with technology since birth and they coexist by adapting between the line of reality and the digital world. Slang words, in this case, refer to "a new language with innovative and novel characteristics, and its use can be considered a form of creative advertising" (Liu et al., 2019). On the other hand, millennials prefer a more formal approach to literature and media because they are still "digital immigrants," people who are slowly shifting into the technological world when it comes to phone usage (Stidham, 2014). Yet, the questionnaire reveals mixed results. Though 62.5% of individuals who claim "Infiniti" as the most impactful word are in the under 18 to 24 age range, the other 37.5% are from the 34 and older age group. Thus, it is not a matter of exposure but how well the linguistic element resonates with the consumer's values. Almost all customers who prioritized entertainment as the main function of their phone preferred "Infiniti" which aims to highlight the quality and display aspect of the phone. While the respondents who prioritized work as the primary function of their phone valued its efficiency, "Yet fits comfortably in your hand." The hyperbolized and repetitive aspect of the advertisement aims to highlight the central aspect of the phone that the advertisement is trying to emphasize. Not only can hyperboles be flexible in creativity, but allowing consumers to imagine a sensory experience makes the product much more memorable and relatable (Barbu-Kleitsch, 2015). Just

like how "face ID" was repeated several times in the iPhone X ad in order to emphasize the new versatile Face ID function or the Google Pixel 2A's "16 millioooooon", customers will resonate with the particular word that is associated with their personal values. In this case, iPhone X users might value convenience while Google Pixel 2A users might value screen quality; as long as the advertisement utilizes some exaggerated connotation and repetition, customers will feel a higher degree of connection and help them resonate with the product.

Aside from the narrative, attitude and emotions play a vital role in influencing customer perception. Specifically, what is the correlation between sentiment and the consumer's favorability towards the product? When creating an advertisement, advertisers focus not only on the details but also on evoke a sense of connection. A stronger connection triggers cognitive appraisal and stirs emotions (Williams, 2014). Using a natural language processing unit, we have found that the Google Pixel 2A created the most positive tone with a score of 0.141 on a scale of -1 to 1. Though it is not too impactful of a sentimental score, it is higher than the other advertisement with an average of 0.128. What makes this advertisement unique, however, is the use of hyperboles and the repetitive use of the word "more." Sentiment does not have to be limited to tearjerkers or incredibly dramatic scenarios, but it can also create a strong positive impression on its viewers. In the case of the Google Pixel 2A, the advertisement successfully incorporates the audience into wanting to know more through repetitive use of the word "more." In general, a higher frequency of a particular word will evoke a higher emission of the same word; emission, in this case, refers to sounding out a word from memory (Duncan, 1966). Emphasizing "more" helps engrave the specific qualities the phone tries to portray into the consumer's memory. The Pixel 2A's direct use of repetition subconsciously makes the advertisement more memorable. It places more value on a particular phone than any other product, allowing the consumer to dive into the experience of wanting to know more.

With such mixed results, how does the manipulation of linguistic elements pique customer interest? Advertisements are essential in capturing the viewer's attention and highlighting all the necessary aspects that might appeal to the customer. However, with a limited amount of time at around 4 seconds, being the human attention span, it is extremely tough to compress all that information as the effects of the advertisement diminish for every second that passes (Subramanian , 2017). However, there is a proven way that brands have been found to incorporate the duality between formality and informality to pique customer interests better. Internet slang, for example, "were proven to be more eye-catching" than the traditional and formal approach (Liu et al., 2019). Additionally, the research revealed that Internet slang, specifically EIL(Embedded Internet Slang), was the most eye-catching (Liu et al., 2019). This proves that the narrative and the mode in which the advertisement is told play a significant role in catching the consumer's attention and making it memorable in the long run. Diving into the narration of the One Plus 5 advertisement, the narrator clearly aims to resonate with the student population. The narrator utilizes sentences such as "He could use the 16-megapixel front camera to say 'hi' to his friends back home" or "He makes excellent use of the expanded screenshot when a love rival threatens his dominance." Unlike the other advertisements, which highlight the

phone as the main subject of interest, the One Plus advertisement focuses on a student's life and narrates the phone as a secondary subject or a supplement that illuminates the student's life. Rather than showboating the advanced technological aspect of a phone, utilizing this form of story-telling helps the audience, especially students, resonate with the familiarity of the daily mundane experience as the narrator unfolds the story piece by piece. Additionally, resonant articles -articles that appeal to the audience's emotions- are proven more effective in attention-grabbing (Taylor, 2017). The story-telling approach, in turn, piques the consumer's interest with something that provides more fulfillment to their lives while also making the ad much more memorable than just the traditional style of advertising. Other than the improved eye-catching slang implementations that immediately hook the viewer, a story-telling approach takes that to the next level by appealing to emotionally connect with the audience.

Summary

This research served to answer the three main questions: How do brands manipulate an advertisement's narration to pique customer interest? What is the correlation between the sentiment expressed in advertisements and the reader's favorability of the product? Moreover, why do certain linguistic elements create an immediate impression on viewers? To answer these questions, we derived the sentimental value of four different transcribed advertisements and surveyed their reactions. With our primary focus on the narrative, the emotional impact, and unique phrases, we collected some mixed results. The Google Pixel 2A had the highest average score in creating the most impressions, with respondents claiming that "Unlimited" was the most memorable phrase. The Google Pixel 2A also received a high sentimental score, which correlates to the viewers' desire to learn more about the product. Finally, the One Plus 5 was considered the easiest to follow and had the most unique narrative, allowing readers to find it the most memorable.

Conclusion

Three main factors drive and influence consumption behavior: familiarity, values, and emotions. Consumers resonate more with a product, the more they feel familiar with it. This familiarity can be appealed through the narrative, a particular substance, or specific word choices. In turn, this familiarity is driven by values. Values are driven almost subconsciously; a consumer's degree of favorability towards a particular phone lies in how well the phone can act as a supplement to its purpose. Not as the primary subject, but as a secondary medium that supplies some form of fulfillment into the consumer's lives. Most importantly, however, emotions play the most vital role in influencing consumption choices. Advertisements do not have to create tear-jerking and dramatic scenes to induce empathy. As long as there is a degree of sentiment that "understands" the consumer, it will paint the product in a much more positive light.

Limitations

Our sample data was chosen from a convenience sample that includes respondents from

Vietnam and the United States. We cannot account for previous exposure to certain advertisements or preferences. We also cannot generalize these findings to products other than smartphones that use less language and more visual queues. These advertisements are transcribed to focus on linguistic elements. Therefore, the transcribed version lacks the videography and sounds that harmonize with the speech, making it a less reliable procedure to replicate an advertisement's actual qualities.

Outlook

For future purposes, research can conduct random sampling to help generalize findings on consumption behavior. Another improvement aspect can include playing live audio to the respondent and replicating the ideal advertisement scenario while focusing on the linguistic aspect. Finally, researchers add another aspect of experimenting by simulating a consumer interaction to provide the most accurate data on purchasing behaviors.

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Applications of Large Language Models in Psychiatry By Sarina Fang

Abstract

Mental illness is one of the most prevalent global disease categories as with increasing societal and economic burdens. Traditional methods of diagnosis, treatment, and prognosis of mental illness are often susceptible to subjectivity and misinterpretations. However, recent developments in machine learning have shown the capacity to standardize and improve the diagnosis and management of mental health disorders. This literature review examines the various applications of large language models (LLMs) in psychiatry. The review highlights LLMs' potential to reshape psychiatric research and practice, for example, sentiment analysis of social media for mood disorder detection and analysis of patient interviews for diagnosis and treatment planning. Ethical considerations and limitations, including data biases and privacy concerns, are also explored. While acknowledging challenges, this review underscores the transformative impact of LLMs on enhancing clinical decision-making and mental health research, emphasizing the need for interdisciplinary collaboration and ongoing refinement of LLM applications.

Introduction

Mental illness, also known as mental health disorders, refers to health conditions that cause aberrant changes in one's mood, thinking, or behavior (American Psychiatric Association, What is mental illness, 2022). Mental health conditions affect a significant amount of the US population each year, with an estimated one in five adults experiencing mental illness to some extent (American Psychiatric Association, What is mental illness, 2022). Recent global events, namely the COVID-19 pandemic, exacerbate the burden. In the first year of the pandemic, rates of common conditions such as depression and anxiety, increased by over 25 percent (World Health Organization, COVID-19 pandemic triggers 25% increase in prevalence of anxiety and depression worldwide, 2022). By 2030, depression is predicted to be the second leading cause of disease burden in the world (Mathers & Loncar, 2006).

The traditional methods of diagnosing and treating mental health disorders have long relied on subjective assessments, clinical interviews, and standardized questionnaires. However, scales often struggle to capture the nuances and complexities of human language and interviews leave room for misinterpretations and subjective results. The lack of access to mental healthcare is largely due to costs and stigma towards mental illness. Developments in artificial intelligence have the opportunity to address these limitations.

Artificial intelligence (AI) is the attempt to mimic the cognitive abilities of humans in computer systems (Artificial intelligence, NSF - National Science Foundation, 2024). Machine learning (ML) is the study of building computational systems that improve task-specific performance through self experience (Artificial intelligence, NSF - National Science Foundation, 2024). The scalability of ML provides the opportunity to mitigate the limited infrastructure and available personnel in mental health services. With the recent advancements in machine learning, researchers and clinicians have started exploring the potential of utilizing language models to improve diagnosis, prognosis, and treatment.

Natural language processing (NLP) is a branch of ML that employs computational techniques for the purpose of learning, understanding, and generating human language content using methods including speech recognition, sentiment analysis, and speech tagging (Hirschberg & Manning, 2015). Various text types used to train these language models include social media messages, patient interview transcripts, and clinical notes from physicians (Zhang et. al., 2022). Recent developments provide a promising opportunity to address the limitations of current mental healthcare by enabling automated analysis and processing of textual data with improved accuracy and efficiency.

This literature review aims to evaluate and compare the language models utilized across variouspsychological disorders, highlighting their strengths, limitations, and potential applications. We will consider various aspects, including the quality of representation, contextual understanding, interpretability, computational efficiency, and ethical considerations. By examining the capabilities of these models, we present a broader scope of NLPs in psychiatry and highlight areas where further development and refinement are needed.

As we cover the potential benefits and risks associated with these AI-driven innovations, we hope to pave the way for the responsible and effective integration of NLP technologies in psychiatry and spark further investigations, ultimately leading to improved patient outcomes and more comprehensive diagnosis and management of mental health disorders.

Depression and Mood Disorders

Depression (major depressive disorder) is a mental health condition that causes a persistently low mood and a loss of interest in previously enjoyed activities (Bibring, 1953). DSM-5 diagnostic criteria includes factors like duration of symptoms, diminished interest, and excessive guilt based on subjective reports or observations (DSM-5 Criteria: Major Depressive Disorder, 2020). A depression screening typically consists of a physiological evaluation and a standard questionnaire such as the PHQ-9 (Kroenke et. al., 2021). Another common mood disorder, bipolar disorder is marked by mania, characterized by frequent fluctuations in one's mood from euphoria to depression (Belmaker, 2004). The DSM-5 criteria includes at least one hypomanic episode and one depressive episode, (National Alliance on Mental Illness, Bipolar disorder, 2017).

In a classification model identifying language markers for depression detection, a Twitter depression dataset consisting of identified users with depression and their tweets to construct a classification combining deep learning model scores, psychological text features, and user demographic information to analyze their relations to depression markers. The test set showed that conscientiousness, neuroticism, use of first person pronouns, talking about biological processes (e.g. eating and sleeping), talking about power, and exhibiting sadness were shown as important features in depression classification. The accuracy of the model was 78.9% on a test set of 446 participants, half with depression (Zhang et. al., 2020).

Another study also used a social media dataset, clustering posts from depression related subreddit communities by expert-validated symptoms (e.g. disordered eating) to develop prediction models with linguistic features and RoBERTa (transformer-based model) embeddings,

to identify specific symptom discourse. Tested on Facebook posts with a ground truth as patient surveys (PHQ-9 for depression, GAD-7 for anxiety, and UCLA-3 for loneliness), RoBERTa embeddings resulted in the highest accuracy (>94.9%), the best at predicting most symptoms, and were particularly strong at predicting the severity of suicidal thoughts and attempts, self-loathing, loneliness, and disordered eating (Liu et. al., 2023). A bipolar and depression language model using refined Reddit data was performed using semantic network analysis, a method of discovering semantic structures within text, with pre-processed word matrices to cluster posts into 10 major topics discussed to uncover patterns in patient expression of feelings and experiences, along with overlaps between the two disorders (Yoo et. al., 2019).

Although many studies focus on detection and pattern recognition, we also found models trained as possible conversational agents (CA). 181 college students were given varying levels of access to a conversational chatbot, Tess, with an average of 472 (SD 249.52) messages between Tess and students exchanged over an 8 week period. By comparing initial and final PHQ-9 scores. Tess proved to be effective in significantly reducing self-identified symptoms of depression measured by depression scores on the Mann-Whitney U and Wilcoxon tests (Klos et. al., 2020). Another chatbot developed to psychoeducate adolescents was tested by 23 participants ages 13-18. Out of the participants, 64.3% said they would use the chatbot in the future and 54.5% of user experience responses were positive. The most common impression was related to symptom improvement, reported by 61.1% of participants (Dosovitsky, 2022).

A study reviewing 8 depression chatbots found that they provided solutions like mindfulness, mood tracking, meditation, and other assessment tools, with apps having over 5 million Android installations (Ahmed et. al., 2021). Another content analysis of dialogues between nine conversational agents and users indicated that agents could exhibit empathy, guide therapeutic exercises, and support mental healthcare of depression (Martinengo et. al., 2022). Tess and other conversational agents offered evidence that AI can serve as a cost-effective and accessible therapeutic aid for depression, while gaining increasing popularity among mobile users. CA studies reported a majority of the participants experiencing symptom improvement, showing that LLMsML can deliver effective therapy to some extent. However, more pilot and user testing will be needed before real-world implementation.

Stress and Anxiety Disorders

Anxiety is marked by a prolonged future-oriented mood state associated with excessive worry towards possible, upcoming negative events (Craske et. al., 2011). The DSM-5 criteria includes marked fear in social situations or to possible scrutiny by others (Substance Abuse and Mental Health Services Administration. DSM-5 Changes: Implications for Child Serious Emotional Disturbance, 2016). The Generalized Anxiety Disorder 7 (GAD-7) scale is also used for diagnosis by criteria of degree of worry, restlessness, irritability, and restlessness (Williams, 2014). The Holmes and Rahe Stress Scale categorizes 43 specific stressors and prompts users to report the level of stress they experienced (Noone, 2017).

A language-based model aimed to predict users anxiety disorder using language based assessment of lexical (BERT, roBERTa) and discourse (phraseBERT, sentenceBERT) models

trained by data from the posts of 12,489 Facebook users and their responses to an anxiety questionnaire. Combining roBERTa, sentenceBERT, and DiscRE achieved the best performance, with the correlation coefficient between model predictions and anxiety scores at 0.473 (Juhng et. al., 2023). Another study compared various models and found the most precise and accurate features for classification of anxiety labeled Reddit posts. The neural network classifier consistently performed the best, with a highest accuracy when combining Linguistic Inquiry and Word Count (LIWC) with N-gram probabilities, with an accuracy of 98% and precision of 99% (Shen & Rudzicz, 2017).

A classification model for anxiety used different aspects of speech to develop digital biomarkers for anxiety screening. Using speech transcripts in a LSTM model with both deep-learned and handcrafted features provided the best performance, with an F1 of 0.73 for no diagnosis and 0.4 for diagnosis (Diep et. al., 2022). For stress language classification, 185 messages from user conversations were compiled into a prototype chatbot system. Each sentence was then assigned a stressor category from a simplified version of the Holmes and Rahe Scale (Noone, 2017) to build a stressor classification model. To improve accuracy, 600 labeled examples were used for a pre-trained BERT (transformer) model and mean f1-score of 0.809 was achieved, indicating a high-performing model (Mauriello et. al., 2021). While both models were trained for classification, the stress model likely performed better because the task was to categorize posts from 10 topics, while the anxiety model had a more difficult task of assigning a score out of 21. Furthermore, the anxiety model may have had a lower accuracy because of a data imbalance in the training data. The model performed significantly better in predicting no diagnosis, likely due to a data imbalance with more training data from users with lower scores (Diep et. al., 2022).

Miscellaneous

Mitchell et al's study on schizophrenia used data from filtered Twitter tweets of users with PTSD as training data for various models. The Linguistic Inquiry Word Count (LIWC) is a psychometrically validated lexicon associating words to psychological concepts, largely in mental health. Each category of the LIWC was used as a feature and assigned a value as the proportion of words in the category. Latent Dirichlet Allocation (LDA) estimates the probability of each word given a topic and the probability of each topic given a document of all tweets from a user. An SVM model with features created from LIWC categories with the distribution over LDA topics resulted in a classification accuracy of 82.3% on a balanced test set. (Mitchell et. al., 1970).

A similar study used a one character n-gram language model (CLM), which predicts the probability distribution over word sequences, to study if PTSD levels differed between the two populations. Bounding boxes of civilian areas included an average of 711k tweets per box and 407k for military bases, which were categorized as PTSD or non-PTSD related. Though statistically significant, there were only approximately 1% more PTSD-like tweets in military areas than civilian areas (Coppersmith et. al., 2014). Although the study found a small effect, it indicates how ML could be used for basic research on studying populations and contribute to existing knowledge.

An autism detection model used data from 50 children with typical autism (ASD), or developmental language disorder (DLD) on average age and IQ, and held activities to record transcripts of speech. Their model with n-gram classification and surprisal (sentence) based features found a low accuracy when discriminating between ASD and DLD and 30-50% accuracy for diagnostic and error classification (Prud'Hommeaux et. al., 2011).

Limitations

While machine learning offers a promising future in the field of psychiatry, limitations apply to the strength of ML models. The heterogeneity of language data and the lack of cleanly labeled data on the Internet may cause inaccuracies. Since most of the available training data is from social media users, models may not be representative or applicable to a wider population. Furthermore, extensive testing and comparison against established diagnostic and treatment methods will be necessary before these models can be fully implemented in real-world settings.

Conclusion

In summary, large language models have the potential to transform the landscape of psychiatry by enhancing diagnostic accuracy, personalizing treatment approaches, and expanding access to mental health services. Due to a lack of publicly available medical data, the majority of these models utilize online forum posts which may harness inaccuracies and less robust trained models. While their integration into clinical practice should be approached with cautious considerations, the continued research and development of LLMs in psychiatry offer promising avenues for improving mental health care and ultimately advancing the well-being of individuals worldwide, from classifying depression severity to being a therapeutic agent for anxiety. As the field continues to evolve, it is imperative that researchers, clinicians, and policymakers work collaboratively to harness the full potential of these powerful tools while upholding standards of ethical and patient-centered care.

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How Unusual was the Spring 2024 Extreme Precipitation in Dubai?

By: Abhinav Sobti

Abstract

This paper investigates the extreme precipitation event that occurred in the UAE during April 2024. The UAE is known for its hot and dry climate. However, during this event, over a period of a week, severe storms flooded large areas of Dubai (Dubai floods, 2024). This research used data obtained from ERA5 reanalysis in order to understand how this event was unusual compared to normal patterns in Dubai. This study aims to identify trends and anomalies in precipitation patterns from 2019 - 2024 to explain the April 2024 event and while also discussing the importance of these findings for future weather prediction and climate change in the region.

Introduction

The United Arab Emirates is known for its arid climate which is characterized by very low yearly rainfall and high temperatures (United Arab Emirates Climatology, 2021). However, in April 2024, Dubai experienced a precipitation event that significantly deviated from the normal weather conditions. Such an event has serious consequences for meteorologists, residents and the government (Dewan, 2024).

It is hence imperative to understand these types of weather events. This study provides useful information about trends observed in the climate in the UAE and thus can help to identify changes in these regional climatic conditions. Also, any trends identified will allow us to improve weather forecast models and make them more precise and accurate. This is beneficial for monitoring and controlling the effects of any upcoming extreme weather events similar to this one in the future.

This study reviews trends that potentially caused the extreme rainfall in Dubai through data analysis, of metrics from 2019 to 2024. Furthermore, it will also contribute to the information available on climate and extreme weather events in the United Arab Emirates which would help improve forecasting models to allow for better future predictions, allowing governments and

policy makers to create more effective plans to reduce the effects of climate change in dry regions, similar to the UAE.

Collection of Data

I have used a dataset from the European Centre for Medium-Range Weather Forecasts ECMWF archive. This source provides data with high accuracy, which is required for detailed analysis into the April 2024 precipitation event in Dubai. This archive includes detailed records of rainfall amounts, including intensity and duration of precipitation events from 2019 to 2024.

Limitations of the data used for the study

In order to interpret the results accurately, it is important to note the limitations in the data collected. Though the data is very accurate, the following sub sections outline key limitations related to data quality and availability, as well as time constraints faced in the study.

Data Quality and Availability:

There is a likelihood of some inaccuracy in the data, due to technical issues or interruptions in data collection because the data is compiled from weather stations. This can potentially affect the accuracy of the analysis. Moreover, small differences in data recorded by different weather stations can also affect results, including but not limited to, potential differences between observed and actual weather conditions in the regions.

Temporal Limitations:

In this study only 5 years of data has been analyzed, which may not be long enough to detect long-term climatic trends. This can affect the overall accuracy of the analysis and may reduce the effectiveness of the information gained through the study.

Spatial Limitations:

It is important to understand that the concentration on data from Dubai might not represent wider regional weather patterns, and the limited spatial resolution of weather stations may not capture microclimatic variations within the city. Additionally, findings specific to Dubai may not be directly applicable to other regions with different climatic conditions.

Results

The following section presents the results of an analysis of precipitation data from weather archives, focusing on rainfall events in Dubai during the month of April in the years 2019, 2021 and 2024. The analysis includes comparative charts and data insights to highlight the variability and patterns observed in the precipitation trends.
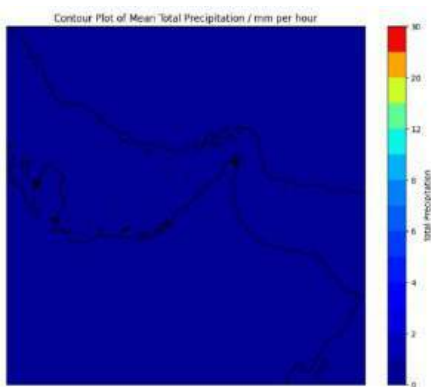

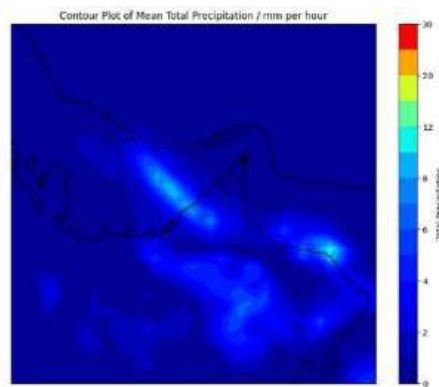*Figure 1: A contour plot of a normal day in Dubai in 2021 (mm per hour)*
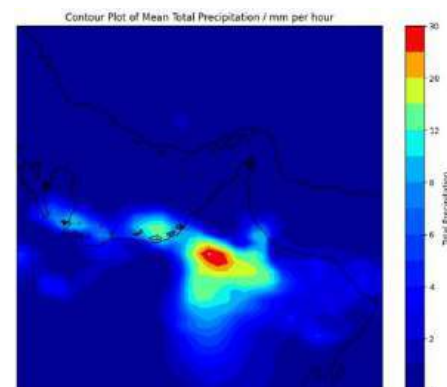

Figure 2: A contour plot during a smaller precipitation event in 2019 (mm per hour)

Figure 3: A contour plot during the extreme precipitation event in April 2024 (mm per hour)

Figure 1 depicts a normal day in Dubai (a day which has precipitation levels at the highest frequency in Figure 6), with minimal to no precipitation activity. The entire map is consistently shaded in dark blue, indicating a mean total precipitation rate of 0 mm/hour across the region. Figure 1 serves as a reference point for understanding the baseline meteorological conditions in Dubai, against which more significant precipitation events can be compared.

In contrast, figure 2 represents a moderate (a smaller spike in between the April 2024 event and a normal day) precipitation event on February 13th 2019. The colour gradient ranges from lighter blue to cyan, illustrating rainfall intensities up to approximately 12 mm/hour in some regions. The distribution of precipitation is uneven, with some areas experiencing higher levels than others, indicating the presence of a localized weather system. The moderate intensity of rainfall suggests a smaller-scale event, likely characterized by scattered showers or light to moderate rain over a broader area. This event, while notable, does not reach the severity of a more

extreme weather pattern but nonetheless has the potential to cause minor disruptions or localized impacts.

Figure 3 captures the extreme precipitation event in Dubai on the 16th of April 2024 at 12pm. Figure 3 reveals a concentration of intense precipitation, with colours progressing from green to yellow and red, corresponding to rates exceeding 12 mm/hour and peaking at over 30 mm/hour in certain areas. This extreme event is marked by a significant clustering of high-intensity rainfall in specific locations, suggesting the presence of a localized convective system or a severe thunderstorm. Such intense precipitation rates are indicative of conditions that could lead to flash floods, severe runoff, and considerable strain on urban infrastructure, highlighting the increased risk associated with such extreme weather phenomena. Looking at Figures 1,2 and 3 can help evaluate which areas suffer from higher rainfall compared to others which could help in assessing their need for rainfall prevention resources.

Figure 4: Plot of Total precipitation against time for Jan 2019 – April 2024 (mm per hour)

Figure 4 reveals intermittent spikes in precipitation levels, indicating periods of heavy rainfall interspersed with longer dry spells. These peaks are scattered throughout the time period, suggesting a pattern of irregular and possibly seasonal rainfall. These intense rainfall episodes could also correspond to storms or heavy downpours. The majority of the time, however, the precipitation levels remain close to zero, reflecting the generally arid climate of Dubai.
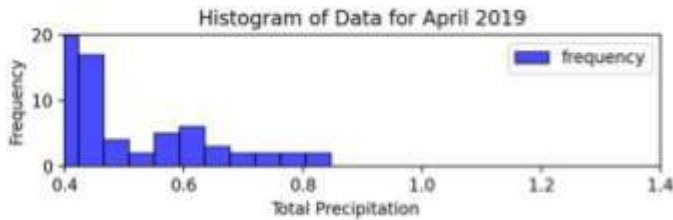
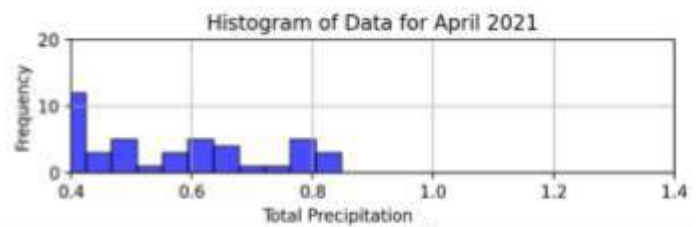*Figure 5: Histogram of precipitation in April 2019 mm/hour*

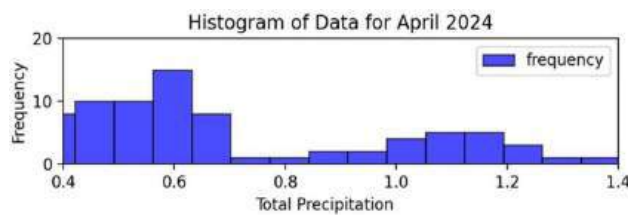*Figure 6: Histogram of precipitation in April 2021 mm/hour*

Figure 7: Histogram of precipitation in April 2024 mm/hour

Figures 5, 6 and 7 display a similar general pattern where the majority of precipitation events are concentrated at the lower end of the scale. This indicates that low precipitation events are the most frequent in all years. This is typical for arid regions like Dubai. In 2019 (figure 5), the precipitation events decrease steadily as we move to higher values of total precipitation. In 2024 (figure 7), there are a few key differences; there is an increased number of high precipitation events compared to 2019 and 2021. Particularly, there are more frequent events with precipitation levels between 1 and 1.4m in 2024. This suggests that extreme rainfall events, although still rare, have increased in frequency in 2024.

The increase in the number of days with higher precipitation levels in 2024 could indicate a shift in the rainfall pattern in Dubai, potentially due to climatic change. The region is experiencing more intense and frequent rainfall events, which could have significant implications for water management, infrastructure, and overall preparedness for extreme weather conditions.

Furthermore, figure 5 and figure 7 show a small increase in the number of higher precipitation events. This suggests that the increased rainfall in 2024 is not an outlier, but a slow increase in rainfall that has sped up in 2024.
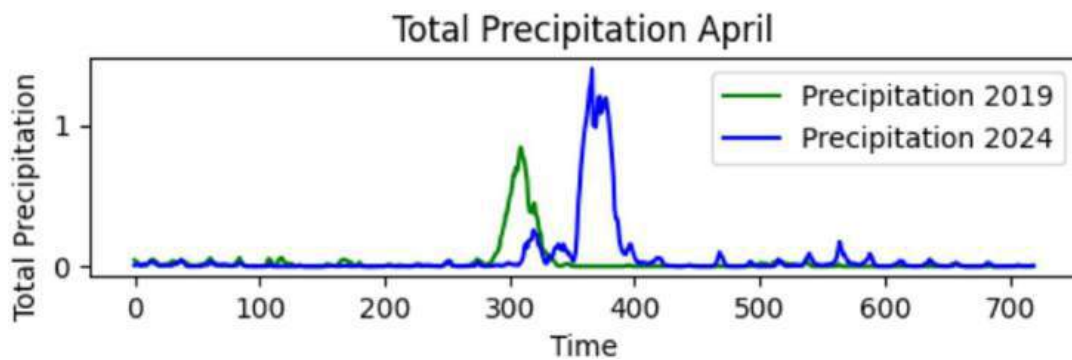

Figure 8: Line graph comparing April 2024 and April 2019 precipitation levels against time (mm / hour)

Figure 8 demonstrates that both April 2019 and April 2024 experienced significant spikes in rainfall mid-month, characterized as extreme events. The 2019 event occurred slightly earlier in the time series, as compared to April 2024 event. These extreme events, given their magnitude and the duration they cover, indicate that such high-intensity rainfall episodes are possible but may not be common occurrences within this timeframe.

The peak in April 2024 is significantly higher than the one in April 2019. This suggests that the intensity of extreme rainfall events has increased over time. The April 2024 peak is more than double the height of the 2019 peak, indicating a substantial increase in rainfall during that event. This could be indicative of changes in atmospheric conditions, potentially driven by broader climatic shifts.

Apart from the major spike, April 2024 data also shows several smaller spikes in precipitation, which are almost absent in the 2019 data. These smaller spikes indicate that in April 2024, there were more frequent rainfall events, contributing to a higher overall rainfall for the month. The presence of these additional smaller events suggests a possible shift towards a wetter climate or an increase in the frequency of rainfall events in the region.
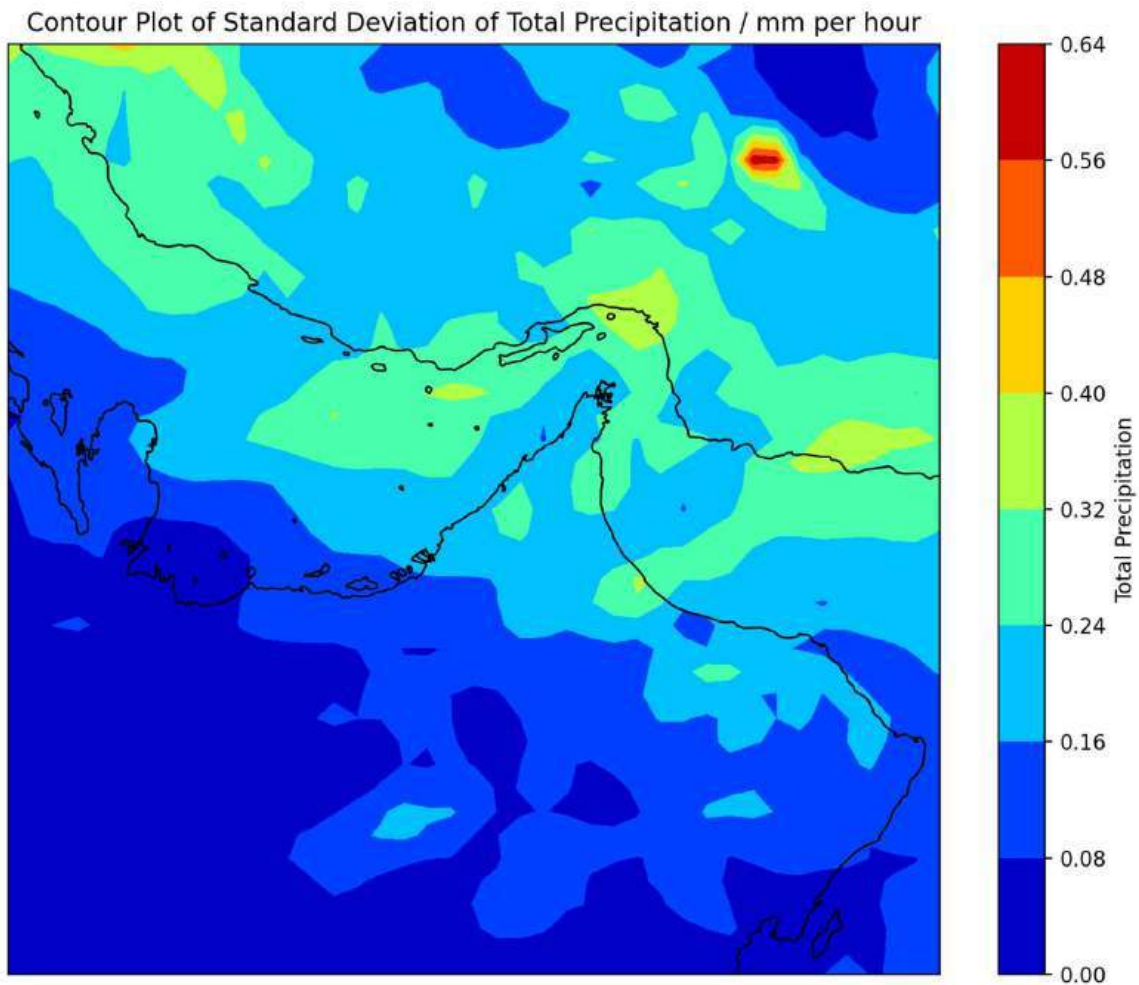
Figure 9: Contour plot showing standard deviation levels in Dubai over the entire 5 year period

Figure 9 spans a wide area surrounding Dubai, covering parts of the Arabian Peninsula, neighboring seas, and adjacent landmasses. Dubai is situated around the center-right of the figure, close to the Persian Gulf. The color gradient, as shown by the scale on the right, ranges from blue (indicating low variability) to red (representing high variability in precipitation). Over the period from Jan 2019 to April 2024, the standard deviation of precipitation in Dubai has ranged between 0.2 to 0.4, as displayed in the chart. In contrast, the event in April 2024 was approximately 4 standard deviations above the mean.

Focusing on local variations, the area around Dubai shows moderate fluctuations in rainfall intensity. This suggests that while the region does receive rain, its intensity does not vary as

drastically compared to other areas. However, the deep red areas located to the west and southwest, likely over water bodies, show highly variable rainfall patterns. These high-variability zones could be a result of the local climatic factors such as sea-land interaction or specific topographical features, which lead to more irregular rainfall events compared to Dubai.

Figure 9 reveals important implications for the variability of rainfall over the area. The fairly average standard deviation in rain for Dubai suggests that it tends not to experience extreme variability in rainfall; however, isolated extreme events are experienced. The high level of variability within the neighboring countries could be due to the even less predictable and stormy rainfall events. Variability within the neighboring areas can also affect weather conditions in Dubai, especially in cases related to storm surges or sudden atmospheric changes.

These results depict that Dubai has a relatively steady pattern of rainfall variation compared to the surrounding areas, particularly over any aquatic environment or dry land. Understanding this trend is critical in terms of meteorological forecasts and planning purposes because even though Dubai normally experiences relatively moderate weather conditions, any severe increase in precipitation variation in the regional context may lead to extreme weather events across the region.

Discussion

1. Climatic Trends and the Influence of Global Climate Change

These results show that the strange weather phenomenon in Dubai in April 2024 is not an isolated anomaly but instead is growing trend in this region, facing enhanced intensification and frequency of these types of events. This can be seen by the periodic rise in rainfall depicted by the histograms and charts included. This aligns with the observation from around the globe where climate change is projected to increase extreme precipitation in various parts of the world (Almheri et. al. 2024). Increasing frequency and intensity of such events can be explained by rising global temperatures that cause higher evaporation rates and thus more moisture in the atmosphere.

This in turn creates conditions more favorable for precipitation and hence stronger rainfall.

2. Comparisons to Previous Extreme Events

By analyzing the trends from 2019 and 2024, it is evident that extreme precipitation occurrences, although infrequent, are not unheard of Dubai. The data indicates that both years saw substantial spikes in rainfall, though the intensities varied. Furthermore, the extreme rainfall events in both years occurred around the same time, suggesting a possible seasonal trend during the month of April. However, the fact that the 2024 event was far stronger in intensity shows that though these events are periodic, the intensity and duration are increasing.

This is crucial because it points out the need to revise the existing information and knowledge that is available for of Dubai's climatic environment. The region was previously seen as having a uniform arid climate with very low precipitation levels. However, data presented in this study suggests that Dubai may be experiencing a more extreme and variable climate than previous years. The highest rainfall in 2024, being more than double compared to 2019, could be a significant indicator of potential changes in atmospheric conditions. This research paper demonstrates the need for further study of climatic data for Dubai in order to improve our knowledge regarding the frequency and intensity of extreme events in the region.

3. Implications for Infrastructure and Urban Planning

The increase in occurrences of extreme weather, especially intense rainfall, presents considerable challenges for the infrastructure and urban planning of Dubai. The infrastructure within the city, which has been predominantly designed for an arid environment, might not possess sufficient capabilities to manage the heightened threat of flooding and water accumulation that arises from severe storms.

This could also include infrastructural factors such as drainage systems and roadways that may need a rebuilding to ensure their resilience due to the effects of these increasingly prevalent and extreme precipitation occurrences. The April 2024 storm emphasizes the need to improve the flood management system within Dubai.

This study suggests that extreme weather conditions might get worse, and hence the city needs to upgrade its drainage infrastructure so that waterlogging does not occur; it also has to reduce the impact of flooding which may be in the form of constructing more flood prevention systems, or by increasing the stormwater retention basins, providing a better drainage network.

4. Impact on Water Resources and Environmental Management

The projected rise in precipitation frequency in Dubai holds significant implications for water resource management in the region. While increased rainfall may be a welcome addition to the availability of water in a desert environment, it also poses some challenges in terms of effectively collecting and making use of the water resources. The unpredictability of extreme events makes reliance on natural precipitation in the management of water resources challenging, but, at the same time, it brings opportunities to increase water sustainability in the region (Sherif et. al., 2014).

The 2024 storm highlights the need for Dubai to develop better mechanisms of water capture and storage. For example, the use of rainwater harvesting, groundwater recharge techniques, and reservoirs can be explored for methods to capitalize on the increased rainfall (Rustamani, 2014).

5. Implications for Future Weather Prediction

This research carries key implications for improving the accuracy of weather forecasting models in the region. Current models do not take into account the increased variability and intensity of precipitation in regions such as Dubai. The April 2024 event reveals the limitations of current models demonstrating that improvement is necessary in building these models, due to the rapidly changing climatic conditions.

6. Challenges and Limitations

Although this study was beneficial, we need to consider it's limitations since the quality and availability of data gathered from the weather archives may not be fully accurate and there may be gaps in the dataset or limited accuracy in the measurements.

Furthermore, the fact that the research is centered around Dubai, the results may not be applicable to the rest of the UAE or other arid regions like Dubai, as city-specific factors could influence the patterns observed. Also, the increase in rainfall could be caused due to many other factors such as cloud seeding, which is very common in the UAE (Almheiri et. al., 2021).

Moreover, though the period analyzed was long enough to identify short term trends, it may not be sufficient for analyzing long-term climatic changes. Additional research with longer time periods, is required to determine the main factors in extreme weather events in regions such as Dubai/

Conclusion

In conclusion, analysis into the April 2024 event in Dubai offers valuable insights into the constantly changing weather patterns in the region. These findings suggest that extreme weather events are becoming increasingly frequent and intense, possibly due to global climate change. These trends have significant consequences for urban planning, infrastructure development, water resource management, and weather forecasting in Dubai.

Next Steps

As a next step, I recommend that future research should be conducted, where we prioritize improving the quality of the dataset by using a longer timeframe, hence allowing more detailed analysis of climatic trends. Furthermore, deeper investigation of the possible relationships between global climatic events and weather conditions in Dubai may yield greater understanding of the factors affecting extreme weather occurrences in the area.

Dubai will be better equipped to deal with the challenges brought about by the changing climate by continuously monitoring and analyzing these precipitation trends.

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YI SOCIETY:

Past, Present, and Future

Charlotte Lin

Contents

Approximately 2,000 years ago, the ancestors of the Yi people transitioned to a patriarchal clan society. According to Yi tradition, their ancestor Zhong Muyou had six sons, who became the forefathers of the six main branches of the Yi people. Over time, the descendants of these branches formed the distinct five-class system of Yi society (Wu, 2002). Each family branch protected its own interests, often engaging in conflicts for resources and power. These intra-family struggles, at times escalating into customary wars, were primarily driven by slave owners vying for control (Xin & Xie, 2024). In modern times, however, the Yi people have largely moved out of the mountains and been influenced by Sinicization. Today, three major points of contention exist between traditional Yi society and the modern world: changes to the class system, the role of Yi women, and shifts in traditional Yi dress.

I.
Hierarchy and Change
From Class to Equality

In ancient times, the Yi people had a strict hierarchical class system that was even more rigid than the comparatively flexible social structure of the Han people. Yi society was divided into five distinct classes: Zimo, Cuno, Novo, and the slave classes Gaja and Gaxi. During my visit to a museum on July 9th, the docents explained that Zimo represented the royal family, Cuno the noble family, and Novo the common people (Baihuasanguoshi, 2024). Different surnames reflected the positions within each family, such as the division between the black and white Yi. In those times, the older generation would greet each other by surname, and the entrenched social hierarchy instilled a sense of fear when encountering someone of a higher status.

This rigid hierarchy extended to marriage, where individuals could not marry outside their class. Yi men were forbidden from marrying women of a lower status, as doing so would result in demotion (Lishiliangzhanglian, 2024). During my fieldwork in the mountains, I interviewed a man named Wu Zuo, whose family was originally part of the Yi royal family. However, his grandfather's marriage to a woman of lower status led to the family's demotion from royalty to commoners, specifically the white Yi. Wu Zuo spoke of this family demotion with regret, seemingly unaware that societal evolution had long since rendered these hierarchical divisions obsolete. Today, laws and equal rights have replaced the rigid social structures of the past.

The Chinese central government once managed minority regions, particularly those in border areas, through the Tusi system. Over time, the contradictions of the Tusi system—marked by frequent conflicts and rebellions—led to instability. During the Ming and Qing dynasties, the government initiated the "Gaitu Guiliu" reforms, replacing hereditary Tusi leaders with centrally appointed officials to unify governance and stabilize these regions. These reforms fostered economic growth, cultural exchange, population movement, and social integration, ultimately helping to incorporate minority regions into the broader political framework and promote national unity.

In contemporary Yi society, the rigid class system has gradually faded. The Yi people no longer base social or economic activities on the old class hierarchy. Those who once belonged to higher classes now focus on proving themselves through their abilities rather than relying on ancestral status. This shift reflects a broader movement toward equality and individual merit, where traditional social ranks have been replaced by an emphasis on personal achievements and contributions.

Interview with an Yi Bimo

Yi Grandma in the village
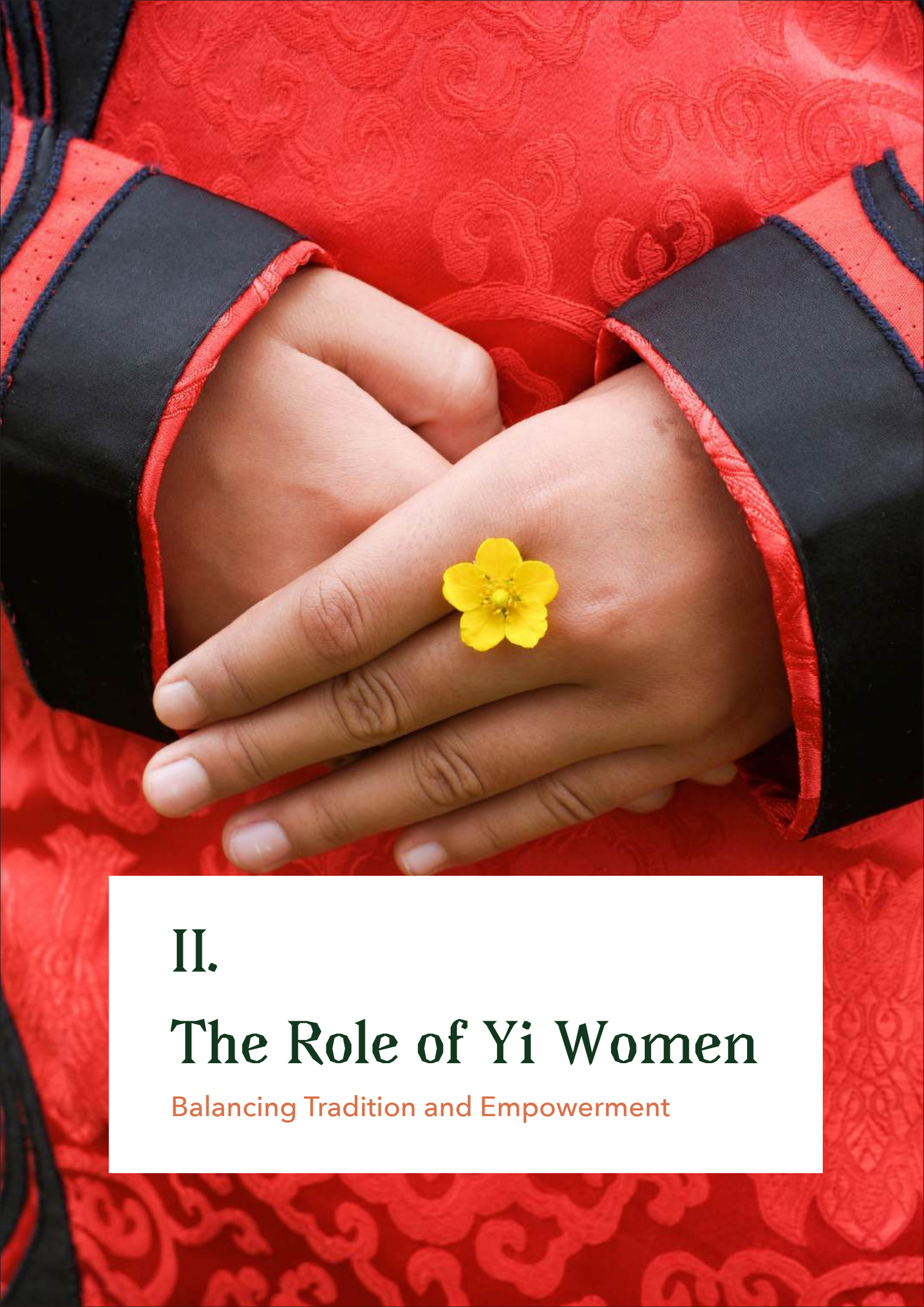
II.
The Role of Yi Women

Balancing Tradition and Empowerment

Yi women have historically played a central role in family life, particularly in childbearing and continuing the family lineage. Despite their vital contributions, they often do not receive the respect and status they deserve. Yi family culture both values and marginalizes women—praising them while simultaneously restricting their roles. From a young age, Yi girls are influenced by patriarchal beliefs, which shape their priorities, often leading them to put family obligations above their own aspirations (Yizu, 2018).

The pressures faced by Yi women are immense, as highlighted by a tragic story shared by Ms. ShaMa during an interview. She spoke of a young Yi girl who took her own life after a man accidentally saw her ankles exposed—a rare but telling incident reflecting the rigid expectations around female modesty. Despite these traditional constraints, many Yi women have defied societal norms and forged their own paths. For instance, Ms. ShaMa, from an ancient imperial family, chose entrepreneurship by establishing a handicraft workshop. Similarly, Ms. Yingzi, who runs an embroidery workshop, empowers other women by providing them with skills and opportunities to escape restrictive societal norms.
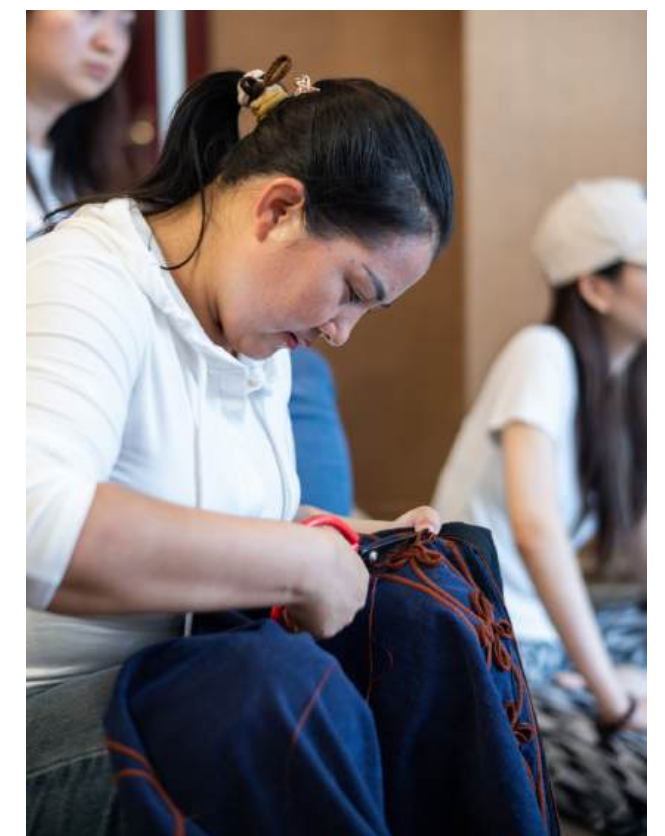
The practice of bride price further entrenches the commodification of Yi women, perpetuating gender inequality. While some argue that bride prices hold economic importance within Yi society, critics emphasize that they impose significant financial burdens and reduce women to mere commodities rather than equal partners (Shumeiyouxishuo, 2024). Despite efforts at reform, the bride price system persists, often placing immense financial strain on families.

In 2022, as part of poverty alleviation policies in the Liangshan Yi Autonomous Prefecture, the local government passed a new bill called "Changing Customs and Habits," aimed at curbing high bride prices and promoting simpler burials with better care for the elderly. Despite social changes since the founding of New China, the bride price remains a common practice in Yi marriages. In Sichuan Province, bride prices generally range from 200,000 to 300,000 RMB, with a maximum of 500,000 RMB in the five eastern counties of Liangshan Prefecture (Meigu, Zhaojue, Butuo, Leibo, and Yuexi). The bride price for a Yi girl depends on various factors, including family rank (commonly referred to as "hardness of the bone"), education level, family economic status, and employment.

The continuous rise in bride prices is closely linked to cultural customs and the social evaluation system of Yi society. On the economic front, high bride prices far exceed the financial capacity of many Yi families. A party secretary from Yanyuan County pointed out, "A bride price of 500,000 RMB is a heavy burden for any family, even for people working in our offices, let alone ordinary residents." Yet, to get married, families must raise the money, often calling on extended family members for contributions. Each household may contribute tens of thousands of RMB to help a young Yi man marry, and this support system is reciprocated when it is another family's turn. Traditionally, the bride price flows from the groom's family to the bride's family, with most of the amount managed by her parents. This system has significantly increased the cost of marriage for the groom's family, leading many to rely on the bride price obtained from their daughter's marriage to help finance their son's wedding. Scholars describe this phenomenon as intra-family exploitation; the original supportive functions of the bride price have vanished, leaving behind starkly exploitative characteristics.

When we spoke with Wu Zuo about his marriage prospects, he mentioned that his family was unwilling to provide the large sum required for the girl he liked, which may compel him to accept an arranged marriage instead.

Ultimately, while the tradition of bride prices reflects deep cultural roots, their impact on women's autonomy and the financial health of families cannot be ignored. The resilience and determination shown by many Yi women illustrate a growing movement toward independence and equality, suggesting that although traditions persist, they do not wholly determine the future of Yi women.


Interview with Wu Zuo

III.
Traditional Clothing

From Heritage to Modern Adaptations

One of the most distinctive aspects of Yi culture is their traditional dress, particularly the intricate embroidery that adorns their clothing. Liangshan Yi embroidery, renowned for its vibrant colors and bold techniques, is deeply tied to the Yi people's totem worship and folk customs. Despite its cultural significance, modernization has posed a significant threat to the survival of this art form. Younger generations may view these traditional crafts as outdated, leading to a decline in their practice and appreciation.

For many young people today, Yi clothing has become little more than a prop for travel photos, with minimal understanding of the cultural heritage behind it. During a visit to the local tourist center, I observed that many of the shops were renting traditional minority costumes, most of which were not even authentic Yi garments. Influenced by social media platforms like TikTok, young tourists seem more focused on generating online engagement rather than understanding the deeper stories behind these garments. The commercialization of traditional crafts further dilutes their authenticity, as mass production strips away the cultural depth inherent in handmade creations (Wang, 2024).
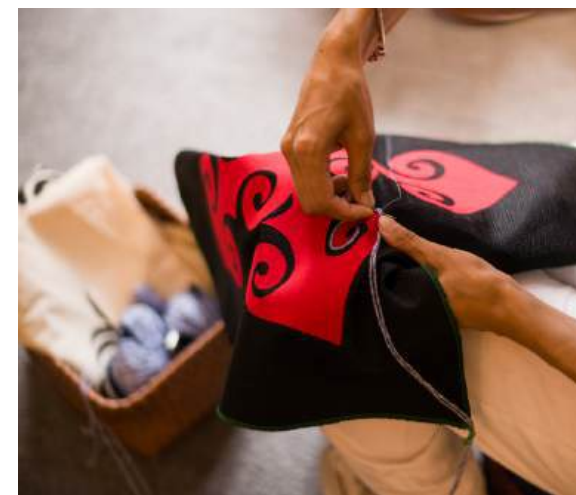
Despite these challenges, Liangshan Yi embroidery remains a powerful symbol of Yi cultural identity. Its designation as a national intangible cultural heritage underscores its significance within both the Yi community and the broader cultural landscape of China. Efforts to preserve and promote Yi embroidery are vital to ensuring that this tradition continues to thrive in the face of societal changes.

IV. Conclusion

Preserving Cultural Heritage While Embracing Change

The experiences of Yi women provide a profound insight into the complexities of gender roles and societal expectations within Yi culture. From the tragic story of a young girl driven to suicide by rigid modesty norms to the constraints of arranged marriages and dowries, Yi women have long been subject to deeply entrenched traditions. However, signs of change are emerging. Women like Ms. ShaMa and Ms. Yingzi represent a new generation of Yi women redefining their roles through independence and entrepreneurship. These changes highlight the ongoing evolution within Yi society, where modern perspectives on marriage and gender roles are reshaping the lives of women. Although the journey toward full autonomy and equality continues, the determination of these women provides hope for a future in which cultural heritage and gender equity coexist. The evolution of Yi society reminds us that while traditions are important, they must adapt to ensure the dignity and rights of all individuals. As we document these changes, it becomes clear that the story of Yi women is not one of victimhood but one of resilience and self-determination within a transforming cultural landscape.

V. Action Plan

The following action plan aims to support the Yi community in adapting to social and cultural changes while preserving their heritage. It aligns with several of the United Nations 17 Sustainable Development Goals, particularly Goal 5: Gender Equality, and Goal 4: Quality Education. By promoting education for women and encouraging them to pursue non-traditional roles, the plan fosters gender equality. Additionally, the economic development of traditional crafts aligns with Goal 8: Decent Work and Economic Growth, helping local artisans gain financial independence while preserving cultural heritage. We can engage international organizations and NGOs to further support these goals, potentially partnering with initiatives aimed at eradicating poverty and promoting sustainable community development (United Nations, 2024).

1. *Science Popularization Lectures*

In rural areas, science popularization lectures will help dispel long-held beliefs about the hierarchical system among the Yi people. These lectures aim to foster a deeper understanding of why consanguineous marriage is harmful, not only because of government policies but also from a scientific perspective. The risk of having intellectually disabled children in consanguineous marriages will be emphasized, allowing the community to understand why such marriages are both inhumane and risky (United Nations, 2024).

2. *Empowerment of Yi Women Through Education and Role Models:*

Workshops and educational programs for Yi women, spanning various age groups including children, adolescents, and adults, will help expand their opportunities and challenge traditional gender roles. Interviews with successful female entrepreneurs like Ms. Shama and Ms. Yingzi can serve as powerful examples, inspiring women to pursue careers and autonomy. By promoting education and exposure to different career paths, these initiatives will work to dismantle the objectification of women and their subjugation to outdated family values (United Nations, 2024).

3.

Whispers of the Hills, Jewelry Collection

My jewelry collection, Whispers of the Hills, draws inspiration from Yi culture, integrating traditional elements with a modern twist. I selected silver, green, and black as the theme colors. Silver is the primary color, reflecting the traditional use of silver in Yi jewelry. Green symbolizes the natural environment of the Yi people, who have long lived in the mountains, while black represents their enduring cultural heritage. Traditional Yi jewelry is often large and cumbersome, typically worn only during special events like weddings. My designs reimagine these pieces for the younger generation—those who appreciate cultural heritage but also have a keen sense of contemporary fashion.

Design Sketches

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How Unusual was the Spring 2024 Extreme Precipitation in Dubai?

By: Abhinav Sobti

Abstract

This paper investigates the extreme precipitation event that occurred in the UAE during April 2024. The UAE is known for its hot and dry climate. However, during this event, over a period of a week, severe storms flooded large areas of Dubai (Dubai floods, 2024). This research used data obtained from ERA5 reanalysis in order to understand how this event was unusual compared to normal patterns in Dubai. This study aims to identify trends and anomalies in precipitation patterns from 2019 - 2024 to explain the April 2024 event and while also discussing the importance of these findings for future weather prediction and climate change in the region.

Introduction

The United Arab Emirates is known for its arid climate which is characterized by very low yearly rainfall and high temperatures (United Arab Emirates Climatology, 2021). However, in April 2024, Dubai experienced a precipitation event that significantly deviated from the normal weather conditions. Such an event has serious consequences for meteorologists, residents and the government (Dewan, 2024).

It is hence imperative to understand these types of weather events. This study provides useful information about trends observed in the climate in the UAE and thus can help to identify changes in these regional climatic conditions. Also, any trends identified will allow us to improve weather forecast models and make them more precise and accurate. This is beneficial for monitoring and controlling the effects of any upcoming extreme weather events similar to this one in the future.

This study reviews trends that potentially caused the extreme rainfall in Dubai through data analysis, of metrics from 2019 to 2024. Furthermore, it will also contribute to the information available on climate and extreme weather events in the United Arab Emirates which would help improve forecasting models to allow for better future predictions, allowing governments and

policy makers to create more effective plans to reduce the effects of climate change in dry regions, similar to the UAE.

Collection of Data

I have used a dataset from the European Centre for Medium-Range Weather Forecasts ECMWF archive. This source provides data with high accuracy, which is required for detailed analysis into the April 2024 precipitation event in Dubai. This archive includes detailed records of rainfall amounts, including intensity and duration of precipitation events from 2019 to 2024.

Limitations of the data used for the study

In order to interpret the results accurately, it is important to note the limitations in the data collected. Though the data is very accurate, the following sub sections outline key limitations related to data quality and availability, as well as time constraints faced in the study.

Data Quality and Availability:

There is a likelihood of some inaccuracy in the data, due to technical issues or interruptions in data collection because the data is compiled from weather stations. This can potentially affect the accuracy of the analysis. Moreover, small differences in data recorded by different weather stations can also affect results, including but not limited to, potential differences between observed and actual weather conditions in the regions.

Temporal Limitations:

In this study only 5 years of data has been analyzed, which may not be long enough to detect long-term climatic trends. This can affect the overall accuracy of the analysis and may reduce the effectiveness of the information gained through the study.

Spatial Limitations:

It is important to understand that the concentration on data from Dubai might not represent wider regional weather patterns, and the limited spatial resolution of weather stations may not capture microclimatic variations within the city. Additionally, findings specific to Dubai may not be directly applicable to other regions with different climatic conditions.

Results

The following section presents the results of an analysis of precipitation data from weather archives, focusing on rainfall events in Dubai during the month of April in the years 2019, 2021 and 2024. The analysis includes comparative charts and data insights to highlight the variability and patterns observed in the precipitation trends.
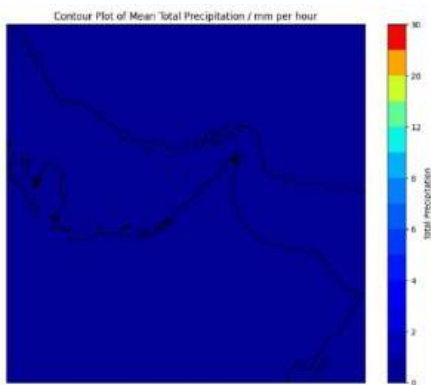

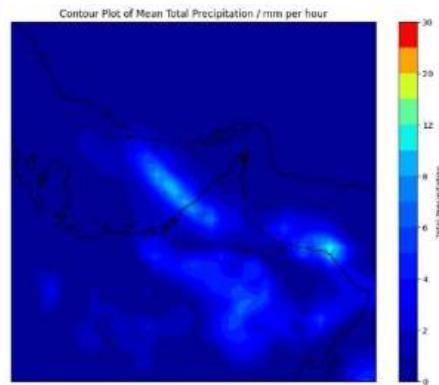*Figure 1: A contour plot of a normal day in Dubai in 2021 (mm per hour)*

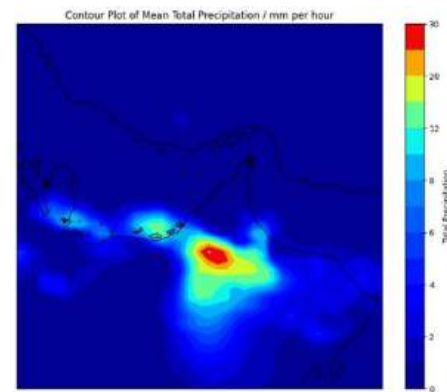*Figure 2: A contour plot during a smaller precipitation event in 2019 (mm per hour)*

Figure 3: A contour plot during the extreme precipitation event in April 2024 (mm per hour)

Figure 1 depicts a normal day in Dubai (a day which has precipitation levels at the highest frequency in Figure 6), with minimal to no precipitation activity. The entire map is consistently shaded in dark blue, indicating a mean total precipitation rate of 0 mm/hour across the region. Figure 1 serves as a reference point for understanding the baseline meteorological conditions in Dubai, against which more significant precipitation events can be compared.

In contrast, figure 2 represents a moderate (a smaller spike in between the April 2024 event and a normal day) precipitation event on February 13th 2019. The colour gradient ranges from lighter blue to cyan, illustrating rainfall intensities up to approximately 12 mm/hour in some regions. The distribution of precipitation is uneven, with some areas experiencing higher levels than others, indicating the presence of a localized weather system. The moderate intensity of rainfall suggests a smaller-scale event, likely characterized by scattered showers or light to moderate rain over a broader area. This event, while notable, does not reach the severity of a more

extreme weather pattern but nonetheless has the potential to cause minor disruptions or localized impacts.

Figure 3 captures the extreme precipitation event in Dubai on the 16th of April 2024 at 12pm. Figure 3 reveals a concentration of intense precipitation, with colours progressing from green to yellow and red, corresponding to rates exceeding 12 mm/hour and peaking at over 30 mm/hour in certain areas. This extreme event is marked by a significant clustering of high-intensity rainfall in specific locations, suggesting the presence of a localized convective system or a severe thunderstorm. Such intense precipitation rates are indicative of conditions that could lead to flash floods, severe runoff, and considerable strain on urban infrastructure, highlighting the increased risk associated with such extreme weather phenomena. Looking at Figures 1,2 and 3 can help evaluate which areas suffer from higher rainfall compared to others which could help in assessing their need for rainfall prevention resources.

Figure 4: Plot of Total precipitation against time for Jan 2019 – April 2024 (mm per hour)

Figure 4 reveals intermittent spikes in precipitation levels, indicating periods of heavy rainfall interspersed with longer dry spells. These peaks are scattered throughout the time period, suggesting a pattern of irregular and possibly seasonal rainfall. These intense rainfall episodes could also correspond to storms or heavy downpours. The majority of the time, however, the precipitation levels remain close to zero, reflecting the generally arid climate of Dubai.

Figure 5: Histogram of precipitation in April 2019 mm/hour

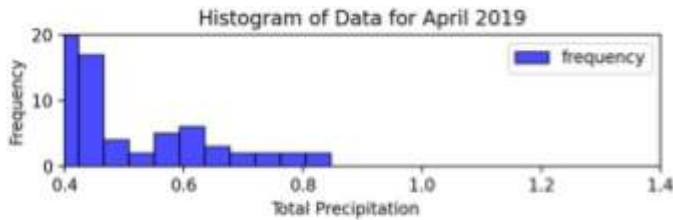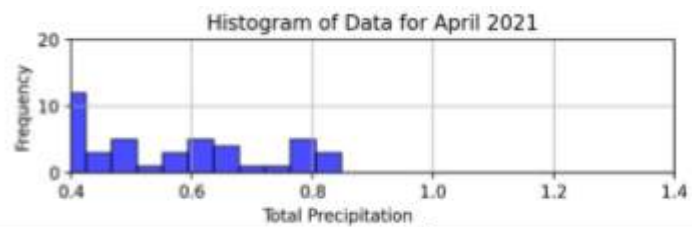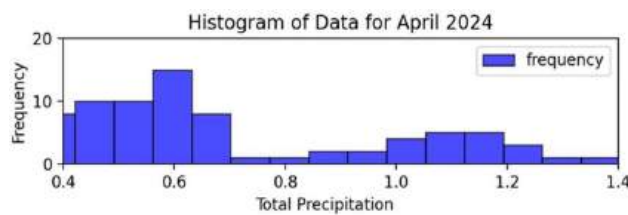*Figure 6: Histogram of precipitation in April 2021 mm/hour*

Figure 7: Histogram of precipitation in April 2024 mm/hour

Figures 5, 6 and 7 display a similar general pattern where the majority of precipitation events are concentrated at the lower end of the scale. This indicates that low precipitation events are the most frequent in all years. This is typical for arid regions like Dubai. In 2019 (figure 5), the precipitation events decrease steadily as we move to higher values of total precipitation. In 2024 (figure 7), there are a few key differences; there is an increased number of high precipitation events compared to 2019 and 2021. Particularly, there are more frequent events with precipitation levels between 1 and 1.4m in 2024. This suggests that extreme rainfall events, although still rare, have increased in frequency in 2024.

The increase in the number of days with higher precipitation levels in 2024 could indicate a shift in the rainfall pattern in Dubai, potentially due to climatic change. The region is experiencing more intense and frequent rainfall events, which could have significant implications for water management, infrastructure, and overall preparedness for extreme weather conditions.

Furthermore, figure 5 and figure 7 show a small increase in the number of higher precipitation events. This suggests that the increased rainfall in 2024 is not an outlier, but a slow increase in rainfall that has sped up in 2024.
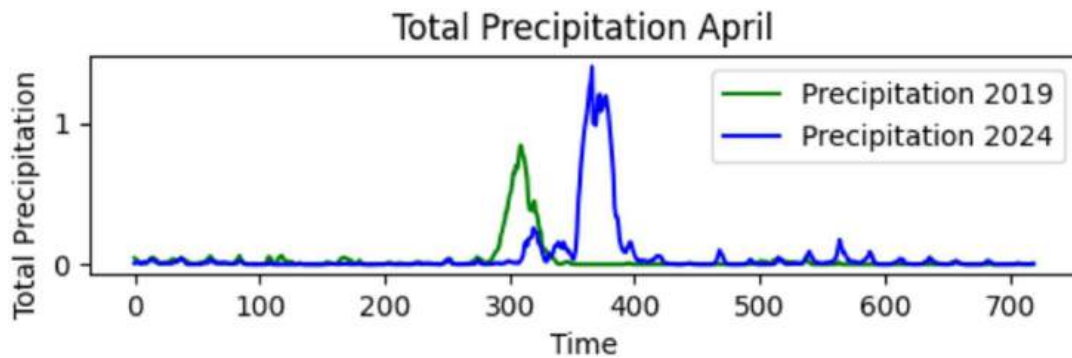

Figure 8: Line graph comparing April 2024 and April 2019 precipitation levels against time (mm / hour)

Figure 8 demonstrates that both April 2019 and April 2024 experienced significant spikes in rainfall mid-month, characterized as extreme events. The 2019 event occurred slightly earlier in the time series, as compared to April 2024 event. These extreme events, given their magnitude and the duration they cover, indicate that such high-intensity rainfall episodes are possible but may not be common occurrences within this timeframe.

The peak in April 2024 is significantly higher than the one in April 2019. This suggests that the intensity of extreme rainfall events has increased over time. The April 2024 peak is more than double the height of the 2019 peak, indicating a substantial increase in rainfall during that event. This could be indicative of changes in atmospheric conditions, potentially driven by broader climatic shifts.

Apart from the major spike, April 2024 data also shows several smaller spikes in precipitation, which are almost absent in the 2019 data. These smaller spikes indicate that in April 2024, there were more frequent rainfall events, contributing to a higher overall rainfall for the month. The presence of these additional smaller events suggests a possible shift towards a wetter climate or an increase in the frequency of rainfall events in the region.

Figure 9: Contour plot showing standard deviation levels in Dubai over the entire 5 year period

Figure 9 spans a wide area surrounding Dubai, covering parts of the Arabian Peninsula, neighboring seas, and adjacent landmasses. Dubai is situated around the center-right of the figure, close to the Persian Gulf. The color gradient, as shown by the scale on the right, ranges from blue (indicating low variability) to red (representing high variability in precipitation). Over the period from Jan 2019 to April 2024, the standard deviation of precipitation in Dubai has ranged between 0.2 to 0.4, as displayed in the chart. In contrast, the event in April 2024 was approximately 4 standard deviations above the mean.

Focusing on local variations, the area around Dubai shows moderate fluctuations in rainfall intensity. This suggests that while the region does receive rain, its intensity does not vary as

drastically compared to other areas. However, the deep red areas located to the west and southwest, likely over water bodies, show highly variable rainfall patterns. These high-variability zones could be a result of the local climatic factors such as sea-land interaction or specific topographical features, which lead to more irregular rainfall events compared to Dubai.

Figure 9 reveals important implications for the variability of rainfall over the area. The fairly average standard deviation in rain for Dubai suggests that it tends not to experience extreme variability in rainfall; however, isolated extreme events are experienced. The high level of variability within the neighboring countries could be due to the even less predictable and stormy rainfall events. Variability within the neighboring areas can also affect weather conditions in Dubai, especially in cases related to storm surges or sudden atmospheric changes.

These results depict that Dubai has a relatively steady pattern of rainfall variation compared to the surrounding areas, particularly over any aquatic environment or dry land. Understanding this trend is critical in terms of meteorological forecasts and planning purposes because even though Dubai normally experiences relatively moderate weather conditions, any severe increase in precipitation variation in the regional context may lead to extreme weather events across the region.

Discussion

1. Climatic Trends and the Influence of Global Climate Change

These results show that the strange weather phenomenon in Dubai in April 2024 is not an isolated anomaly but instead is growing trend in this region, facing enhanced intensification and frequency of these types of events. This can be seen by the periodic rise in rainfall depicted by the histograms and charts included. This aligns with the observation from around the globe where climate change is projected to increase extreme precipitation in various parts of the world (Almheri et. al. 2024). Increasing frequency and intensity of such events can be explained by rising global temperatures that cause higher evaporation rates and thus more moisture in the atmosphere.

This in turn creates conditions more favorable for precipitation and hence stronger rainfall.

2. Comparisons to Previous Extreme Events

By analyzing the trends from 2019 and 2024, it is evident that extreme precipitation occurrences, although infrequent, are not unheard of Dubai. The data indicates that both years saw substantial spikes in rainfall, though the intensities varied. Furthermore, the extreme rainfall events in both years occurred around the same time, suggesting a possible seasonal trend during the month of April. However, the fact that the 2024 event was far stronger in intensity shows that though these events are periodic, the intensity and duration are increasing.

This is crucial because it points out the need to revise the existing information and knowledge that is available for of Dubai's climatic environment. The region was previously seen as having a uniform arid climate with very low precipitation levels. However, data presented in this study suggests that Dubai may be experiencing a more extreme and variable climate than previous years. The highest rainfall in 2024, being more than double compared to 2019, could be a significant indicator of potential changes in atmospheric conditions. This research paper demonstrates the need for further study of climatic data for Dubai in order to improve our knowledge regarding the frequency and intensity of extreme events in the region.

3. Implications for Infrastructure and Urban Planning

The increase in occurrences of extreme weather, especially intense rainfall, presents considerable challenges for the infrastructure and urban planning of Dubai. The infrastructure within the city, which has been predominantly designed for an arid environment, might not possess sufficient capabilities to manage the heightened threat of flooding and water accumulation that arises from severe storms.

This could also include infrastructural factors such as drainage systems and roadways that may need a rebuilding to ensure their resilience due to the effects of these increasingly prevalent and extreme precipitation occurrences. The April 2024 storm emphasizes the need to improve the flood management system within Dubai.

This study suggests that extreme weather conditions might get worse, and hence the city needs to upgrade its drainage infrastructure so that waterlogging does not occur; it also has to reduce the impact of flooding which may be in the form of constructing more flood prevention systems, or by increasing the stormwater retention basins, providing a better drainage network.

4. Impact on Water Resources and Environmental Management

The projected rise in precipitation frequency in Dubai holds significant implications for water resource management in the region. While increased rainfall may be a welcome addition to the availability of water in a desert environment, it also poses some challenges in terms of effectively collecting and making use of the water resources. The unpredictability of extreme events makes reliance on natural precipitation in the management of water resources challenging, but, at the same time, it brings opportunities to increase water sustainability in the region (Sherif et. al., 2014).

The 2024 storm highlights the need for Dubai to develop better mechanisms of water capture and storage. For example, the use of rainwater harvesting, groundwater recharge techniques, and reservoirs can be explored for methods to capitalize on the increased rainfall (Rustamani, 2014).

5. Implications for Future Weather Prediction

This research carries key implications for improving the accuracy of weather forecasting models in the region. Current models do not take into account the increased variability and intensity of precipitation in regions such as Dubai. The April 2024 event reveals the limitations of current models demonstrating that improvement is necessary in building these models, due to the rapidly changing climatic conditions.

6. Challenges and Limitations

Although this study was beneficial, we need to consider it's limitations since the quality and availability of data gathered from the weather archives may not be fully accurate and there may be gaps in the dataset or limited accuracy in the measurements.

Furthermore, the fact that the research is centered around Dubai, the results may not be applicable to the rest of the UAE or other arid regions like Dubai, as city-specific factors could influence the patterns observed. Also, the increase in rainfall could be caused due to many other factors such as cloud seeding, which is very common in the UAE (Almheiri et. al., 2021).

Moreover, though the period analyzed was long enough to identify short term trends, it may not be sufficient for analyzing long-term climatic changes. Additional research with longer time periods, is required to determine the main factors in extreme weather events in regions such as Dubai/

Conclusion

In conclusion, analysis into the April 2024 event in Dubai offers valuable insights into the constantly changing weather patterns in the region. These findings suggest that extreme weather events are becoming increasingly frequent and intense, possibly due to global climate change. These trends have significant consequences for urban planning, infrastructure development, water resource management, and weather forecasting in Dubai.

Next Steps

As a next step, I recommend that future research should be conducted, where we prioritize improving the quality of the dataset by using a longer timeframe, hence allowing more detailed analysis of climatic trends. Furthermore, deeper investigation of the possible relationships between global climatic events and weather conditions in Dubai may yield greater understanding of the factors affecting extreme weather occurrences in the area.

Dubai will be better equipped to deal with the challenges brought about by the changing climate by continuously monitoring and analyzing these precipitation trends.

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Development of a 1U CubeSAT for Real-Time Cosmic Debris Tracking and GPS-Based Location Reporting to Proximal Cosmic Stations By Sagnalin Miras

Abstract

Space debris is piling up at such a high rate that it is seriously threatening operational satellites, future space missions, and even long-term sustainability of Earth's orbit. This paper presents the design and development of a 1U CubeSAT featuring advanced debris detection and GPS-enabled real-time location reporting in mitigation of cosmic debris risks. The CubeSAT covers integrated machine learning algorithms and imaging systems to detect and monitor space debris, sending vital information to nearby space stations and earth operators for the purpose of preventing potential collisions. A constellation of CubeSATs thus conveys a scalable, economically feasible, and real-time method toward the observation and regulation of space debris in order to enable safer operations in orbit. This paper reviews CubeSAT functional abilities, design considerations, and implementation methods and identifies them as a must have item for an international system of debris monitoring. It further explores promising next steps, including active debris mitigation methods, aimed at protecting the orbital environment for the sustainable use of space by future generations.

Introduction

Humanity has got the modern age space technologies which are helpful in many ways to mankind but on the other hand introduces the problem of space debris. Numerous pieces of defunct satellites, rocket bodies, and other space debris are found in Earth's orbit, which threaten the existing satellites and future endeavors. As reported by NASA and ESA, there are over 36,500 objects higher than 10 cm out of Earth's surface and are regarded as unique for more than 36,500 debris problems as referred to higher degrees of the risk of collisions as well as further space pollution. (National Aeronautics and Space Administration, n.d.). There has been a tremendous increase in population that will generate an even more dangerous feedback loop: new collisions create more debris - increased risk of collision creating, more debris. One possible remedy is an assembly of specialized CubeSAT which is simply a small satellite intended to be used for detection and location of space debris and provision of GPS position on cosmic stations. Such adjustments could be done in case of danger of collision. A similar small satellite may also form a part of the larger network for tracking and removing debris in outer space hence preventing contamination of space in future. This could be a very important step in the realization of the goal of this project, which is to save space missions, as well as remove the high congestion level from the orbit of the earth and make it safe for all future activities.

Characteristics and Impact of Space Debris on Orbital Safety

It also includes defunct satellites, spent rocket stages, collision fragments, and other discarded hardware that come out in space, mostly in Low Earth Orbit and much of the Geostationary Orbit. Such objects range in size from tiny paint flecks unto large, defunct satellites. Among the primary sources of space debris are satellite explosions, accidental

collisions, and the intentional destruction of space objects in anti-satellite tests. Objects orbiting the Earth at high speed will cause great damage even if their size is as small as debris. There have been some serious incidents of space debris. This includes a 2009 collision between the dead Russian satellite Cosmos 2251 and the functional Iridium 33 communications satellite that produced thousands of debris pieces (Weeden & Secure World Foundation, 2010). In 2007, China carried out an anti-satellite missile test that destroyed one of its own weather satellites, producing over 3,000 pieces of debris. These incidents illustrate how collisions could lead to exponential growth in the mass of debris in space (Weeden & Secure World Foundation, 2007).

Unlike Earth's contamination, which is to a certain degree cleanable or controllable, space debris presents a few essential challenges. For example, debris could remain in orbit for years or even centuries. Wherever there is pollution on Earth, it usually stays within a special area, whereas space debris could cover great distances, crossing with operational satellites and spacecraft. Also, the immense speed that space debris travels at makes even the smallest pieces harmful. A piece of debris no larger than a marble would have the impact of a bullet traveling at great speeds because of the speeds involved in orbit, and this is the main problem.

Sources, Risks, and Consequences of Space Debris

Sources of space debris are basically from defunct satellites, rocket stages, and fragmentation following collisions or explosions. Additional debris is generated with increased space activities. The well-known 2009 Iridium-Cosmos collision alone created over 2,000 new trackable pieces, while the 2007 Chinese anti-satellite test is estimated to have produced over 3,000 fragments. Besides, the accumulation of space debris was contributed by the lack of strict rules and international agreements concerning the "expiration date" of satellites.

The most direct hazard of the space debris is their risk of collision with active satellites and spaceships. What is considered that collisions between objects in orbit result in increasing debris, which again can be a chain reaction of further collisions. If left unchecked, consequences could render certain orbits unusable, severely limiting access to space. The consequences of such collisions are serious enough. Not only will vital satellite services such as GPS, weather forecasting, and telecommunications be disturbed, but human space exploration and manned missions also run the risk of being seriously endangered. A collision with space junk could damage or destroy spacecraft, similar to what happened in 1996 when a fragment from a defunct Ariane rocket collided with and damaged a French military satellite (Reichhardt, 2013). Moreover, the International Space Station has done several debris avoidance maneuvers to avoid some potential catastrophic collisions.

Possible Solutions to Space Debris

A number of solutions have been put forward to try and resolve the increasing issue of space debris. Each has its own advantages and disadvantages. These are international practices formulated by agencies such as NASA and the United Nations that help limit new debris generation. Examples include practices for the disposal of satellites when they reach the end of

their life - for instance, moving a dead satellite to a "graveyard orbit" or assuring re-entry into the atmosphere. This method is comparatively cheap and technologically easy, but it is effective only when wide usage and implementation of such technology are adopted. As another solution CubeSATs have huge potential for finding and tracking space debris. The low-cost and small-sized satellites can be launched in large quantities to work cooperatively in monitoring debris, hence providing real-time data to ground stations and cosmic facilities.

Overall, it is highly cost-effective, scalable, and flexible,and also CubeSATs can be integrated with existing satellite constellations with ease. While there are many solutions available, the use of CubeSATs offers a unique approach to the problem. Since there was growth in space debris, measures to prevent cosmic collisions has become the main priority for companies like NASA and ESA. That is why CubeSATs can be launched into space to monitor and track debris, thereby gathering important data for cosmic stations that could avoid collisions. By combining the CubeSAT into a whole space network, space agencies could deal with the issue of accumulated debris even more effectively. This would ensure, right from the start, that no possibility of future collisions occurs and further humans' activity in space develops in a safer way. Thus, CubeSAT assembly is an innovative step toward the purification of the cosmic space and long-term sustainability of Earth's orbital environment.

Current Volume of Space Debris

According to NASA and ESA data, there are over 36,500 objects (*Space Environment Statistics · Space Debris User Portal*, n.d.) larger than 10 cm and about 1 million pieces of debris between 1-10 cm currently orbiting Earth. Though minute, debris in this size range, traveling at high speeds, creates enormous hazards to operational satellites and spacecraft. Low Earth Orbit, where most of the functional satellites are placed, is getting so congested that collisions can occur any time. Our CubeSATs will be equipped with cameras that can detect debris and are focused on mitigating the threat in this congested zone.

Functionality of CubeSAT

Each CubeSAT would be equipped with web cameras, solar panels with a system of tracking light for autonomous work, and GPS to identify and track debris. A constellation of 50 such CubeSATs will help in establishing a wider network that will monitor continuously in real time. Data relayed back to nearby space stations is further transmitted to ground stations for collision avoidance. The GPS position of the debris will be provided by the CubeSATs. Any collision threat detected will be sent as an alert to the satellite operators, thereby allowing them to perform evasive measures. This preventive system costs much less than the damage possible from collision. The debris detection will be done by a web camera system, which can then be translated into the cosmic debris heat map. The example of this heat map is shown in sport technologies (STATSports APEX GPS Tracker). The principle of this work is discussed in Beato et al. (2023).

Data Transmission: Real-time tracking data, including the GPS coordinates and velocity of debris, shall be transmitted by the CubeSAT to ground stations or other space stations like the ISS. For example, there are three main methods currently in use to accomplish this: frequency-division multiple access, time-division multiple access, and code-division multiple access. These technologies were further discussed in research done by Sobolewski (2003).

Data Storage and Updates: All tracking data will be stored and might be refreshed every 24 hours to ensure correct predictions. For instance, data storage will be stored in a SD card that would be placed in a microcomputer.

Material and Design of CubeSAT

It will be built from light and heat-resistant materials, including aluminum 6061 or 7075 (*6.0 Structures, Materials, and Mechanisms - NASA*, n.d.). This ensures the temperature of operations for CubeSATs in space is reached and they are resistant to minimal debris impacts. Small size and low weight mean they will be inexpensive to launch into larger numbers, opening up the option of launching them into groups.

Working MVP model of CubeSAT

The project represents the development of a model of CubeSAT based on principal elements: ESP32-CAM module, Arduino Uno, and several other peripherals. An ESP32-CAM is the most important component in developing the prime element for the CubeSAT debris detection system. This will serve to identify and locate debris with increased functionality in such a way that the located debris is to be marked with high precision. This was achieved through Edge Impulse, where a well-curated dataset from sources such as Kaggle was used to train the onboard machine learning model of ESP32-CAM. Training on Edge Impulse was performed over a couple of hours to achieve the best level of accuracy. The F1 score, accuracy and sample classification output are shown in figure 1.
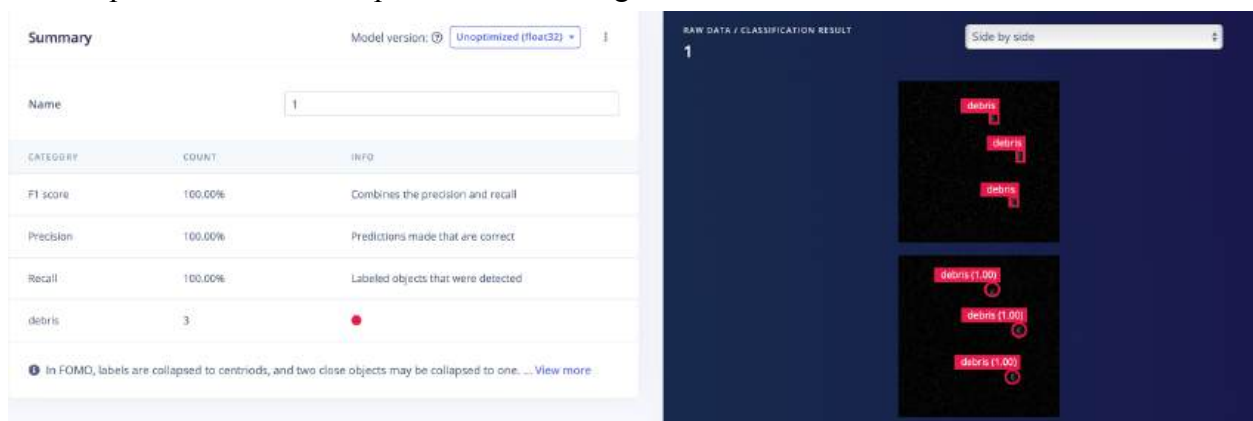

Fig 1: Classification of sample 1 from the open source dataset

The second significant element in the setup is Arduino Uno, which is meant for sun orientation tracking. In summary, the Arduino Uno controls the solar energy harvesting system to ensure work of the ESP32-CAM as a space and orbital debris detector. This subsystem consists

of a solar panel actuated by two servos that allows sun alignment by 2 axes and two photoresistors. It self-aligns to the sunlight for efficient energy capture. In other words, the position of the solar panel depends on light intensity from the photoresistors in order to optimize this energy constant. Other components further enhance the functionality of the CubeSAT: the power bank to store gained energy, servos to provide the rotation of the solar panel, and photoresistors tracking sunlight intensity. All these are connected in such a way as to form a small, compact, highly efficient CubeSAT model.

Purification of space is possible in the future

While the main usage of the CubeSAT is debris detection and tracking, its future variants can be fitted with debris capture mechanisms or launching them into the stratosphere where debris will be burnt - that would be a safer method of debris removal. For example, the debris will be pushed to its release height and then, after undocking, an uncontrolled reentry takes place ending with a burn up of the object and the foam in the atmosphere within a given time frame. The method requires an efficient way to change the orbit between two debris. (Gabriele et al., 2017)

Conclusion

These will enable groups of CubeSATs for the tracking of debris, helping to significantly reduce the risks of collision in space and contributing to the long-term sustainability of space exploration. The key reasons CubeSATs are valid for the management of debris in space are scalability, low cost, and real-time data acquisition, while active debris removal may be another possible future application area. These changes would be fundamental to preserving Earth's orbit for future generations.

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