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BAU 2023

**T.C.
BAHCESEHIR UNIVERSITY
GRADUATE SCHOOL OF EDUCATION
DEPARTMENT OF GRADUATE SCHOOL OF NATURAL SCIENCES**

**COMPARISON OF CRYPTOCURRENCIES AND SUSTAINABLE
ENERGY AS INVESTMENT OPPORTUNITIES.**

MASTER'S THESIS

HAGAR ALILABIB

ISTANBUL 2023

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ISTANBUL 2023

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MASTER THESIS APPROVAL FORM

| | |
|------------------------------------|--|
| Program Name: | Industrial Engineering Masters Program. |
| Student's Name and Surname: | Hagar Alilabib. |
| Name of The Thesis: | Comparision of Cryptocurrencies and Sustainable Energy as Investtment Opportunities. |
| Thesis Defense Date | 7 September 2023 |

This thesis has been approved by the Graduate School, which has fulfilled the necessary conditions as a Master thesis.

.....

...

Institute

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This thesis was read by us, quality and content as a Master's thesis has been seen and accepted as sufficient.

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ABSTRACT

COMPARISON OF CRYPTOCURRENCIES AND SUSTAINABLE ENERGY AS INVESTMENT OPPORTUNITIES

Hagar, Alilabib

Master's Program in Industrial Engineering

Supervisor: Pro. Dr. Gokhan Gelisen

October 2023, 143 pages

This thesis investigates the perception and the potential of cryptocurrencies against energy investments. For this purpose, keywords such as cryptocurrencies, Bitcoin, and Blockchain are defined. A survey has been conducted in four languages Arabic, English, Spanish, and Turkish, to target different audience of different cultures' views on crypto versus energy investments. This paper provides an overview of people's sentiments regarding crypto and energy investments while comparing and contrasting their potential and impacts.

Keywords: Cryptocurrencies, Bitcoin, Blockchain, Sustainability, Energy

ÖZ

KRİPTO PARALARIN VE ENERJİ YATIRIMLARININ GÖRÜNÜMLERİNİ VE POTANSİYELLERİNİ ARAŞTIRARAK BİR YATIRIM FIRSATI OLARAK İNCELEMEK.

Hagar, Alilabib

Endüstri Mühendisliği Yüksek Lisans Programı

Tez Danışmanı: Prof. Dr. Gokhan Gelisen

Ekim 2023,143 sayfa

Bu tez, kripto para birimlerinin enerji yatırımlarına karşı görüşlerini ve potansiyellerini araştırmaktadır. Bu amaçla kripto para birimleri, Bitcoin, Blockchain gibi anahtar kelimeler tanımlanır. Farklı kültürlerden farklı kitlelerin kripto ve enerji yatırımları hakkındaki görüşlerini hedeflemek için Arapça, İngilizce, İspanyolca ve Türkçe olmak üzere dört dilde bir anket gerçekleştirildi. Bu makale, potansiyellerini ve etkilerini karşılaştırırken ve karşılaştırırken, insanların kripto ve enerji yatırımlarıyla ilgili düşüncelerine genel bir bakış sunar.

Anahtar Kelimeler: Kripto para birimleri, Bitcoin, Blockchain

Dedicated to my family,

This thesis has a personal meaning and inspiration behind it. It was inspired by my parents who rose from a middle class and never had investment or retirement plans and barely any saving plans who were very educated but not financially. This research helped me understand what is financial education and how vital it is. It explores investment options, people's behaviour with money, spending, investing and lifestyles. It goes beyond that to sustainability and sustainable awareness and potential investments in energy.



ACKNOWLEDGMENTS

I wish to express my deepest gratitude to my supervisor Prof. Dr. GOKHAN GELISEN, for his guidance, advice, criticism, encouragement, and insight throughout the research.

I would also like to thank my parents, Ali LABIB and Elham HADDAD, for their tremendous support throughout my life. I would also like to sincerely thank my beloved husband, Alfredo ALFONSO, for the immense support he has provided me. Without their understanding and continuous support, I could have never been able to aspire to this level of education and complete this study

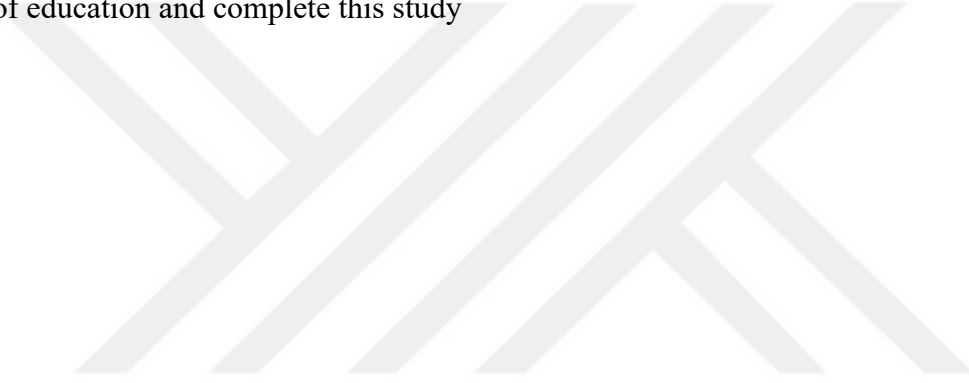


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Chapter 1

Introduction

This thesis examines the perception and potential of cryptocurrencies against energy investment. The survey was conducted in four languages - Arabic, English, Spanish, and Turkish – to investigate how cryptocurrencies and energy investments are perceived by different target groups in different cultures. This thesis provides an overview of testing people’s literacy regarding cryptocurrencies and energy investing while comparing and contrasting their potentials and impacts. Blockchain is the technology that enables the existence of cryptocurrency. Blockchain technology, by definition and according to Investopedia, is a distributed database shared between nodes in a computer network. Typically, as a database, blockchains store information electronically in digital form. Blockchain is best known for playing an essential role in cryptocurrencies like Bitcoin to provide a secure and decentralized record of transactions.

The inspiration for choosing this topic arose amid the pandemic of COVID-19, where cryptocurrencies have witnessed extraordinary flows of demands from crypto platform users, especially with Bitcoin reaching its historical all-time high in November 2021, which demonstrates signs of a recovering economy through increased investing demands. Nevertheless, this growing demand for cryptocurrencies was assumed to act as a hedge against inflation at a forty-year high. With inflation surging worldwide, investing became a must-use tool as a hedge against inflation. To understand how people are coping with inflation, their lifestyle behaviors, their financial management, and their awareness of sustainability and energy are discussed through a series of questions that they were required to answer through a survey that was conducted in four languages- Arabic, English, Spanish, and Turkish. The results are analyzed to comprehend their sentiment, awareness, education, culture, and financial state toward cryptocurrencies and energy. This research also investigates the potential and the impacts of cryptocurrencies and energy in the literature review.

1.1 Theoretical framework. This thesis reviews people's knowledge of cryptocurrencies and energy investments. Additionally, it compares and contrasts their potential and impacts. For this study to be conducted, a survey was conducted in four languages- Arabic, English, Spanish, and Turkish-to explore how cryptocurrencies and energy investments are perceived by different audiences in different cultures. The data from the survey was collected and analyzed using survey monkey with a total of 160 respondents, where 44 of 160 were Arabic speakers, 20 were English speakers, 29 were Spanish speakers, and 67 from Turkish speakers. The collected data was later analyzed to obtain the results.

1.2 Statement of the problem. The surge of inflation negatively affected the value of the USD, which has been decreasing over time, and weaker currencies are losing purchasing power in developing countries. The main motive of this study was the high prices, rising costs, and the economic uncertainties with inflation, Surging to its all-time high in 40 years. This is because, in an inflationary environment, the purchasing power of some consumers will inevitably decline as prices rise unevenly. This reduction in real income is the tremendous cost of inflation. With inflation reaching record highs and, therefore, declining purchasing power, people can no longer afford what they were capable of affording. The consequence of this is a massive drop in their quality of life. On the other hand, several people lack the essential financial education required to protect themselves against inflation.

1.3 Purpose of the study. The primary purpose of this study is to scrutinize people's knowledge of cryptocurrency and energy investments while weighing and contrasting their potential and impacts. To elaborate, this study mainly focuses on two critical topics, cryptocurrencies, and energy. The first purpose is to apprehend how people deal with inflation, their views on investing, and test their awareness of digital currencies. This study also examines the impacts of cryptocurrencies on the environment while assessing their risk-reward potentials compared to energy investments which would achieve the second purpose of this research. For this investigation, a survey was conducted in four languages - Arabic, English, Spanish, and Turkish – on a small group of people to investigate how cryptocurrencies and energy investments are perceived by different target groups in different cultures.

1.4 Hypotheses / Research Questions. The scope of this thesis revolves around examining the perception and potential of cryptocurrencies against energy investment with groups in different cultures. The main questions to be answered in the study is: Do people invest to counteract inflation? What is their awareness of sustainability and digital currencies? How different cultures, age groups, and genders' perceptions of financial and environmental literacy differ. A survey has been conducted with a series of 45 questions in each survey translated into four languages- Arabic, English, Spanish, and Turkish. The survey was collected and analyzed using survey monkey with a total of 160 respondents, where 44 of 160 were Arabic speakers, 20 were English speakers, 29 were Spanish speakers, and 67 from Turkish speakers. Following the analysis, the data was represented in pie and bar chart forms, and statistical significance, including minimum, maximum, mean, median, and standard deviation, was applied to each question in the survey in all four languages.

1.5 Significance of the study. This study is quite unique for several reasons, including the attempt to comprehend people's perceptions towards financial and environmental literacy, digital assets, and energy. Previous research has always been dedicated to scrutinizing how cryptocurrencies negatively impact the environment due to their enormous amount of energy consumption; At the same time, this study covers these impacts as well; it also explores how different age groups of different cultures view investing, saving, digital assets, and energy consumption.

1.6 Definitions.

Asset: An asset is a resource of economic value owned or controlled by an individual, organization, firm, or country with the prospect of future profit. An asset can be considered something that can generate cash flow, reduce expenses, or increase sales in the future, whether it is manufacturing equipment or patents.

Blockchain: is a distributed database shared between nodes in a computer network. Typically, as a database, blockchains store information electronically in digital form. Blockchain is best known for playing an essential role in cryptocurrencies like Bitcoin to provide a secure and decentralized record of transactions.

Bitcoin: Bitcoin, or BTC for short, is a cryptocurrency, or digital currency, that is meant to function as money and a form of payment independent of any one person, organization, or entity, hence eliminating the requirement for third-party involvement in financial transactions. It is awarded to blockchain miners in exchange for their efforts in verifying transactions and can be purchased on numerous platforms.

Cryptocurrency: Commonly known as crypto, which is a digital currency that is an alternative form of payment created using cryptographic algorithms. By using encrypted or cryptographic technology, cryptocurrencies can function both as currency and as virtual accounting systems.

Digital assets: A digital asset is any asset created and stored digitally, is identifiable and traceable, has value, or offers value. Digital assets have gained popularity and have become valuable as technological advances have been integrated into our personal and professional lives. It has been viewed as a proprietary digital asset for a long time. Traditionally, digital assets such as data and scanned documents were owned by companies and used to create value. However, with the advent of blockchain and cryptocurrencies, digital assets have once again been redefined. Anything in digital form can now be used to create value through tokenization on the blockchain.

Inflation: Inflation is an escalation in prices that can be translated as a decrease in purchasing power over time. The purchasing power's declination rate is reflected in the average price increase over a period for a basket of selected goods and services. A price increase, often expressed as a percentage, means that a currency unit buys substantially less than in the previous period. Inflation contrasts with deflation, which occurs when prices fall and purchasing power increases.

Sustainability: The indefinite ability to persist substantially throughout many realms of life is called sustainability. It refers to the capacity of the Earth, the ecosystem, and human civilization to coexist in the twenty-first century.

Blockchain: A distributed database shared between nodes in a computer network. Typically, as a database, blockchains store information electronically in digital form. Blockchain is best known for playing an essential role in cryptocurrencies like Bitcoin to provide a secure and decentralized record of transactions.

Chapter 2

Literature review

2.1 Blockchain Technology

Blockchain technology, by definition and according to Investopedia, is a distributed database shared between nodes in a computer network. Typically, as a database, blockchains store information electronically in digital form. Blockchain is best known for playing an essential role in cryptocurrencies like Bitcoin to provide a secure and decentralized record of transactions. The innovation of blockchain lies in ensuring the accuracy and security of data records and creating trust without the need for trusted third parties. Blockchain technology stores public transaction records, also called "blocks," in multiple databases called "chains" on networks connected by peer-to-peer nodes. This memory is commonly referred to as the "digital ledger." The owner's digital signature approves or verifies all the transactions in this digital ledger. The owner then authenticates the transaction and protects it from tampering. Therefore, the information in the owner's digital ledger is entirely secure from being tampered with. Blockchain is particularly promising and is considered a revolutionary and innovative technology since it aids in mitigating risk and combating possible fraud while providing absolute transparency in a scalable way across multiple applications. To further elaborate, a digital ledger is like a Google spreadsheet shared across multiple computers on the network that stores transaction records based on actual purchases. The fascinating aspect is that everyone can see the data presented yet. It cannot be tampered with in any way.

2.2 Blockchain's History. Milestone events in internet development can divide the process into phases. Among these significant milestones are the establishment of the first wide-area computer networks in the 1960s, the development of an electronic mail system in the 1970s, the establishment of ethernet later in that decade, the establishment of the world wide web in the 1990s, and the establishment of the first browsers and search engines later in that decade, among others. The internet changed dramatically as a result of each of these landmark developments. Each step was critical in developing the internet we know and depend on today. Similarly, it is possible to look back on the evolution of blockchain and divide it into phases denoted by significant developments and advancements. Blockchain technology has only existed or existed for just a fraction of the time that the internet has, so there are likely to be more significant developments to come. Even so, experts have begun classifying blockchain's history into at least three distinct periods.

First Phase: Bitcoin and Digital Currencies

Bitcoin and other digital currencies are included in the first stage. While the insights for the blockchain were circulating in computer science circles, Bitcoin's pseudonymous developer, Satoshi Nakamoto, outlined the blockchain as we know it in the white paper for BTC. As a result, blockchain technology began with the Bitcoin network. While blockchain has been widely utilized in a range of other areas, it was explicitly designed for this digital currency and enhanced digital currencies' objectives more widely.

Second Phase: Smart Contracts

Over the course of time, developers realized that a blockchain could do more than just record transactions. The creators of Ethereum, for example, believed that assets and trust agreements could also benefit from blockchain management. In this context, Ethereum is the second generation of blockchain technology. The establishment of smart contracts was the most substantial innovation brought about by Ethereum. Contracts in the conventional business world are traditionally managed by two separate entities, with other entities assisting in the oversight process. On a blockchain, smart contracts are self-managing contracts. The world may still be in the process of realizing the untapped potential of smart contracts at this point. As a result, whether the world has progressed to the next phase of blockchain development is subject to debate.

Third Phase: The Future

Scalability is a significant issue for blockchain. Bitcoin is still plagued by long transactional times and bottlenecks. Numerous new digital currencies have strived, with varying degrees of success, to revise their blockchains in order to accommodate these issues. Scalability is likely to be among the most significant developments paving the way for blockchain technology in the future. Besides that, new blockchain applications are being discovered and adopted constantly. It is difficult to predict where these advancements will take technology and the cryptocurrency industry as a whole.

2.3 Blockchain and the Global Economy. Numerous investors and analysts saw the 2008 financial crisis as a striking example of what occurs when the financial sector relies excessively on centralized systems. Whereas cryptographers and computer scientists had already devised suggestions for digital cash and some of the techniques used in contemporary cryptocurrencies, the events of 2008 catalyzed the digital currency field as it currently exists. The famous Bitcoin white paper by Satoshi Nakamoto was published in the same year as the financial crisis. Although it is difficult to go back in time, however, numerous blockchain enthusiasts believe that if the new technology had existed earlier in the century, it might have prevented the events of 2008 from occurring in the first place. According to a recent Coin Telegraph report, some members of the cryptocurrency community believe that distributed ledger technology can now help prevent future global financial crises.

On the other hand, for blockchain enthusiasts, the scenario is as specified: Individual banks would no longer be inspected by a central bank to verify their operations and records. Regulators can control cash flows as they occur since there is a shared record of transactions. Corollary, central banks would always have an accurate picture of liquidity and risk distribution. They would also grasp how each unique financial firm operates. This might remove a significant amount of uncertainty from the process of measuring the financial system's health; as a result, authorities would know ahead of time when things were becoming unstable, and they could adjust accordingly before a crisis developed. Blockchain advocates believe that the technology could also deliver countless additional improvements to the financial world's health. This would include fraud and identity theft

prevention, among other things. The technology seems to provide a great deal of potential. Nevertheless, whether and how it could be integrated into the conventional financial scene remains to be seen.

2.4 Blockchain for Trust and Transparency. While the 2008 financial crisis tested society's confidence in large financial institutions, overall trust remains high. Furthermore, transparency is still a massive concern. A considerable portion of the 2008 events was possible due to a severe lack of transparency in giant banks' financial status and indefinite public confidence in those banks. According to the 2018 report by Coin Telegraph, blockchain technology could help prevent future disasters such as the one in 2008. Furthermore, as per the report, if the value and ownership of all assets are securely recorded in a shared ledger that is entirely public and unchangeable, unscrupulous techniques that allowed institutions to conceal their troubles will no longer be viable. Alex Tapscott, a blockchain expert, has also stated that blockchain technology can improve the transparency of capital transfers, hence aiding in preventing future financial crosses.

2.5 Blockchain's Risks and Disadvantages.

Blockchain Technology is not a Distributed Computing System.

For the blockchain to perform efficiently, a network that relies on nodes. The quality of the nodes determines the quality of the blockchain. For instance, Bitcoin's robust blockchain incentivizes nodes to join the network. The same cannot be said for a blockchain network that does not reward nodes. This implies it is not a distributed computing system in which the network is indeed not dependent on the involvement and participation of the nodes.

A distributed computing system, on the other hand, aims at ensuring that transactions are verified as per the rules, that they are recorded, and that they have the transactional history for each transaction. Each of these operations is analogous to the blockchain but lacks synergy, mutual help, and parallel. Evidently, blockchain is a distributed network, but it lacks the elements that make a distributed computing system valuable to organizations.

Scalability is a Major Concern.

The primary concern is that blockchains are less scalable than their centralized counterparts. If an individual ever uses the Bitcoin network, it will be recognized that transactions are processed based on network congestion. This issue is connected to blockchain network scalability issues. Simply put, the more individuals or nodes join the network, the more likely it will slow down.

Nevertheless, there has already been a significant shift in how blockchain technology operates. Scalability solutions are also being introduced into the Bitcoin network as the technology evolves. The key is to conduct transactions outside of the blockchain and solely utilize the blockchain to store and retrieve data.

Some Blockchains Consumes Excessive Amounts of Energy.

Bitcoin was the first to use blockchain technology. It employs the Proof-of-Work consensus algorithm, which relies on miners to do the heavy work. Miners are rewarded by solving challenging mathematical puzzles. The tremendous energy consumption makes these complex mathematical problems unsuitable for real-world applications. When the ledger is updated with a new transaction, the miners must solve the problems requiring a significant amount of energy. However, not all blockchain solutions function in the same way. Other consensus algorithms have already overcome the problem. Permissioned or private networks, for example, do not have these issues because the number of nodes in the network is limited.

Furthermore, whereas global consensus is not required, they use efficient consensus mechanisms to establish an agreement. However, when it comes to the most prominent blockchain network, Bitcoin, a problem still needs to be fixed. To summarize, authorized networks are efficient in energy consumption, but public networks might take a significant amount of energy to remain active.

2.6 Bitcoin. Bitcoin's decentralized ledger is called the blockchain. Despite their unique association, Bitcoin and blockchain are conceptually different. Blockchain technology is responsible for the overall structure that allows Bitcoin transactions to be transmitted and recorded reliably and securely. The blockchain was first prototyped in the early 1990s by computer scientist Stuart Haber and physicist W. Scott Stornetta, who used encryption technology to protect digital documents from data tampering. Haber and Stornetta's work undoubtedly influenced the work of Dave Bayer, Hal Finney, and many other computer scientists and crypto enthusiasts, ultimately leading to the development of the first decentralized electronic payment system (or just the

first). Bitcoin was initially invented by a person (or group of people) going by Satoshi Nakamoto's alias. The goal was to develop a one-of-a-kind digital transactional or payment system that would enable borderless financial transactions to take place, excluding the need for intermediaries such as banks or governments. Bitcoin is highly resilient to fraud due to the distributed architecture provided by blockchain technology, accompanied by cryptographic techniques.

'As a cryptocurrency, I invented Bitcoin,' under the pseudonym Satoshi Nakamoto; the Bitcoin white paper was published in 2008. Although blockchain technology predates Bitcoin, it is a critical component of most cryptocurrency networks. It is a decentralized decentralization responsible for continuously recording all previously identified transactions (chain of blocks). Initially, Bitcoin is the name of a peer-to-peer (P2P) digital currency that is also known as bitcoin (with a lower "b") or simply BTC. Bitcoin is essentially a cryptocurrency, which is a digital currency that is protected by cryptographic techniques. This was the first cryptocurrency to exist and the first Bitcoin block, commonly known as the genesis block (or block 0), which was mined back on January 3, 2009.

Secondly, the Bitcoin decentralized public ledger is referred to as the blockchain. Despite their unique association, Bitcoin and blockchain are conceptually distinct. Blockchain technology is responsible for the overall framework that enables Bitcoin transactions to be broadcasted and recorded trustless and securely. It is crucial to highlight that in this frame of reference, trustless means that the blockchain system does not require any kind of trust to function because it is supported by computer code and mathematical algorithms. As a result, the Bitcoin blockchain functions as a decentralized digital ledger that publicly lists all confirmed BTC transactions. Finally, the term Bitcoin was used to relate to the protocol, which is constantly being developed as open-source software. To prevent unnecessary further misunderstandings, the original Bitcoin client software was officially rebranded as Bitcoin Core in 2014. As open-source software, Bitcoin Core has many contributors from all over the world.

2.7 Bitcoin and Energy. According to Cambridge Center for Alternative Finance (CCAF), bitcoin miners are expected to consume around 130 terawatt-hours of energy (TWh) per year which is around 0.55% of global electricity production. This puts the Bitcoin economy on par with the carbon emissions of small countries like Jordan, Sri Lanka, Malaysia, and Sweden. Ten million people live mainly in Jordan. It is

impossible to say how many people use Bitcoin each month, but data from Coin Metrics shows that more than one million Bitcoin addresses are active daily, out of no less than 106 million active accounts over the past decade, as reported by the Crypto.com exchange.

Energy consumption does not match carbon emissions.

First, there is an essential difference between system energy consumption and CO2 emissions. Determining energy usage is relatively straightforward, but it is impossible to estimate the associated carbon emissions without knowing the exact energy mix. H. Composition of different energy sources used by computers mining bitcoins. For example, one hydropower unit has a much lower environmental impact than the same unit of coal power. Bitcoin's energy consumption is relatively easy to estimate. By looking at the hash rate (i.e., the total computing power used to mine Bitcoin and process transactions), we can make an educated guess about the power requirements of the hardware miners use. Nevertheless, her CO2 footprint is much more difficult to ascertain. Mining is a highly competitive business, and miners are usually not particularly open about the details of their operations. The best estimate of the geolocation of energy production (from which the energy mix can be derived) comes from her CCAF, which worked with significant mining pools to compile an anonymized dataset of miner locations.

Based on this data, CCAF can estimate the energy sources miners use by country, and in some cases, by state. However, their dataset does not include all mining pools, nor is it current, so we still know very little about Bitcoin's energy mix. Moreover, many high-profile analyses generalize the energy mix at the national level, rendering the picture inaccurate for countries such as China, which has highly diverse energy environments. As a result, estimates of the percentage of Bitcoin mining that uses renewable energy vary widely. A December 2019 report suggested that 73% of Bitcoin's energy usage is carbon neutral. This is mainly due to the abundance of hydropower in major mining hubs such as Southwest China and Scandinavia. Meanwhile, according to CCAF estimates for September 2020, that number is approaching 39%. But even if the lower numbers are correct, it's still almost double the size of the US grid, suggesting that looking at energy use alone isn't a reliable way to determine Bitcoin's carbon footprint.

Bitcoin can harness energy not available in other industries.

Another critical factor that sets Bitcoin's energy consumption apart from most other

industries is that Bitcoin can be mined anywhere. Almost all energy consumed worldwide must be produced relatively close to the end user, but Bitcoin has no such constraint, allowing miners to tap into energy sources inaccessible to most other uses. Anyone can take advantage of it.

Hydro is the most famous example of this. An enormous amount of renewable hydropower is wasted yearly during the rainy season in Sichuan and Yunnan provinces. In these regions, production capacity far exceeds local demand, and battery technology is not worth storing energy from these rural areas and transporting it to urban centers where it is needed. These regions most likely represent the most significant single energy resource on the planet, which is why these provinces are China's mining hubs, accounting for nearly 10% of global bitcoin mining during the dry season; it is no coincidence that it is responsible for 50% of the dry season. The dry season is responsible for the wet season.

Another promising avenue for carbon-neutral mining is flaring natural gas. The oil production process releases large amounts of natural gas as a by-product. This is energy that pollutes the environment without reaching the grid. Due to its confinement to remote oilfield locations, most conventional applications to date have not been able to use this energy effectively. Nevertheless, bitcoin miners from North Dakota to Siberia have jumped at the opportunity to monetize this wasted resource. Some companies are looking at ways to further reduce emissions by burning the gas more controlled. Of course, this is still a tiny player in the Bitcoin mining space today, but behind the turnover, a calculation is that there uses enough Flare natural gas to power the entire Bitcoin network only in the US and Canada.

To be fair, monetizing excess natural gas with Bitcoin also creates emissions, and the practice also acts as a subsidy to the fossil fuel industry, allowing energy companies to make more money than they otherwise would. Some argue that it encourages investors to invest in oil exploration. Bitcoin miner earnings, however, are a dip in the bucket compared to demand from other industries that rely on fossil fuels. Given the reality that oil is produced and will continue to be produced for the foreseeable future, exploiting the natural byproducts of the process (and perhaps even reducing its environmental impact) is a positive outcome.

Interestingly, the aluminum smelting industry offers surprisingly relevant parallels. The process of converting natural bauxite ore into usable aluminum is very energy intensive, and the cost of transporting aluminum is often not prohibitive, so many

countries with excess energy are looking to sell their surplus resources. We are building smelters to harness it. Regions with the capacity to produce more energy than they can consume locally, such as Iceland, Sichuan, and Yunnan, have become net energy exporters through an aluminum rice field. Today, these locations have the same conditions that have made smelting investments favorable, making them a prime choice for mining. Bitcoin. Several former aluminum smelters have been converted directly to Bitcoin mining, such as the Alcoa Hydroelectric Plant in Massena, New York.

Mining Bitcoin requires significantly more energy than it uses.

How energy is generated is part of the equation. However, misconceptions about how Bitcoin uses energy and how it may change over time are typical. Many journalists and academics talk about Bitcoin's high "energy cost per transaction," but this metric is misleading. Most of Bitcoin's energy consumption occurs during the mining process. Once the coin is spent, the energy required to validate the transaction is minimal. Therefore, it is illogical to just divide Bitcoin's total energy consumption so far by the number of transactions. Most of that energy was used to mine Bitcoin instead of supporting transactions. Moreover, that leads to a severe final misunderstanding. The energy costs associated with mining Bitcoin will continue to grow exponentially.

Excessive growth unlikely.

Bitcoin's energy footprint is expanding so quickly that some believe it will eventually take over the entire energy grid. This was the premise of his widely publicized 2018 study, recently cited in the New York Times. The study made the shocking claim that Bitcoin will cause the Earth to warm by 2 degrees Celsius. However, there are good reasons to believe that this will not happen. First, as is common in many industries, Bitcoin's energy mix is becoming less carbon dependent each year. Publicly traded and increasingly ESG-focused mining companies have gained market share in the United States, and China recently banned coal mining in Inner Mongolia, one of the largest remaining coal-producing regions. At the same time, many organizations within the mining industry have launched initiatives such as the Crypto Climate Agreement, inspired by the Paris Climate Agreement, to advocate and defend Bitcoin's carbon footprint reduction. And, of course, as renewable options like solar power become more efficient and mining more profitable, Bitcoin could act as a severe incentive for miners to scale up these technologies.

Bitcoin's energy footprint is expanding so quickly that some believe it will eventually

take over the entire energy grid. This was the premise of his widely publicized 2018 study, recently cited in the New York Times. The study made the shocking claim that Bitcoin will cause the Earth to warm by 2 degrees Celsius. However, there are good reasons to believe that this will not happen.

First, as is common in many industries, Bitcoin's energy mix is becoming less carbon dependent each year. In the U.S., publicly traded and increasingly ESG-focused mining companies are gaining market share, and China recently banned coal mining in Inner Mongolia, one of its largest remaining coal-producing regions. Bottom. At the same time, many organizations within the mining industry have launched initiatives such as the Crypto Climate Agreement, inspired by the Paris Climate Agreement, to advocate and defend Bitcoin's carbon footprint reduction. Furthermore, as renewable options like solar power become more efficient and mining more profitable, Bitcoin could act as a severe incentive for miners to scale up these technologies.

Additionally, miners are unlikely to continue expanding their mining operations at the current pace indefinitely. The Bitcoin protocol subsidizes mining, but these subsidies have built-in growth controls. Today, miners receive a small fee for the transactions they validate while mining (accounting for about 10% of a miner's revenue) and a profit margin if they sell their mined bitcoin. However, the protocol is designed to halve the output-driven component of miner revenue every four years. A miner's earnings will eventually drop to zero. Also, in terms of transaction fees, Bitcoin's natural limit on the number of transactions it can process (less than 1 million per day), combined with the limited user tolerance for paying fees, gives us the potential for growth in this revenue stream is restricted. It can be assumed that some miners will continue to operate in exchange for these transaction fees. In fact, the network relies on miners to keep it functioning, but when profit margins decline, the financial incentive to invest in mining naturally diminishes. Of course, there are a myriad of factors that can affect Bitcoin's environmental impact. It is essential to understand that many environmental issues are exaggerated or based on false assumptions and misunderstandings about how the Bitcoin protocol works. This means that when asked, "Is Bitcoin worth its impact on the environment," the actual negative impacts being mentioned about are probably much less than imagined. However, it cannot be denied that Bitcoin (like almost everything that adds value to society) consumes resources. Similar to any other energy-consuming industry, it is vital to recognize and address these environmental issues, work diligently to reduce Bitcoin's

carbon footprint, and ultimately realize the social value Bitcoin provides.

Below in Figure. 1 showing the most recent chart reflecting Bitcoin's current price.

This chart is taken from www.tradingview.com



Figure 1. Updated Bitcoin's price 7 May 2023

(Tradingview,2023)

2.8 Cryptocurrencies and the crypto market.

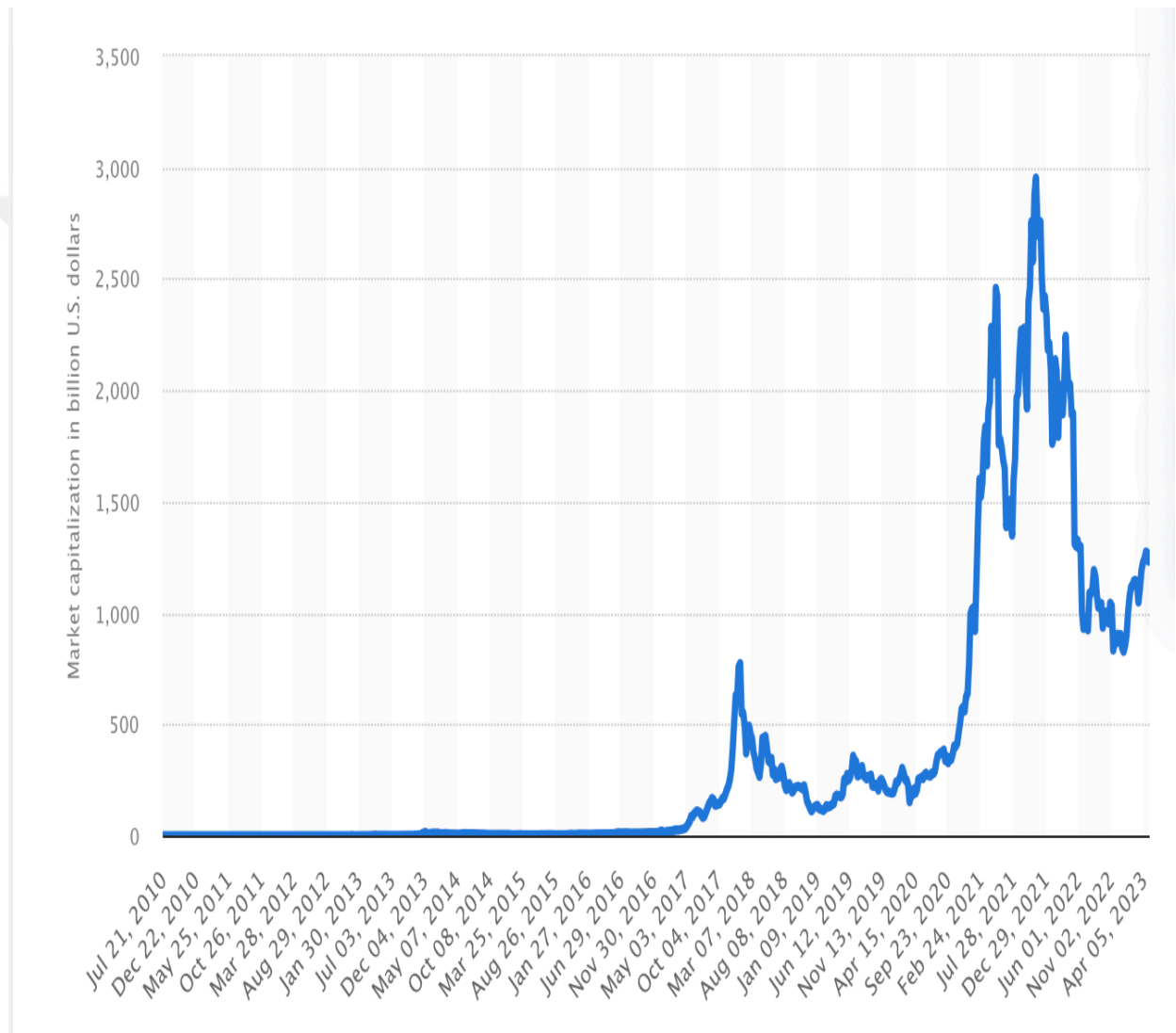


Figure 2. Cryptocurrency market capitalization per week July 2010 to April 2023 (in billion U.S. dollars).

(Statista,2023)












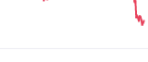












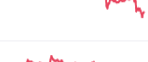




Market capitalization is a financial statistic for publicly listed companies that is calculated by multiplying the share price by the number of outstanding shares. However, cryptocurrency analysts compute it by multiplying the price of virtual

currencies by the number of coins in circulation. This gives cryptocurrency investors a notion of the overall market size, and following the measure's evolution indicates how much money flows in or out of each cryptocurrency. It is projected that the cumulative market cap of cryptocurrencies fell considerably between May 2021 and June 2021 as digital coins became less likely to be used as an investment tool. This was ascribed to China's efforts to reduce mining and the spread of cryptocurrencies within the country. Bitcoin's market capitalization accounted for the vast bulk of total market capitalization, according to statista.com. Following June 2021 until November 2021, cryptocurrencies have witnessed extraordinary flows of demands from crypto platform users, especially with Bitcoin reaching its historical all-time highs in November 2021, placing its market cap at almost three trillion US dollars, which was demonstrating signs of a recovering economy through increased investing demands. However, this growing demand on cryptocurrencies was assumed to act as a hedge against inflation, which is at a forty-year high. Nonetheless, Bitcoin, combined with other cryptocurrencies has proven to be just another speculative asset/s that skyrockets when evangelists get behind it and collapses when enthusiasm wanes and investors get agitated.

2.9 Price volatility in Cryptocurrencies. Apart from excessive energy consumption and e-waste, there are concerns about price volatility associated with Bitcoin and other cryptocurrencies. If the price is higher, bitcoin miners may be willing to operate on clean electricity. But as bitcoin's price falls, profit margins dwindle, meaning industry players are likely to look for the cheapest streams that aren't always the cleanest. We are currently estimating the “cost percentage” of Bitcoin mining, showing that miners spend the majority of their income on electricity. There are also attempts to use Bitcoin for grid demand response, Texas-based ERCOT being a prime example. However, there are concerns about the reliability of Bitcoin miners for these services. If the price is too high, miners will not prioritize limiting power usage, increasing pressure on the power grid, which has been heavily strained in recent years.

According to Coinmarketcap, as of 7 May 2023, attached below is Table 1. Showing today's cryptocurrency prices by market cap with the top fifteen cryptocurrencies.

Table 1. Showing Today's Cryptocurrency Prices, Charts and Market Capitalizations ranked by Market Cap with the Top Fifteen Cryptocurrencies.

| # | Name | Price | 1h % | 24h % | 7d % | Market Cap ¹ | Volume(24h) ¹ | Circulating Supply ¹ | Last 7 Days |
|----|--|---------------|--------|--------|--------|-------------------------|--|---------------------------------|---|
| 1 |  Bitcoin BTC | \$27,861.86 | ▼0.08% | ▼3.75% | ▼2.50% | \$539,611,782,800 | \$15,612,988,864 562,220 BTC | 19,367,400 BTC |  |
| 2 |  Ethereum ETH | \$1,860.32 | ▼0.02% | ▼2.76% | ▲0.67% | \$223,862,032,547 | \$8,855,159,288 4,770,512 ETH | 120,334,908 ETH |  |
| 3 |  Tether USDT | \$1.00 | ▼0.03% | ▼0.06% | ▲0.08% | \$82,156,337,551 | \$26,596,767,113 26,572,995,014 USDT | 82,088,431,876 USDT |  |
| 4 |  BNB BNB | \$316.79 | ▼0.28% | ▼2.39% | ▼5.47% | \$49,375,510,964 | \$686,498,787 2,168,212 BNB | 155,861,219 BNB |  |
| 5 |  USD Coin USDC | \$0.9999 | ▼0.02% | ▼0.01% | ▲0.00% | \$30,361,965,722 | \$3,652,097,264 3,652,075,291 USDC | 30,365,657,254 USDC |  |
| 6 |  XRP XRP | \$0.436 | ▼0.21% | ▼5.03% | ▼6.48% | \$22,603,379,321 | \$979,913,869 2,248,335,807 XRP | 51,837,820,505 XRP |  |
| 7 |  Cardano ADA | \$0.3702 | ▲0.04% | ▼3.12% | ▼5.09% | \$12,893,795,463 | \$246,304,339 666,918,898 ADA | 34,833,643,626 ADA |  |
| 8 |  Dogecoin DOGE | \$0.07478 | ▼0.35% | ▼2.93% | ▼5.27% | \$10,414,219,243 | \$315,975,364 4,226,316,753 DOGE | 139,260,276,384 DOGE |  |
| 9 |  Polygon MATIC | \$0.9366 | ▼0.00% | ▼4.41% | ▼4.18% | \$8,662,867,802 | \$391,331,706 418,292,432 MATIC | 9,249,469,069 MATIC |  |
| 10 |  Solana SOL | \$21.25 | ▼0.02% | ▼4.21% | ▼4.44% | \$8,391,834,046 | \$490,739,014 23,114,045 SOL | 394,890,158 SOL |  |
| 11 |  Polkadot DOT | \$5.45 | ▲0.17% | ▼4.13% | ▼6.25% | \$6,437,562,469 | \$138,942,151 25,520,898 DOT | 1,181,733,158 DOT |  |
| 12 |  TRON TRX | \$0.06832 | ▲0.16% | ▼2.25% | ▼0.76% | \$6,184,186,542 | \$201,918,531 2,959,261,587 TRX | 90,521,428,769 TRX |  |
| 13 |  Binance USD BUSD | \$1.00 | ▲0.00% | ▼0.02% | ▲0.12% | \$5,969,680,986 | \$2,691,499,234 2,689,929,114 BUSD | 5,965,614,740 BUSD |  |
| 14 |  Litecoin LTC | \$81.53 | ▲0.17% | ▼3.00% | ▼6.97% | \$5,941,135,514 | \$518,849,219 6,372,545 LTC | 72,874,464 LTC |  |
| 15 |  Shiba Inu SHIB | \$0.000009025 | ▲0.05% | ▼4.33% | ▼9.58% | \$5,320,422,272 | \$148,495,458 16,457,194,623,545 SHIB | 589,539,336,573,628 SHIB |  |

2.10 Sustainability. The definition of sustainability is not as relatively straightforward as it might seem, likewise with the definition of sustainable development. The fact that there are hundreds of distinct definitions for what defines sustainability and sustainable development is a good illustration of this. The indefinite ability to persist substantially throughout many realms of life is referred to as sustainability. It refers to the capacity of the Earth and the ecosystem, and human civilization to coexist in the twenty-first century. On the other hand, Sustainable Development has been the current development catchphrase during the last few years. It has been adopted as the new development paradigm by a wide variety of nonprofit and governmental organizations. Sustainable development is a framework for achieving human development goals while preserving natural systems' ability to supply the natural resources and ecosystem services that the economy and society rely on. In simple words, sustainability is the key to the survival of all humans on this planet. At the same time, sustainable development is the development that satisfies current demands without jeopardizing future generations' capacity to meet their own. Sustainability refers to the Earth's inherent life-supporting system's capacity to adapt to changing conditions. Human activities significantly impact the Earth's natural environment and ecosystem. Therefore, these activities should be conducted without deteriorating or degrading the quality or function of the biological system. In civil engineering and construction management, the concept of sustainability is becoming more prevalent. Construction engineering and management encompass all stages of a building's life cycle, such as design, construction planning and management, construction works, maintenance, and rehabilitation of structures or infrastructure items.

2.11 Sustainability Traces and Background. From the dawn of civilization to the present, the history of sustainability tracks human-dominated ecological systems. This history is marked by a society's growing regional prosperity, followed by crises that were either addressed, resulting in sustainability, or not, resulting in decline. Since the 18th century, interest has been increasing in the environment. The conception of the idea of "sustainability," or "Nachhaltigkeit" in German, can be traced back to Hans Carl von Carlowitz between 1645–1714. Carlowitz suggested proposals for the forest's "sustainable use." His belief that just as much wood should be harvested as can be

regrown through planned or organized reforestation initiatives became a guiding concept in contemporary forestry. Coal was utilized to power increasingly efficient engines and eventually create electricity. In the mid-twentieth century, a growing environmental movement highlighted that the numerous material gains that were now being experienced had ecological consequences. The energy crises of 1973 and 1979 revealed how reliant the global society had become on nonrenewable energy supplies. The threat presented by the human-induced increased greenhouse effect, primarily caused by forest clearance and the combustion of fossil fuels, is becoming more widely recognized in the twenty-first century.

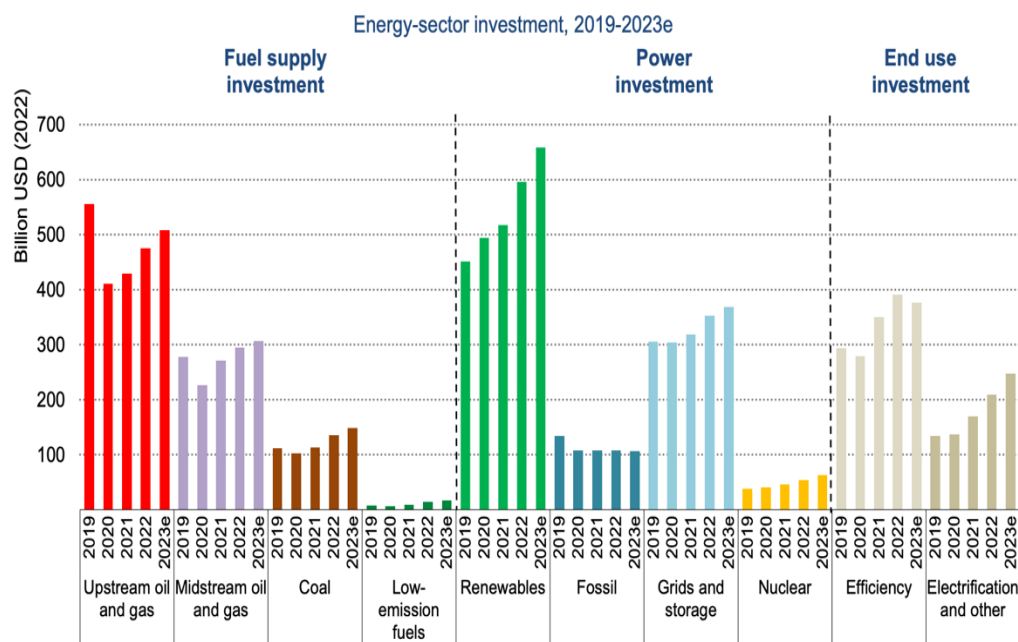
2.12 Sustainable Construction. The technique of building a healthy environment based on ecological principles is known as sustainable construction. Professor Charles J. Kibert states that sustainable building is based on six principles: "conserve, reuse, recycle/renew, protect nature, develop non-toxic and high-quality materials." Furthermore, sustainable construction should not cease once construction is over; the structure should have a lower environmental effect during its lifecycle. This indicates that components in the building design should have a long-term positive impact on the building's ecological impact. Proper insulation to minimize heat loss, solar panels to reduce energy use, and long-lasting building materials are just a few examples. Sustainable construction aims to decrease the industry's environmental effects by implementing sustainable development methods, increasing energy efficiency, and deploying green technologies. Although many business sectors strive to become far more sustainable, the construction industry is unique. It could have a substantial impact on how these practices are implemented. This is due to the industry's enormous use of resources and energy. Below are a few methods that can be followed or taken as a guide towards transitioning into sustainable construction.

2.13 Centralized and Decentralized Finance. Centralization as a concept refers to the centralization of economic decision-making rather than the dispersal of such decision-making across numerous distinct decision-makers in a country; this is accomplished by the acceptance of a centrally planned economy in which the state agrees to own, control, and direct resources to specific uses. Centralization entails senior executives retaining responsibility for all critical decisions and delivering precise instructions to particular divisions and departments. According to

Investopedia, Decentralized finance (Defi) is an emerging financial technology built on secure distributed ledgers, quite similar to those utilized by cryptocurrencies. Defi system eliminates banks' and institutions' control over money, financial products, and financial services. It's important to note that while Defi aids in eliminating control from external parties, it does not provide anonymity. The transactions may not bear the identity of an individual or an organization, but they can be traced by the companies that have access to them. These entities could be governments, police enforcement, or other organizations that exist to defend people's financial interests.

2.14 World investments in Energy. According to yahoo finance, in 2022, the energy sector is a \$6 trillion industry that employed approximately 6.8 million people in the United States. The energy industry can be split into two significant subgroups: non-renewable or conventional energy and renewable energy. Non-renewable energy includes oil and gas products, nuclear power, and coal. Renewable energy sources include wind, biofuels, hydro, and solar.

Increases across almost all categories push anticipated spending in 2023 up to a record USD 2.8 trillion



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Notes: "Low-emission fuels" include modern liquid and gaseous bioenergy, low-emission hydrogen and low-emission hydrogen-based fuels; "Other end use" refers to renewables for end use and electrification in the buildings, transport and industrial sectors. The terms grids and networks are used interchangeably in this report and do not distinguish between transmission and distribution; 2023e = estimated values for 2023.

Figure 3. Bar graph showing energy-sector investment, 2019-2023.

(International Energy Agency, 2023)

2.15 The Conventional Energy Market. In 2022, excluding nuclear energy, conventional energy accounted for 85% of the world’s energy supply. According to a McKinsey report, global coal demand peaked in 2013 and will accelerate again in 2021. However, demand is expected to decline after that. Moreover, the International Energy Agency (IEA) predicts that US coal-fired power generation will fall from 20% in 2022 to 17% in 2024. Regarding fossil fuels, oil, and natural gas are the most used energy sources. According to the IEA, global oil demand is expected to rise by 1.9 million barrels per day to a record of 101.7 million barrels per day. The most needed is kerosene, at 840,000 barrels per day. McKinsey expects global oil demand to peak between 2023 and 2025. However, it is expected to decline by 35-50% by 2050 due to the global shift to renewable energy sources. The rise in electric vehicles is expected to significantly reduce demand, according to the IEA, which is expected to account for 60% of new car sales by 2030. According to the International Energy Agency (IEA), global gas demand was 87.9 billion cubic feet per day. According to a McKinsey report, it will likely grow 10-20% through 2035, after which it will likely begin to decline. In conventional energy markets, the current global market leader in is now Exxon Mobil Corporation (NYSE: XOM), Chevron Corporation (NYSE: CVX) and Shell plc (NYSE: SHEL). Below is Figure 4 and Table 2. Showing the world’s fuel supply investment from 2019 to 2023.

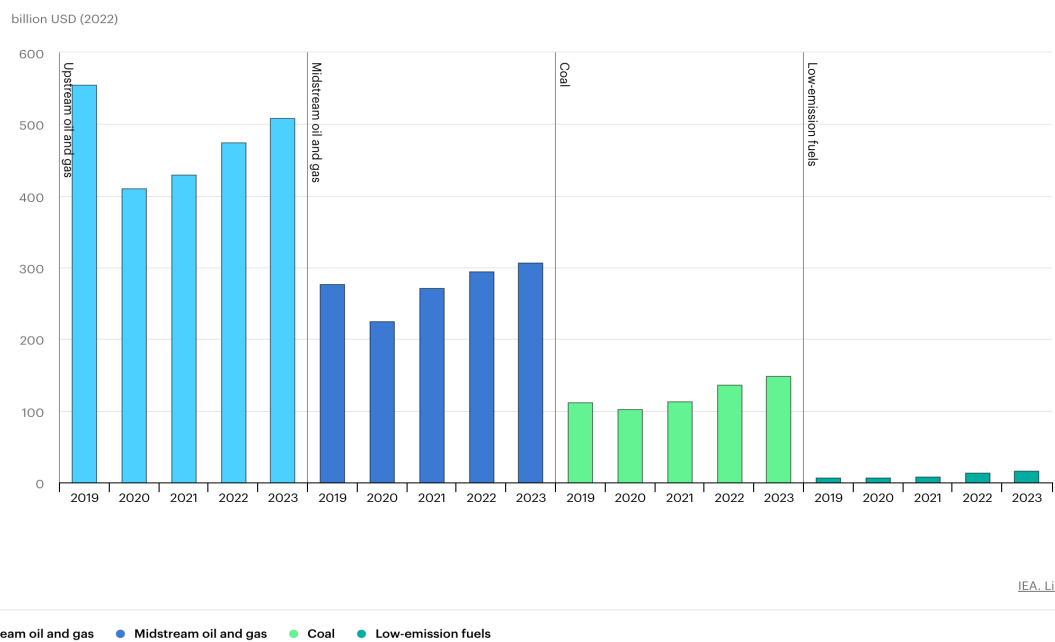


Figure 4. Bar chart showing fuel supply investment 2019-2023

(International Energy Agency, 2023)

Table 2. Showing Fuel Supply Investment

fuel-supply-investment-2019-2023

| Source: IEA. Licence: CC BY 4.0 | | | | |
|---|----------------------|-----------------------|------|--------------------|
| This data is subject to the IEA's terms and conditions: https://www.iea.org/t_c/termsandconditions/ | | | | |
| Units: billion USD (2022) | | | | |
| | Upstream oil and gas | Midstream oil and gas | Coal | Low-emission fuels |
| 0 | 555 | | | |
| 1 | 411 | | | |
| 2 | 429 | | | |
| 3 | 474 | | | |
| 4 | 508 | | | |
| 5 | | 277 | | |
| 6 | | 225 | | |
| 7 | | 271 | | |
| 8 | | 294 | | |
| 9 | | 307 | | |
| 10 | | | 112 | |
| 11 | | | 102 | |
| 12 | | | 113 | |
| 13 | | | 136 | |
| 14 | | | 148 | |
| 15 | | | | 7 |
| 16 | | | | 7 |
| 17 | | | | 8 |
| 18 | | | | 14 |
| 19 | | | | 17 |

2.16 The Renewable Energy Market. The global renewable energy market was worth US\$881.7 billion in 2020 and is expected to grow to nearly US\$2 trillion by 2030 at a CAGR of 8.4% due to decarbonization, making energy. The sector is expected to grow at an annual rate of 4%. According to Allied Market Research, annual investment in supply and production is most likely to reach \$1.5 trillion to \$1.6 trillion by 2035. Electrification is the first step towards decarbonizing the energy mix. Power generation from wind, solar, and hydrogen will account for nearly 50% of the global electricity mix by 2035 and is expected to grow to 85% by 2050. Additionally, green hydrogen is expected to account for 28% of renewable energy sources—an increase in global electricity demand by the end of the forecast period. In the article, we have already mentioned the decline in coal power generation. The IEA expects this problem to be offset by renewable energy sources, as their share will increase from 22% in 2022 to 24% in 2024. With the growing demand for renewable energy, significant players in the traditional energy market are also switching to renewable energy. Major oil companies also have contracts with BP p.l.c. Started investing in renewable energy projects. (New York Stock Exchange: BP) was among the first to make significant investments. Among the companies currently targeting global giants in the renewable energy space are NextEra Energy, Inc. (New York Stock Exchange: NEE), Enbridge Inc. (NYSE: ENB) and Duke Energy Corporation (NYSE: DUK), and some others.

In Renewables, solar and EVs are leading the expected increase in clean energy investment in 2023.

Below Figure 5 and Table 3 Showing annual clean energy investment from 2015 to 2023.

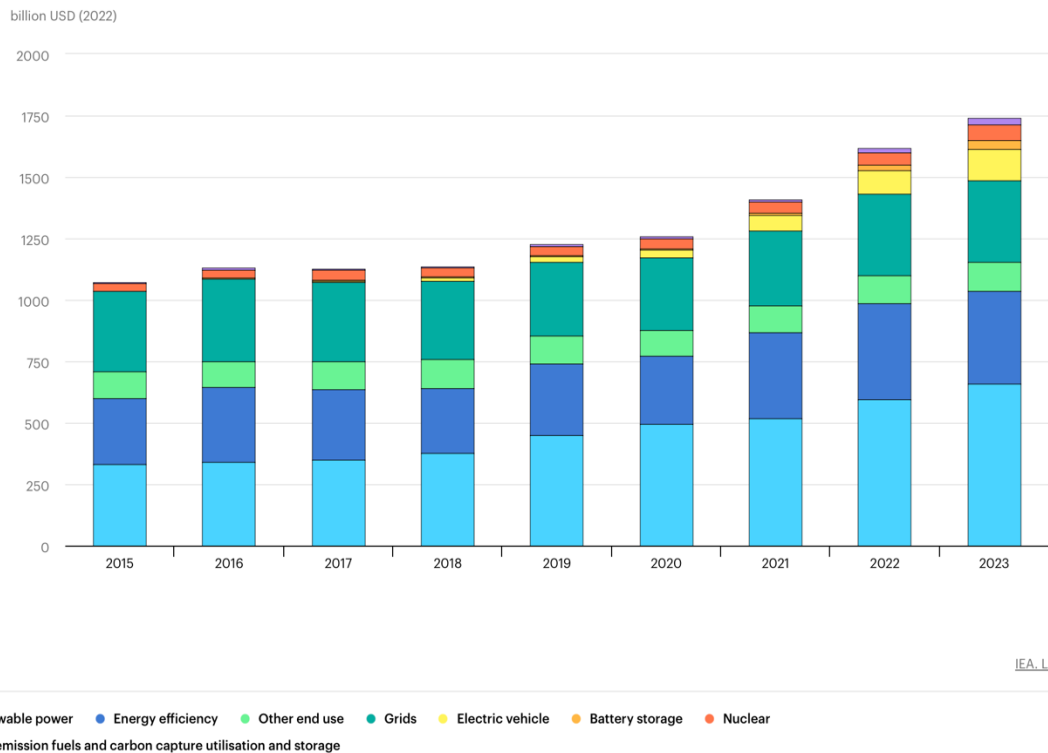


Figure 5. Bar chart showing annual clean energy investment from 2015 to 2023.

(IEA,2023)

Table 3. Showing Annual Clean Energy Investment From 2015 to 2023.

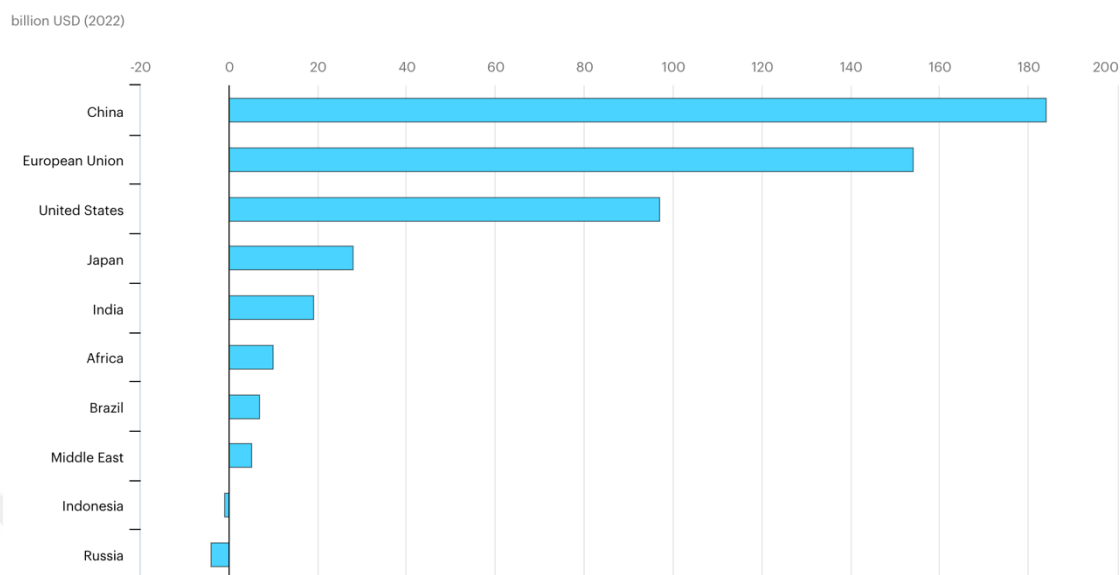
Source: IEA. License: CC BY 4.0 This data is subject to the IEA's terms and conditions: <https://www.iea.org/termsandconditions/>

annual-clean-energy-investment-2015-2023

| Units: billion USD (2022) | Renewable power | Energy efficiency | Other end use | Grids | Electric vehicle | Battery storage | Nuclear | Low-emission fuels and carbon capture utilisation and storage |
|---------------------------|-----------------|-------------------|---------------|-------|------------------|-----------------|---------|---|
| 2015 | 331 | 271 | 109 | 325 | 0 | 2 | 29 | 7 |
| 2016 | 340 | 304 | 106 | 336 | 1 | 3 | 35 | 7 |
| 2017 | 351 | 287 | 110 | 326 | 5 | 3 | 39 | 7 |
| 2018 | 377 | 264 | 118 | 317 | 14 | 5 | 36 | 6 |
| 2019 | 451 | 292 | 113 | 300 | 21 | 5 | 37 | 7 |
| 2020 | 494 | 278 | 107 | 296 | 29 | 7 | 40 | 7 |
| 2021 | 517 | 349 | 110 | 308 | 60 | 10 | 45 | 8 |
| 2022 | 596 | 391 | 114 | 332 | 95 | 21 | 53 | 15 |
| 2023 | 659 | 377 | 118 | 331 | 129 | 37 | 63 | 26 |

<https://www.iea.org/termsandconditions/>Units:

Figure 6 and Table 4. Showing the increase in annual clean energy investment in selected countries and regions from 2019 to 2023



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Figure 6. Bar chart showing the increase in the annual clean energy investment from 2019 to 2023.

(IEA, 2023)

Table 4. Showing the Increase in the Annual Clean Energy Investment From 2019 to 2023.

increase-in-annual-clean-energy-investment-in-selected-countries-and-regions-2019-2023

| Source: IEA. Licence: CC BY 4.0 | |
|---|--------------------------------|
| This data is subject to the IEA's terms and conditions: https://www.iea.org/termsandconditions/ | |
| Units: billion USD (2022) | |
| | Annual clean energy investment |
| China | 184 |
| European Union | 154 |
| United States | 97 |
| Japan | 28 |
| India | 19 |
| Africa | 10 |
| Brazil | 7 |
| Middle East | 5 |
| Indonesia | -1 |
| Russia | -4 |

The recovery from the COVID-19 pandemic and the response to the global energy crisis has significantly boosted investment in clean energy globally. The driving force behind clean energy investments emerges from a strong alignment of costs, climate and energy security goals, and industrial strategy. Below is Figure 7 and Table 5 showing the global energy investment in clean energy and fossil fuels from 2015 to 2023.

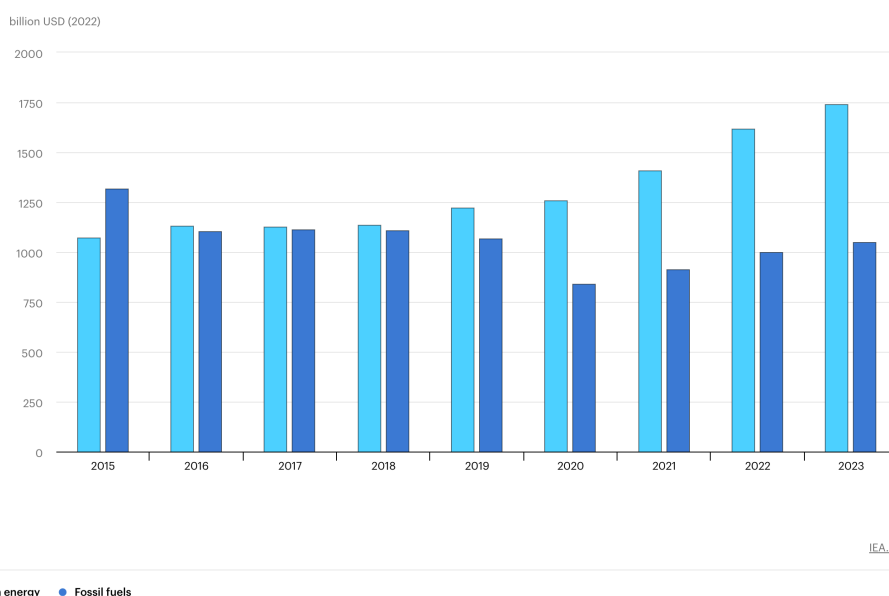


Figure 7. Bar chart showing the global energy investment in clean energy and fossil fuels from 2015 to 2023.

(IEA,2023)

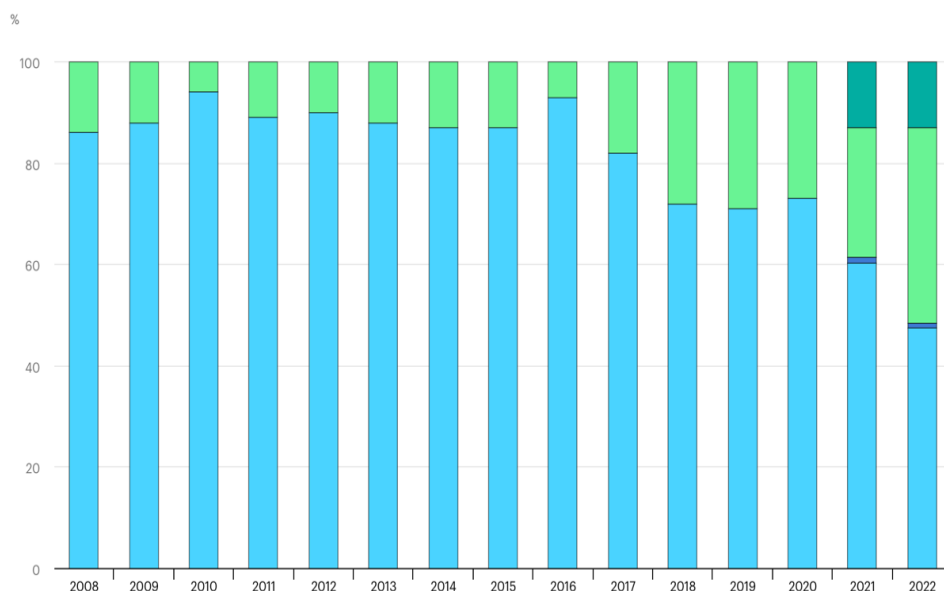
Table 5. Showing the Global Energy Investment in Clean Energy and Fossil Fuels From 2015 to 2023

global-energy-investment-in-clean-energy-and-in-fossil-fuels-2015-2023

| Source: IEA. Licence: CC BY 4.0 | | |
|---|--------------|--------------|
| This data is subject to the IEA's terms and conditions: https://www.iea.org/t_c/termsandconditions/ | | |
| Units: billion USD (2022) | | |
| | Clean energy | Fossil fuels |
| 2015 | 1074 | 1319 |
| 2016 | 1132 | 1105 |
| 2017 | 1129 | 1114 |
| 2018 | 1137 | 1109 |
| 2019 | 1225 | 1066 |
| 2020 | 1259 | 839 |
| 2021 | 1408 | 914 |
| 2022 | 1617 | 1002 |
| 2023 | 1740 | 1050 |

Source: IEA. License: CC BY 4.0 This data is subject to the IEA's terms and conditions: https://www.iea.org/t_c/termsandconditions/Units:

Less than half of the oil and gas industry’s unprecedented cash flow from the energy crisis goes back into traditional supply and only a tiny fraction to clean technologies. Below is Figure 8 and Table 6 showing the distribution of cash spending by the oil and gas industry from 2008 to 2022.



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● Oil and gas capital expenditure ● Low-carbon capital expenditure ● Dividends plus buybacks minus issuances ● Net debt repaid

Figure 8. Bar chart showing the distribution of cash spending by the oil and gas industry from 2008 to 2022. (IEA, 2022)

Table 6. Showing the Distribution of Cash Spending By the Oil and Gas Industry From 2008 to 2022.

distribution-of-cash-spending-by-the-oil-and-gas-industry-2008-2022

| Source: IEA. Licence: CC BY 4.0 | | | | |
|---|---------------------------------|--------------------------------|---|-----------------|
| This data is subject to the IEA's terms and conditions: https://www.iea.org/L/c/termsandconditions/ | | | | |
| Units: % | | | | |
| | Oil and gas capital expenditure | Low-carbon capital expenditure | Dividends plus buybacks minus issuances | Net debt repaid |
| 2008 | 86 | 0 | 14 | 0 |
| 2009 | 88 | 0 | 12 | 0 |
| 2010 | 94 | 0 | 6 | 0 |
| 2011 | 89 | 0 | 11 | 0 |
| 2012 | 90 | 0 | 10 | 0 |
| 2013 | 88 | 0 | 12 | 0 |
| 2014 | 87 | 0 | 13 | 0 |
| 2015 | 87 | 0 | 13 | 0 |
| 2016 | 93 | 0 | 7 | 0 |
| 2017 | 82 | 0 | 18 | 0 |
| 2018 | 72 | 0 | 28 | 0 |
| 2019 | 71 | 0 | 29 | 0 |
| 2020 | 73 | 0 | 27 | 0 |
| 2021 | 61 | 1 | 26 | 13 |
| 2022 | 48 | 1 | 39 | 13 |

The driving force behind clean energy investments emerges from a strong alignment of costs, climate and energy security goals, and industrial strategy.

Recovery from the recession caused by the pandemic, the new coronavirus infection, and dealing with the global energy crisis was vital in encouraging investment in clean energy. A comparison of forecasts for 2023 with data from 2021 shows an Increase in Annual Clean Energy Investment much faster than fossil fuel investments over this period (24% vs.15%). IEA analysis shows what times of intense volatility have been like the fossil fuel market caused by Russia's invasion of Ukraine has accelerated the momentum behind the transition towards a range of clean energy technologies, even as it also sparked a short-term scramble for oil and gas supply. IEA estimates that about US\$2.8 trillion will be invested in energy in 2023. Over \$1.7 trillion will go into clean energy, including renewable energy, nuclear power, power grids, storage, low-emission fuels, efficiency improvement, and end use of renewable energy and electrification. The remaining \$1 trillion-plus continues to flow unabated into fossil fuels. Fuel supply and power, of which about 15% is coal, the rest is coal, oil, and gas. For every \$1 spent on fossil fuels, \$1.7 is now spent on clean energy. This ratio was 1:1 five years ago.

Inflation control laws and new initiatives in Europe, Japan, China, etc. Strong alignment of climate and energy security goals, especially in import-dependent economies. Focus on industrial strategies as countries seek to strengthen their position in the emerging clean energy economy. This momentum is being driven by renewable energy and electric vehicles, with other sectors such as batteries, heat pumps, and nuclear power also making significant contributions. By 2023, low-emission electricity is expected to account for nearly 90% of total power generation investment. Solar power is the frontrunner, with more than \$1 billion a day in 2023 (his \$380 billion for the entire year) expected to spend on solar power, significantly exceeding upstream oil spending for the first time. Consumers are also investing in more electrified end uses. The demand for electric vehicles is soaring, with sales hitting a record high in 2022, and is anticipated to grow by more than a third just this year. Consequently, investment in EVs (defined as additional EV spending compared to the average price of vehicles sold) has increased in certain countries)

and will more than double from 2021 onwards, reaching \$130 billion in 2023. Global sales of heat pumps are experiencing double-digit growth from 2021 onwards.

The expected increase in fossil fuel investment in 2023 is unevenly distributed worldwide. Less than half of the cash flow available to the oil and gas industry goes toward new supply.

2022 has witnessed extreme profits for many fossil fuel companies, with earnings skyrocketing due to high fuel prices. Net revenues from fossil fuel sales have more than doubled on average in recent years, with global oil and gas producers receiving about \$4 trillion. Based on IEA analysis, investment in the available supply of fossil fuels is set to increase by more than 6% to \$950 billion in 2023, based on analyzing the issued spending plans of all large and medium-sized oil, gas, and coal companies. Upstream oil and gas will account for the largest share of this, with investment expected to be absorbed by cost inflation by 7% in 2023 to exceed \$500 billion. Several large oil and gas companies have disclosed plans to increase spending in pursuit of record profits. However, long-term demand uncertainty, cost concerns, and pressure from many investors and owners to focus on earnings over production growth have pushed the Middle East's major national oil companies to spend in 2023 is expected to increase significantly compared to 2022. Moreover, it is the only place the industry spends more than before the pandemic.

A significant increase in spending on new oil and gas shipments accounted for less than half the cash flow available to the oil and gas industry. From 2010 to 2019, three-quarters of cash outflows were typically invested in new products. It's now less than half, mostly going to dividends, share buybacks, and debt repayments. The oil and gas industry's investment in low-emission energy sources is less than 5% of its upstream investment. This metric varies widely from company to company but is often in the double digits for large European companies. Industry investment in clean fuels such as bioenergy, hydrogen, and CCUS has increased in response to more supportive policy measures. Still, it remains well below levels that must be reached in climate-driven scenarios. Coal supply investment is projected to increase by 10% in 2023, well above pre-pandemic levels. Investment in new coal plants continues to decline, but 40 GW of new coal plant approvals in 2022 set a red flag, the highest since 2016. Almost

all of these are in China, reflecting the political upsurge. Energy dies becoming a higher priority, despite China's widespread adoption of various low-emission technologies following severe electricity market tensions in 2021 and 2022.

Russian Invasion of Ukraine.

Russia's invasion of Ukraine was one of the most exciting events that created perplexity in global conventional energy markets, as much of Europe relied on Russian fuels. The invasion prompted U.S. President Joe Biden to issue an executive order banning imports from Russia, and Britain followed suit. The European Union did not wholly stop imports because of Russia's dependence on fossil fuels but decided to reduce imports by about two-thirds, mainly in response to reluctance by Germany and the Netherlands. In 2021, Russia accounted for 13% of global crude oil supply, 45% of global natural gas imports, and 40% of European Union demand. In addition, the country accounted for nearly 18% of world coal imports. The above decisions have reduced global fossil fuel supplies and significantly increased demand. As a result, oil prices rose from \$76 per barrel at the beginning of the year to \$110 per barrel in March 2022. Heading into 2023, S&P Global expects global oil supply and demand to balance gradually. Nevertheless, the impact of Russia's oil freeze is more severe than expected, and it will take years for global markets to return to normal levels. The company expects growth to slow in 2023 to 1.7 million barrels per day compared to 4.5 million per day last year. Nevertheless, fuel commodity prices are expected to decline throughout the year.

Chapter 3

Methodology

3.1 Research design. This study follows an interview format by conducting a questionnaire with 45 questions constructed in four languages – Arabic, English, Spanish, and Turkish. The surveys were distributed to targeted participants depending on their first languages to be able to fill out the survey accordingly. The total number of participants who agreed to fill out the surveys was 160 participants, where 44 of them were Arabic speakers, 20 were English speakers, 29 were Spanish speakers, and

67 were Turkish speakers. A Cross-sectional study design is a type of research design that this study followed, which is a kind of observational study design. In cross-sectional studies, the investigator or the researcher measures the outcome and the exposures in the study participants at the same time. A type of Cross-sectional study was chosen for this research given its tendency to be relatively faster and inexpensive to conduct. The reason for this is that conducting a study in four languages is demanding in terms of linguistic skills and terms of communication with the participants. All questionnaires were checked repeatedly by first-language Arabic, English, Spanish, and Turkish speakers to ensure that all questions were clearly translated into the correct form so all participants could comprehend them clearly.

3.2 Setting and participants /Target population and participants. This section solely focuses on the participants of this study. In this section, the number of respondents and the participants of the study characterized by gender, race/ethnicity, and socioeconomic status will be discussed, in addition to how were the participants' confidentiality and privacy will be protected. Firstly, the total number of responses collected was 160, where 44 were Arabic speakers, 20 were English speakers, 29 were Spanish speakers, and 67 were Turkish speakers. The questionnaires were prepared in four languages- Arabic, English, Spanish, and Turkish to target participants that speak different languages from cultures with a variety of socioeconomic statuses. The surveys were distributed to participants only above 18 years, with no age limit above 18 years old. Secondly, each participant was given four survey links with each language written on every link to help them choose in which language they could fill their questionnaires effortlessly. The participants were also asked to fill out their surveys in their first language to analyze the results most efficiently since 77.5 % of the participants speak more than one language, and 22.5% speak two languages and above. 77.5% is a significant percentage of the participants. Therefore, all participants were required to fill out their questionnaires in their first language out of the four language options.

3.3 Procedures

3.3.1 Data collection instruments. The instruments used to collect the data required

for this research heavily relied on a specifically customized questionnaire with a series of 45 questions. The questionnaire was developed precisely to focus on the scope of this research, which included vital elements such as personal information such as gender, age, regional origin, and current location for proper personal identification. Subsequently, social status, education level, and profession-related questions were asked. In the second part of the questionnaire, questions related to financial literacy, cryptocurrencies, investments, and savings were asked. In the third part of the survey, sustainability-associated questions were asked to understand their consciousnesses on sustainability; these questions discussed their spending, saving, transportation, and social and leisure behaviors, and one crucial question was asked, ‘Would you invest in crypto or energy?’

3.3.2 Data collection procedures. The data required for this research was collected as follows: The questionnaire was prepared for the survey in a specific structure that highlighted the scope of this research, which is explained in the section above. Subsequently, the questionnaire was distributed to a population mainly concentrated in the targeted regions, including the Middle East, Europe, Africa, and America. This spotlights the main reason behind creating the survey in four languages, in such a manner that, the questionnaire can smoothly be communicated to the targeted audience in a manner that is parallel to achieving the goal of the research.

Consequently, the survey was distributed across social media accounts such as WhatsApp, Instagram, Telegram, LinkedIn, and Gmail. The amount of audience that received the survey cannot be quantified given that the survey was spread across different platform and several people. However, the total amount of responses received were 160 responses where 44 of 160 were Arabic speakers, 20 were English speakers, 29 were Spanish speakers and 67 from Turkish speakers. The data collection process lasted for months, given the natural process of any sort of data collection procedure and the limitations that were explained in detail in the limitation section. It is important to note that at the beginning of each survey, all participants were informed of the purpose of the study and that their data would be kept completely anonymous. This information is attached below in the four languages.

Turkish

Bu çalışma Bahçeşehir Üniversitesi Endüstri Mühendisliği Bölümü ve Yapı İşletmesi Yüksek Lisans Programı için hazırlanmıştır. Çalışmanın amacı, yatırımcıların kripto

paralara ve enerji yatırımlarına karşı görüşlerini araştırmaktır. Anket sadece eğitim amaçlıdır ve tüm bilgiler anonim tutulacaktır.

<https://www.surveymonkey.com/r/H7ZP6Q6>

English

This study is conducted for the Bahcesehir University, Department of Industrial Engineering and Construction Management Program. The purpose of this study is to understand the approaches of investors toward cryptocurrencies and energy investments. This survey is for educational purposes only; all information will be kept anonymous.

<https://www.surveymonkey.com/r/T2V6DRB>

Spanish

Este estudio se realiza para la Universidad de Bahcesehir, Maestría Departamento de Ingeniería Industrial y gestión de la construcción. El propósito de este estudio es investigar las perspectiva de las personas contra las criptomonedas y la inversión en energía. Toda tu información es completamente anónima. Esta encuesta es solo para fines educativos.

<https://www.surveymonkey.com/r/BQDXH56>

Arabic

أجريت هذه الدراسة لجامعة بهجة شهير، قسم الماجستير في الهندسة الصناعية و إدارة المباني. الغرض من هذه الدراسة هو التحقيق في آراء الناس ضد عملات الكريبتو واستثمار الطاقة كل المعلومات الخاصة بك مجهولة تماما. هذا الاستطلاع للأغراض التعليمية فقط.

<https://www.surveymonkey.com/r/HCMVVV3>

3.3.3 Data analysis procedures.

In this section, the analysis process will be discussed in detail. Firstly, the platform used to collect and analyze the data for the research was Survey Monkey. After reaching 160 responses, the surveys were no longer distributed for further potential responses. Once the responses were completed, it was demonstrated that each survey consumed from four to seven minutes to complete. To elaborate, in the English

questionnaire, the total accumulated responses were 20, the completion rate was 100%, and approximately 7 minutes were spent on average per respondent per survey, as shown in the Table 7 below.

Table 7. Showing Time Spent on Average per Respondent in the English Survey.

TOTAL
RESPONSES

20

COMPLETION RATE ?

100%

TYPICAL TIME SPENT ?

6m:57s

Furthermore, in the Arabic questionnaire, the total accumulated responses were 44, the completion rate was 100%, and approximately 6 minutes were spent on average per respondent per survey, as shown in Table 8 below.

Table 8. Showing Time Spent on Average per Respondent in the Arabic Survey.

TOTAL RESPONSES

44

COMPLETION RATE ?

100%

TYPICAL TIME SPENT

6m:5s

Last, but not least, in the Spanish questionnaire, the total accumulated responses were 29, the completion rate was 100%, and approximately 6 minutes were spent on average per respondent per survey, as shown in Table 9 below.

Table 9. Showing Time Spent on Average per Respondent in the Spanish Survey.

TOTAL RESPONSES

29

COMPLETION RATE ?

100%

TYPICAL TIME SPENT ?

5m:58s

Lastly, the total accumulated responses in the Turkish questionnaire were 67, the completion rate was 100%, and approximately 6 minutes were spent on average per respondent per survey, as shown in Table 10 below.

Table 10. Showing Time Spent on Average per Respondent in the Turkish Survey.

| | | |
|--------------------|----------------------|-------------------------|
| TOTAL RESPONSES | COMPLETION ? RATE | TYPICAL TIME ? SPENT |
| 67 | 100% | 6m:16s |

Once the data was fully collected, it was ready for analysis. The program used for analysis was also Survey Monkey. Each question in each survey has all the essential statistics calculated for it, which included Minimum, Maximum, Medium, Mean, and Standard deviation. The basic statistics were calculated and displayed as follows: Each answer choice by a respondent was assigned a numeric value. Additionally, any combined or hidden answer choices were still included as separate answer choices. Defined below is how the answer choices were calculated.

Minimum The lowest value (answer choice) is selected by at least one respondent.

Maximum: The highest value (answer choice) selected by at least one respondent.

Mean: The average of all responses.

Median: The midpoint at which all responses are evenly divided above or below.

Standard deviation: The amount of spread or distance from the mean.

All the charts and the results summarizing the responses of all the participants in four languages are attached in the appendices section.

3.4 Limitations. Limitations of this study were the due to the COVID-19 pandemic and the psychological and financial burden it brought with it that have hindered its progress. Additionally, there have not been many people willing to participate in the study or answer the questions, given that they did not have enough time, they were not interested, or they would not prefer sharing their personal information with anyone even though each participant's identity was kept extremely anonyms and not even their names were asked to be shared in the study. If the sample size had been more extensive and this study had reached a higher number of respondents, perhaps the study results would have been navigated in a different direction.

Chapter 4

Findings

The Arabic speaking group had a total of 44 respondents.

The Arabic survey was distributed to participants that spoke Arabic as their first language.

The total number of participants that agreed to participate in the survey was 44 people, of which 50% (22 participants) were males, and the other 50% were females. 20.5% of the participants' ages ranged from 45-54 years old, and 11.4% from 18-24 years old. 68.9% of the participants were Middle Eastern which is anticipated since these were the targeted participants in the Arabic survey, where only 2.3% were from East and West Europe, respectively. The bilingual participants accounted for 50% of the respondents, and only 2.3% spoke five languages. 77.3% lived in megacities, while only 4.5% lived in the suburbs. Most respondents were married, accounting for 68.2, % and almost half of the total respondents (47.7%) had children.

The percentage of the employed participants was 58.1% and almost 21% were retired. Most Arabic speakers graduated with a university/college degree, accounting for 70.5%. 27% were engineers, and 39.5% had managerial positions. 77.3% live in an apartment, and 29.5% have four members in their household. They were also asked about the number of cars per household, and the responses demonstrated that 37.2% had just one car while 25.6% had none. 57.1% said they preferred using their private vehicles over any other sort of public transportation. Since public transportation is not quite common in the majority of middle eastern countries compared to other regions in the world, the results obtained were reasonably expected. They were also asked about the type of cars they drive, and 53.5% said that they drive a diesel, 25.6% do not drive at all, and not one respondent drives an electric car. Again, these results were quite awaited since electric-powered cars are not standard in the middle east, and the leading ones are diesel-powered cars.

Further questions regarding their lifestyles were asked, like their preferred

shopping destination, which mainly concentrated around the supermarket and the shopping mall, with 46.5% and 27.9%, respectively. About their preferred vacation accommodation, approximately 48% prefer staying in a hotel, while around 26% prefer staying at their vocational residence, and 9.5% said that they would stay at a small hotel. This is common because, looking at the demographics and the middle eastern culture, being conservative with their own privacy is quite common; therefore, most prefer a hotel or a private residence. Interestingly, 60.5% of the respondents only made less than \$25000 per year, whereas only 7.5% made between \$100,000 and \$150,000. This shows that even though the majority of the participants graduated with a university/college degree, with their ages mainly distributed between 25-54 years old, living in megacities with an average(mean) number of people per household of 3.75, they still do not earn enough money. According to Point2homes, an international website where real estate professionals can advertise or post their listings, the average annual household income in the Middle East is US\$49,773, and the median household income is US\$38,807. Residents aged 25-44 have an average wage of \$40,612, while those aged 45-64 earn an average of \$43,061. By contrast, under 25 and over 65 earn less, at \$21,908 and \$32,334, respectively.

This leads us to the anticipated part of the survey, where it turned out that 61.4 % of the participants received no financial education. This shows that financial education or financial literacy is as vital as reading, writing, and math skills. Monticone (2010) found that high-income individuals were more likely to practice financial literacy themselves, whereas low-income individuals felt it was too expensive or did not have the same incentives to do so. Therefore, to mitigate long-term economic problems, it is imperative to assess financial literacy's impact on groups with low to no financial literacy.

Regarding crypto knowledge, 50% have no idea what cryptocurrencies are, while 31.8% only know that it is a digital currency. However, no one believes it is a real currency, which is why 56.8% of the respondents have never owned any cryptocurrencies, and 25% believe owning any cryptocurrencies is a good idea. 81.4% said they have no idea what a is 'Blockchain' and 90.9% of the participants said that they would not invest in cryptocurrencies at all; this builds up anticipation that they are possibly avoiding investing in cryptocurrencies because they possibly see it as a

risky investment or some sort of a scam. However, 56.8% said they do not even know if crypto is risky, while 40.9% said it is risky to buy crypto. When it comes to rating their knowledge of crypto, most of them account for 61.9%, have very little information on cryptocurrencies, and only 2.4% consider themselves knowledgeable in the area. They were also asked if they think that cryptocurrencies are meant to solve a problem or replace the current currencies; 86% said that they do not know, which is an awaited kind of response.

This brought to light this question if participants are avoiding investing in cryptocurrencies due to their beliefs that it is either risky or they don't have the knowledge required in the area, can they possibly have another investment? Such as energy, commodities, stocks, etc.? Or do they have any investments? Keeping in mind that 61.4 % of the participants received no financial education. When participants were asked a 'Yes' or a 'No' question on whether they have any investments, the engrossing finding was that 59.1% of them answered with a 'No.' Since this is a small study done on a small group of people, it is a possibility that the ones who received no financial education could be the ones who have no investments, given the very close percentage of respondents. When asked what other kind of investments they had, if any, the results showed that 51.2% did not have any investments, while 12.2% of the total owned government bonds and 9.8 % of the total were in real estate and other sectors, respectively.

Further questions were asked on this topic to understand how they handle their finances, and they were asked to state the percentage of their monthly income that goes into their investments only; 58.1% said that 0% of their monthly income goes into their investments while 20.9% allocate just between 10%-20% of their monthly income to investments. Meanwhile, no participant invests more than 40% each month. On the other hand, they were also asked how much of their monthly income goes into savings; almost 27% don't save any money at all, around 24% save between 10% - 20% and again, no respondent saves more than 40% of their monthly income.

This demonstrates that the participants were more savers than investors. This drives us back to the financial literacy issue; the problem with saving is that savings are mainly done in cash left in the bank and are rewarded in minimal amounts of

interest rewards by banks. These banks offer interest rates that don't even meet the inflation rate. The issue with inflation and savings is that when the money sits down in the bank account, it slowly loses its value to inflation. This is why investing is the best hedge against inflation. However, savings in terms of emergency funds is quite vital. When the participants were given a list of the most common commodities, which included Natural gas, Gold, Silver, Crude oil, Wheat, all or none of the above or other commodities. 39% of the total participants said that they would not invest in any of the above, while 22% said that they would invest in gold, and the minority, which accounted for 7.3%, said that they would invest in all the given commodities. Since commodities are very much a common form of investing compared to cryptocurrencies, the obtained results were anticipated given their familiarity with commodities; however, still, the majority chose not to invest at all.

A significant percentage of the respondents, 79.1% said that they do not know if crypto is a long- or short-term investment. Approximately 5% of the participants are invested in crypto and believe that crypto is the future, whereas 50% said they do not know if crypto would be the future, and almost 30% said that it depends on various factors. Digging deep into their knowledge about crypto, the participants were given a list of the top 10 cryptocurrencies according to their market capitalization, such as Bitcoin, Ethereum, Solana, ADA, Doge and XRP. 47.7% were aware of only Bitcoin, and 40.9% were unaware of any of them. Going back and linking financial literacy to investing in general to crypto, when participants were asked what was inhibiting them from cryptocurrencies to currencies, 37.2% said that they lacked the required financial knowledge in the field, while 30.2% did not trust cryptocurrencies at all and its worth mentioning that 14% said they lack the liquidity needed to invest in crypto.

In reference to sustainability and energy, the participants were asked to rate their knowledge of Sustainability on a scale of very low as lowest and expert as highest. It transpired that 70% of the respondents had shallow information on sustainability which is quite a significant number while only 15% had little information on the topic. They were also given a list of the most common renewable energy projects such as Wind, Solar, Bio, Hydro, and Geothermal energy and were asked in which project they would invest and, if possible, all of the above or just non of the above.

The results here were engrossing; 50% of the participants said they would not invest

in any of the above, whereas 23.8% chose Solar energy; meanwhile, wind, geothermal, and hydro were not selected by any of the participants. Gradually building up to the question of our research, which focuses on investigating the sentiment towards crypto and energy, the most critical question was asked to the participants if they would invest in crypto, energy, none, or both. The intriguing results showed that 61.9% chose not to invest in either crypto or energy, 28.6% chose to invest in energy, and 9.5% chose both, and none of the participants chose to invest in cryptocurrencies. This demonstrates that when middle eastern participants were given a choice to put their money in either cryptocurrencies or renewable energy projects, the majority would avoid investing after all, while the minority would invest in renewable energy projects.

The English-speaking group, a total of 20 respondents.

The English survey was distributed to citizens of an English-speaking country or participants whose first language was from the given options of the four languages in which the questionnaires were prepared. The total number of participants who agreed to participate in the survey was 20, of which 65% (13 participants) were males, and the other 35% (7 participants) were females. 40% of the participants' ages ranged from 35 to 44 years old, and 35% from 25 to 34 years old. 45% of the participants were from Middle Eastern, and 30% were from North America. East and West Europe, South Africa, and South America account for 5% each. The bilingual participants accounted for 50% of the respondents, and no one spoke over four languages. 50% lived in cities, while only 15% lived in the suburbs. Most respondents were married, accounting for 55%, while 35% were single. Exactly half of the total respondents (50%) had children.

On the educational level, 55% graduated from a university/college, 10% graduated with a Doctor of Philosophy (Ph.D.), and another 10% only finished high school. Interestingly, 35% of the respondents made less than \$25000 per year, and only 15% made above \$200,000 yearly. The percentage of the employed participants was 75%, and 15% were unemployed. 20% of the total were engineers working in the field, and 35% worked in other sectors. 65% live in an apartment, and only 5% of the total participants live in a studio. The mean of the members in their household was 3; 30% of the respondents had 2 and 3 members per household each. They were also asked about the number of cars per household, and the responses demonstrated

that 45% had just one car while 25% had none. 45% said they preferred using their own private vehicles over any other sort of public transportation. They were also asked about the type of cars they drive, and 50% said that they drive Gas powered vehicles, 20% do not drive at all, and only one respondent drives an electric car. These results were quite awaited since electric-powered cars are more common in regions apart from the middle east. However, still, the leading ones are Gas and diesel-powered cars.

Further questions regarding their lifestyles were asked, like their preferred shopping destination, which mainly concentrated around the shopping mall and the local market, with 25% each, whereas the ones that preferred shopping online and at a farmer's market were 15% each. It was not a surprise to see that no one self-grows food organically. In reference to their preferred vacation accommodation, precisely 85% prefer staying in a hotel, while around 10% prefer staying at an Air BnB. These results were anticipated given that Hotels and Air BnB are typically the most common choices in cultures other than Middle Eastern, especially Arabs. Additionally, Airbnb, motels, couch surfing, etc., is rare around the middle east yet extremely common and even compete with hotels in other regions like Europe, America, etc.

Concerning finances, when participants were asked if they ever received any sort of financial literacy education in their lives, 80% of them said 'No' and the rest of them which was 20% said 'Yes'. Regarding crypto knowledge, the obtained results were different compared to the Arabic-speaking individuals. The results revealed that 50% of the English-speaking participants said cryptocurrencies mean digital currencies, 25% viewed them as assets, and 15% said they did not know. The rest, which was 10%, said that cryptocurrencies are money. Comparing these results to the Arabic speakers, the English speakers seem to have some knowledge about the basics of the crypto world compared to the Arabic speakers. It would be predicted that since these participants had some sort of knowledge regarding crypto, they would be keen to invest in it; however, the responses demonstrated that 70% of the respondents have never owned any cryptocurrencies, and 30% have some cryptocurrencies. Some intriguing answers were found when asked if they knew what a 'Blockchain' is; 40% said 'Yes' while 35% said 'No.'

Additionally, 50% of the participants said that they would not invest in

cryptocurrencies at all, 35% said they would invest, and 15% said that maybe; this builds up the assumption that they are possibly avoiding investing in cryptocurrencies because they possibly see it as a risky investment or some sort of a scam. Therefore, as assumed earlier, 80% of them said that it is risky to buy crypto, while 20% said they do not even know if crypto is risky or not. When required to rate their knowledge of crypto, 40% said they had some knowledge about crypto, another 40% stated that they have low knowledge, and only 5% had high knowledge. They were also asked if they think that cryptocurrencies are meant to solve a problem or replace the current currencies; 55% said that they do not know, while 20% believed that cryptocurrencies could replace money in the future. These were awaited responses, given that this group of people has some extra knowledge in the field compared to the Arabic speakers.

This brought to light the question that if participants are avoiding investing in cryptocurrencies due to their beliefs that it is either risky, not or they just do not have the knowledge required in the area, can they possibly have another investment? Such as energy, commodities, stocks, etc.? Or do they have any investments? Keeping in mind that 80 % of the participants received no financial education at any time in their lives. When participants were asked a "Yes" or a "No" question on whether they have any investments, the engrossing finding obtained was that 55% said that they do have investments, and 45% of them answered with a "No." When asked what other kind of investments they had, if any, and a list of Gold, Foreign exchange, Government Bonds, Stocks, Real estate, Crypto, others, and none, the results showed that 31.58 % owned stocks which is precisely the same percentage (31.58%) as the people did not own any at all, while 26.32% all respondents own cryptocurrencies and just 5.26 % of the total own in real estate and Gold each respectively. Since commodities are very much a common form of investing compared to crypto currencies, the obtained results were anticipated given their familiarity with commodities but also crypto currencies; however still a significant percentage have no investments at all.

Further questions were asked on this topic to understand how they handle their finances; they were asked to state the percentage of their monthly income that goes into their investments only; 35% said that 0%-10% of their monthly income goes into their investments while 10% allocate above 50% of their monthly income to

investments; meanwhile, 30% of the participants invest nothing at all every month. On the other hand, they were also asked how much of their monthly income goes into savings, and almost 30% save from 20%-30% every month, 20% save between 10% - 20%, and the same percentage applies to the rest of the options given. Additionally, no respondent saves more than 40% of their monthly income. To elaborate, 14 people out of 20 invest money monthly, while 18 people out of 20 save money monthly. This demonstrates that the participants were keen to both being savers and investors since the differences were not colossal; however, they are slightly more on the savers' side.

A significant percentage of the respondents accounting for 70% of them, said that they had never owned any cryptocurrencies before, while the rest (30%) owned some crypto. Moreover, 45% said they do not know if crypto is a long- or short-term investment, while 40% said crypto is a long-term investment. When asked their opinion if crypto was the future, 40% of the participants said that 'it depends,' 30% said that they did not know, 15% each said 'Yes,' and the last 15% said 'No.' Digging deep into their knowledge about crypto, the participants were given a list of the top 10 cryptocurrencies according to their market capitalization, such as Bitcoin, Ethereum, Solana, ADA, Doge, and XRP. 70% were aware of only Bitcoin, 25% were aware of all of them, and 5% were unaware of any of them. Going back and linking financial literacy to investing in general to crypto, when participants were asked what was inhibiting them from investing in cryptocurrencies, 30% said that they were afraid of losing their money, while 20% each lacked cash, knowledge, and did not trust cryptocurrencies at all.

In reference to Sustainability and energy, the participants were asked to rate their knowledge of Sustainability on a scale of low, some, medium, and high. Low as lowest and high as highest. It transpired that 35% of the respondents selected 'Medium,' 30% selected 'Some,' 20% selected 'High' while only 15% had very little information on the topic. This proves that the English-speaking participants had higher awareness of the topic of Sustainability than the Arabic-speaking participants. They were also given a list of the most common renewable energy projects, such as Wind, Solar, Bio, Hydro, and Geothermal energy. They were asked which project they would invest in and, if possible, 'all the above' or just 'non of the above.' The results here were engrossing where 40% chose Solar energy, 25% chose

all of the above, and 10% of the participants said they would not invest in any of the above.

Meanwhile, wind and bio projects were not selected by any of the participants. Gradually building up to the question of our research, which focuses on investigating the sentiment towards crypto and energy, the most critical question was asked to the participants if they would invest in crypto, energy, none, or both. The intriguing results showed that 55% chose to invest in energy, 20% chose not to invest in either crypto or energy, 20% chose both, and 5% of the participants chose to invest in cryptocurrencies. This demonstrates that when English-speaking participants were given a choice to put their money in either cryptocurrencies or renewable energy projects, unlike Arabic-speaking respondents, where the majority would avoid investing after all. While the minority would invest in renewable energy projects, the results here are somewhat different with the English-speaking participants since most would choose to invest in energy, and even some would invest in both.

The SPANISH-speaking group, a total of 29 respondents.

The Spanish survey was distributed to participants that spoke Spanish as their first language. The total number of participants that agreed to participate in the survey was 29, of which 62.1% (18 participants) were females, and the other 37.9% (11 participants) were males. 34.5% of the participants' ages ranged from 45-54 years old, 24.1% from 35-44 years old, 20.7% were 18-24, 13.8% were 25-34, and finally, 3.4% each from 55-64 and above 65 years old. Most participants were North Americans accounting for 48.3% of the total, while Latin Americans were 31%, and South Americans accounted for 17.2%. The bilingual participants predominated, accounting for 62.1% of the total respondents, and 17.2% spoke only one language; no respondent spoke more than four languages. 72.4% lived in cities, while only 3.4% lived in villages. More than half of the respondents (51.7%) were married, and just 10% were divorced. The child-free participants predominated, accounting for 44.8%, and those with more than one child contributed to 13.8%.

Further questions regarding their lifestyles were asked, like their preferred shopping destination, which mainly concentrated around supermarkets, online shopping, and shopping mall, with 58.6%, 24.1%, and 10.3%, respectively. These outcomes were foreseen given that online shopping is habituated in

America. In reference to their preferred vacation accommodation, 72.4% prefer staying in a hotel, while around 10% prefer staying in their private residence. These outcomes were anticipated given that typically Hotels and owning properties for vacational destinations are the top common choices in America. The percentage of the employed participants was 69%, and almost 21% were unemployed. Some Spanish speakers graduated with a university/college degree, accounting for 34.5%, while 20.7% graduated with a high school diploma, approximately 7% had a postgraduate degree and no one with a Ph.D. When asked about the sector they worked in, most of the results concentrated around these three sectors 'Other sectors', 'Government sector,' and 'Educational Sector,' with percentages of 41.4%, 20.7%, and 10.3%, respectively. Similar results were obtained when asked about their job titles; most responses concentrated around 'Other titles,' 'Supervisor' and 'Entry Level' with percentages of 44.8%, 17.2%, and 13.8%, respectively. 60.7% live in an apartment, and 27.6% of the total have four members in their household, while 24.1% have two members per household. They were also asked about the number of cars per household, and the responses revealed that most of them owned cars, where 39.3% owned more than one car while 32.1% owned one. 55.2% said they preferred using their private vehicles over any other sort of public transportation. These results were awaited because, according to Statista's Global Consumer Survey 2019, 76% of American commuters use their vehicle to commute between home and work, making it the most popular mode of transportation.

Meanwhile, only 11% of the 5,649 respondents used public transportation, and 10% used bicycles. Several aspects contribute to the low acceptance of other means of transportation as a mode of everyday transportation. One of the main reasons is that Americans are more accustomed to commuting longer distances than most Europeans, which automatically precludes many from other means of transport. On the other hand, a study was conducted on car ownership in Latin America, and the study indicated a substantial annual growth rate in Latin America, which is foreseen only to increase. They were also asked about the type of vehicles they drive, and 69% said that they drive gas-powered vehicles, 24.1% do not drive at all, only 6.9% drive a diesel car, and no one drives either electric or hydro-powered cars. Even though electric cars are much more common in

America, the leading ones are still Gas-powered cars.

Concerning finances, when participants were asked if they ever received any sort of financial literacy education in their lives, 82.8% of them said 'No,' and the rest of them, which was 17.2%, said 'Yes.' Regarding crypto knowledge, the participants were asked what cryptocurrencies meant to them, and the obtained outcomes were quite different compared to the Arabic and English-speaking individuals. The results revealed that 82.8% of the Spanish-speaking participants said that cryptocurrencies meant digital currencies, 6.9% viewed them as assets and money each, and only one person (3.4%) said they didn't know what cryptocurrencies meant. Comparing these results to the Arabic and English speakers, the Spanish speakers seem to have more knowledge about the basics of the crypto world since cryptocurrencies are originally digital currencies. It would be predicted that since these participants had some sort of knowledge regarding crypto, they would be keen to invest in it; however, the responses demonstrated that 44.8% of the respondents have never owned any cryptocurrencies, and 20.7% wasn't sure if it is a good idea to own cryptocurrencies and 10.3% said that they would like to own some crypto. Some intriguing answers were found when asked if they knew what a 'Blockchain' is; 75% said 'No' while 10.3% said 'a little'.

Additionally, 55.2% of the participants said that maybe they would invest in cryptocurrencies, 24.1% said 'Yes' they would invest, and 20.7% said 'No.' This builds up the assumption that there is a possibility of avoiding investing in cryptocurrencies because they possibly see it as a risky investment or some sort of scam. Therefore, as assumed earlier, 58.6% of them said it is risky to buy crypto, while 27.6% said they do not even know if crypto is risky. When required to rate their knowledge of crypto on an ascending scale where 'Very little,' 'Little,' 'Adequate,' and 'Expert' were given as options. 51.7% said they had some knowledge about crypto, another 27.6% adequate knowledge, and only 20.7% they do not have any knowledge. They were also asked if they think that cryptocurrencies are meant to solve a problem or replace the current currencies; 39.3% said that they do not know, 28.6% that crypto could possibly solve a problem and replace money in the future, while almost 18% believed that

cryptocurrencies could solve problems and finally 14.3% said that crypto could possibly replace money in the future. These were awaited responses, given that this group of people has some extra knowledge in the field compared to the Arabic and English speakers, which explains why they see more potential in cryptocurrencies.

This brought to light the question that if participants avoid investing in cryptocurrencies due to their beliefs that it is either risky or not or they just do not have the knowledge required in the area, can they possibly have another investment? Such as energy, commodities, stocks, etc.? Or do they have any investments? Keeping in mind that 82.8 % of the participants received no financial education at any time in their lives. When participants were asked a "Yes" or a "No" question on whether they have any investments, the engrossing findings obtained were that 69% said that they do not have investments, and 31% of them answered with a "Yes." When asked what other kind of investments they had, if any, and a list of Gold, Foreign exchange, Government Bonds, Stocks, Real estate, Crypto, others, and none, the results showed that 55.2 % did not own any commodities at all, 17.2% all respondents' cryptocurrencies and just 13.8 % own other types of commodities. Since commodities are very much a common form of investing compared to cryptocurrencies, the obtained results were supported by a study done by yahoo finance, they asked if they are currently investing or saving their money, and the study showed that over 47% of respondents said they were not investing in either Stocks, Bonds, Mutual funds, exchange-traded funds, Cryptocurrency, Real estate, Individual retirement account, 401(k) or Deposit accounts. In fact, several people who invest or save play it safe. Deposit accounts, such as savings and checking accounts, are the most common account types. These accounts are suitable for short-term investments as the loss risk is lower than for stocks and other investments. However, the savings account will not grow much in the long run because the interest rates are so low compared to riskier investments. On the other hand, according to Yahoo Finance, Latin American countries have expressed or even hinted at their interest in Bitcoin in 2021. Both El Salvador and Paraguay have indicated their willingness to adopt Bitcoin. However, they mentioned that they had adopted them for practice. Nevertheless, this is not the end of the story. Other

Latin American countries such as Argentina, Brazil, Mexico, and Panama have similar intentions.

Further questions were asked on this topic to understand how they handle their finances; they were asked to state the percentage of their monthly income that goes into their investments only; 37.9% said that they do not allocate any money on a monthly basis toward investments. 34.5% allocate less than 10% towards their investments, while 17.2% invest 10%-20% of their income every month, and no one invests more than 40% per month. On the other hand, they were also asked how much of their monthly income goes into savings; the results revealed that 44.8% save 10%-20% every month, 37.9% save less than 10%, and just 10.3% save between 20%-30% every month. Additionally, one respondent saves 40%-50%, and no respondent saves more than 50% of their monthly income. To elaborate, 18 people out of 29 invest money monthly, while 28 people out of 29 save money monthly. This demonstrates that the participants were keen to save more than invest. The differences are significant, so it is safe to say that they were more savers than investors.

A significant percentage of the respondents accounting for 44.8% of them, said they had never owned any cryptocurrencies before. Meanwhile, 20.7% of the participants said that if they do not know if it is a good idea to own crypto, the same percentage said they own some crypto. Furthermore, 55.2% said they do not know if crypto is a long - or short-term investment, while 41.4% said crypto is a long-term investment. When asked about their opinion if crypto was the future, 48.3% of the participants said that 'it depends,' 17.2% of each answered with 'I don't know,' 'Yes,' and 'No.' Digging deep into their knowledge about crypto, the participants were given a list of the top 10 cryptocurrencies according to their market capitalization, such as Bitcoin, Ethereum, Solana, ADA, Doge, and XRP. 62.2% were aware of only Bitcoin, 13.8% were unaware of any of them, and 10% were aware of all of them. Going back and linking financial literacy to investing in general to crypto, when participants were asked what was inhibiting them from investing in cryptocurrencies, 51.7% said they lacked the knowledge needed to invest, finally 20.7% each lacked cash, and the same percentage said that they did not trust cryptocurrencies at all.

In reference to Sustainability and energy, the participants were asked to rate their knowledge of Sustainability on a scale of low, some, medium, and high. Low as lowest and high as highest. It transpired that 41.1% of the respondents selected 'Very little,' 31% selected 'Medium,' and 27.6% selected 'Little.' This proves that the Spanish-speaking participants had higher awareness of the topic of Sustainability than the Arabic-speaking participants, but lesser awareness compared to the English-speaking participants. They were also given a list of the most common renewable energy projects, such as Wind, Solar, Bio, Hydro, and Geothermal energy. They were asked in which project they would invest and, if possible, 'all the above' or just 'none of the above.' The results here were engrossing where 51.7% chose Solar energy, 20.7% chose all of the above, and 10.3% of the participants said they would not invest in any of the above.

Meanwhile, only bio projects were not selected by any of the participants. Gradually building up to the question of our research, which focuses on investigating the sentiment towards crypto and energy, the most critical question was asked to the participants if they would invest in crypto, energy, none, or both. The intriguing results showed that 58.6% chose to invest in energy, 27.6% chose to invest in both, 10.3% of the participants would not invest in any, and only one respondent chose to invest in cryptocurrencies. This demonstrates that when Spanish-speaking participants were given a choice to put their money in either cryptocurrencies or renewable energy projects, unlike Arabic-speaking respondents, where the majority would avoid investing after all, and English speakers who favored energy projects, in this case, the Spanish speakers preferred renewable energy projects. The results here are somewhat different from the Arabic-speaking participants but similar to the English-speaking participants.

TURKISH-speaking group of 67 respondents.

The Turkish survey was distributed to participants that spoke Turkish as their first language. The total number of participants that agreed to participate in the survey was 67 people, of which 59.7% (40 participants) were males, and the other 40.3% (27 participants) were females. 34.5% of the participants' ages ranged from 45-54 years old, 26 % from 35-44 years old, 20.7% were 18-24, 13.8% were 25-34,

and finally, 3.4% each from 55-64 and above 65 years old. Most of participants, accounting for 42.9% of the total, were Eastern Europeans, 38.1% were Middle Eastern, and 9.5% were Western Europeans. The bilingual participants predominated, accounting for 44.8% of the total respondents, and 22.4% spoke only one language; 19.4% spoke three languages, and only one respondent spoke more than five languages. Almost all the participants live in cities, accounting for 98.5%, and only 2.5% lived in towns. More than half of the respondents (59.7%) were married, and just 4.5% were divorced. The child-free participants accounted for 43.9%, and those with more than one child contributed 10.6%.

Further questions regarding their lifestyles were asked, like their preferred shopping destination, mainly concentrated around supermarkets, shopping malls, and local markets, with 44.8%, 22.4%, and 11.9%, respectively. Nevertheless, it is noteworthy to share an intriguing case study on Consumers' Perceptions of Online Grocery in Turkey in 2021. The study discussed that grocery shopping applications have increased, especially during the COVID-19 crisis. As online shopping applications grow, so does the research on online shopping. Ramus and Nielsen (2005), Kuman (2016), Walters et al. (2005), İşçioğlu (2017), and Morganosky and Cude (2000) conducted focus groups and online survey studies of people who had experienced online market shopping. Studies show that the main benefits of online shopping are time and energy savings. This diminishes the risk of physical communicable diseases while making it more convenient for people with disabilities to use online shopping applications than going to the market. It also provides great value for families with children. The study also cited online grocery shopping also facilitates comparisons of products, better total spending tracking and planning, and more meals cooked and eaten at home. It turns out that freshness and delivery time are more important than the product price. On the other hand, some participants find that going shopping is more fun than shopping online. In this way, both traditional and online shopping have their advantages. Although conventional shopping is fun, some participant finds their shopping online cheaper.

Regarding their preferred vacation accommodation, 53.7% prefer staying in a hotel, around 24% prefer staying in their private residence, and 16.4% chose Airbnb. These outcomes were anticipated given that typically Hotels, Airbnb, and owning properties

for vocational destinations are the topmost common choices among Turkish speakers. The percentage of employed participants was 70.1%, and 7.5% were unemployed. Some Turkish speakers graduated with a university/college degree, accounting for 44.8%, while 22.4% did post-graduate studies, and approximately 12% graduated with a high school diploma. When asked about the sector they worked in, most of the results concentrated around these three sectors 'Other sectors,' 'Engineering sector,' and 'Physical wellness Sector,' with percentages of 37.3%, 20.9%, and 11.9%, respectively. Similar results were obtained when asked about their job titles; most of the responses concentrated around 'Middle Managers/Supervisors,' 'Managers,' 'Directors,' and 'General Managers' with percentages of 30.2%, 23.8%, 20.6%, and 15.9%, respectively. 65.7% live in an apartment, and the rest lives in a house. The predominance had three members per household, contributing to 32.8%; the ones with only two members per household contributed to 25.4% of the total, while the ones with one and four members per household accounted for the same percentage, each of 17.9%. They were also asked about the number of cars per household, and the responses revealed that most of them owned cars, where 43.9% owned one car while 30.3% owned more than one.

38.8% said they preferred using their private vehicles over other public transportation, while almost the same percentage (37.3%) said they preferred using public transportation. These results were awaited because a great deal of Turkish speakers owns cars. However, turkey is considered very rich with its public transportation systems, accessibility, and affordability; in fact, the participants were also asked about their preferred means of transportation, and the predominance said answered in this order 'Metrobus,' 'water transportation, and 'Trains/Subways. These outcomes were exceedingly foreseen considering that major cities in Turkey have extreme traffic volumes; therefore, if participants preferred public transportation, they would save time and energy instead. According to Statista, a study focused on the distribution of registered cars in Turkey from 2010-2022 by fuel type. They were also asked about the type of vehicles they drive, and 41.8% said that they drive gas/benzene-powered cars, 23.9% do not drive at all, 31.3% drive a diesel car, and just two people drive either electric car. The study revealed that in Turkey, the share of registered gasoline-powered vehicles decreased from 42.3% in 2010 to 26.8% in 2022. Meanwhile, the share of registered diesel cars increased from 18.3 % in 2010 to 36.9% by 2022. The possible reason for this could be inflation; Turkey has been experiencing

a prominent drop in its currency value for the past thirteen years, and no substantial subsidies encourage consumers to shift towards more sustainable options. Besides, according to the International Council on Clean Transportation, Diesel vehicles consume less volumetric fuel than equivalent gasoline vehicles. However, the CO₂ emission benefit is relatively lower, as burning 1 liter of diesel fuel releases roughly 13% more CO₂ than the identical amount of gasoline fuel.

Concerning finances, when participants were asked if they ever received any sort of financial literacy education in their lives, 78.8% of them said 'No,' and the rest of them, which was 21.2%, said 'Yes.' Regarding crypto knowledge, the participants were asked what cryptocurrencies meant to them, and the obtained outcomes were quite different compared to the Arabic, English, and Spanish-speaking individuals. The results revealed that 61.2% of the Turkish-speaking participants said that cryptocurrencies meant digital currencies, 19.4% said that they did not know, 10.4% viewed them as assets, and the rest, which was 9%, said that it meant money to them. Comparing these results to the Arabic, English, and Spanish speakers, the Turkish speakers seem to have more knowledge compared to the English and Arabic speakers about the basics of the crypto world since cryptocurrencies are originally digital currencies. It would be reasonable to assume that since these participants had some sort of knowledge regarding crypto, they would be keen to invest in it; however, the responses demonstrated that 53.7% of the respondents have never owned any cryptocurrencies, 28.4% said that they own some cryptocurrencies, and 7.5% owned but sold the crypto they had. Ultimately, 6% said it is not a good idea to own any crypto, and 4.5% said they would like to own some crypto. Some intriguing answers were found when asked if they knew what a 'Blockchain' is; 35.8% said 'No,' and the same percentage, 35.8%, said 'Yes.'

Additionally, 40.3% of the participants said they would not invest in cryptocurrencies, 26.9% said 'Yes,' and the rest said 'Maybe.' This builds up the assumption that there is a possibility of avoiding investing in cryptocurrencies because they possibly see it as a risky investment or some sort of scam. Therefore, as assumed earlier, 70.1% of them said that it is risky to buy crypto, while 26.6% said they do not even know if crypto is risky or not. When required to rate their knowledge of crypto on an ascending scale where 'Very little,' 'Little,' 'Adequate,' and 'Expert' were given as options. 49.3% said they had very little knowledge about

crypto, another 26.9% had adequate knowledge, and only 17.8% had little knowledge, while 6% had a lot of knowledge. They were also asked if they think that cryptocurrencies are meant to solve a problem or replace the current currencies; 34.3% said that they do not know, 28.6% that crypto could solve and replace money, while 19.4% said that crypto could replace money in the future, ultimately, 13.4% believed that cryptocurrencies could solve problems. These were awaited responses, given that this group of people has some extra knowledge in the field compared to the Arabic and English speakers, which explains why they see more potential in cryptocurrencies.

This brought to light the question that if participants avoid investing in cryptocurrencies due to their beliefs that it is either risky or not or they do not have the knowledge required in the area, can they possibly have another investment? Such as energy, commodities, stocks, etc.? Or do they have any investments? Keeping in mind that 78.8 % of the participants received no financial education at any time in their lives. When participants were asked a "Yes" or a "No" question on whether they have any investments, the engrossing findings obtained were that 80.3% said that they do have investments, and 19.7% of them answered with a "No." When asked what other kind of investments they had, if any, and a list of Gold, Foreign exchange, Government Bonds, Stocks, Real estate, Crypto, others, and none, the results showed that 33.3 % are invested in foreign currencies, 16.7% currently do not have any investments just 10.6% each were invested in Crypto, Gold, and Stocks. It would be reasonable to assume that given the economic situation in Turkey for the past seven years, the Turkish lira has been witnessing a significant decline in its value, presumably supporting that a substantial percentage of the participants are invested in foreign currencies.

Further questions were asked on this topic to understand how they handle their finances; they were asked to state the percentage of their monthly income that goes into their investments only; 40.3% allocate less than 10% towards their investments, almost 21% said that they do not allocate any money monthly towards investments. At the same time, 19.4% invest 10%-20% of their income every month. On the other hand, they were also asked how much of their monthly

income goes into savings; the results revealed that 44.8% save less than 10% every month, 22.4% save 10%-20%, and 13.4% do not allocate any of their income to their savings. To elaborate, 53 people out of 67 invest money monthly, while 58 people out of 67 save money monthly. This demonstrates that the participants were keen to save and also invest. The differences are not quite substantial, so it is safe to say that they were both savers and investors but more on the saver's scale. When asked their opinion if crypto is the future or not, 35.8% said they do not know if crypto is a long - or short-term investment, while 34.3% said crypto is a long-term investment. When asked about their opinion if crypto was the future, 43.8% of the participants said that 'it depends,' 22.4% of each answered with 'Yes,' and 19.4% said 'No.'

Digging deep into their knowledge about crypto, the participants were given a list of the top 10 cryptocurrencies according to their market capitalization, such as Bitcoin, Ethereum, Solana, ADA, Doge, and XRP. 49.3% were aware of only Bitcoin, 34.3% were aware of all of them, and only 13.4% did not recognize any of them. This indicates that since the highest percentage of the participants are aware of all the cryptocurrencies, this suggests that these participants could probably be actively involved in the crypto world. Going back and linking financial literacy to investing in general to crypto, when participants were asked what was inhibiting them from investing in cryptocurrencies, 25.8% said they lacked the money needed to invest, and 19.7% said that they do not trust crypto yet. Finally, 20.7% each lacked cash, and the same percentage said they did not trust cryptocurrencies.

In reference to Sustainability and energy, the participants were asked to rate their knowledge of Sustainability on a scale of low, some, medium, and high. Low as lowest and high as highest. It transpired that 38.8% 'Medium,' 26.9% selected 'High,' and 23.9% selected 'Very Little. 'This proves that the Turkish-speaking participants had higher awareness of Sustainability than the Arabic, English, and Spanish-speaking participants. They were also given a list of the most common renewable energy projects, such as Wind, Solar, Bio, Hydro, and Geothermal energy. They were asked in which project they would invest and, if possible, 'all the above' or just 'non of the above.' The results here were engrossing where 38.8%

chose Solar energy, 32.8% chose all of the above, and 16.4% of the participants said they would not invest in any of the above. Meanwhile, only bio projects were not selected by any of the participants.

Gradually building up to the question of our research, which focuses on investigating the sentiment towards crypto and energy, the most critical question was asked to the participants if they would invest in crypto, energy, none, or both. The intriguing results showed that 58.6 % chose to invest in energy, 27.6% chose to invest in both, 10.3% of the participants would not invest in any, while only one respondent chose to invest in cryptocurrencies.

Chapter 5

Discussion and conclusions

5.1 Discussion of findings for research questions.

In this section, the major findings will be summarized in four groups, Arabic, English, Spanish and Turkish speakers, explaining how cryptocurrencies and energy investments are perceived by different target groups in different cultures.

ARABIC speakers

This sets the foundation for the conclusion that the majority of those millennials aging from 25-55 years old graduated from a university/college degree, employed with a good position, yet earning an annual income less than the average with no financial literacy or little to no sorts of investments, with them being more of savers less of investors while their knowledge on Sustainability, cryptocurrencies, and renewable energy is relatively weak. They still leaned towards renewable energy versus cryptocurrencies when given the option between which is an anticipated result. This demonstrates a great deal of how they navigate their finances which does not seem to be on the positive aspect given amid the covid-19 pandemic; the inflation levels have been soaring, and the world has been witnessing a major problem in increased prices. It can be agreed that the main issue is not how many languages they speak, where they

are from, what are their ages, degrees, or even job titles; it is the “Financial literacy” which demonstrates their capability in comprehending and efficiently using several financial skills, including investing or personal finance. This makes them quite vulnerable to financial fraud, lack of debt management, and poor credit scores leaving them with no clear goals for their future. This can possibly damage their financial success significantly.

ENGLISH speakers

This sets the foundation for the conclusion that the preponderance of those millennials accounting for 75% of the total number of participants aged from 25-55 years old, 55% of the total, is considered most of them who graduated from a university/college degree, employed with a good position, with 65% of them earning between \$25,000 - \$200,000 yearly income and only 20% of them who are financially literate yet 55% of them has investments, with them being more of savers and investors but slightly more of savers. Their knowledge of Sustainability, cryptocurrencies, and renewable energy is significant. They still leaned towards renewable energy versus cryptocurrencies when given the option for investing, which was not an expected result. This gives clues on how they navigate their finances which is promising, especially if it is dug deep into. The results from this group are unique and cannot be adhered to a particular culture, region, or language given that this group is relatively small and very diversified, so conclusions to be made on the acquired results here cannot be easily correlated to a particular culture or region. Nevertheless, the compelling fact about this group is that even though most of them have not received any financial education, they seem to be earning adequate incomes with satisfactory job titles while investing and saving. Notably, they have a reasonable awareness of Sustainability and are open to investing in energy and crypto.

SPANISH speakers

This sets the foundation for the conclusion that the preponderance of the participants was a mixture between Generation X and Millennials, but mainly Millennials(58.5% of 29 respondents) old, 34.5% of the total graduated from a university/college degree, employed with a good position, with 75.8% of them earning between \$25,000 - \$200,000 yearly income and only 17.2% of them who are financially literate yet 31% of them has investments, with them being more of savers and

investors mainly on the savers' side. Their knowledge of Sustainability, cryptocurrencies, and renewable energy is adequate. They still leaned towards renewable energy versus cryptocurrencies when given the option for investing. These results are slightly close to the Arabic speakers in some aspects, especially regarding investing, Sustainability, and crypto. Again, this group is relatively small and diversified, so conclusions on the acquired results can be correlated to a particular culture and region since 96.6%, almost all the participants, are concentrated in America. Nevertheless, the compelling fact about this group is that even though most of them have not received any financial education, they seem to be earning adequate incomes with satisfactory job titles while investing and saving. Notably, they have some awareness of Sustainability and are open to investing in energy and crypto.

TURKISH speakers

This sets the foundation for the conclusion that the preponderance of the participants was a mixture of Generation X(43.2% out of 67 respondents) and Millennials(47.8% of 67 respondents) old, 44.8% of the total graduated from a university/college degree, employed with a good position, with 80.6% of them earning between TRY 25,000 – TRY 200,000 yearly income giving a mean of 4.58 showing that majority of the participants are making high rather than low incomes. 21.2% of participants are financially literate, yet 80.3% of them have investments, with them being both savers and investors, slightly more on the savers' side. Their knowledge of Sustainability, cryptocurrencies, and renewable energy is quite satisfactory compared to other groups. They still leaned towards renewable energy versus cryptocurrencies when given the option for investing. Most of Turkish speakers have sufficiently remarkable information on both Sustainability and crypto. The results from this are slightly close to the English speakers in some aspects, especially concerning, Sustainability and crypto. Again, this group is relatively small but not as diverse, so conclusions to be made on the acquired results can be correlated to a particular culture and region. since All the participants speak Turkish, it is safe to link them to the Turkish culture. Nevertheless, the compelling fact about this group is that even though most of them have not received any financial education, they earn adequate incomes with satisfactory job titles while investing and saving. Notably, they have some remarkable awareness of Sustainability and are open to investing in energy and crypto.

5.2 Conclusions.

Energy is the primary resource of human civilization; for this reason, human beings should always strive to become better masters of energy. The reality of how human beings innovate and accomplish what matters is closely related to how humans control energy. So are issues of geopolitics, war, and peace. Even the ability to reduce the environmental impact depends on how much humans can control their consumed energy. The only way human beings can make progress toward the energy future is by building, using, operating, repairing, and improving our energy production knowledge, processes, and resources. The more energy being consumed, the more jobs there are working in energy, and the more energy researchers and innovators that will be funded by the flows of capital throughout the world economy. The amount of capital that is being invested in energy, even including the recent financing of renewables, has fallen precipitously over the last century as a percentage of total capital investments. This means the energy future can't be built if it's not being invested in energy.

On the other hand, the most energy consuming crypto currency is Bitcoin; however crypto might have a chance of proving its value beyond its risks and volatility by becoming a leader in the transition towards more sustainable energy sources. Its quite vital that for crypto mining to help in supporting the transition and the development of renewable energy otherwise the crypto industry will only be contributing to another climate crisis apart from the fact that it is known to be a speculative asset and is not yet regulated by the government. Similar to any other sectors, the crypto space will inevitably face several challenges in its attempt in going green by considering its positive and negative impact on the environment and by integrating ethical sustainable solutions and practices into its operational processes. Nonetheless, if the crypto community is ready to meet such challenges, it can leverage both technology and finance to lead and drive the transition towards renewable energy sources and become a truly transformative community. Nature is here to stay and so is the need for energy since the beginning of humanity until the end of all civilizations. Cryptocurrencies could possibly revolutionize the world of finance and technology through increased transparency with major steps towards integrating renewable sources, however; of the cryptocurrencies bubble bursts, not only investors but the whole planet will be held accountable.

The primary purpose of this study is was scrutinize people's knowledge of cryptocurrency and energy investments while weighing and contrasting their potential and impacts. This study mainly focuses on two critical topics, cryptocurrencies, and energy. The first purpose is to apprehend how people deal with inflation, their views on investing, and test their awareness of digital currencies. This study also examines the impacts of cryptocurrencies on the environment while assessing their risk-reward potentials compared to energy investments which would achieve the second purpose of this research. For this investigation, a survey was conducted in four languages - Arabic, English, Spanish, and Turkish – on a small group of 160 respondents in total to investigate how cryptocurrencies and energy investments are perceived by different target groups in different cultures.

Forty-four Arabic-speakers, of which 50% (22 participants) were males, and the other 50% were females. The predominance were millennials aging from 25-55 years old who graduated with a university/college degree accounting for 70.5% as they were employed in good positions. 60.5% of the respondents only made less than \$25000 per year, whereas only 7.5% made between \$100,000 and \$150,000. This shows that even though the majority of the participants graduated with a university/college degree, with their ages mainly distributed between 25-54 years old, living in megacities with an average(mean) number of people per household of 3.75, they still do not earn enough money.

Additionally, 61.4 % of the participants received no financial education. 50% have no idea what cryptocurrencies are, while 31.8% only know that it is a digital currency. However, no one believes it is a real currency, which is possibly why 56.8% of the respondents have never owned any cryptocurrencies, which is the same percentage of the respondents that don't know if crypto is risky or not. 61.9% have very little information on cryptocurrencies, and only 2.4% consider themselves knowledgeable in the area. 51.2% did not have any investments,58.1% said that 0% of their monthly income goes into their investments, and 74% said that they save money on monthly basis. However, no one saves or invests more than 40% of their monthly income. This demonstrates that the Arabic-speaking participants were more savers than investors.47.7% were aware of only Bitcoin. 37.2% said they lacked the required financial knowledge in the field, inhibiting them from investing in cryptocurrencies. In comparison, 30.2% did not trust cryptocurrencies. 70% of the respondents had shallow information on sustainability, while only 15% had little information on the

topic. 50% of the Arabic-speaking group said that they wouldn't invest in either Wind, Solar, Bio, Hydro, or Geothermal energy, and almost 91% said they wouldn't invest in cryptocurrencies. 61.9% chose not to invest in either crypto or energy. This demonstrates that when Arabic-speaking participants were given a choice to put their money in either cryptocurrencies or renewable energy projects, the majority would avoid investing after all. In contrast, the minority would invest in renewable energy projects.

To sum up, the Arabic speakers were mainly millennials, highly educated, yet their annual income was less than average. They acquire a low financial literacy rate as they are more savers than investors. They are more conservative with their money as they would avoid investing in either crypto or energy; however, when given the choice between both would rather invest in renewable energy over crypto. They also assess low knowledge of sustainability and cryptocurrencies and are a risk-averse sort of group with lower incomes and lower tendencies to take risks.

The English-speaking participants were 20, of which 65% (13 participants) were males, and the other 35% (7 participants) were females. 75% of the total number of participants were millennials. On the educational level, 55% graduated from a university/college, 10% graduated with a Doctor of Philosophy (Ph.D.), and another 10% only finished high school. Interestingly, 35% of the respondents made less than \$25000 per year, and only 15% made above \$200,000 yearly, with a total of employed participants of 75%. 80% never received any financial education before. Regarding crypto knowledge, the obtained results were different compared to the Arabic-speaking individuals. The results revealed that 50% of the English-speaking participants said cryptocurrencies mean digital currencies, while in the Arabic group, the same percentage doesn't know, which proves that the English group is more knowledgeable in crypto compared to the Arabic one; however, 70% of the English group never owned any crypto. 35% said they would invest in crypto, and 50% wouldn't. 80% find crypto to be a risky investment which is true. 55% have investments, and 45% don't. Concerning investing, 14 people out of 20 invest money monthly, while 18 people out of 20 save money monthly. Only 15% had very little information on the SustainabilitySustainability, and the rest had adequate information demonstrating that English-speaking participants had higher awareness of the topic of SustainabilitySustainability than the Arabic-speaking participants. Additionally, 55%

chose to invest in energy, 20% chose not to invest in either crypto or energy, and 20% chose both, proving that This demonstrates that when English-speaking participants were given a choice to put their money in either cryptocurrencies or renewable energy projects, unlike Arabic-speaking respondents, where the majority would avoid investing after all. To sum up, this group shared some similar characteristics with the Arabic-speaking group; however, their yearly income was much higher, and a minority of them were financially literate, yet more than half of them had investments. They also possessed remarkable knowledge regarding crypto and energy. Investing in energy was their top choice over crypto. This group showed a neutral sentiment toward risk-taking.

Last but not the least, 62.1% (18 participants) were females, and the other 37.9% (11 participants) were males that speak Spanish. The preponderance of the participants was a mixture between Generation X and Millennials, but mainly Millennials (58.5% of 29 respondents) old, 34.5% of the total graduated with a university/college degree, employed with a good position, with 75.8% of them earning between \$25,000 - \$200,000 yearly income and only 17.2% of them who are financially literate yet 31% of them has investments. 82.8% of the Spanish-speaking participants said that cryptocurrencies meant digital currencies; comparing these results to the Arabic and English speakers, the Spanish speakers have more knowledge about the basics of the crypto world since cryptocurrencies are originally digital currencies which justifies the fact that 44.8% only of the respondents have never owned any cryptocurrencies. 24.1% said 'Yes' they would invest in crypto, and 58.6%% of them viewed it as risky. 18 people out of 29 invest money monthly, while 28 people out of 29 save money monthly. This demonstrates that the participants were keen to save more than invest. The differences are significant, so it is safe to say that they were more savers than investors. Spanish speakers possessed awareness of the topic of Sustainability than the Arabic-speaking participants, but lesser awareness compared to the English-speaking participants. 58.6% chose to invest in energy, 27.6% chose to invest in energy and crypto. To sum up this group Spanish-speaking group was a mixture between millennials and Generation X, with a minority that is highly educated. Yet, their annual earnings were within the average and slightly above. They possess adequate knowledge of cryptocurrencies and sustainability as they are open to investing in crypto and energy. This group is more of a risk-taker compared to all other groups.

Sixty-seven people filled out the survey in Turkish, of which 59.7% (40 participants) were males, and the other 40.3% (27 participants) were females. This group was a mix of millennials and generation x. 21.2% were financially literate. 61.2% labeled crypto as a digital currency, almost 20% less than the Spanish speakers. Turkish speakers seem to have more knowledge than English and Arabic speakers about the basics of the crypto world but less than Spanish speakers, yet more than half never owned any crypto, and 70.1% labeled crypto as risky. 80.3% said that they have investments. 53 people out of 67 invest money monthly, while 58 people out of 67 save money monthly, proofing that this group is keen to invest and save. Turkish-speaking participants had higher awareness of Sustainability than the Arabic, English, and Spanish-speaking participants. that 58.6 % chose to invest in energy, and 27.6% chose to invest in both. Therefore, when this group was given a choice to put their money in either cryptocurrencies or renewable energy projects, unlike Arabic-speaking respondents, where the majority would avoid investing after all, English speakers who favored energy projects just like the Spanish speakers who favored investing in renewable energy as well, in this case, the Turkish speakers weren't any different, their top choice was still energy. The results here differ from the Arabic-speaking participants, but the preferences are similar to the English and Spanish-speaking participants.

To sum up, this group shared similar generational characteristics; the majority of the participants earned more than average income as they owned investments, yet the minority was financially literate. Compared to all groups, they possess the most knowledge on crypto, sustainability, and energy, as their top choice, similar to all groups, was energy over crypto. This group displayed a sentiment between neutral and risk-taker. This study is unique and was done on a small group of people. The participants that possess different backgrounds, languages, races, religions, education, income, ages, etc., had their similarities and differences. Nonetheless, the results could vary if this research was conducted on a larger scale. Cultural differences possess a huge impact on how individuals navigate life; therefore, this research could add substantial value to academia once expanded furtherly.

As a summation, all groups originate from different cultures, languages, ages, educational levels, etc.; nonetheless, they have their own similarities. The most significant similarity between all groups is that more than 55% of all participants in

each group prioritized investing in sustainable energy over crypto, which is the core of this thesis in terms of investigating sustainable energy versus crypto as an investment opportunity. Choosing to invest in sustainable energy is not limited to its optimistic impact on the environment but also generates an extended favorable return on investment. Another similarity all groups shared was their low financial literacy rate; more than 60% of the participants in each group didn't receive any financial education in their lives. It can be agreed that the main issue is not how many languages they speak, where they are from, what are their ages, degrees, or even job titles; it is the "Financial literacy" which demonstrates their capability to comprehend and efficiently use several financial skills, including investing or personal finance.

This makes them quite vulnerable to financial fraud, lack of debt management, and poor credit scores leaving them with no clear goals for their future. This can damage their financial success significantly. This can be reversed easily through compulsory financial education in schools and universities for the younger generation and perhaps government support courses for the older generation to educate them on this matter. Apart from financial literacy, all groups demonstrated quite average knowledge levels about sustainability, which is a critical issue since the better the awareness and the knowledge possessed regarding sustainability, the better the ability to create and preserve the conditions in which humans and nature can exist together in productive harmony to support the current and future generations. This is because sustaining the planet's ecosystems is only possible if more sustainable choices are made. If humans aren't educated on living sustainably, then toxic processes will deplete fossil fuels, leading to the loss of many animal species and causing irreparable damage to the atmospheric environment. On top of that, more landfills will exist everywhere, and more animals will be extinct due to deforestation and environmental pollution, apart from the increased level of diseases that will affect humans. The group with the least sustainability knowledge was the Arabic-speaking group; 70% of this group possessed 'very little' knowledge of sustainability on a scale of 'very little' to 'high.' This is due to the fact that sustainable practices are not motivated or employed in middle eastern countries compared to other regions of the world like Europe, Asia, America, etc. The reason why the government and the education system urgently need to emphasize the importance and the application of sustainability. The outcomes obtained from the Arabic group were slightly similar to

those of the Spanish-speaking group since 41% said that their knowledge of sustainability is 'very little.'

On the other hand, the group with the highest sustainability awareness was the Turkish-speaking group, where approximately 27% of them selected 'high' for sustainability knowledge. The second-ranked group was the English-speaking group, where 20% selected 'high' on their sustainability knowledge. These outcomes are quite expected due to the reasons mentioned above regarding the government and the education system that doesn't highlight how critical the sustainability issue is compared to other regions. This can be improved in several ways; first, the government should stress sustainability education and awareness in schools and universities. Second, the government must attract investors and propose incentives to businesses to those willing to invest in or adopt sustainable practices. Finally, extreme penalties should be opposed to businesses and citizens who violate sustainable practices.

Ultimately, in the final part of the thesis, which is cryptocurrencies, all groups seem to have low to average knowledge of cryptocurrencies, with 40%-70% across all groups agreeing that buying cryptocurrencies is risky, which is true since, at this moment, as this conclusion is being written down, the Securities and Exchange Commission has launched a series of indictments against Coinbase and Binance, two of the world's largest cryptocurrency exchanges, launching a legal battle that will help define the future of cryptocurrencies. As a result of this lawsuit, cryptocurrencies have witnessed extreme amounts of withdrawals impacting the prices of all cryptocurrencies, as the fact that money kept in crypto exchanges is always susceptible to cyber-attacks and isn't protected by the government. In a nutshell, among all groups, Arabic speakers possessed the highest percentage of receiving financial education, in contrast to Spanish speakers, who acquired the highest rate among all groups for not receiving financial education. Yet, they were the most risk-averse group, which was opposite to the Arabic speakers, that were the most risk-averse group. Interestingly, in reference to sustainability and crypto knowledge, Arabic speakers revealed the least knowledge of both sustainability and crypto, contrary to Turkish speakers who exhibited the most on both compared to all groups. Finally, when all groups were asked the big question of whether to invest in crypto or energy, the majority of all groups voted mainly for investing in energy except the Arabic speakers, where the majority voted for investing in nothing at all.

In fact, investing in cryptocurrencies received the lowest votes from all groups. This clearly determines that despite all the diversified cultures, languages, geographical locations, education, ages, and genders of all the participants, they seem to have answered the research question of investing in either energy or crypto, and the votes favored investing energy over cryptocurrencies. After all, cryptocurrencies are heavily dependent on energy as energy is scarce, but cryptocurrencies are not. New coins can be mined daily, which requires a significant amount of energy, while on the other hand, energy does not depend on cryptocurrencies by any means. Miners indeed find the move towards renewable energy for mining attractive, which promises a better future in the transition towards renewables. For Bitcoin miners, using renewable-sourced energy is an economically sensible move, given that it is cheaper than fossil fuel equivalents, mainly when accessed close to the source. Overall, sustainable energy is the primary resource of human civilization; for this reason, investing in sustainable energy is a favorable option compared to digital currencies that came into existence less than fifteen years ago, while its long-term existence is never guaranteed.

5.3 Recommendations for future research. The recommended area for further research is to conduct this study on more individuals. The outcomes obtained in this study will inevitably vary if this research was conducted on a bigger sample size. Additionally, more in-depth questions could be asked in the survey testing the participant's sentiment and knowledge of sustainability and cryptocurrencies. It is also a suggestion to expand this study and target participants that own cryptocurrencies and investigate in depth the reasons behind their sentiment towards cryptocurrencies. Concerning sustainability, further questions need to be addressed concerning an individual's daily lifestyle and consumption behavior to achieve a more precise assessment of the topic.

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