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A Research on How digital traceability can help companies improve efficiency, resilience and competitiveness

Compiled by:

Alessandra Moraes da Silva

This project is submitted in part fulfilment of the Degree of Bachelor of Arts (Honours) in Business Studies.

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A Research on How digital traceability can help companies improve
efficiency, resilience and competitiveness

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Abstract

This study focusses on digital traceability and how it can help companies improve efficiency, resilience and competitiveness.

A quantitative research strategy has been applied, with data collection via a survey of 100 participants.

The result of the survey prove that digital traceability has a significant positive influence on all the outcomes, even though the positive impact on the competitiveness of companies was the strongest. Traceability must be encouraged within all enterprises.

Table of Contents

Chapter 1	11
Introduction	11
1.1 Objective of Study	11
1.2 Key Research Objectives	11
1.3 Purpose of Study	12
1.4 Significance of the study	12
1.5 Limitations	12
Chapter 2	13
Literature Review	13
2.1 Digital Traceability, Traceability, and its Need	13
2.2 Digital Traceability Technologies	16
2.3 Business Sustainability through Digital Traceability	16
2.4 Importance of Traceability to improve Efficiency and Competitiveness	18
Chapter 3	20
3.1 Introduction	20
3.2 Research Method	20
3.3 Research Approach	21
3.4 Data Collection Method	21
3.5 Sampling	24
3.6 Research Process	24
3.7 Data Analysis	25
Chapter 4	26
4.1 Overview	26
4.2 Descriptive analysis	26

4.3 Reliability and validity analysis	29
4.4 Inferential analysis	33
4.5 Regression analysis	34
4.6 Demographic analysis	39
4.7 Demographic charts	40
4.8 Variable analysis	46
4.9 Discussion	56
Chapter 5	58
5.1 Overview	58
5.2 Alignment with objectives	59
5.3 Key limitations and future scope	60
5.4 Recommendations	61
References	62
Appendices	66
Appendix II: Survey questionnaire	68
Appendix III: Ethical Form A	81

Tables of Figures

Figure 1: Gender	41
Figure 2: Income	42
Figure 3: Education	43
Figure 4: Workplace experience	44
Figure 5: Post	45
Figure 6: The digital traceability is essentially affected by the state of art technology used by the enterprise.....	46
Figure 7: The digital traceability is strongly influenced by the supply chain design within a firm	46
Figure 8: The competitiveness of the enterprise is greatly influenced by the presence of competitors within the enterprise.....	47
Figure 9: The competitiveness of the enterprise is influenced by the strength of the internal offerings	48
Figure 10: The competitiveness of the enterprise is determined by the resources used	48
Figure 11: The competitiveness of the enterprise is affected by the management of different talents and skills.	49
Figure 12: The efficiency within the domain of a business is strongly influenced by the size of the firm	50
Figure 13: The efficiency within a firm is influenced by growth rate of the assets.....	50
Figure 14: The efficiency of the firm is affected by the business financial position	51
Figure 15: The efficiency of the firm is affected by the transparency in business	51
Figure 16: The resilience within the business is affected by the workforce employed within the workplace.....	52
Figure 17: The resilience within the context of an enterprise is affected by social aspects of an enterprise	53

Figure 18: The resilience is largely influenced by the overall the financial standing of the enterprise 53

Figure 19: The resilience is affected by the external environmental aspects..... 54

Figure 20: The digital traceability helps in carrying out internal operations better..... 55

Figure 21: The digital traceability allows better opportunities for managing customer relationships . 55

Tables of Tables

Table 1: Thematic analysis	22
Table 2: Descriptive statistics	26
Table 3 Realisbility statistics	29
Table 4 KMO and Barlett's test	30
Table 5 Communalities	30
Table 6 Explanation of total variances.....	31
Table 7 Correlations statistucs	33
Table 8 Model summary for Digital traceability and efficiency	34
Table 9 ANNOVA table for Digital traceability and efficiency	35
Table 10 Coefficient table for Digital traceability and efficiency	35
Table 11 Model summary for Digital traceability and resilience	36
Table 12 ANOVA table for Digital traceability and resilience	36
Table 13 Coefficient table for Digital traceability and resilience	37
Table 14 Model summary for Digital traceability and competitiveness	37
Table 14 Model summary for Digital traceability and competitiveness	38
Table 16 Coefficient table for Digital traceability and competitiveness	39
Table 17 Demographic analysis	39
Table 18 Gender.....	41
Table 19 Income.....	42
Table 20 Education	43
Table 21 Workplace experience.....	44
Table 22 Post.....	45

Chapter 1

Introduction

A Research on How digital traceability can help companies improve efficiency, resilience, and competitiveness

1.1 Objective of Study

The goal of this study is to analyse the importance of making use of digital traceability within an enterprise.

According to Olsen and Borit (2013), digital traceability has a significant role to play in ensuring that products can be tracked, and makes use of a digital system that can mitigate human error in the process. Companies and brands can keep track of all items being sold. In addition to product tracking, traceability has also become more important in improving manufacturing and distribution processes transparency.

Malek (2021) highlights the increased complexity within today's business environment that leads to situations where higher efficiency and resilience are essential. For this, tracking and tracing are helpful techniques.

The study is focused on identifying how traceability does lead to better organizational outcomes.

1.2 Key Research Objectives

1. Analysing the significance of digital traceability to improve organisational efficiency
2. Analysing how digital traceability can help addressing competitive threats in the market
3. Analysing the perspective of managers on the topic to avoid operational errors
4. To find how digital traceability can improve organizational resilience.
5. Identifying solution to foster adoption of digital traceability in operation to increase competitiveness

1.3 Purpose of Study

With the increased complexity and dynamic within today's business environment, companies have started to realizing the need for better systems and technologies to understand and oversee what is happening within the company.

The study intend to understand the errors and complexities within business operations which are critical for success.

1.4 Significance of the study

Businesses have become more and more digital. In fact 90% of CEOs believing that the digital economy will impact their industries, less than 15% of them are implementing a digital strategy. (MIT Sloan. Capgemini, 2018).

Therefore, business procedures and norms have become more digital, or need to.

Research on digital traceability can generally help with understanding of how the topic can improve business efficiency (Malek 2021).

1.5 Limitations

At the beginning of the task looking for suitable literature. As so often, while there a lot of sources on the web talking about the topic, most of them were irrelevant as being from blogs, Wikipedia etc. and it was difficult to select the ones that make sense.

Another area that was hard was the design of the study. With the option of either a qualitative or quantitative research the quantitative design was opted for the study, due to the lack of people willing to be interviewed.

That decision lead to other difficulties, one being coming up with 20+ survey questions, the other being the importance of keeping questions short to improve feedback rates from the survey participants.

Chapter 2

Literature Review

A Research on How digital traceability can help companies improve efficiency, resilience, and competitiveness

2.1 Digital Traceability, Traceability, and its Need

In recent decades, several sectors have started to adopt the concept of traceability (Karlsen et al., 2012), which previously has mostly been associated with the manufacturing industry (Han et al., 2011). When it comes to the implementation of traceability systems, the automobile and food industries have taken the lead (Dai et al., 2012).

Many different methods to traceability have been researched in recent years as an interdisciplinary study subject (Karlsen et al., 2012).

With digital traceability, a product can be tracked without the possibility of human mistake. If a product's traceability can be verified, then it may be used to verify sustainability claims in the fields of human rights, labour (including safety and health), environmental protection, and anti-corruption (Campos, and Míguez, 2006).

Digitized tracing may ease and minimise many of the most important hazards in business today. When it comes to food safety and food fraud, for example, these technologies can help speed remedial activities by recognising concerns promptly and making it easier to monitor the path of a problem. They can also maximise the use and re-use of materials and resources, hence enhancing the food supply chain's sustainability and efficiency. Indeed, farmers that use digital technology may expect to get \$10 in benefits for every \$1 invested. Product certification using digital traceability technology helps ensure that only fair and sustainable products reach the market, as well as communicating to customers how legitimate they are (Budak, et. al., 2018).

On the other hand, most of the study focuses on the consequences, advantages, or adoption of these technologies within the food or agriculture business (Karlsen et al., 2012) A literature study

undertaken by Karlsen et al. (2012) found that neither a standard definition of the term "traceability" nor a theoretical foundation for its implementation exist. Researchers such as Kvarnström (2010), Olsen and Borit (2010), and others have bolstered this claim (2013). According to them, the way that traceability is currently defined leaves leeway for interpretation, which ultimately results in principles that are neither clear nor consistent.

The scientific literature on traceability lacks a consensus definition and theoretical discussion, so Kvarnström (2010) investigated the existing literature, described how various traceability concepts are connected, and presented his point of view on a conceptual framework for traceability in the scientific literature.

It is the capacity to track and trace the whereabouts of the lot, its sub-components and raw materials along the supply chain that is traceability.

As stated in (Kvarnström 2010), the definition will be employed in this study since it is all-inclusive and includes all necessary features of traceability. A generic definition may be applicable to businesses that create a few goods with numerous sub-components and raw materials as well as companies that manufacture a wide variety of products from the same sub-components and raw materials. Defined this way, the significance of ensuring continuity from and among subcomponents and/or raw materials was made abundantly evident. In Kvarnström's (2010) definition, "a lot" can refer to either a single thing or a group of items. Tracing refers to the capacity to locate the prior location of a lot, while monitoring refers to the ability to keep track of its current location. As a result, tracking means the identification of lots with components from a specific batch and recording the lot's history.

As defined by JansenVullers et al. (2003), forward traceability enables the investigation of lots' where-used relationships while backward traceability enables the investigation of lots' where-from. Comparing the terms with Kvarnström's (2010) definition, back traceability and trace are viewed as synonyms, while forward traceability is also considered as a synonym for tracking.

Smart Factory (2021) explains that after a shift in perspective, the company must comprehend why they need an enhancement in the traceability idea. This must be emphasised at all costs. No time like the present when there are so many active endeavours.

Scholars agree on one issue, notwithstanding disagreements in the literature: that chain traceability is dependent on the full internal traceability of all enterprises in the supply chain. If the organisation wants to thrive in digital transformation initiatives like DTP 1.0 and 2.0, and reap the full benefits of their investments, they must recognise the need of thorough internal tracking of their own manufacturing processes and provide the appropriate resources accordingly. Starting by ensuring internal traceability, and only after that to consider expanding to include the entire supply chain. When developing a system, keep in mind the system's future development goals.

A digital traceability system enables firms to track commodities and products as they move through the supply chain, allowing them to obtain precise information about the source of inputs, supplier sourcing procedures, and the conversion processes that are used. Using data, firms can also forecast and run scenarios, detect wasteful resource usage, respond faster to demand fluctuations, and reduce the impact of internal and external shocks. Increasing growth and lower costs will lead to increased market share and a better return on investments for all stakeholders because of these combined benefits.

Leaders in the field of traceability will also have a hand in establishing industry-specific standards and regulations. There is no doubt about the need of traceability, yet many firms have struggled to adopt it. Traceability may be compared to a digital transition in several respects. It may be difficult to keep up with all the many application areas and technology that are out there. Scaling and amplifying a pilot are far more difficult than setting one up from scratch. There is also a new level of complication that comes with traceability: working with a wide network of value chain partners.

2.2 Digital Traceability Technologies

According to Eichstädt, et. al., (2021), through the collection and transfer of data with minimal or no human interaction, automatic identification (auto-ID) technology may track and trace things, products, assets, and humans across the value chain. As a result, early judgments can be made, and error-prone manual processes can be eliminated. Even though a variety of auto-ID technologies are employed in automated tracking, barcodes, RFID, RTLS, and GPS are the most often seen at various stages of the industrial value chain. It is possible to use these technologies in a variety of ways for a variety of reasons.

There are further uses for blockchain technology in Digital traceability within supply chain department of organisations as discussed by Paliwal, et. al., (2020). This breakthrough has the potential to aid in the tracking and security of supply chains and the ever-increasing complexity of subcontracting setups in production and manufacturing, food processing, or medicines. A public ledger that is distributed, decentralised, and available to everyone on a network is what means by the term "blockchain." Users of blockchains exchange data in real time without the use of middlemen. The data becomes an immutable block when it has been authorised by all parties.

2.3 Business Sustainability through Digital Traceability

Companies that wish to remain competitive in today's market and adhere to the ever-increasing number of rules must adopt a sustainable business plan. When it comes to environmental and societal effect, most firms have come to realise that they need to do more than simply talk about it (WEF, 2021).

According to Forcam. (2020), ICPEN (International Consumer Protection and Enforcement Network) is pushing down on non-compliance and deceptive promises in the ESG sector, and governments are enforcing stricter regulations. Extended producer responsibility, supply chain transparency legislation and climate acts are all promoting sustainability in diverse industries. New trade policy constraints are also being enforced.

The traceability system is the driving force behind the transition to a more sustainable company model. With the help of the traceability system, data can be collected and validated at every step of the supply chain. In order to scale the transformation, it is essential to have processes in place for managing the design, development, production, sales, and marketing departments. Instead of a separate competence, it's crucial to think about sustainability as a manner at conducting business. To run a sustainable business, every aspect of the company's operations must take into account the impact they have on both the surrounding community and the natural world.

For many years, traceability was a straightforward procedure that relied on farmers and markets to be accepted by small towns and villages, but now, food brands and corporations confront the problem of manufacturing mass-market products while preserving integrity and customer confidence.

Despite consumers' increasing confidence in merchants as their primary point of contact with agriculture and food, the EIT Food Trust Report shows that more must be done. While many retailers are working hard to meet the expectations of customers, the survey indicated that many consumers want merchants to be clearer on their criteria for food goods and boost supply chain transparency. As a result, merchants have a clear window of opportunity to meet the changing needs of their customers and serve the public good by embracing digital (Prnewire, 2021).

As per the article of Ford, (2018), there is a presumption that each company's traceability system will be unique, especially in terms of managing internal data and knowledge. However, external cooperation with partners upstream and downstream is required to ensure the right transfer of information. Internal traceability processes are needed by businesses to ensure the transmission of necessary information to maintain batch traceability. There are a number of ways to get the information you need to a specific person, but the most common is to send it to a central web server where it may be accessed by many people. As an alternative to e-mail or EDI (Electronic Data Interchange) formats, conventional e-mail, Extranet, or other Internet-based exchange

systems can be used. Given its ability to facilitate the sharing of electronic, computer-based information, EDI has become a common coordination tool in the B2B setting (Bechini et al., 2008). Further, Malek, (2021) explains that when information is transmitted in a way that eliminates the possibility of manipulation or interference, consumers might have more faith in the product. With the help of several start-ups and partners, EIT Food is advancing digital traceability in the agri-food business. Marketing food has always relied on a culture of secrecy and the concealment of all that occurs throughout the value chain of food goods. Consumers have been left feeling betrayed by corporations and sceptical of product promises because of this, according to Coline Laurent, the Marketing and Head Of communications of Connecting Food, which she says may be alleviated by technology like blockchain (Shin, and Hwang, 2020).

2.4 Importance of Traceability to improve Efficiency and Competitiveness

According to Saney, (2021). Traceability has become an essential part of supply chain optimization considering new problems and the advancement of digitalization in business. Technology, procedures, and people are increasingly being integrated across the supply chain in an effort to reduce waste. Most businesses understand the need of investing in traceability, but not all of them are at the same state of implementation. One survey found that 58% of businesses are still in the early phases of creating their traceability approach or beginning pilot testing, while just 15% had seen a return on their investment.

These days, organisations have the technology to trace every part of a manufacturing system using various methods, such as the IoT (Internet of Things), big data analysis, and new communication networks (5G or WiFi 6). Using this new traceability capabilities, businesses will be able to increase their productivity while also strengthening their sustainability and resilience. Companies that do not have a traceability system are constantly vulnerable to any unexpected event (Grunning, 2019).

Increasingly, medical, automotive, and aerospace goods rely on electronics, making product reliability even more crucial. Many individuals use USB devices as crucial backup devices today. A

product may fail in the market owing to a flaw or weakness, or it may fail due to misuse or treatment that goes against the product's original goal. As a result, when important failures occur, it is necessary to determine who is to blame. It is not uncommon for the manufacturer to be viewed as a possible source of a concealed problem, given this is where the bulk of the product's production occurred. The manufacturer is protected by following established standards and processes and demonstrating that no errors or deviations occurred during the production of a faulty product for which they bear responsibility. This might involve using only approved materials and techniques. Digital build records can meet such requirements quickly, as every activity taken as part of the conformance or compliance is documented.

As a result, the manufacturer will be shielded from costly legal processes, as well as preserving the company's reputation (Beliatis, et. al., 2021).

While it may have been a while since the material was used, comprehensive digital traceability construction records make it possible to trace back the source of counterfeit materials. It is also possible to identify and take appropriate action before a potential failure of any other product, whether in the manufacture or dispatched, that also uses materials from the recognised carrier. The impact on both the firm that owns the logo on the goods and the manufacturer is greatly lessened because individual serial numbers and even potential owners may be addressed directly. A trustworthy digital supply-chain control must be established to avoid counterfeit material liability. Material providers must then construct their own secure traceability. Automated supply chain policing will be completed as soon as the source of entry can be tracked back far enough to disclose it, making the fabrication of counterfeit materials too hazardous and therefore, deterring them.

Chapter 3

Methodology

3.1 Introduction

The focus of the chapter is to outline and identify the key way in which data would be collected in regards to the research and the way in which the methods applied can be justified. The chapter follows a structured format of research method, research approach and the data collection method. This is then followed by the research process, sampling technique and the data analysis technique. Through these a strong understanding of the way in which the research can attain its objectives may be established.

3.2 Research Method

The research method intends to identify the data collection and analysis technique as followed with respect to the study in order to establish the way in which the data for the research is being collected and the way in which the data would be critically analysed (Camacho et al. 2020). In this regard, the primary quantitative data analysis technique has been opted for the study whereby the information for the research is collected from the participants of the same field and the analysis is engaged in a quantitative manner so as to give way to effective identification of the technique in which the research outcomes are attained and the impact of digital traceability on the efficiency, resilience and the competitiveness can be well established. Relating to this, the use of the primary quantitative research strategy has given way to ensuring a better understanding of the digital traceability as a concept and the way in which ensuring this traceability would lead to better results for the overall management of the firm (Harris et al. 2019).

3.3 Research Approach

The research approach is the research plan formulated to give way to adopting an analysis technique such that the desired responses are attained. In association with this, it becomes significantly critically to note that there are two main approaches with respect to the data and these can be rightly categorised into the deductive research approach and the inductive research approach (Bougie and Sekaran 2019). Within the deductive research approach, the researcher is involved in deducing the critical information out of the data being collected with respect to the study whereas, in the inductive research approach, the author induces critical information out of the data collected and engages in analysis based on their own perspective. However, this study is intended to understand the way in which the digital traceability impacts the efficiency within an enterprise and therefore, the involvement of the researcher is not required (Cypress 2018).

3.4 Data Collection Method

The data collection method is one of the most integral parts of any research and in consideration with this, in order to be successful in the long run, an appropriate type of data needs to be collected. In relation to this, there are two main techniques of data collection. Primary data collection and the secondary data collection (Dźwigoł 2019). Within the primary data collection the focus is to collect the information for the study from the first hand sources and to apply unique insights into the study. However, it is critically important to assess and identify the fact that this data collection technique is time consuming and may involve certain costs as well. As opposed to this, the secondary data collection can be identified as a way in which the existing data is collected. In this regard, the data collection technique which was selected for the study may be rightly identified as primary data collection technique (Eden and Nielsen 2020).

The research instrument used within the context of the study can be assessed to be the survey questionnaire. Within the survey questionnaire, the following questions have been asked as per the themes formulated for the study within the appendix (Bechini et al. 2008).

The close ended questionnaire using Multiple choice and Likert scale questions have allowed effective data collection and analysis to enable better understanding of the research context and the way in which the influence of digital traceability may be examined within the business.

General Survey

Table 1: Thematic analysis

THEMES	QUESTIONS USED IN EACH THEME
Theme 1 To analyse the significance of digital traceability to improve efficiency in organizational operation.	Question 7 and 8 Digital traceability is essentially affected by the state of art technology used by the enterprise Digital traceability is strongly influenced by the supply chain design within a firm
Theme 2 To analyse how digital traceability can help in addressing the competitive threat in the market	Questions 19, 20,21 and 22 The competitiveness of the enterprise is greatly influenced by the presence of competitors within the enterprise The competitiveness of the enterprise is influenced by the strength of the internal offerings The competitiveness of the enterprise is determined by the resources used The competitiveness of the enterprise is affected by the management of different talents and skills.

<p>Theme 3</p> <p>To analyse the perspective of managers on digital traceability to avoid errors in the operation.</p>	<p>Question 11,12,13 and 14</p> <p>The efficiency within the domain of a business is strongly influenced by the size of the firm</p> <p>The efficiency within a firm is influenced by growth rate of the assets</p> <p>The efficiency of the firm is affected by the business financial position</p> <p>The efficiency of the firm is affected by the business financial position</p>
<p>Theme 4</p> <p>To find how the digital traceability can positively encourage organizational resilience.</p>	<p>Questions 15,16,17 and 18</p> <p>The resilience within the business is affected by the workforce employed within the workplace.</p> <p>The resilience within the context of an enterprise is affected by social aspects of an enterprise</p> <p>The resilience is largely influenced by the overall the financial standing of the enterprise</p> <p>The resilience is affected by the external environmental aspects</p>

Theme 5	Questions 9 and 10
To identify effective solution to increase the adoption of digital traceability in organizational operation to generate high competitiveness	<p>Digital traceability helps in carrying out internal operations better</p> <p>Digital traceability allows better opportunities for managing customer relationships</p>

3.5 Sampling

The sampling technique can be identified as the technique where the data is collected with respect to identification of certain participants within the context of the study. In association with this, the simple random probability sampling technique was opted for in regards to the research study whereby the employees and managers of varying industries have been targeted for the understanding of the information in a critical manner (Bechini et al. 2008). Therefore, a total of 100 participants had been approached critically via social media platforms on the different departments with the assistance of which a strong understanding of how the digital traceability can affect business was identified (Marvasti 2018).

3.6 Research Process

The research process is that the data has been collected from the managers and employees within the different industries to assess the concept of the digital traceability and the way in which it influences competitive rivalry, resilience and overall efficiency. The survey has been a close ended survey and once the responses were captured, it was exported to the excel sheet.

3.7 Data Analysis

The data analysis is a technique where data can be rightly analysed. In this context, it can be underlined significant to note that the analysis is carried out using quantitative data analysis technique. Within the data analysis, the quantitative data analysis with the statistical tools have been chosen (Marvasti 2018). The descriptive analysis, correlation and regression have been applied to derive a relationship between digital traceability and efficiency, competitiveness and resilience.

Chapter 4

Findings and Discussion

4.1 Overview

The chapter outline the key results of the quantitative analysis engaged in with the assistance of the descriptive analysis, the inferential analysis and the critical discussion on the findings.

4.2 Descriptive analysis

In the descriptive analysis, the distribution of the data has been discussed in a critical manner. Pertaining to this, it could be rightly assessed that the mean value is close to 2 which reflects the fact that a majority of the respondents are in agreement of the statements given in the Likert scale in regard to the statements made about the digital traceability, competitiveness and the resilience alongside the efficiency of the entire system.

Table 2: Descriptive statistics

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Digital traceability is essentially affected by the state of art technology used by the enterprise	100	1	5	2.33	1.326	.774	.241	-.612	.478
Digital traceability is strongly influenced by the supply chain design within a firm	100	1	5	2.09	1.164	.919	.241	-.115	.478
Digital traceability helps in carrying out internal operations better	100	1	5	2.25	1.242	.833	.241	-.359	.478
Digital traceability allows better opportunities for managing customer relationships	100	1	5	2.19	1.169	.897	.241	-.110	.478
The efficiency within the domain of a business is strongly influenced by the size of the firm	100	1	5	2.07	1.121	1.000	.241	.239	.478
The efficiency within a firm is influenced by growth rate of the assets	100	1	5	1.93	1.066	1.112	.241	.615	.478
The efficiency of the firm is affected by the business financial position	100	1	5	2.17	1.240	1.001	.241	.029	.478

The efficiency of a firm is strongly influenced by the transparency in business.	100	1	5	2.16	1.170	.996	.241	.176	.478
The resilience within the business is affected by the workforce employed within the workplace.	100	1	5	2.01	1.168	1.145	.241	.554	.478
The resilience within the context of an enterprise is affected by social aspects of an enterprise	100	1	5	2.24	1.215	.765	.241	-.510	.478
The resilience is largely influenced by the overall the financial standing of the enterprise	100	1	5	2.30	1.259	.774	.241	-.446	.478
The resilience is affected by the external environmental aspects	100	1	5	2.19	1.339	.882	.241	-.491	.478
The competitiveness of the enterprise is greatly influenced by the presence of competitors within the enterprise	100	1	5	2.21	1.289	.896	.241	-.372	.478
The competitiveness of the enterprise is influenced by the strength of the internal offerings	100	1	5	2.17	1.215	.977	.241	.021	.478
The competitiveness of the enterprise is determined by the resources used	100	1	5	2.23	1.317	.972	.241	-.196	.478

The competitiveness of the enterprise is affected by the management of different talents and skills.	100	1	5	2.39	1.317	.568	.241	-1.000	.478
Digital traceability	100	1.00	5.00	2.2350	1.01119	.747	.241	-.248	.478
Efficiency	100	1.00	4.50	2.0500	.87761	.668	.241	-.348	.478
Resilience	100	1.00	4.50	2.1700	.97758	.577	.241	-.695	.478
Competitiveness	100	1.00	4.50	2.3150	1.02162	.538	.241	-.736	.478
Valid N (listwise)	100								

4.3 Reliability and validity analysis

Reliability analysis

The reliability statistics gives the idea about the way in which the data as sourced for the study can be relied upon. In this context, it can be identified significantly critical to understand the fact that the value of the Cronbach alpha may be identified to be 0.928 which reflects on the fact that the data is highly reliable (Gupta 2022).

Table 3 Realisbility statistics

Cronbach's Alpha	N of Items
.928	20

Validity analysis

In the context of the validity analysis, it may be assessed that the KMO measure of sampling adequacy shows that the study is valid as the value is above 0.571. The communalities value reflects that all values can be included.

Table 4 KMO and Bartlett's test

KMO and Bartlett's Test			
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.			.571
Bartlett's Test of Sphericity	Approx. Chi-Square		1708.347
	df		190
	Sig.		.000

Table 5 Communalities

Communalities

	Initial	Extraction
Digital traceability is essentially affected by the state of art technology used by the enterprise	1.000	.657
Digital traceability is strongly influenced by the supply chain design within a firm	1.000	.632
Digital traceability helps in carrying out internal operations better	1.000	.589
Digital traceability allows better opportunities for managing customer relationships	1.000	.483
The efficiency within the domain of a business is strongly influenced by the size of the firm	1.000	.622
The efficiency within a firm is influenced by growth rate of the assets	1.000	.605
The efficiency of the firm is affected by the business financial position	1.000	.555
The efficiency of a firm is strongly influenced by the transparency in business.	1.000	.589
The resilience within the business is affected by the workforce employed within the workplace.	1.000	.581

The resilience within the context of an enterprise is affected by social aspects of an enterprise	1.000	.555
The resilience is largely influenced by the overall the financial standing of the enterprise	1.000	.564
The resilience is affected by the external environmental aspects	1.000	.590
The competitiveness of the enterprise is greatly influenced by the presence of competitors within the enterprise	1.000	.524
The competitiveness of the enterprise is influenced by the strength of the internal offerings	1.000	.573
The competitiveness of the enterprise is determined by the resources used	1.000	.532
The competitiveness of the enterprise is affected by the management of different talents and skills.	1.000	.758
Digital traceability	1.000	.880
Efficiency	1.000	.821
Resilience	1.000	.856
Competitiveness	1.000	.826

Extraction Method: Principal Component Analysis.

The total variance table explains the fact that a majority of the variance is explained by the first 8 components

Table 6 Explanation of total variances

Total Variance Explained						
Component	Initial Eigenvalues			Extraction Sums of Squared Loadings		Extraction Sums of Squared Loadings
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.874	44.372	44.372	8.874	44.372	44.372
2	1.552	7.758	52.131	1.552	7.758	52.131
3	1.273	6.366	58.497	1.273	6.366	58.497

4	1.093	5.467	63.964	1.093	5.467	63.964
5	.996	4.980	68.944			
6	.938	4.691	73.635			
7	.879	4.394	78.029			
8	.756	3.781	81.810			
9	.698	3.491	85.301			
10	.563	2.815	88.116			
11	.479	2.394	90.510			
12	.436	2.180	92.690			
13	.388	1.942	94.632			
14	.374	1.870	96.503			
15	.347	1.736	98.239			
16	.218	1.092	99.331			
17	.063	.314	99.645			
18	.032	.161	99.806			
19	.024	.119	99.925			
20	.015	.075	100.000			

Extraction Method: Principal Component Analysis.

4.4 Inferential analysis

Correlation analysis

The correlation analysis is a statistical tool which is generally made use of in order to find the association between the different variables and identify how the change in one of the variables has the capability to bring about a considerable change in another (Gupta et al. 2022). The values of the correlation may be identified to be high or low and accordingly negative or positive. From the given table it can be assessed that, the association between competitiveness and traceability is the highest followed by resilience and lastly the efficiency.

Table 7 Correlations statistics

Correlations

		Digitaltraceability	Efficiency	Resilience	Competitiveness
Digitaltraceability	Pearson Correlation	1	.533**	.549**	.671**
	Sig. (2-tailed)		.000	.000	.000
	N	100	100	100	100
Efficiency	Pearson Correlation	.533**	1	.629**	.512**
	Sig. (2-tailed)	.000		.000	.000
	N	100	100	100	100
Resilience	Pearson Correlation	.549**	.629**	1	.717**
	Sig. (2-tailed)	.000	.000		.000
	N	100	100	100	100
Competitiveness	Pearson Correlation	.671**	.512**	.717**	1
	Sig. (2-tailed)	.000	.000	.000	

	N	100	100	100	100
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** . Correlation is significant at the 0.01 level (2-tailed).

4.5 Regression analysis

The regression analysis is a statistical tool which is focused on arriving at a relationship between the independent variable and the dependent variables. When the relationship between the variables is established it identifies the way that digital traceability can have a strong influence on the overall competitiveness, resilience and efficiency.

Digital traceability and efficiency

Table 8 Model summary for Digital traceability and efficiency

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.533 ^a	.284	.277	.74635

a. Predictors: (Constant), Digital traceability

The table reflects on the fact that the correlation between the variables is 0.533. In line with this, the value of the adjusted R square reflects that the digital traceability influences the efficiency by 27%.

Table 9 ANNOVA table for Digital traceability and efficiency

ANOVA^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	21.660	1	21.660	38.884	.000 ^b
	Residual	54.590	98	.557		
	Total	76.250	99			

a. Dependent Variable: Efficiency

b. Predictors: (Constant), Digital traceability

The value of the p under the significant F reflects on the fact that a strong relationship exists between the independent and the dependent variable as the value is under the standard 0.05 and hence, a strong relationship would be established between the variables.

Table 10 Coefficient table for Digital traceability and efficiency

Coefficients^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.016	.182		5.589	.000
	<u>Digitaltraceability</u>	.463	.074	.533	6.236	.000

The value of the coefficients has been given.

Digital traceability and resilience

Table 11 Model summary for Digital traceability and resilience

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.549 ^a	.302	.295	.82105

a. Predictors: (Constant), Digitaltraceability

The table reflects on the fact that the correlation between the variables is 0.549. In line with this, the value of the adjusted r square reflects that the digital traceability influences the resilience by 2%.

Table 12 ANOVA table for Digital traceability and resilience

ANOVA^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	28.546	1	28.546	42.345	.000 ^b
	Residual	66.064	98	.674		
	Total	94.610	99			

a. Dependent Variable: Resilience

b. Predictors: (Constant), Digitaltraceability

The value of the p under the significant F reflects on the fact that a strong relationship exists between the independent and the dependent variable as the value is under the standard 0.05 and hence, a strong relationship would be established between the variables.

Table 13 Coefficient table for Digital traceability and resilience

Coefficients^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.983	.200		4.915	.000
	<u>Digitaltraceability</u>	.531	.082	.549	6.507	.000

The value of the coefficients have been given.

a. Dependent Variable: Resilience

Digital traceability and competitiveness.

Table 14 Model summary for Digital traceability and competitiveness

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.671 ^a	.450	.444	.76159

a. Predictors: (Constant), Digitaltraceability

The table reflects on the fact that the correlation between the variables is 0.671. In line with this, the value of the adjusted r square reflects that the digital traceability influences the competitiveness by 44 %.

Table 15 Model summary for Digital traceability and competitiveness

ANOVA ^a						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	46.486	1	46.486	80.145	.000 ^b
	Residual	56.842	98	.580		
	Total	103.328	99			

a. Dependent Variable: Competitiveness

b. Predictors: (Constant), Digitaltraceability

The value of the p under the significant F reflects on the fact that a strong relationship exists between the independent and the dependent variable as the value is under the standard 0.05 and hence, a strong relationship would be established between the variables.

Table 16 Coefficient table for Digital traceability and competitiveness

Coefficients^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.800	.186		4.314	.000
	<u>Digitaltraceability</u>	.678	.076	.671	8.952	.000

a. Dependent Variable: Competitiveness

The value of the coefficients have been given.

4.6 Demographic analysis

Table 17 Demographic analysis

Age				
		Frequency	Percent	Cumulative Percent
Valid	18-25 years	1	1.0	1.0
	26-32 years	12	12.0	13.0
	33-40 years	29	29.0	42.0
	41-50 years	30	30.0	72.0
	50 and above	28	28.0	100.0
	Total	100	100.0	

4.7 Demographic charts

Pie Chart

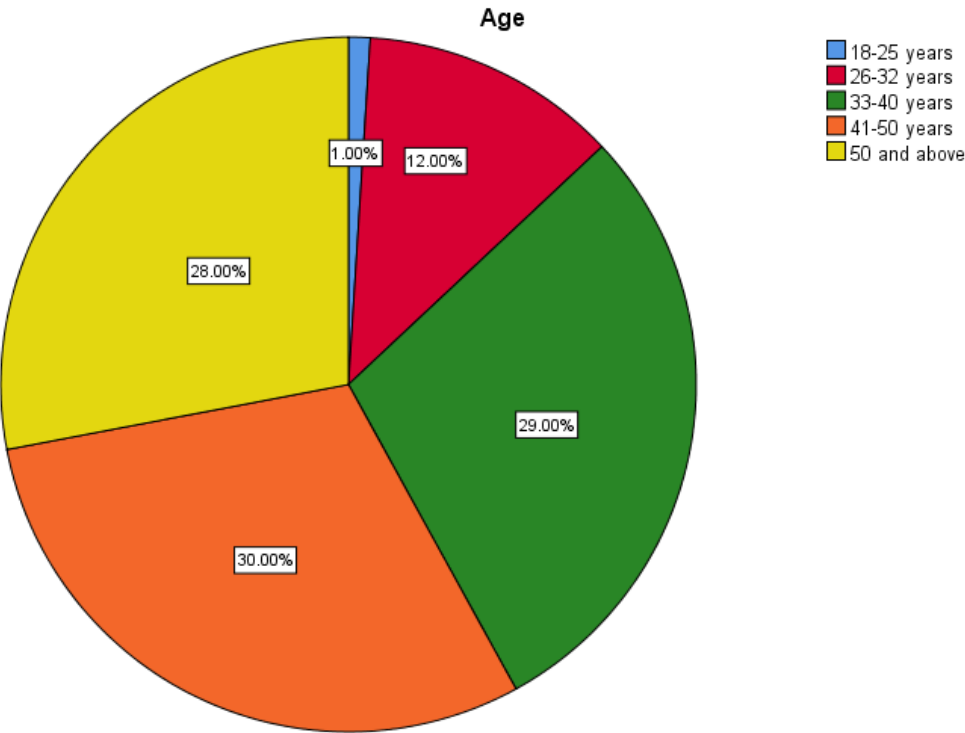


Table 18 Gender

Gender				
		Frequency	Percent	Cumulative Percent
Valid	Female	41	41.0	41.0
	Male	56	56.0	97.0
	Others	3	3.0	100.0
	Total	100	100.0	

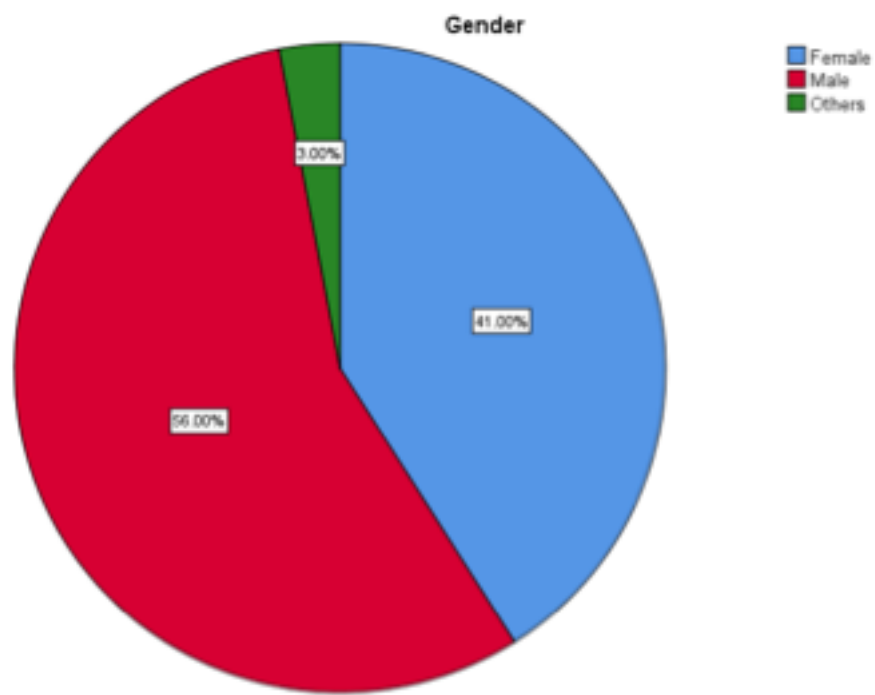


Figure 1: Gender

Table 19 Income

Income				
		Frequency	Percent	Cumulative Percent
Valid	Above £50000	28	28.0	28.0
	Below £25000 annually	38	38.0	66.0
	Between £25000 to £50000	34	34.0	100.0
	Total	100	100.0	

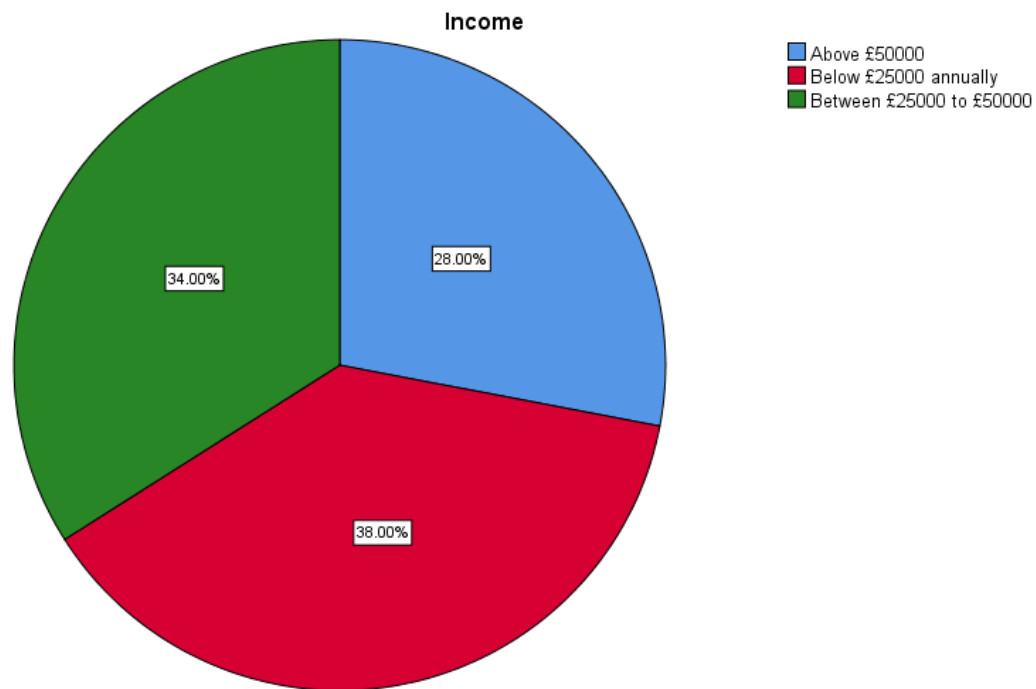


Figure 2: Income

Table 20 Education

Education				
		Frequency	Percent	Cumulative Percent
Valid	Diploma	15	15.0	15.0
	Graduate	25	25.0	40.0
	High school	1	1.0	41.0
	Others	23	23.0	64.0
	Postgraduate	36	36.0	100.0
	Total	100	100.0	

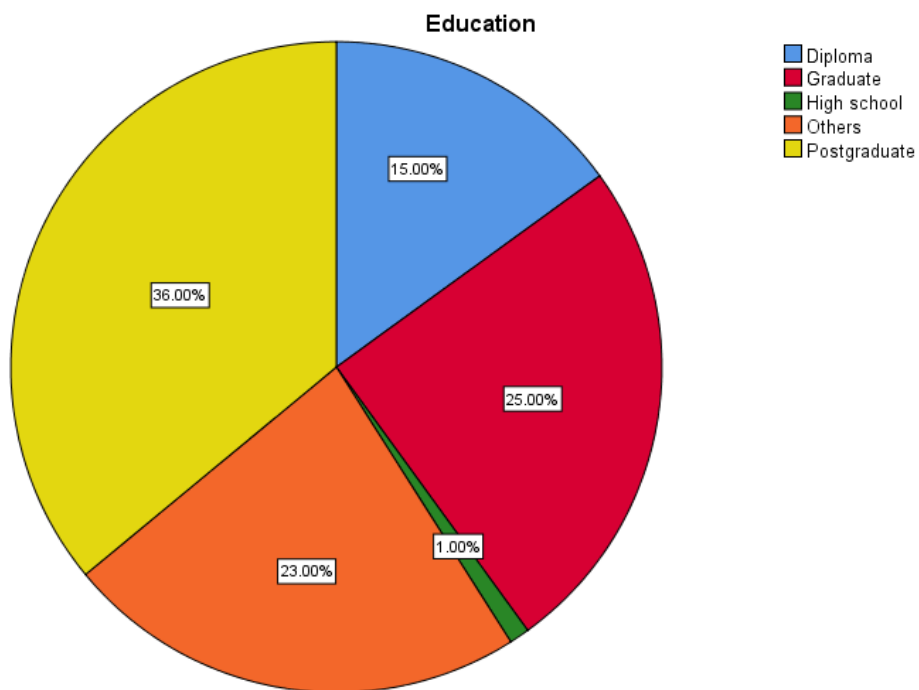


Figure 3: Education

Table 21 Workplace experience

Workplace experience				
		Frequency	Percent	Cumulative Percent
Valid	3-5 years	41	41.0	41.0
	Less than 3 years	38	38.0	79.0
	More than 5 years	21	21.0	100.0
	Total	100	100.0	

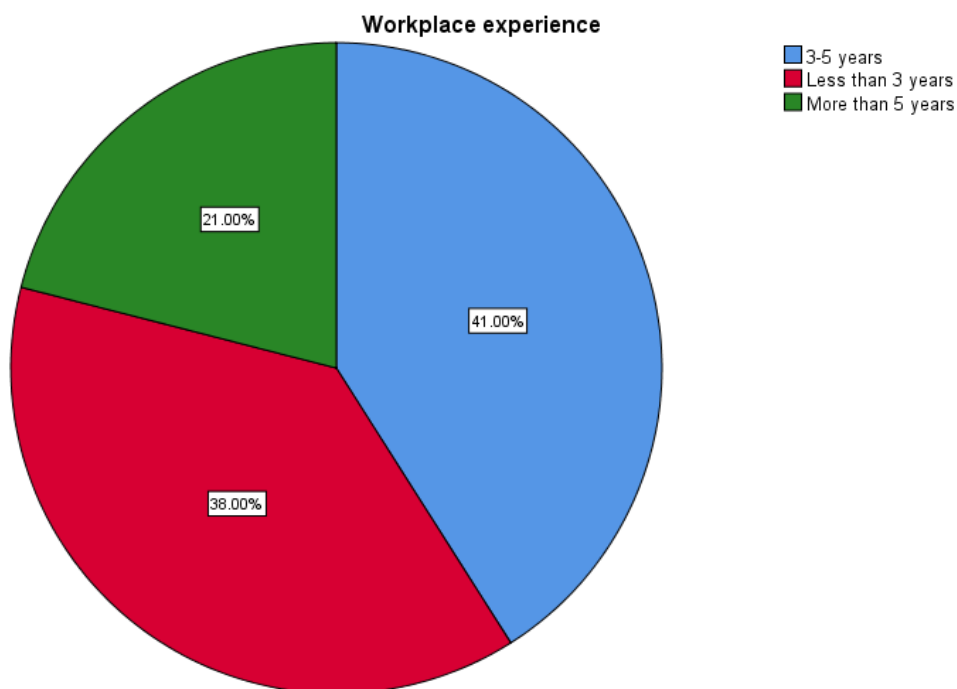


Figure 4: Workplace experience

Table 22 Post

Post				
		Frequency	Percent	Cumulative Percent
Valid	Management	41	41.0	41.0
	Supervisor	59	59.0	100.0
	Total	100	100.0	

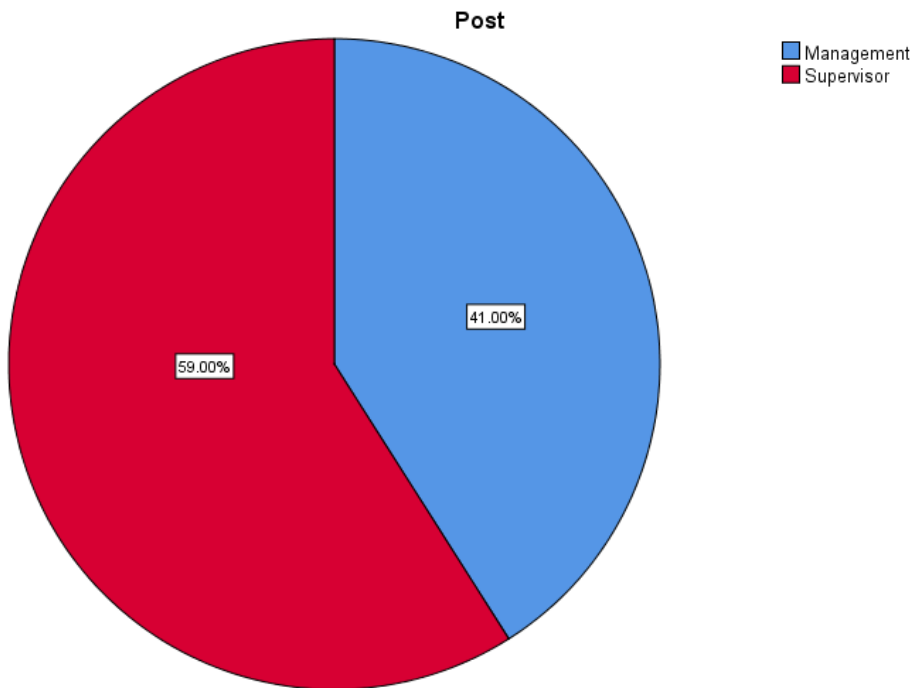


Figure 5: Post

4.8 Variable analysis

Theme 1: Significance of digital traceability to improve efficiency in organizational operation

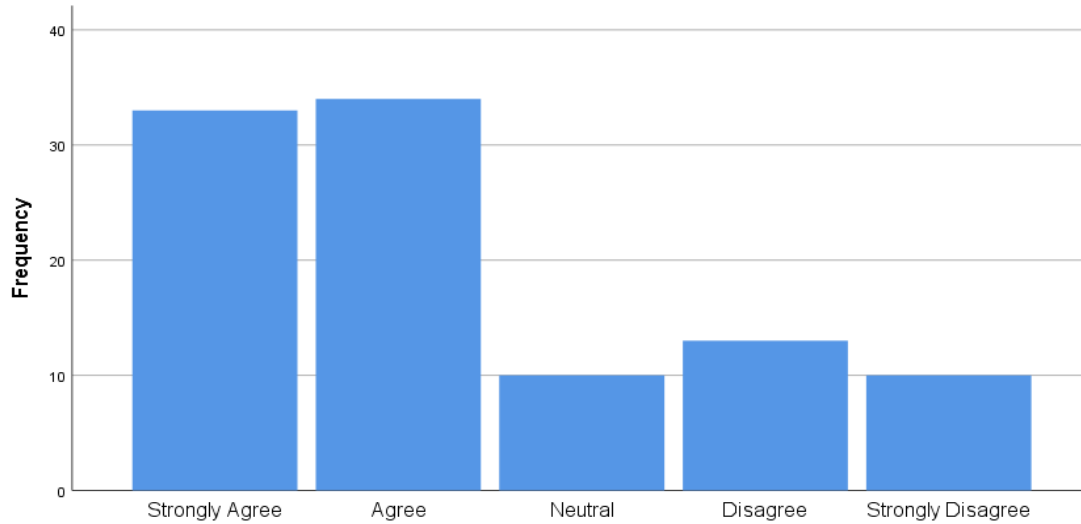


Figure 6: The digital traceability is essentially affected by the state of art technology used by the enterprise

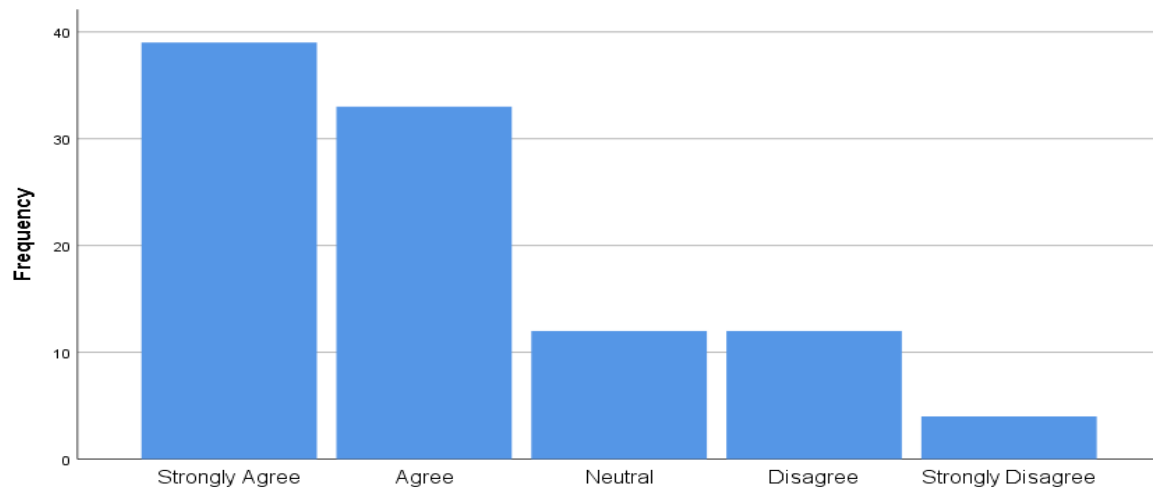


Figure 7: The digital traceability is strongly influenced by the supply chain design within a firm

As seen in figure 6 and 7, most of the participant agreed that the data traceability is influenced by the technological implementation and supply chain design of a firm. This survey outcome matches the findings in the part of literature review.

Eichstädt, et. al., (2021) stated that the technological use in the data collection and data transfer can actually reduce the time and errors in the data traceability process. On the other hand, data traceability is stated to be influenced by the supply chain arrangement of the company. According to the survey most of the participants agreed and strongly agreed that the data traceability is influenced by the supply chain arrangement or designs. Linking back to the findings in the study of Paliwal et. al. (2020) stated that the blockchain technology in the supply chain acts in favour of the data traceability competence in the organisations.

Theme 2: how digital traceability can help in addressing the competitive threat in the market

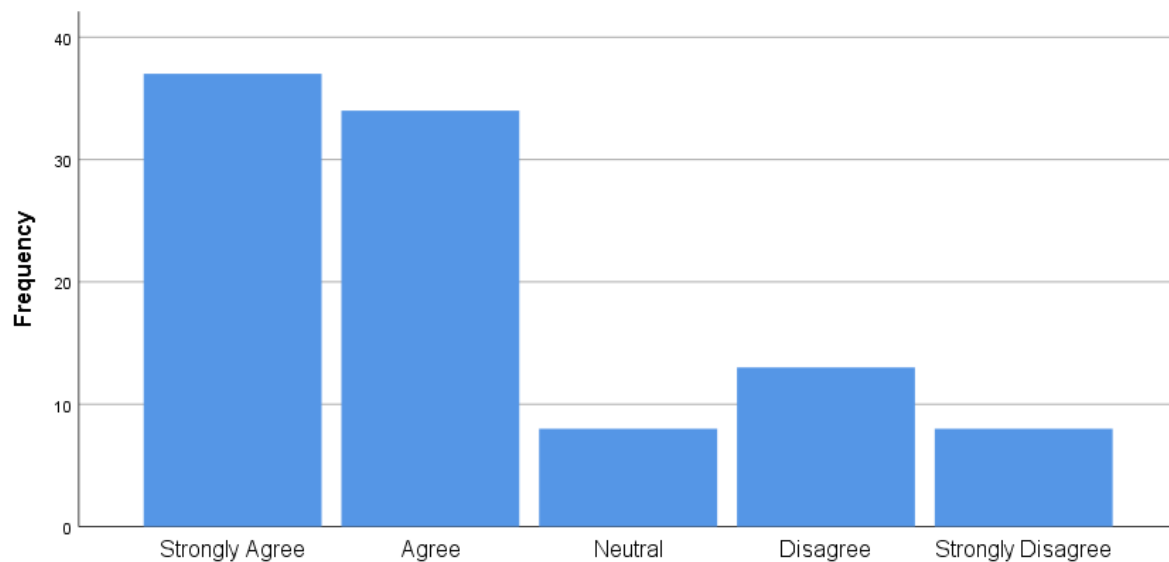


Figure 8: The competitiveness of the enterprise is greatly influenced by the presence of competitors within the enterprise

According to the study results, majority of the participants agreed and strongly agreed that the competitiveness of an enterprise is highly influenced by the competitors within the enterprise. In the section 2.4 of literature review, some of the literary evidence showed that traceability and the competitiveness of the company are reacted to each other.

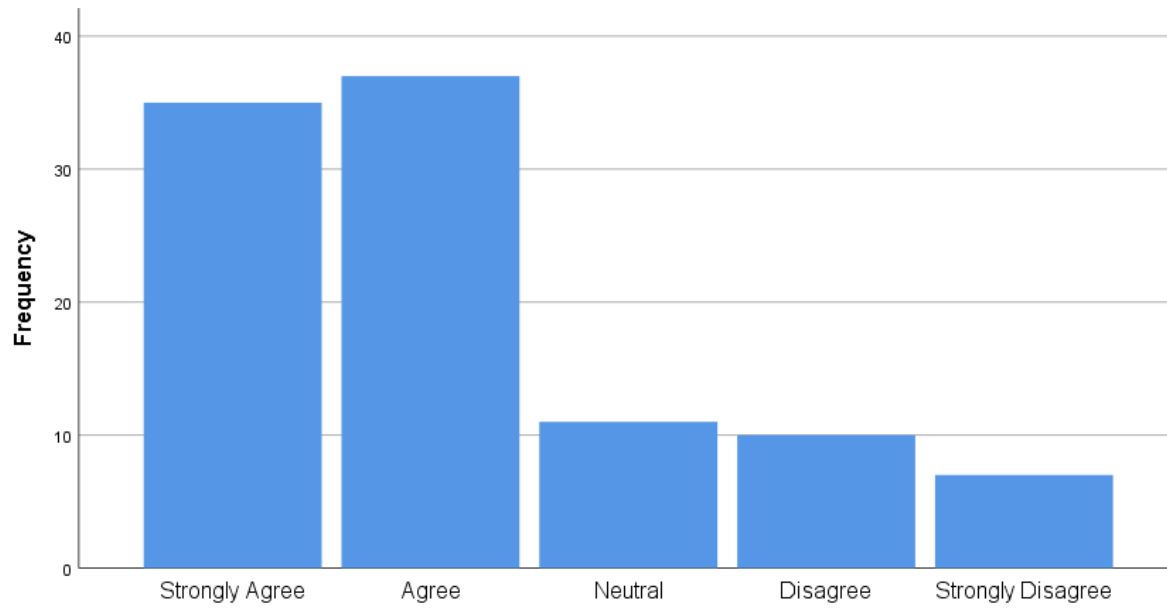


Figure 9: The competitiveness of the enterprise is influenced by the strength of the internal offerings

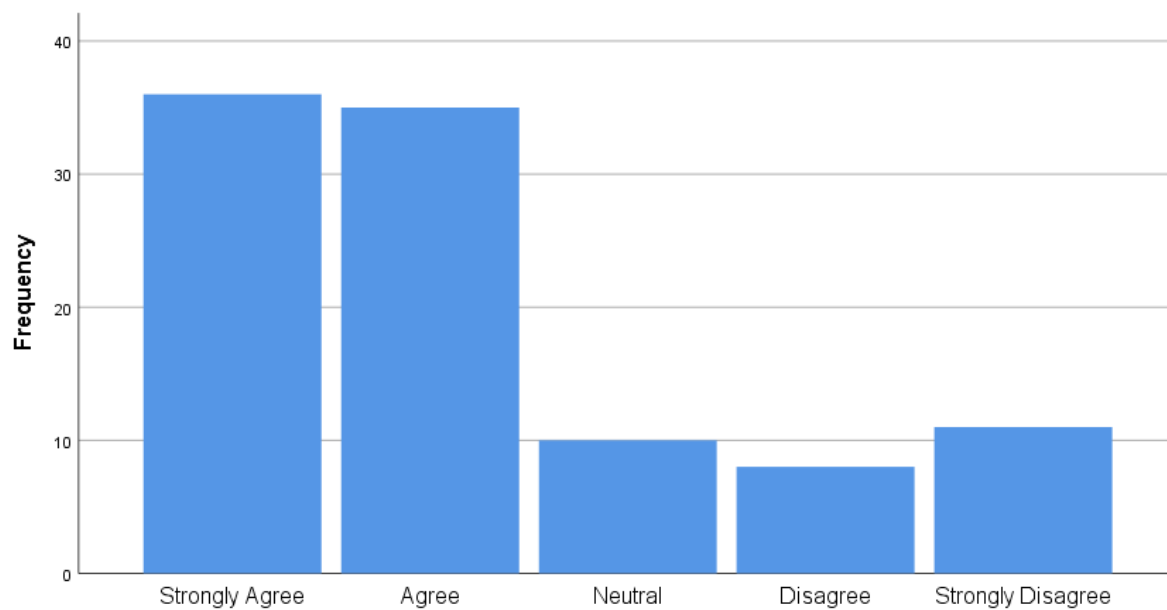


Figure 10: The competitiveness of the enterprise is determined by the resources used

Figures 8, 9, and 10 are about the company resources and their impact on the data traceability results. The primary data findings show that most of the respondents agreed that the competitiveness of an enterprise is dependent on the management of different talents and skills.

These data results are in compliance with the existing literature findings. The study of Prnewire (2021) showed that the internal resources of a company contributes towards their market competitiveness and efficiencies. The companies that are more efficient in their internal resources have the chance to get positive outcomes in lesser time. The market efficiency and competitiveness, therefore, are dependent on the use of resources, internal capabilities and the management skills of the talented workforce.

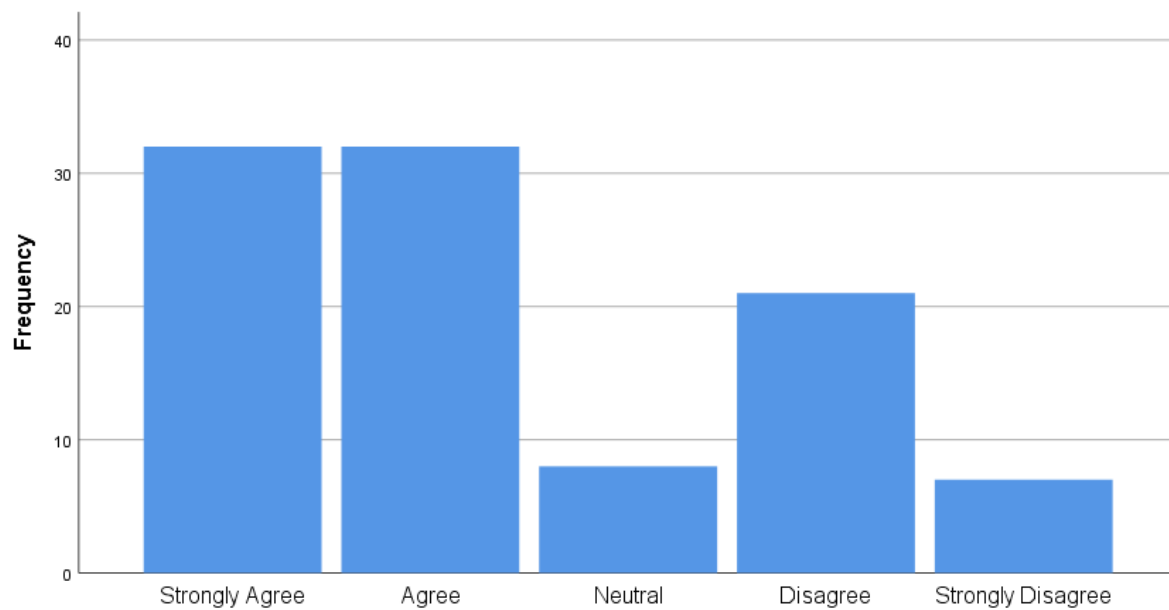


Figure 11: The competitiveness of the enterprise is affected by the management of different talents and skills.

Theme 3: The perspective of managers on digital traceability to avoid errors in the operation.

Theme 3 in the study centred with the perspectives of the firm managers in the digital traceability aspects. The researcher has developed the questions for the survey on the basis different operational aspects in the firm- firm size, growth rate of the assets, financial position and transparency in business. Figure 11, 12, 13 and 14 represents the results from the primary data source.

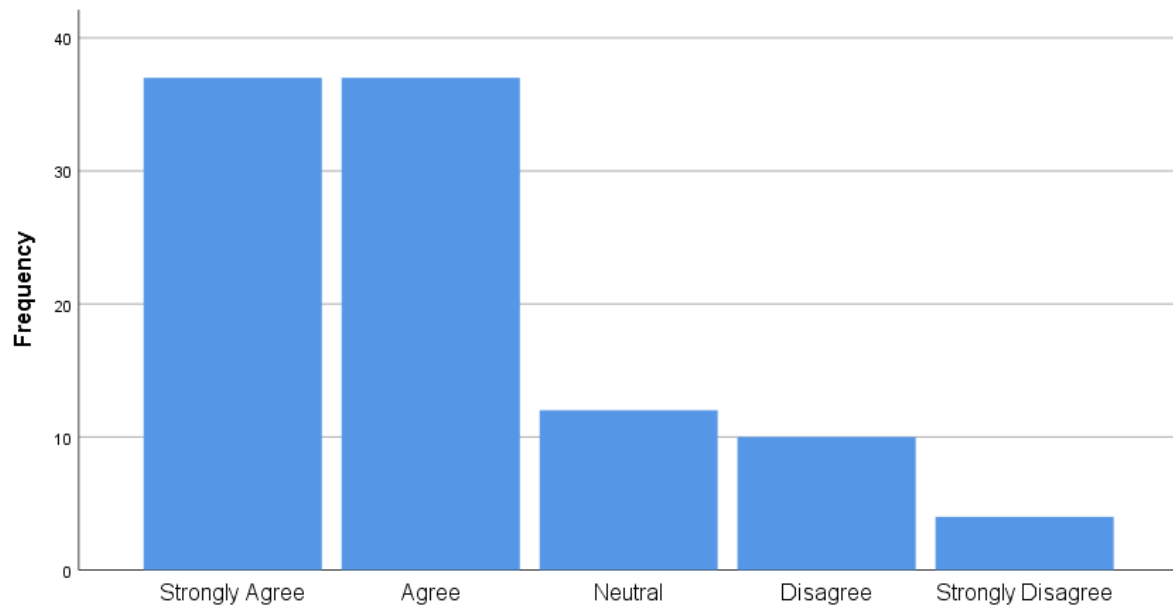


Figure 12: The efficiency within the domain of a business is strongly influenced by the size of the firm

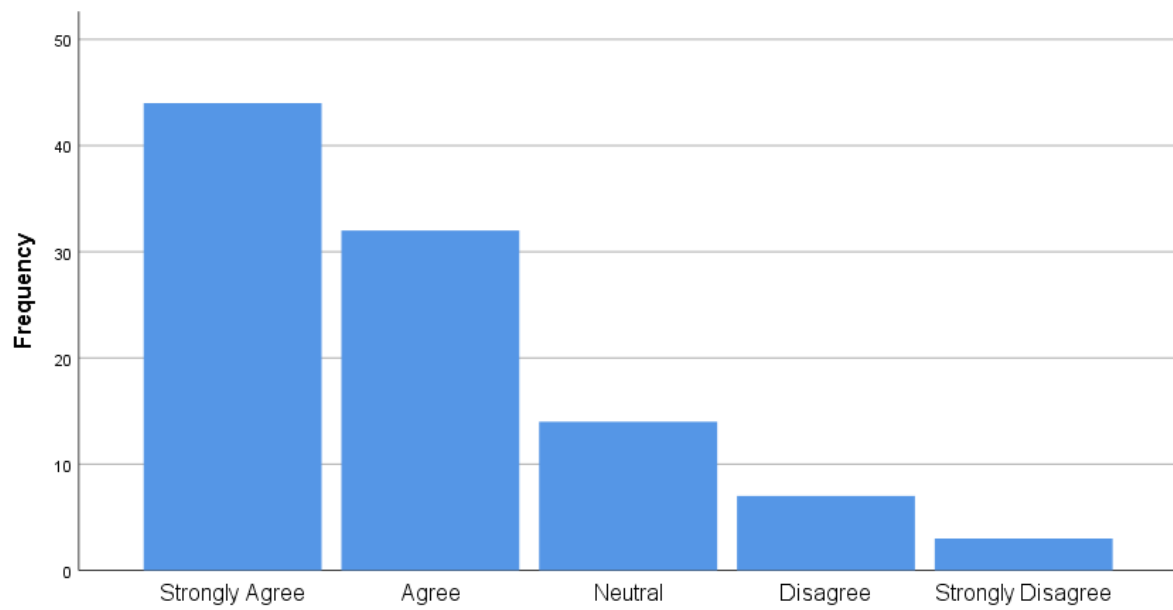


Figure 13: The efficiency within a firm is influenced by growth rate of the assets

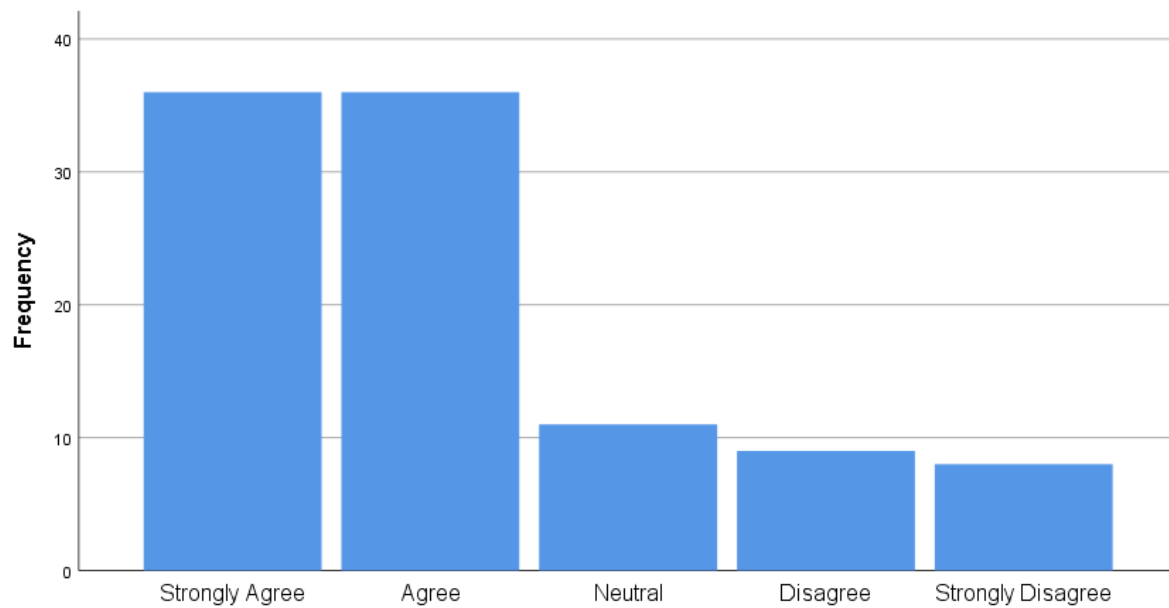


Figure 14: The efficiency of the firm is affected by the business financial position

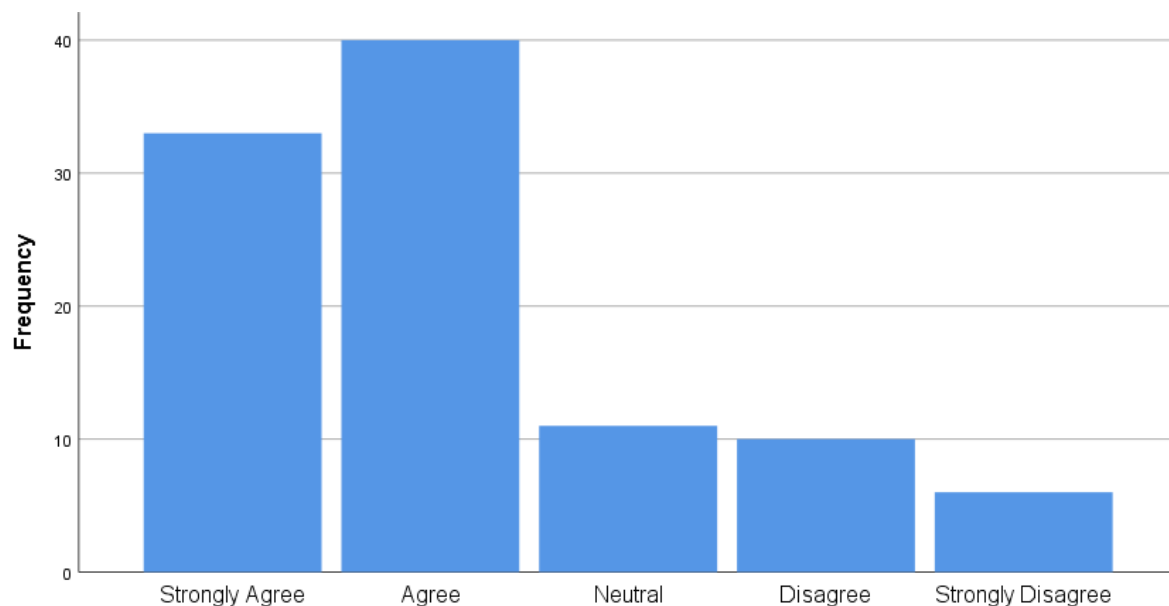


Figure 15: The efficiency of the firm is affected by the transparency in business

All the responses in the above-mentioned survey questions are related to the connection between the manager's perspectives, firm's operations and the reduction of error through data traceability. Majority of the participant confirmed that efficiency of the firm is related to the size of the firm, growth rate of the assets, financial position and transparency in business.

The findings are in coherence with the Ford (2018). The study stated that the efficiency of business in the data traceability aspects depends on how the managers are using their resources and financial positions to gain competitive advantages.

Theme 4: how the digital traceability can positively encourage organizational resilience.

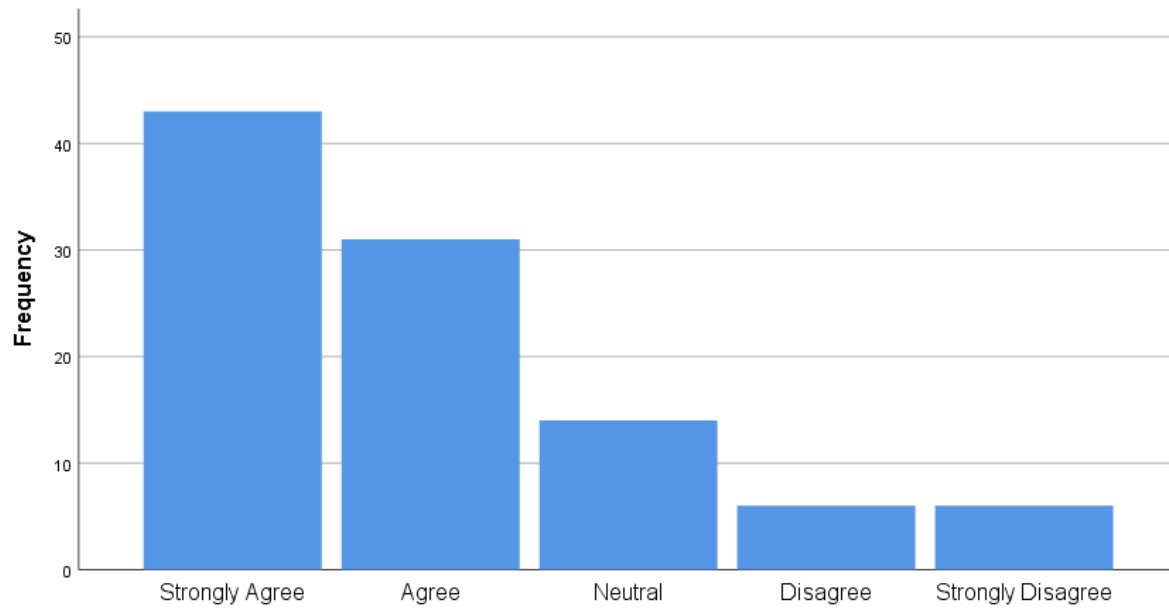


Figure 16: The resilience within the business is affected by the workforce employed within the workplace.

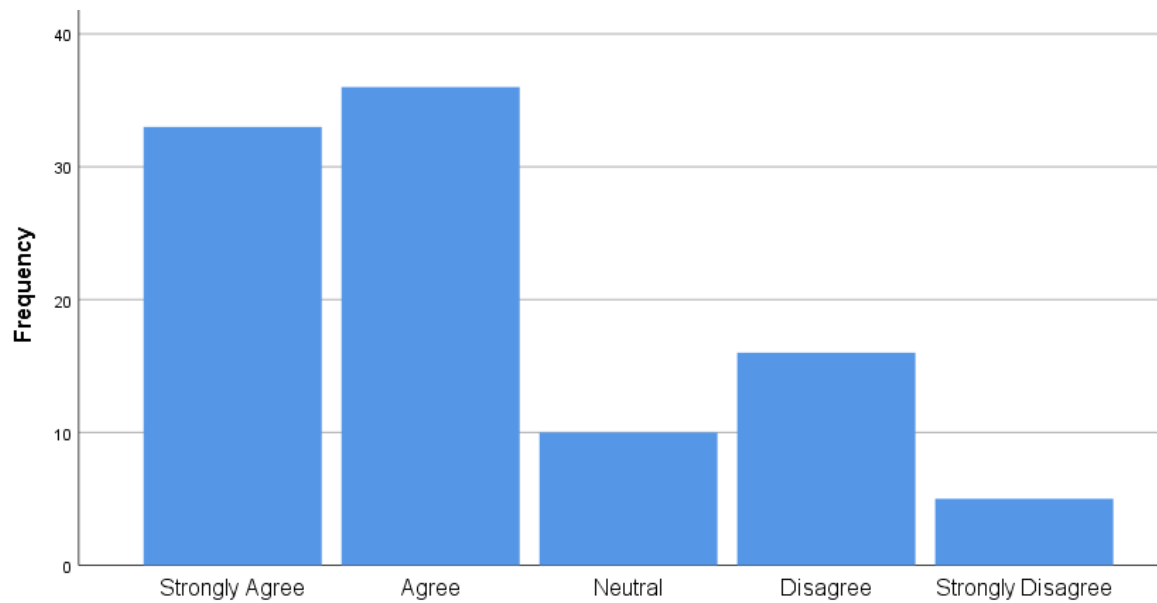


Figure 17: The resilience within the context of an enterprise is affected by social aspects of an enterprise

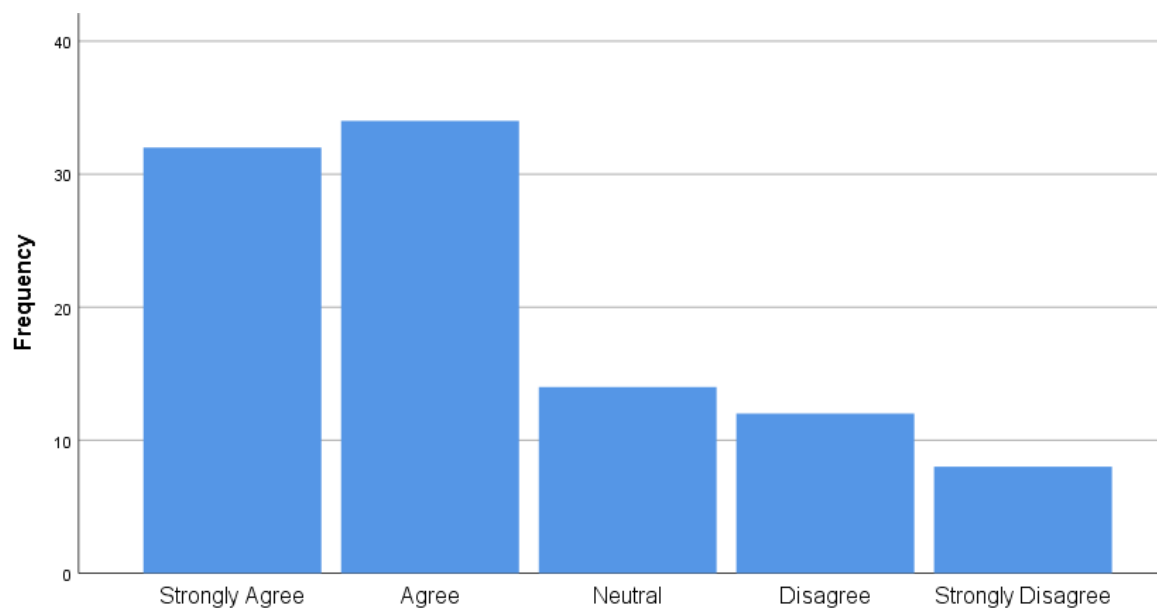


Figure 18: The resilience is largely influenced by the overall the financial standing of the enterprise

The figure 15, 16, 17 and 18 is the response to the questions related data traceability can be related to organisational resilience. Most of the respondents agreed and strongly agreed that the resilience of the organisation is affected by workforce, social aspects of an enterprise, financial standing of the enterprise and external environmental aspects.

The literature confirms that the organisational resilience is one of the major factors for the business success. The study of Grunning (2019) stated that, using this new traceability capabilities, businesses will be able to increase their productivity while also strengthening their sustainability and resilience. While data traceability can help in managing some of the external environmental and operational aspects, therefore, both the primary data and literature review confirms that digital traceability can positively encourage organizational resilience.

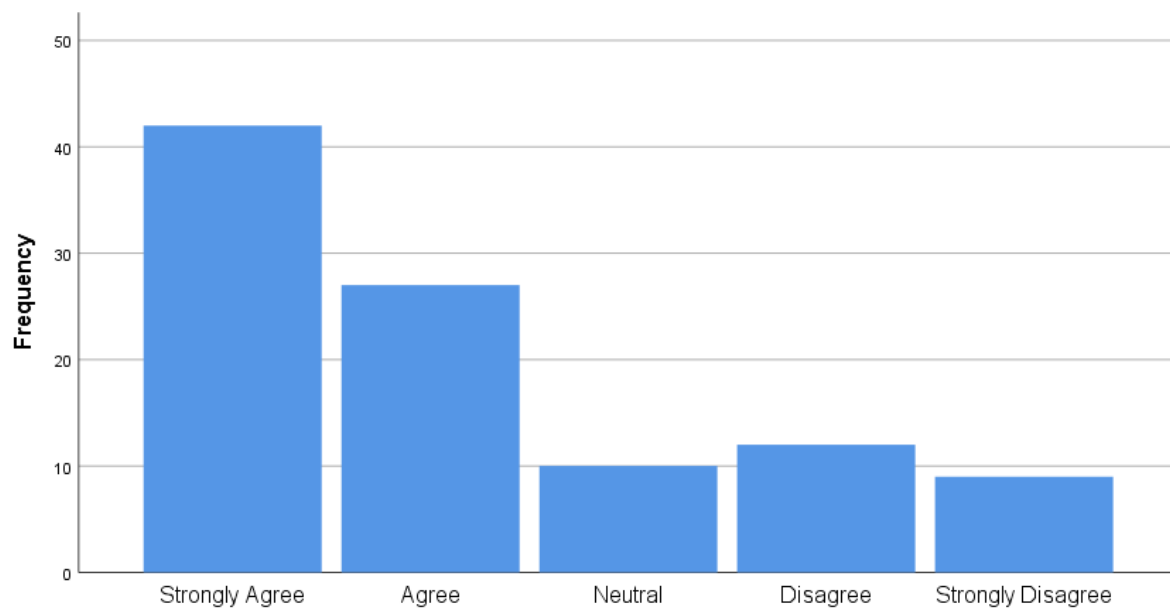


Figure 19: The resilience is affected by the external environmental aspects

Theme 5: To identify effective solution to increase the adoption of digital traceability in organizational operation to generate high competitiveness

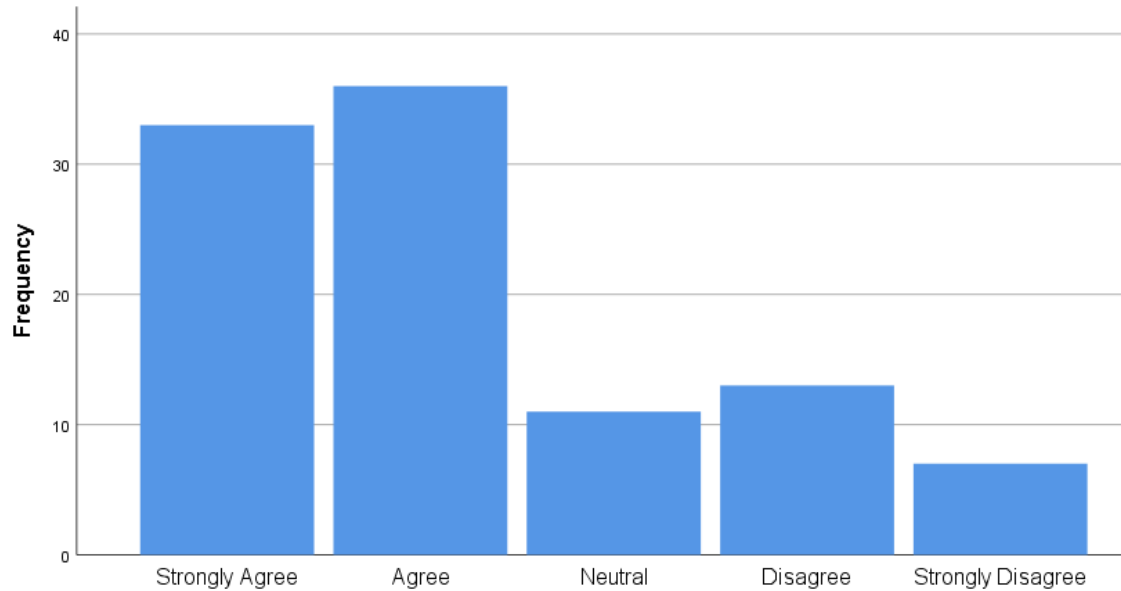


Figure 20: The digital traceability helps in carrying out internal operations better

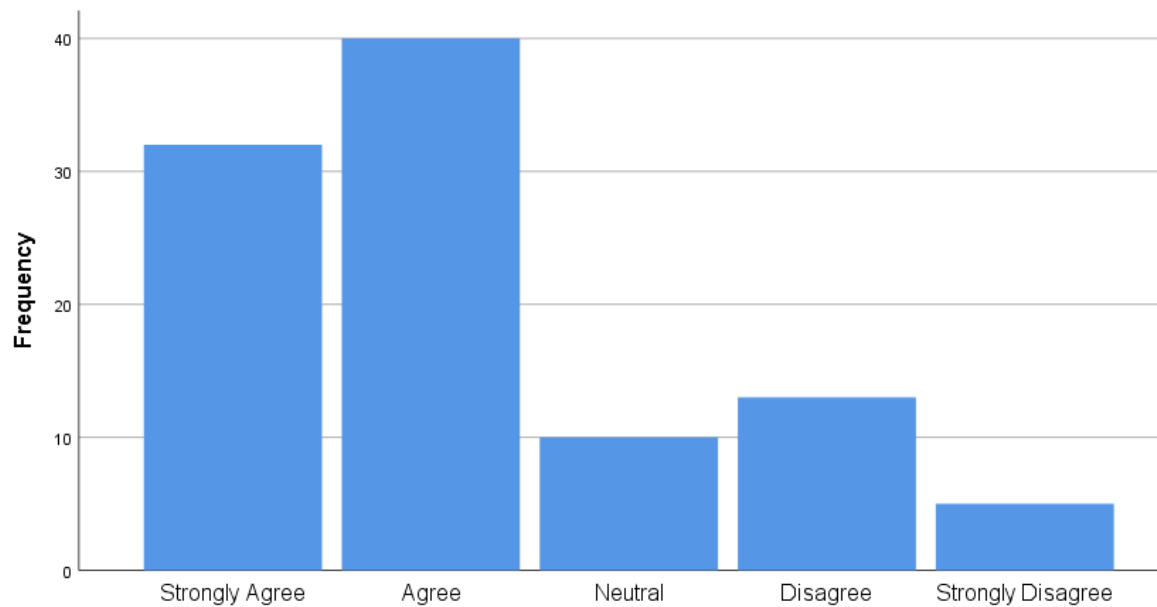


Figure 21: The digital traceability allows better opportunities for managing customer relationships

Figure 19 and 20 shows that most of the participants are in favour of the statements that digital traceability allows better opportunities for managing customer relationships and helps in carrying out internal operations better. The study of Saney (2021) showed that data traceability has become an integral part of the company success and opportunity grabbing. The organisational process can be better executed through the data traceability outcomes. Hence, the survey data compliments the information from the literature review part.

4.9 Discussion

From the given analysis, it has been identified that the digital traceability has several advantages for the business. These could be bringing about better efficiency, ensuring better resilience management, increasing transparency and improving the competitiveness within the context of the enterprise. It is through the correlation and regression analysis, it could be established that the digital traceability is significantly important for the enterprise as it brings about several benefits for the firm (Malek 2020). Such benefits may be rightly categorised as bringing about efficiency of operations, ensuring resilience in difficult times and giving way to a competitive edge. The digital traceability was identified to have a strong influence on the competitiveness as it allows the enterprise to gain a sustainable advantage with the assistance of which the firm can elevate its positioning in the market. Moreover, the digital traceability was identified to have a significant impact on the overall efficiency of operations as well due to the fact that it helps in maintaining good relationships with the different parties. Lastly, the digital traceability ensures resilience in changing times as the firm needs to be well prepared at all times (Paliwal, Chandra and Sharma 2020). In this regard, the digital traceability can be promoted by imbining it within the values of the enterprise, training employees to bring about better performance and ensuring resource availability. Another notable aspect which could be well identified may be stated to be related to the fact that the digital traceability is a helpful tool for the different employees as it enables them to identify and minimise the errors.

It could be identified that when the errors are minimised better efficiency can be assured. Hence, the research has been successful in answering all its research questions.

Chapter 5

Conclusion

5.1 Overview

Therefore, the focus of the study was to gain an understanding of the way in which digital traceability has a significantly strong influence on the overall way in which an organisation tends to perform. In this context, it is suitably important to understand and assess the fact that the study undertook a primary quantitative research approach so as to assess the way in which this relationship could be well established. The study followed a structured format which is largely focused upon analysing and assessing the key way in which digital traceability influences the efficiency, competitiveness and the resilience reflected by a business. The introduction chapter outlined the background of the study alongside the key research questions which was then followed by the review of literature which critically discussed the key concepts of traceability, resilience and the competitive engagements. In this regard, the gaps were identified that only a few number of studies had been undertaken in a similar line of work and pertaining to this, the research was essential to fulfil the gap between the different variables. Hence, the research methodology as a chapter identified and discussed the ways in which the relationship between the variables could be well established. The findings of the study reflected the fact that the digital traceability strong influences all three aspects of the firm but has the strongest impact on the competitiveness. In this regard, it becomes effective to understand the fact that the digital traceability ensures that the enterprise is successful in its overall engagements to keep a track of all the activities and in association with this, they can ensure efficient delivers thus enabling work quality. Moreover, this was identified to affect resilience by giving away to transparency. Lastly better competitive engagements could also be assured through a systematic and efficient procedure which would thereby propose a threat to the existing competition and give away to ensuring better end results. Through these processes and procedures, an enterprise can assure that they have a better sustainable future.

5.2 Alignment with objectives

1. To analyze the significance of digital traceability to improve efficiency in organizational operation.

The study can be identified to have analyzed the significance of digital traceability to improve efficiency in organizational operation and this was identified to be very significant. This was found within the review of literature and the survey findings as well. Within the review of literature, it could be assessed that when the goods and services of the enterprise could be tracked well, then in this regard, the organization could deliver its items in a suitable technique. Here it is effective to understand the fact that when the organization is being able to assess the keyways in which its overall operations may be improved through traceability, they should be focused on implementing it to give way to better outcomes. Through this technique better opportunities may be assured.

2. To analyze how digital traceability can help in addressing the competitive threat in the market

The digital traceability was identified to have a significant role to play in combating against the competitive threat. This objective was attained through the survey findings and the review of literature. In this scenario, it was identified that the digital traceability can help in addressing the competitive threat in the market and is identified to have a significant role to play in ensuring better results. In the literature, it could be rightly understood that when an enterprise was focused upon its overall opportunities in terms of competition, then in this regard, it would be able to serve the different customers well. When the customers would be served well against the competitors, then in consideration with this, the enterprise would enjoy its positioning.

This was further confirmed in the form of the survey whereby clarity was achieved, and it could be rightly identified that the digital traceability helps in achieving a strong positioning in the market which gives way to better performance.

3. To analyze the perspective of managers on digital traceability to avoid errors in the operation.

The digital traceability was identified to have a significant role to play in a context such that the perspectives of the managers can be well gained so as to avoid any errors. When the efficiency is increased, the performance also improves and any errors can be minimized. In this concern, through the literature review, it could be well analyzed that the managers are under the strong belief that the digital traceability should be carried out in a way such that it helps in avoiding the errors within the operations by minimizing any scope of error. Here it is significantly important to assess the fact that when the errors are avoided, better performance is achieved. The survey was also able to confirm the fact that when errors can be avoided, the efficiency is ensured.

4. To find how the digital traceability can positively encourage organizational resilience.

The digital traceability was identified to have a strong encouragement on the organizational resilience. Relating to this, it can be identified critical that when the organization faces tough times, it is the resilience which is integral. However, through the research it could be established that it is the resilience within the organization which gives way to better focus may be enhanced by the traceability as the point of focus may be well established. In this regard, it is suitably important to establish the fact that for a firm to be successful, they are required to ensure better engagements.

5.3 Key limitations and future scope

The limitation of the study was that it is focused on the primary quantitative findings only.

In the future, to engage in an in-depth analysis, the interview method of data collection can be combined with quantitative method for whereby in-depth information can be well secured.

5.4 Recommendations

It can be recommended that enterprises must be able to engage in digital traceability with the assistance of which they would be able to ensure better efficiency, better resilience and better performance in terms of competition. Implementation the training opportunities for the firm would be suitable for better adaptation.

1. Installing the right type of digital traceability system is critical to a better future for the enterprise. In this regard, it could be well assessed that, if the traceability system is not in favour of the organisation. Then in this regard, the operations may not be improved.

2. Secondly, ensuring timely upgradation to the system may also be identified as significant as it would give way to ensuring better efficiency and seek to ensure a better focus for the firm.

3. Lastly, it is critical that adequate organisational training is provided to the employees. When regular training would be given, the operations can be reviewed critically.

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Appendices

Appendix I: Informed Consent for survey

How digital traceability assists companies survey

Informed Consent.

The purpose of this research project is to analyse the technique in which digital traceability assists the companies in achieving efficiency, competitiveness and resilience. You are invited to participate in this research project because you are an essential part for my research. This survey has a total of 22 questions.

Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time.

The procedure involves filling an online survey. Your responses will be confidential, and we do not collect identifying information such as your name, email address or IP address.

We will do our best to keep your information confidential. All data is stored in a password protected electronic format. To help protect your confidentiality, the surveys will not contain information that will personally identify you. The results of this study will be used for scholarly purposes only and may be shared with academic staff in ICD.

This is a research project being carried out by Alessandra Moraes as part of a Degree in Business Studies in Independent College Dublin.

The study is being conducted under the supervision of Prof Klaus Walter and Dr. Daniel O'Sullivan (School of Business ICD) and has been granted ethical approval by Independent College Dublin.

If you have any questions about the research study, please contact Dr. Daniel O'Sullivan at daniel.osullivan@independentcolleges.ie.

This research has been reviewed according to Independent College Dublin procedures for research involving human subjects.

ELECTRONIC CONSENT: Please select your choice below.

Clicking on the "agree" button below indicates that:

- **you have read the above information**
- **you voluntarily agree to participate**
- **you are at least 18 years of age**

If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.

☐

Agree.

☐

Disagree.

Appendix II: Survey questionnaire

Survey questionnaire

General Section

Please select one response

Age

- 18-25 years
- 26-32 years
- 33-40 years
- 41-50 years
- 50 and above

Gender

- Male
- Female
- Others

Income

- Below £25000 annually
- Between £25000 to £50000
- Above £50000

Education

- High school
- Graduate
- Postgraduate
- Diploma
- Others

Workplace experience

- Less than 3 years
- 3-5 years
- More than 5 years

Position

- Supervisor
- Management

Data traceability

The data traceability is essentially affected by the state of art technology used by the enterprise

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

The data traceability is strongly influenced by the supply chain design within a firm

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

The data traceability helps in carrying out internal operations better

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

The data traceability allows better opportunities for managing customer relationships

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Efficiency

The efficiency within the domain of a business is strongly influenced by the size of the firm

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

The efficiency within a firm is influenced by growth rate of the assets



1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree



The efficiency of the firm is affected by the business financial position

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

The efficiency of a firm is strongly influenced by the transparency in business.

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Resilience

The resilience within the business is affected by the workforce employed within the workplace.

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

The resilience within the context of an enterprise is affected by social aspects of an enterprise

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

The resilience is largely influenced by the overall the financial standing of the enterprise

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

The resilience is affected by the external environmental aspects

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Competitiveness

The competitiveness of the enterprise is greatly influenced by the presence of competitors within the enterprise

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

The competitiveness of the enterprise is influenced by the strength of the internal offerings

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

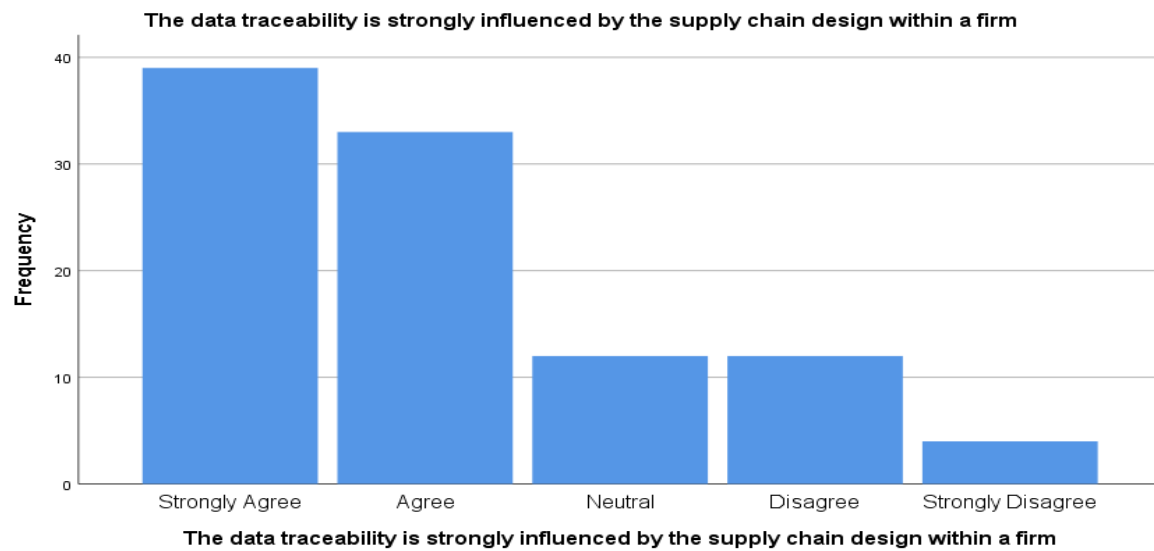
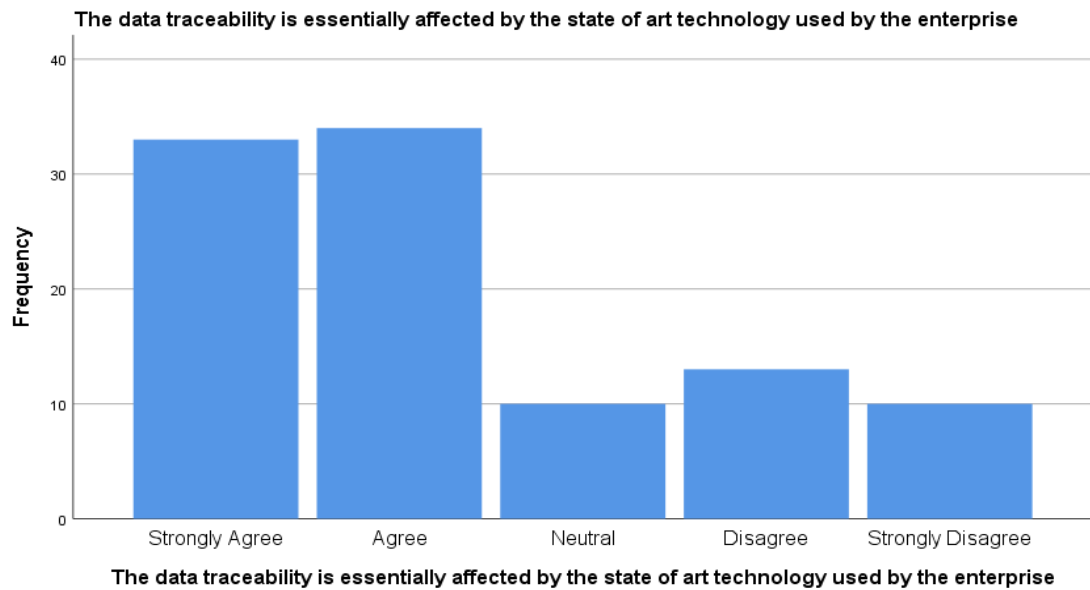
The competitiveness of the enterprise is determined by the resources used

1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

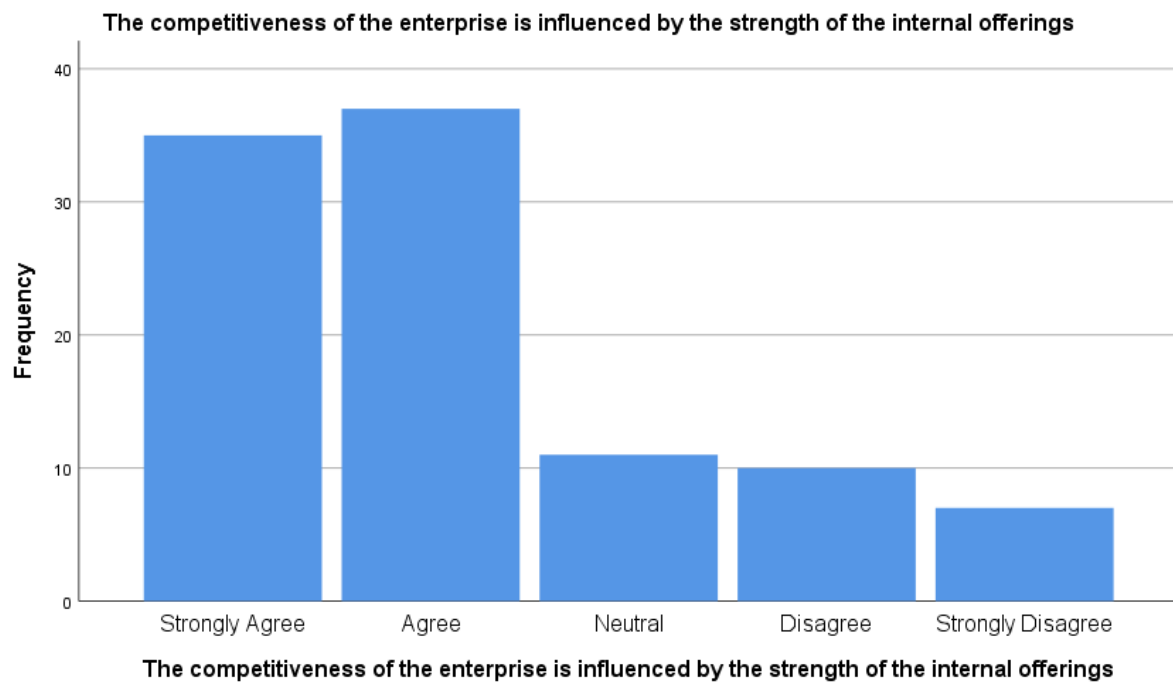
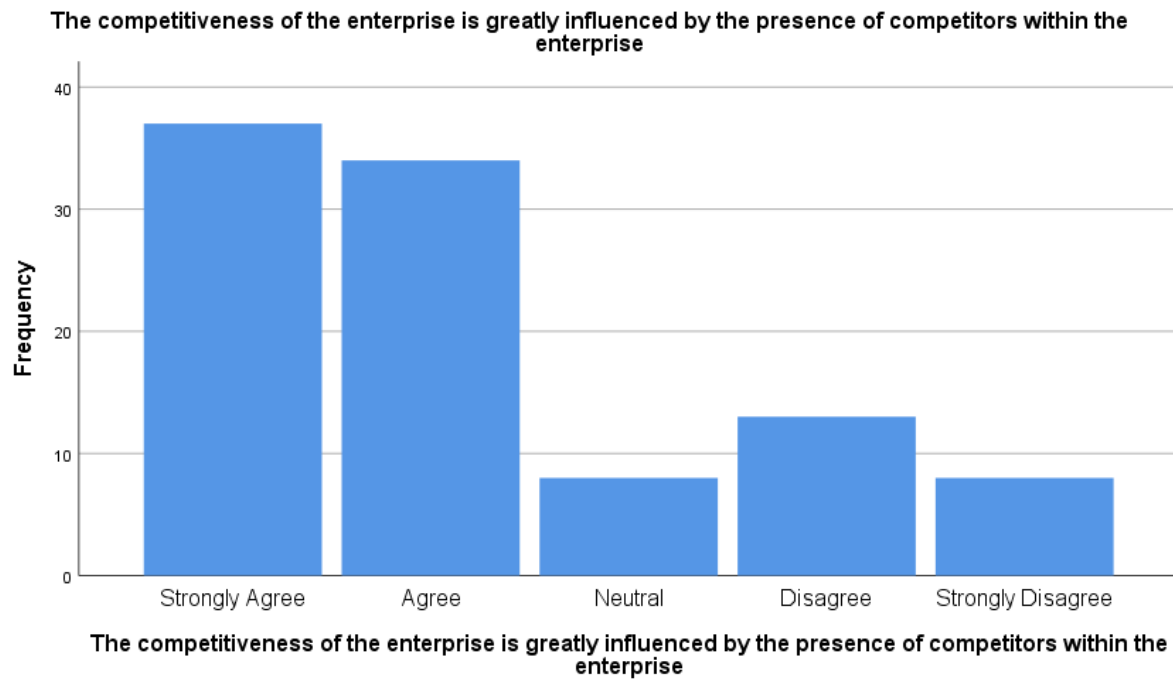
The competitiveness of the enterprise is affected by the management of different talents and skills.

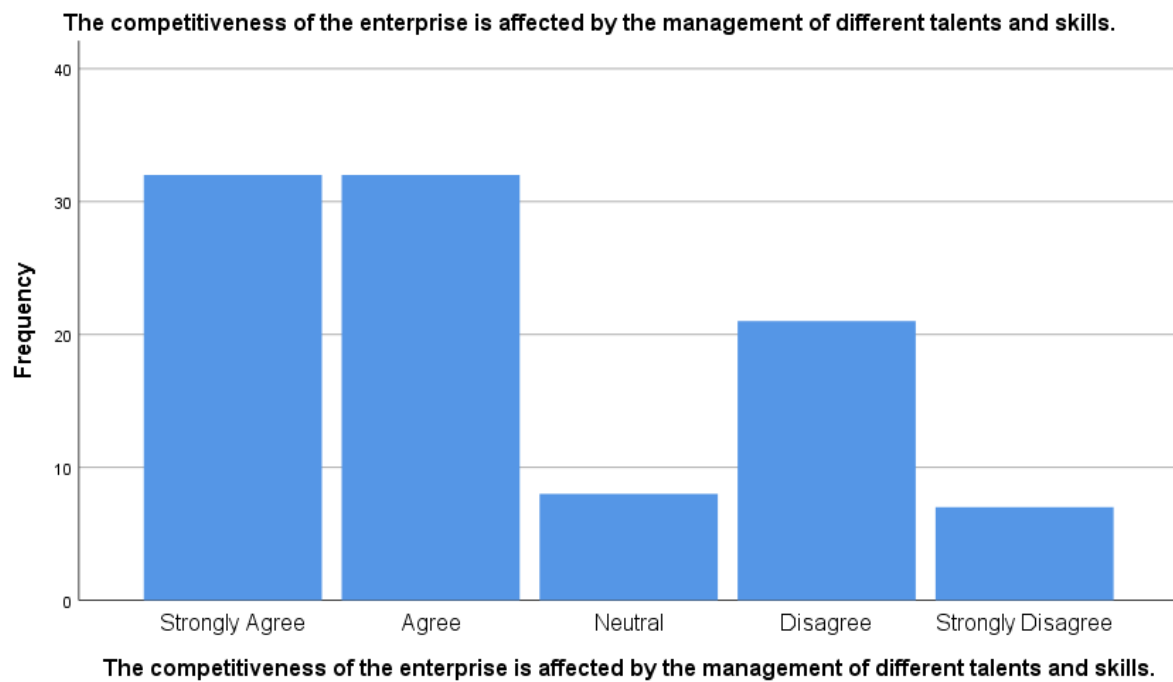
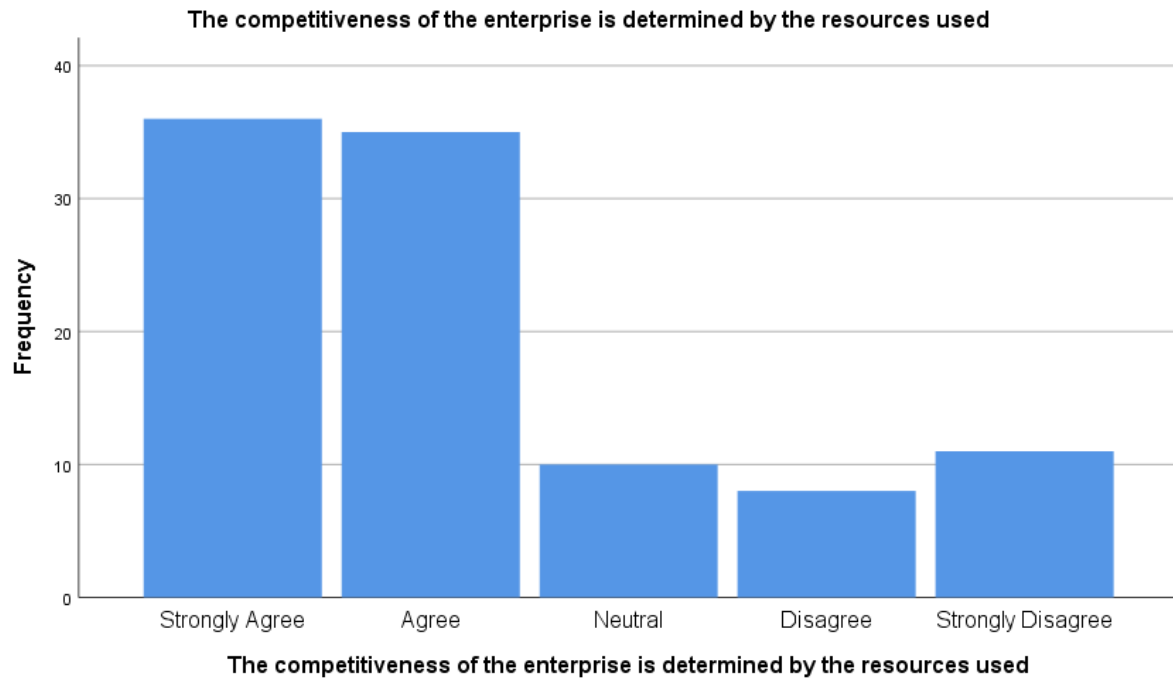
1	2	3	4	5
Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree

Theme 1: Significance of digital traceability to improve efficiency in organizational operation

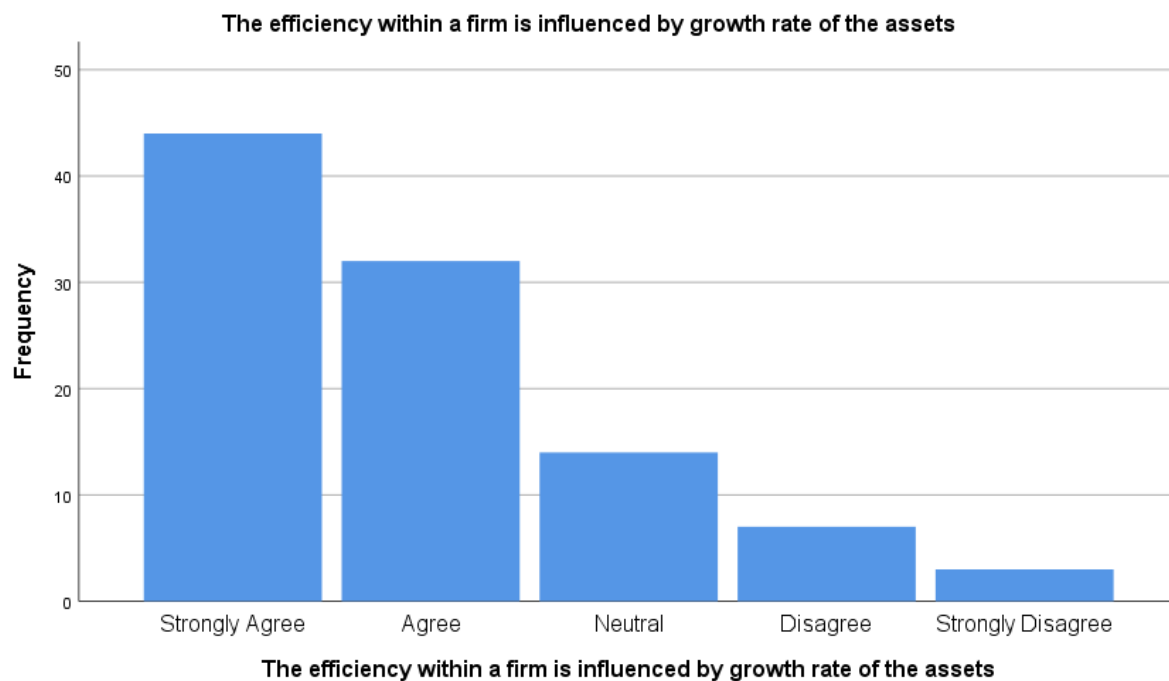
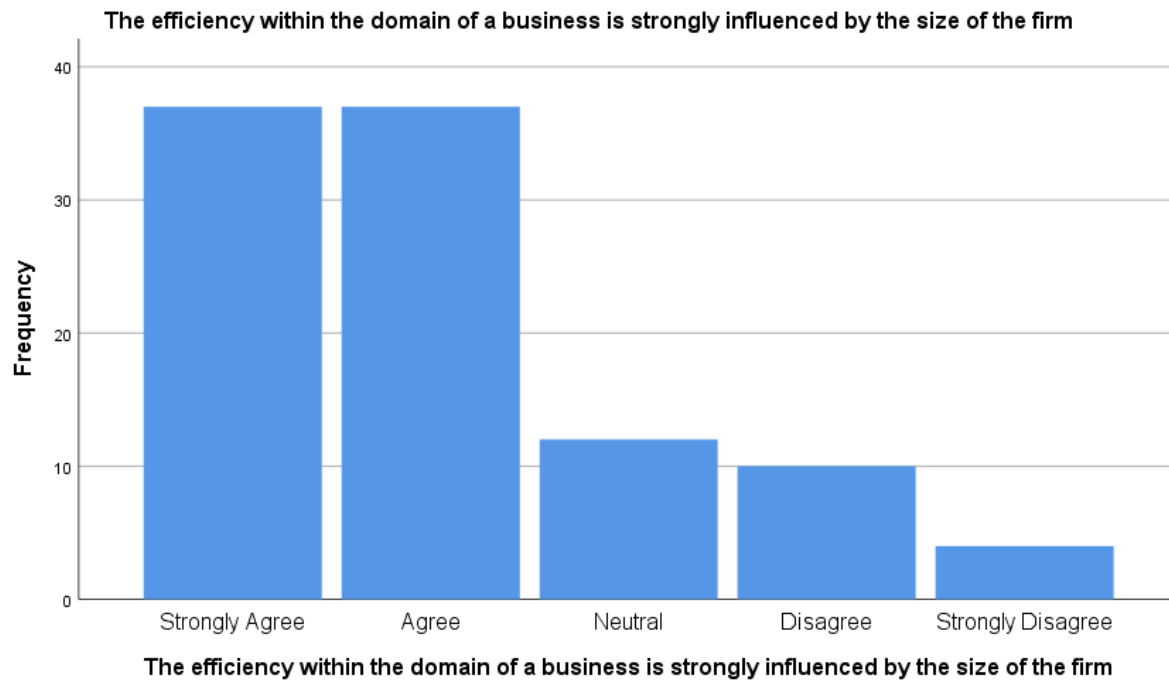


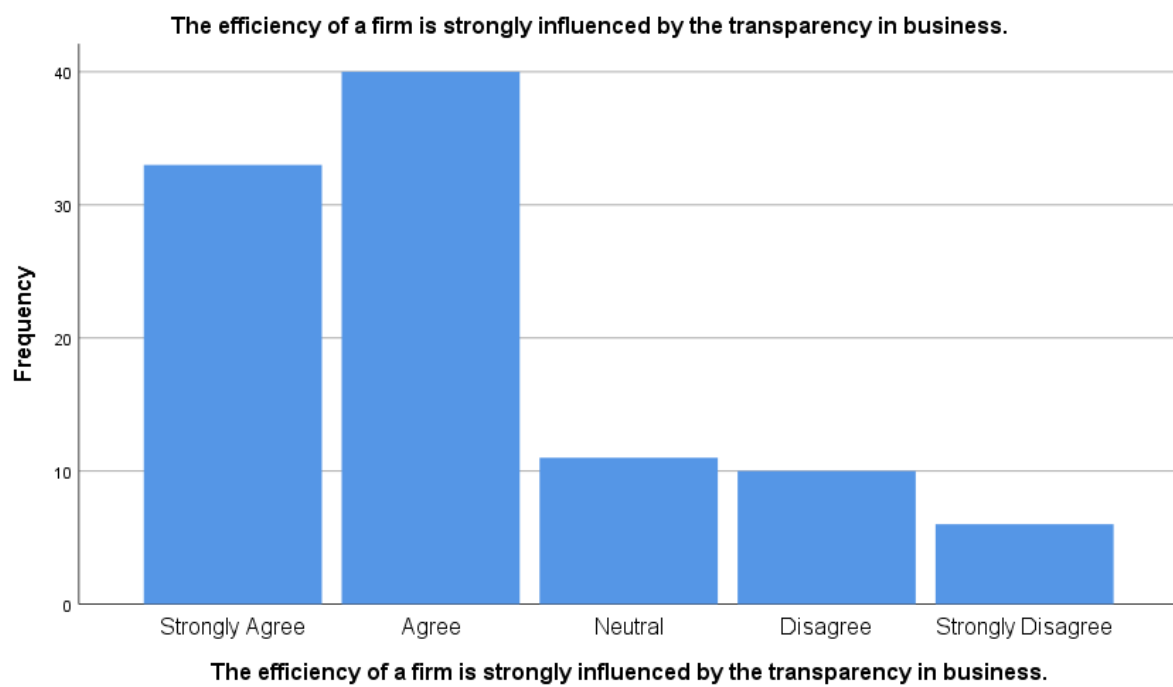
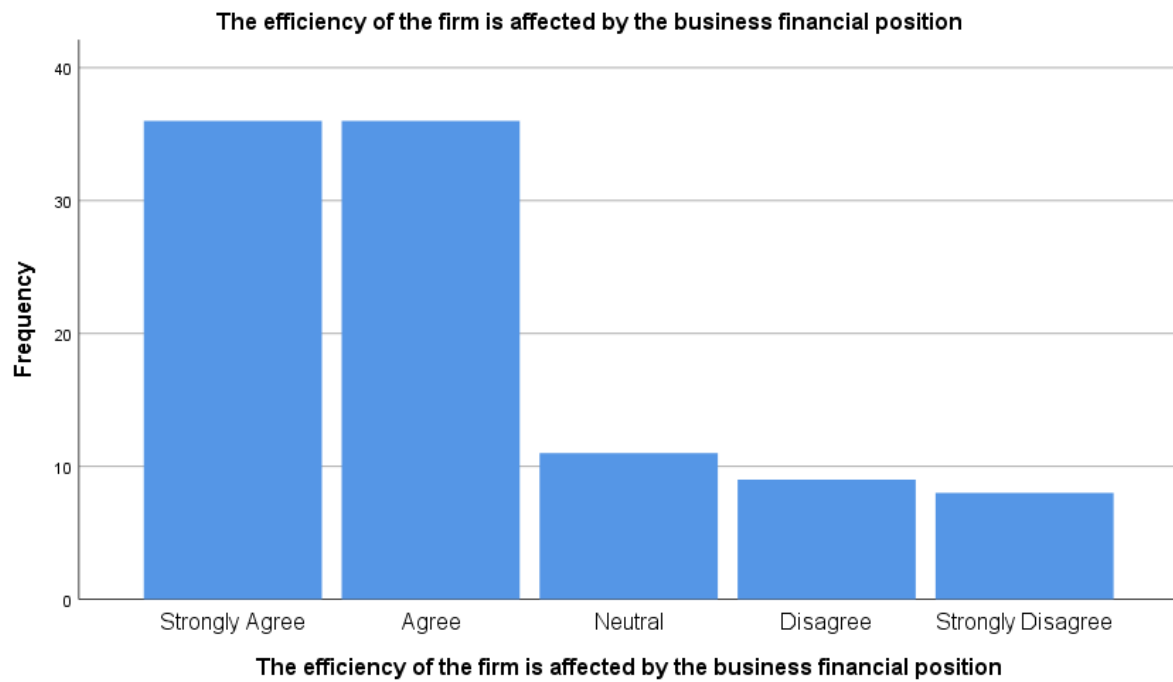
Theme 2: how digital traceability can help in addressing the competitive threat in the market



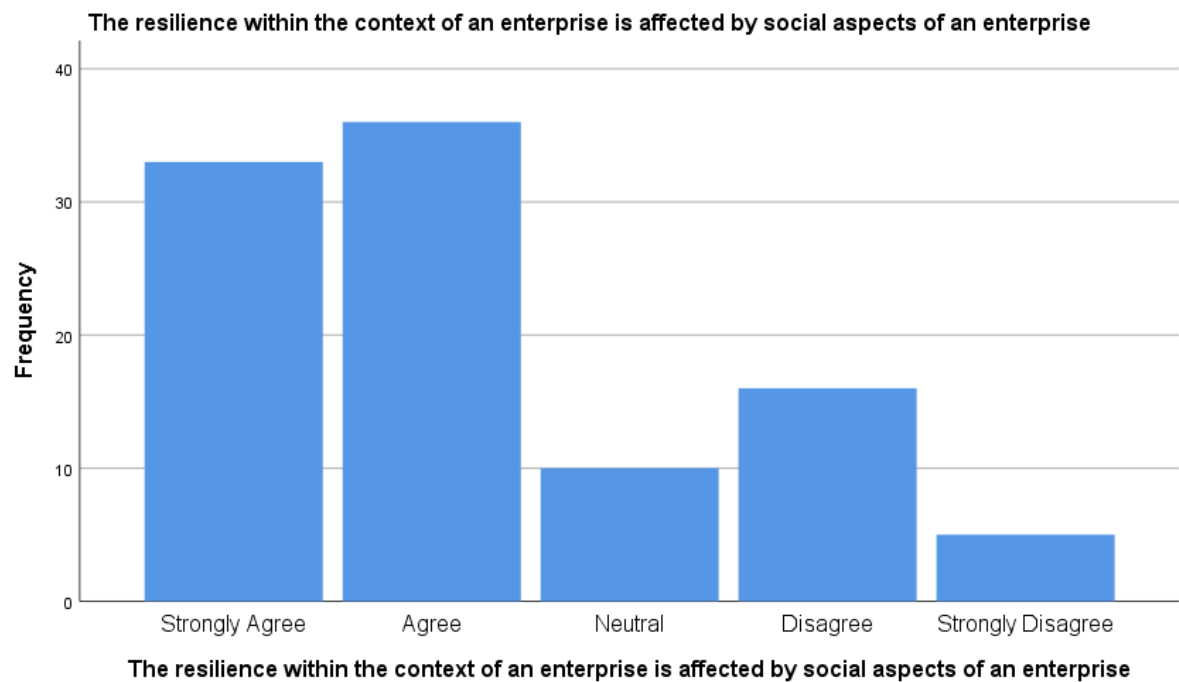
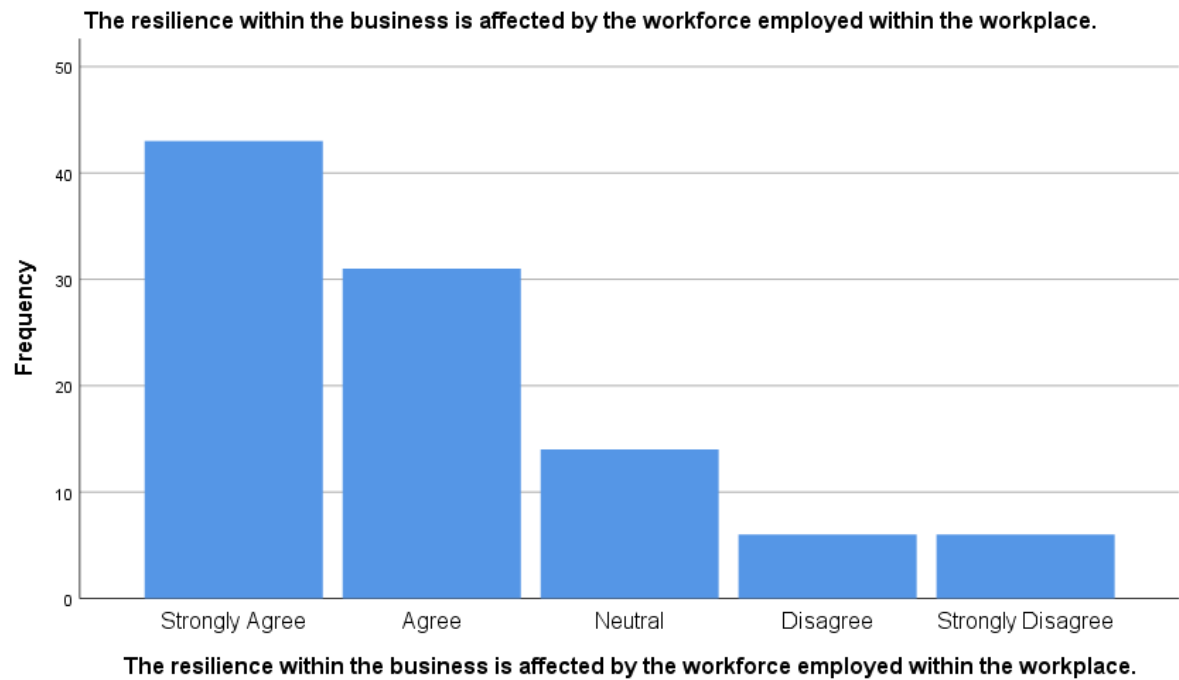


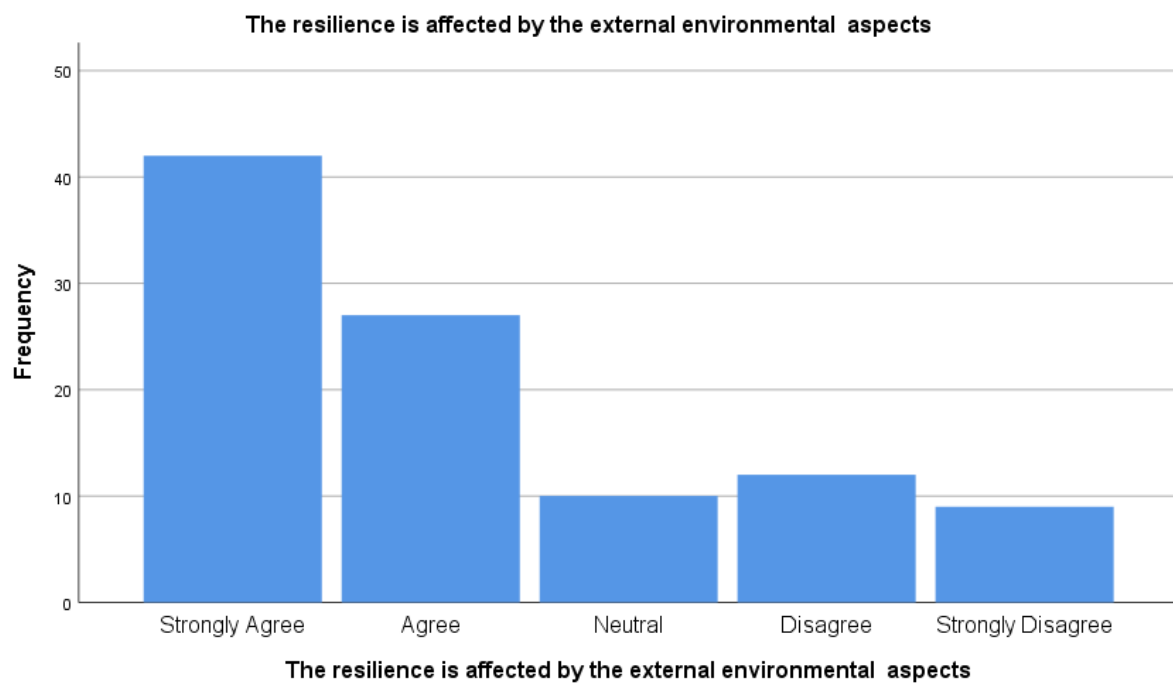
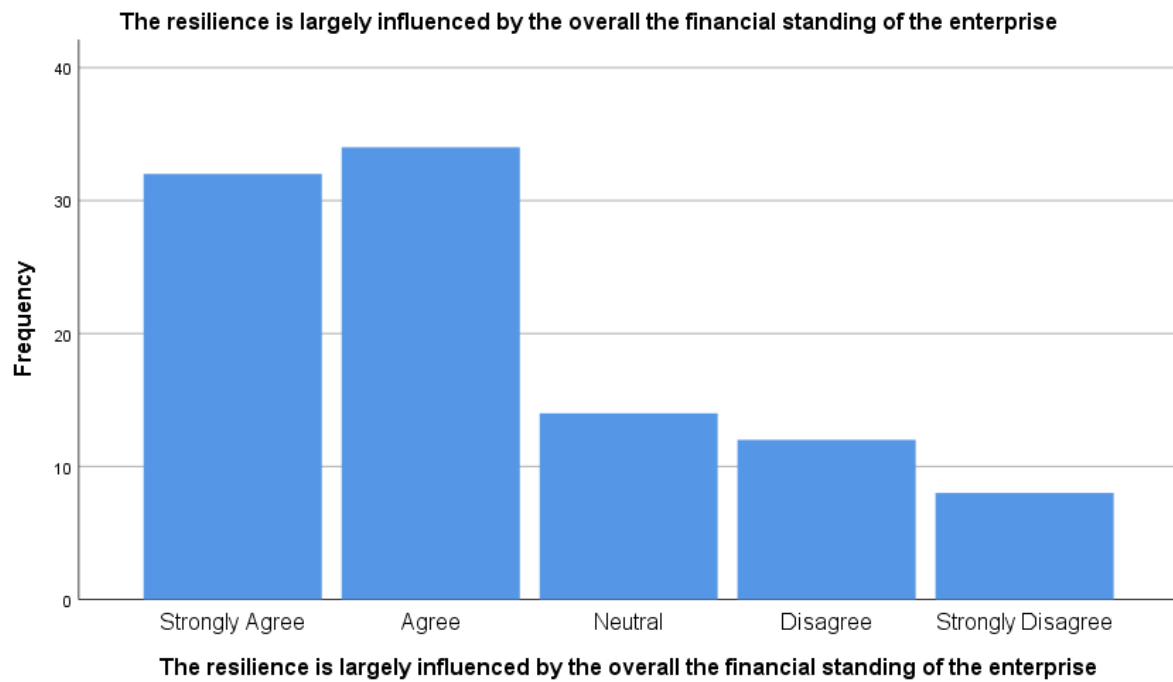
Theme 3: The perspective of managers on digital traceability to avoid errors in the operation.



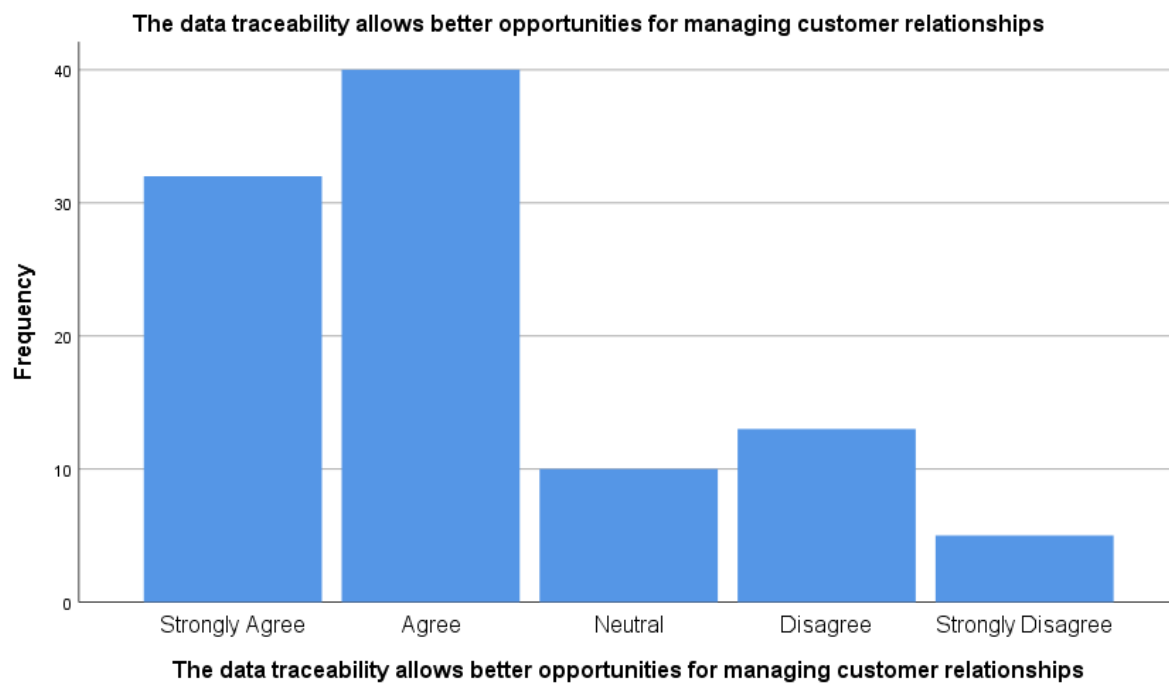
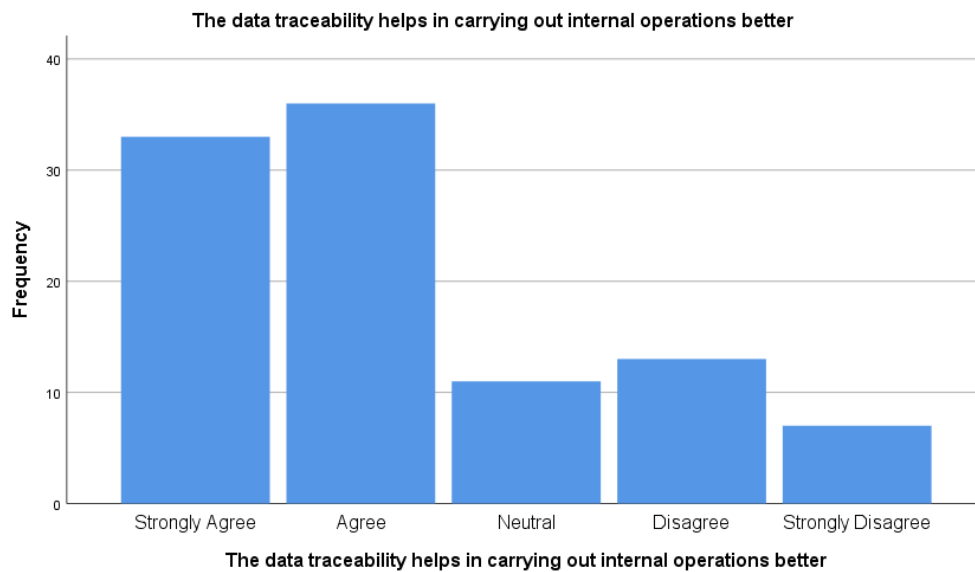


Theme 4: how the digital traceability can positively encourage organizational resilience.





Theme 5: To identify effective solution to increase the adoption of digital traceability in organizational operation to generate high competitiveness



Appendix III: Ethical Form A

Form A: Application for Ethical Approval	
Undergraduate/Taught Postgraduate Research	
This form should be submitted to the module leader for the relevant initial proposal and/or the relevant supervisor is the proposal has already been accepted.	
Please save this file as <i>STUDENT NUMBER_AEA_FormA.docx</i>	
Title of Project	How digital traceability can help companies improve efficiency, resilience and competitiveness?
Name of Learner	Alessandra Moraes da Silva
Student Number	51702100
Name of Supervisor/Tutor	Klaus Walter

Check the relevant boxes. All questions must be answered before submitting to the relevant lecturer / supervisor. Note: only one box per row should be selected.

Item	Question	Yes	No	NA
1	Will you describe the main research procedures to participants in advance, so that they are informed about what to expect?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
2	Will you tell participants that their participation is voluntary?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
3	Will you obtain written consent for participation (through a signed or 'ticked' consent form)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
4	If the research is observational, will you ask participants for their consent to being observed.	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
5	Will you tell participants that they may withdraw from the research at any time and for any reason?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
6	Will you give participants the option of not answering any question they do not want to answer?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Will you ensure that participant data will be treated with full confidentiality and anonymity and, if published, will not be identifiable as any individual or group?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
8	Will you debrief participants at the end of their participation (i.e., give them a brief explanation of the study)?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
9	If your study involves people between 16 and 18 years, will you ensure that passive consent is obtained from parents/guardians, with active consent obtained from both the child and their school/organisation?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	If your study involves people less than 16 years, will you ensure that <u>active</u> consent is obtained from parents/guardians <u>and</u> that a parent/guardian or their nominee (such as a teacher) will be present throughout the data collection period?	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Item	Question	Yes	No	NA
11	If your study requires evaluation by an ethics committee/board at an external agency, will you wait until you have approval from both the Independent College Dublin and the external ethics committee before starting data collection.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	If you are in a position of authority over your participants (for example, if you are their instructor/tutor/manager/examiner etc.) will you inform participants in writing that their grades and/or evaluation will be in no way affected by their participation (or lack thereof) in your research?	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
13	If you are in a position of authority over your participants (for example, if you are their instructor/tutor/manager/examiner etc.), does your study involve asking participants about their academic or professional achievements, motivations, abilities or philosophies? (please note that this does not apply to QA1 or QA3 forms, or questionnaires limited to market research, that do not require ethical approval from the IREC)	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
14	Will your project involve deliberately misleading participants in any way?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
15	Is there any realistic risk of any participants experiencing either physical or psychological distress or discomfort?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
16	Does your project involve work with animals?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
17	Do you plan to give individual feedback to participants regarding their scores on any task or scale?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
18	Does your study examine any sensitive topics (such as, but not limited to, religion, sexuality, alcohol, crime, drugs, mental health, physical health, etc.)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
19	Is your study designed to change the mental state of participants in any negative way (such as inducing aggression, frustration, etc?)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
20	Does your study involve an external agency (e.g. for recruitment)?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
21	Do your participants fall into any of the following special groups?	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
		<input type="checkbox"/>	<input checked="" type="checkbox"/>	
	<i>(except where one or more individuals with such characteristics may naturally occur within a general population, such as a sample of students)</i>			

If you have ticked any of the shaded boxes above, you should consult with your module leader / supervisor immediately. **You will need to fill in Form B Ethical Approval** and submit it to the Research & Ethics Committee **instead** of this form.

There is an obligation on the researcher to bring to the attention of the Research & Ethics Committee any issues with ethical implications not clearly covered by the above checklist.

I consider that this project has **no** significant ethical implications to be brought before the relevant Research & Ethics Committee. I have read and understood the specific guidelines for completion of Ethics Application Forms. I am familiar with the codes of professional ethics relevant to my discipline (and have discussed them with my supervisor).



Name of Learner Alessandra Moraes da Silva

Student Number 51702100

Date 01/11/2022

I have discussed this project with the learner in question, and I agree that it has no significant ethical implications to be brought before the Research & Ethics Committee.



Name of Supervisor/Lecturer Klaus Walter

Date 01/11/2022