MSc in Management

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Big Data and Business Intelligence for Organizational Sustainability

Abstract

Aim/Purpose: The aim of the research study is to evaluate the importance of big data and business intelligence for organizational sustainability.

Method: The research study used quantitative data collected by conducting a survey of 151 participants that were post-graduate students in Ireland. The data was collected in alignment with the positivism philosophy, deductive approach and exploratory research design. The collected data is analysed with the help of descriptive and inferential analysis.

Findings: The findings of the research study suggest that the use of big data and business intelligence is vital for organisations in order to ensure long-term sustainability as it helps in risk management and optimal allocation of resources. It also helps in developing suitable strategies on the basis of the insights developed from the analysis of the data. However, the use of big data provides challenges in maintaining the security of the data.

Conclusion: It can be concluded that the use of big data and business intelligence helped ensure the sustainability of an organisation and provide a competitive edge. The data-driven insights helped the management in providing details on the performance and proper strategies can be developed that help in the growth of an organisation.

Keywords: Business Intelligence, big data, sustainability, data-driven insights, resource allocation and risk management

Submission of Thesis and Dissertation

National College of Ireland
Research Students Declaration Form
(Thesis/Author Declaration Form)

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Student Number: x22136126

Degree for which thesis is submitted: MSc in Management

Title of Thesis: Big Data and Business Intelligence for Organizational Sustainability

Thesis supervisor: Victor Del Rosal

Date: 6th May 2024

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Acknowledgement

I am extremely thankful to my supervisor for constant support and guidance throughout the research study your valuable insights and guidance helped me a lot in the research study. I also want to thank the university administration for allowing me to conduct the research study. However, I also want to thank all the participants for their valuable insights that helped in developing findings for the study. Finally, I am extremely thankful to my family members and friends for their constant motivation.

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Chapter 1: Introduction

1.1 Background of the Research

In the modern world, companies across different industries are highly driven by data which are identifying the crucial role played by big data and business intelligence in attaining sustainability and competitive advantage. With the increase in volume and variety of data and its continuous expansion, catering to this wealth of information has become an important strategic option for the organisations intending to thrive in a significantly emerging business environment (Mikalef *et al*., 2020). Big data is defined as the significant amount of structured as well as unstructured data gathered from a wide variety of sources such as social media, transactions, processes, sensors and interactions. This data overload leads to the development of both challenges as well as opportunities for various businesses across industries (Elgendy & Elragal, 2014). According to one perspective, the absolute volume and diversity of the identified data can be enormous. However, on the other hand, in cases involving proper collection, evaluation and usage, big data can result in the development of indispensable insights into areas such as customer behaviour, important market trends in addition to operational efficiency (Vassakis, Petrakis & Kopanakis, 2018).

Business Intelligence (BI) consists of the tools, processes in addition to technologies that are utilised to gather, evaluate and highlight presentable data. This is aimed at supporting processes like decision-making and planning strategically within the companies. In this way, businesses can engage in transforming the available raw data by utilising crucial BI solutions. This enables the companies to engage in informed decision-making by identifying useful and critical opportunities, addressing risks and maximising performance (Skyrius, 2021).

Furthermore, the concept of organisational sustainability defines the capability of the company to manage or enhance its overall performance as well as relevance with time while optimising the negative impact in terms of environmental, social and economic aspects. In the

current world which is highly competitive and interconnected, it is a key concern for businesses to attain sustainability thereby looking for long-term viability as well as success (Mustapha, Manan & Alwi, 2017). This defines the way sustainability consists of social responsibility, economic resilience and important ethical practices apart from important environmental concerns.

The convergence of big data and the concept of business intelligence in intersection with organisational sustainability provides a captivating direction for research as well as exploration. By utilising the power vested in big data and BI, companies can gain access to detailed knowledge about their operations, crucial stakeholders in addition to the external environment. This has led the companies to engage in informed decision-making which is aligned with their sustainability objectives (Abbasi, Sarker & Chiang, 2016). One core component in which concepts of big data and BI can steer organisational capability is identified in the company's supply chain management. The implementation of various data analytics tools can help businesses to optimise their overall supply chain processes by decreasing waste and reducing the adverse impact on the environment in turn improving their efficiency (Mageto, 2021). For instance, real-time data analytics support the identification of important opportunities in case of energy savings and inventory management resulting in cost reductions in addition to environmental benefits.

Similarly, the role of big data in collaboration with BI is significant in the process of customer relationship management companies' marketing. The evaluation of customer data collected from different touchpoints can help companies to gain access to important insights into the current trends, preferences and behaviour of the customers. This results in development of customised marketing campaigns and targeted product offerings and improved experiences of the customers thereby resulting in loyalty and enhanced sustainability (Jin & Kim, 2018).

In addition to this, big data analytics can result in predictive maintenance along with risk management initiatives. This can provide increased support to the companies to anticipate and address possible disruptions even before they take place. With the help of proactive identification of risks and important opportunities, the companies can lead to improved resilience and sustainability throughout their operations (Jeble *et al.*, 2018). On the contrary, it is important to identify the potential that lies in big data and BI for the attainment of sustainability but with a lot of challenges. The implementation of these aspects is also exposed to challenges arising from concerns related to privacy and security issues. These concerns are important and need to be managed to provide effective and responsible use of data. The issues can also be relayed to data integration aspects and the lack of suitable talent for managing the change implementation process (Sivarajah *et al*., 2017).

1.2 Justification of the Research

The adoption of big data analytics as well as the concept of business intelligence mechanisms for attaining organisational sustainability is gaining increased relevance for the companies as per the changing requirements in the contemporary business world (Pappas *et al*., 2018). With regard to this, the current study intends to delve deeply into important mechanisms and approaches that can help companies to develop sustainability. Further, customers and businesses are increasingly identifying the significance of sustainability in previous years mainly because of the enhanced concerns and debates going around this topic. Companies are shifting to the use of big data analytics and important BI tools to optimise their overall sustainability goals (Ren *et al*., 2019). On the contrary, there is a huge gap seen in the evidence seen in the adoption of different technologies which can help in managing organisational sustainability. In this regard, the current research has been done to reduce the gap by developing important insights into the way these tools and approaches can be used to make further progress in their journey of attaining sustainability.

Moreover, the enhanced understanding related to the future benefits that can be gained by using big data analytics in collaboration with BI for the development of organisational sustainability (Jeble *et al*., 2018). However, the debate around this topic identifies limited evidence regarding the advantages and challenges experienced by organisations in the overall process of their implementation. In this way, cooperative exploration of the challenges as well as advantages can provide a range of important strategies which can help the organisation for attaining sustainability through the adoption of effective technologies. The research can thereby lead to the development of an increased understanding resulting in effective decision-making which can help the companies in the aspect of engaging in strategic planning. This improved understanding developed from the research can also help in analysing important frameworks and models which can help in the effective evaluation of the data analytics capabilities and thereby provide crucial information into the approaches and strategies of companies to optimise the implementation of their sustainability strategies.

In addition to this, practical suggestions and guidance developed from detailed empirical research are way important for the organisations to navigate the complications arising in the implementation of sustainability frameworks including the technological aspects in important business contexts (Kohler *et al*., 2019). The collaboration of results derived from various studies in combination with suitable recommendations can help the current research to act as a valuable one for companies in the attainment of their sustainability journey.

Moreover, the inclusion of data analytics in combination with BI tools in the companies' existing frameworks and strategies is seen to be a process that can be directly implemented and thus requires careful planning. In addition to this, the execution process of the overall strategy implementation requires detailed planning (Olszak & Mach-Król, 2018). Thus, the current study can identify best practices and strategies by evaluating a range of strategies for the successful implementation of sustainability initiatives. It can be thereby inferred that the

organisations can gain access to practical recommendations which can help the ones willing to engage in sustainability practices. The current study thus intends to develop an awareness of the significance of big data analytics as well as BI in the attainment of organisational sustainability. This can also help the organisations to enhance the effectiveness of these tools resulting in improved performance for the businesses.

Thus, the overall research plans to overcome the huge gaps identified in the existing knowledge by providing various crucial insights which can guide varying companies willing to utilise big data analytics and BI tools to engage in effective planning for enhancing the sustainability performance of the organisations.

1.3 Research Aim and Objectives

The following elements can be used to specifically defines the goals and objectives of the research on "Big Data and Business Intelligence for Organizational Sustainability":

Aims:

To look into how business intelligence and big data analytics can be used to accomplish organizational sustainability objectives.

To understand the advantages and difficulties of using business intelligence and big data for sustainability projects.

To investigate the most effective methods and approaches for incorporating business intelligence and big data analytics into the sustainability frameworks that are currently in use.

To offer useful advice and suggestions to companies looking to use this technology for environmentally friendly operations.

Objectives:

Evaluate how big data analytics and business intelligence solutions are currently being adopted and used by enterprises for sustainability goals.

In the context of organizational sustainability, list and evaluate the main advantages and opportunities provided by big data analytics and business intelligence.

Examine the difficulties and impediments that businesses encounter when attempting to use business intelligence and big data for sustainability projects.

Examine the best methods and approaches for incorporating business intelligence and big data analytics into the sustainability frameworks that are currently in place.

Provide organizations practical advice on how to use business intelligence and big data analytics for sustainable operations.

1.4 Research Questions

R.Q. 1 What are the best practices and strategies for integrating big data analytics and business intelligence into existing sustainability frameworks?

R.Q.2 What challenges and barriers are faced by organizations in leveraging big data and business intelligence for sustainability initiatives

1.5 Organisation of Research

Chapter 1: Introduction

It offers a detail background of the chosen research topic, aims and objectives along with research questions and justification for the selected research topic.

Chapter 2: Literature Review

This chapter conducts critical analysis of the opinions provided by authors in a range of scholars in previous literature in link with the designed research objectives and questions.

Chapter 3: Methodology

This chapter explains the research method which has been applied for collecting and evaluating data including aspects such as research design, data collection method, data analysis in addition to ethical considerations.

Chapter 4: Findings and Analysis

The chapter details the findings of the research which are systematically arranged to derive results. The common aspects in the findings are thereby analysed as per the designed objectives and questions of the research.

Chapter 5: Discussion

The chapter comprise of discussions about the main research findings in alignment with the previous literature intending to identify the practical implications and results of the research for a range of stakeholders.

Chapter 6: Conclusion and Recommendations

The chapter consist of summary of the overall research findings and the way they can be boon for a range of stakeholders. It also details recommendations for the benefit of future researchers by contributing to the research area.

Chapter 2: Literature Review

2.1 Introduction

In the modern emerging business environment, the collaboration of big data analytics and BI is increasing to develop a competitive edge. This is also leading increase in the importance of sustainability initiatives which has made it a significant focus area for companies to strive in the current competitive world. Big data and BI are providing immense support to organisations to streamline their operations and thereby drive innovation. They also contribute to the improvement of their capability to measure and manage their overall performance. These aspects also help the companies to address various societal as well as environmental challenges (Mikalef *et al*., 2018). In this regard, the current literature review intends to examine the multifaceted relationship that exists between big data analytics, business intelligence in addition to organisational sustainability. This review plans to explore the current adoption, benefits, opportunities along with challenges and barriers of using big data analytics and business intelligence to attain sustainability.

2.2 Importance of Big Data Analytics and Business Intelligence for Sustainability

As per Vassakis, Petrakis & Kopanakis (2018) the use of integrated big data analytics tools and BI plays a crucial role in the improvement of the businesses' sustainability efforts. This helps the organisations by recognising crucial improvement areas and adopting even more sustainable practices by conducting a thorough analysis of the current processes and strategies of the companies in bringing sustainability to their business surroundings.

Ajah & Nweke (2019) explored the contributions made by big data analytics and BI in the attainment of sustainability by analysing past articles on this topic. This study thereby examines the technologies which can help in increasing the effectiveness of the organisations' decision-making processes. The reason for this is the effective monitoring of past trends in any field of business operations as it can help to derive actionable insights regarding efficient

sustainable practices in the organisations in alignment to their areas of operations. Along with this, Chiang *et al*. (2018) explored the benefits of using these tools in improving risk management and predictive analysis which can help organisations to minimise fraud through their early detection. For instance, this can be implemented to recognise sufficient patterns based on predictive analysis of any method or strategy and thus strengthen their existing processes and associated sustainability aspects.

Furthermore, Gupta *et al*. (2020) also explained that these tools provide sample support to businesses to optimise their supply chain by bringing innovation in varying processes. This is done majorly by analysing the trending aspects in the industry and the way other companies in this sector are adapting to the frequently altering customer preferences to develop sustainable practices and business models. The data-driven insights can also support companies in their overall decision-making processes which can also encourage the adoption of integrated actions in enhancing the effectiveness of their sustainability attainment journey.

In addition to this, Popovič *et al*. (2018) discussed with the help of a case study method the benefits of big data and BI tools in improving the monitoring of their sustainability metrics and related KPIs. In this way, businesses can benefit from real-time data streams to measure important KPIs related to important environmental and governance-related processes. It can thereby result in recognition of crucial trends and emerging challenges which can help in the derivation of timely and important strategies.

It can be thereby inferred that the importance of these tools is present in the transformative capability possessed by the business to manage challenges in their journey of sustainability attainment.

2.3 Current Adoption of Big Data Analytics and Business Intelligence for Sustainability

According to the viewpoints of Raul *et al.* (2019), the business environment in contemporary settings is experiencing significant changes from the effective adoption of big data and BI tools. This is primarily due to the increased need for businesses to provide sustainability reporting including three important aspects of environmental, social in addition to governance aspects. The reason for the increase in their familiarity and usage is the increasing competition in various industries wherein this can be managed by using effective data-driven technologies to cater to diverse business needs. In consideration of this, Ittmann (2015) identified that the core components enhancing this aspect are due to the huge data available online related to varying aspects and processes of the businesses. The companies are seen to be making significant investments in strengthening their data infrastructure in addition to analytics abilities. In this way, businesses can not only collect large data sets but also effectively process and analyse them and derive important findings from the ones gathered from social media platforms and different IoT devices. Thus, businesses can have improved accessibility to real-time data which is highly reliable and can help maintain sustainability indicators of their performance.

Further, Ghavami (2018) asserted that the enhanced process of recognising the importance vested in data-driven insights-based decision-making in companies related to the management of varying sustainability practices. Concerning this, the use of analytics in the form of machine learning supports the identification of important insights that can be converted into important mechanisms for optimising the efficiency of their sustainability efforts. In addition to this, Zhu *et al*. (2022) explained by deriving important information from online data and testing of research hypotheses that the shift in usage of these tools is highly driven by the current business trends. The reason for this is the shift witnessed towards integrated reporting and disclosure which has been made compulsory in varying sectors and areas. The organisations are seen to be incorporating important sustainability metrics in addition to KPIs

in their reporting frameworks in alignment with global industry standards. It has been seen that this can result in increased transparency for customers regarding companies' sustainability performance and thus drive optimum stakeholder engagement.

On the contrary, the study by Rodríguez-Mazahua *et al*. (2016) explored the challenges with analysis of important papers that can be faced in the implementation of these tools. The issues can vary from individuals' concern for managing data privacy and security to internal issues disturbing organisational culture. It can be seen that the current adoption of these aspects indicates a promising trend towards data-driven decision making which can help to manage complicated sustainability challenges.

2.4 Benefits and Opportunities of Using Data Analytics and Business Intelligence for Sustainability

Akter *et al*. (2018) dictates one of the major benefits of using these aspects is the capability to improve operational efficiency as well as resource optimisation. The analysis of diverse data sets focusing on energy utilisation, waste collection and utilisation of important resources, the companies can identify any type of inefficiency and streamline processes to decrease their environmental footprint. There are cases where companies are using predictive analysis to optimise their production schedules resulting in overall cost savings.

Moreover, Bahrami & Shokouhyar (2020) explained by conducting a survey and analysing its responses that data analytics and BI empower companies to improve their risk management as well as resilience in the case of emerging sustainability challenges. With the evaluation of important historical data and identification of evolving trends, companies can proactively engage in the mitigation of crucial risks related to supply chain disruptions, reputational damages and climate change. For example, real-time weather monitoring can derive adaptive strategies to manage the impact of adverse weather conditions on supply chains. Further, according to Bachmann *et al*. (2020) as per the content analysis that the data-

driven insights promote decision-making based on important decisions along with strategic planning in favor of sustainability goals. The organisations can track progress and benchmark their performance against important industry standards by including sustainability metrics in their KPIs. This empowers the stakeholders to engage in effective allocation of their resources and prioritise processes which results in social and environmental benefits at the same time.

Apart from the operational and strategic advantages, Williams (2016) discussed the implementation of data analytics and BI for availing opportunities for gaining competitive advantage and engaging in innovation. With the evaluation of important market trends and current technologies in use and demand, companies are increasingly able to find out new profitable business opportunities and thereby provide sustainable offerings and implementation of business models. For instance, data analytics can help in designing efficient circular economy initiatives involving the reuse and recycling of products which in turn minimises waste and optimises the efficiency of the involved resources. Furthermore, Balachandran & Prasad (2017) asserted that the use of data-driven insights by businesses allows them to enhance their transparency by engaging in the exchange of accurate information related to sustainability performance promptly. With the utilisation of interactive dashboards in combination with visualisation tools and important stakeholder feedback mechanisms, companies can build trust and fulfill their responsibility to stakeholders such as investors, employees, external communities and customers.

It can be thereby inferred that the benefits and opportunities of using these technologies for attaining organisational sustainability are multifaceted due to their contribution to resilient future development. However, the realisation of these advantages needs a huge commitment to aspects such as investment in the development of technology infrastructure and increased human capital.

2.5 Best Practices for Integrating Big Data Analytics and Business Intelligence in Existing Sustainability Frameworks

The integration of big data analytics and BI in the companies' current sustainability frameworks needs the inclusion of an important strategic approach designed considering aspects such as organizational culture, stakeholder engagement in addition to technological capabilities. Furthermore, as per Rajagopal *et al*. (2022), the adoption of best and suitable practices can help businesses to gain optimum benefits in their sustainability journey. However, this requires various aspects to be fulfilled first such as identifying organisational objectives and priorities in their sustainability processes. It consists of overseeing a thorough examination of important sustainability goals, data requirements in addition to KPIs. This process can help businesses to make sure that the introduction of data analytics is complementary to strategic means. This can also be understood by the way businesses can identify suitable initiatives for managing their carbon footprint by aligning their data analytics processes accordingly.

Grover *et al*. (2018) examined that companies need to make significant investments for to improve capabilities in terms of analytics and suitable infrastructure for managing huge chunks of data. This supports the integration of important aspects such as big data analytics and BI in their existing sustainability frameworks. It consists of employing data storage solutions at a large scale and applying appropriate data governance policies along with upskilling their employees in the field of data analytics approaches. By developing a robust base, organizations can ascertain the accuracy, accessibility along with reliability of the sustainability data thus empowering decision-making as well as performance tracking.

In addition to this, Charles *et al.* (2023) demonstrated the way effective inclusion of these aspects in sustainability frameworks demands association as well as cooperation among organizational departments and varying stakeholder groups. It consists of breaking down different departmental barriers and encouraging the development of cross-functional teams.

For example, increased cooperation among sustainability, finance and IT teams can result in the introduction of sustainability data in the company's financial reporting systems thus enabling enhanced reporting as well as comprehensive performance measurement.

Further, Jagatheesaperumal *et al*. (2021) conducted a review of important literature and identified that organizations need to prioritise the aspects of data privacy as well as security considerations during the integration of these aspects into important sustainability frameworks. It consists of applying strong data protection measures and compliance with strict regulatory requirements which helps to ensure derivation of transparency as well as accountability in the process of the company's data handling. The company's safeguarding of important and sensitive information resulting in trust development with stakeholders helps them in mitigating all of the potential risks and thus improve trustworthiness in their overall sustainability efforts.

In addition to this, as per Cambria *et al*. (2017), the organisations can benefit from utilisation of advanced logistics approaches like machine learning and sentiment analysis to derive important insights from the collected unstructured data from sources like social media and text documents. One of the examples of this is the scenario involving derivation of valuable insights from sentiment analysis gathered from social media. These insights define public viewpoints of sustainability initiatives thereby empowering organisations to customise their communication strategies and address important concerns of the stakeholders.

Further, Ramakrishnan *et al.* (2020) conducted research using a questionnaire and the companies conducted survey analysis to identify that the companies can engage in identifying suitable opportunities for engaging in effective collaboration as well as knowledge sharing with important stakeholders such as industry associates, non-profit companies and important academic institutions. With the detailed analysis of important resources, the businesses can leverage innovative options and take collective actions to offer innovative offerings.

Thus, the necessity to include these tools in business' sustainability frameworks highlights the need to engage in an integrated approach for their effective implementation.

2.6 Challenges and Barriers to Using Data Analytics and Business Intelligence for Sustainability

As per the primary research done by Shukla & Mattar (2019), the adoption of BI and data analytics for attaining business sustainability can be exposed to varying challenges as well as barriers. The major challenge in this case is the complexities arising due to the collection of data in fragments which may be complex to understand and convert into meaningful information. The reason for this is the diverse and unorganised nature of data that will be accessed related to sustainability which makes it challenging to analyse. Similarly, as per insights of Haupt, Scholtz & Calitz (2015), companies need to pay increased attention to aspects like managing data security and privacy which is one of the pre-requirements before engaging in using any technology for any business purpose that involves the customer's data. Apart from this issue, the limited presence of a skilled workforce to manage the complicated process of data analytics is another challenge in its utilisation to the attainment of sustainability. The reason for this may be it is a new field due to which awareness may not be there among the employees and the potential ones to leverage these technologies for sustainability. This has resulted in a considerable skills gap restricting them to leverage from the full capability of these technologies. There is an urgent need to manage this issue and prevent it from exploiting its successful implementation in the future also.

Muntean *et al.* (2021) have done secondary research and opined that the organisational culture in addition to change resistance by employees may develop barriers in the successful deployment of these technologies to attain sustainability. The businesses adhering to the old hierarchical structure in addition to employees' reluctance to adopt the use of important

advanced technologies can exhibit businesses to collaborate effectively thereby hampering the overall decision-making process.

Apart from the internal challenges, the companies may also experience external challenges due to the presence of significant regulatory issues and changing market dynamics behind processes impacting sustainability. The presence of huge customer expectations of the businesses' stakeholders may also create barriers for the businesses in implementing these tools in their sustainability processes (Muntean *et al.,* 2021). On the other hand, according to Jain, Tambuskar & Narwane (2023), businesses are exposed to strict regulations guiding the process of data privacy and security. The issues related to intellectual property and disclosure of sustainability efforts related to regulations may also challenge the businesses. The reason for this is the huge variance in the policies and practices of companies from one region to another resulting in challenges for their compliance. Additionally, changing market dynamics, preferences of the consumer and competitive pressure need firms to stay agile in their sustainability approach. Data privacy, as well as security concerns, represent hurdles to BI and data analytics implementation for sustainability. Thus, organisations should know about complicated regulatory environments, safeguard sensitive information and facilitate transparency in practices of data handling to establish trust with different stakeholders and reduce risks. If organisations fail to solve data privacy concerns, it can lead to reputational damage and loss of trust among stakeholders (Jain, Tambuskar & Narwane, 2023).

2.7 Recommendations for Organizations Seeking to Leverage Big Data Analytics and Business Intelligence for Sustainable Practices

The organizations are making increased use of big data analytics and BI for sustainable practices which makes it necessary to provide actionable recommendations to guide their efforts:

- The organizations are recommended to articulate a clear and integrative sustainable strategy linked with business objectives and stakeholder expectations. This strategy needs to outline particular sustainability goals and targets for specific improvements thereby offering a roadmap for including big data analytics and BI in organizations' sustainability initiatives. This can help the organizations to plan a clear and concise plan for the effective inclusion of these technologies in the companies' sustainability frameworks (Awan, Sroufe & Shahbaz, 2021).
- The organizations should develop strong data infrastructure as well as analytics abilities is important for the successful inclusion of big data analytics and BI in sustainability practices. In this case, the businesses have to invest in strengthening their existing data storage solutions and tools which help in collecting and managing large chunks of data and convert it into useful insights for them to take collective actions. This can be beneficial for the companies to manage any challenges arising due to a lack of suitable infrastructure which can be the reason for generating security-based issues for them (Singh & El-Kassar, 2019).
- The cultivation of a highly data-driven culture can result in driving positive organizational change and encouraging innovation development in companies' sustainable practices. In this regard, organizations should encourage data literacy among all of their employees working at varying levels and thereby promote decision-making based on the collected and analyzed data. They should also identify and reward crucial initiatives that can leverage data analytics for sustainability (Khan & Vorley, 2017).
- The inclusion of big data analytics and BI in the companies' sustainability practices demands increased collaboration as well as coordination among varying departments and important stakeholders. The organizations need to develop important cross-

functional teams, encourage development of partnerships with varying important external organizations and thereby engage with prime stakeholders to benefit from collective expertise as well as resources (Jagatheesaperumal et al., 2021).

- The aspect of data privacy as well as security are significant when adopting data analytics and BI for inclusion of sustainability practices. They should adopt strong data protection measures, adhere strictly to regulatory requirements and thereby ensure transparency as well as accountability in case of data handling practices. This can help the organizations to shield information and sensitive information and thus develop increased trust with all the stakeholders. In this way, this step can offer dual benefits to the organizations through protection of important data and compliance to the regulatory requirements at the same time (Mikalef et al., 2020).
- The presence of constant monitoring and analysis of sustainability performance are required for bringing continuous enhancement and leading progress towards attainment of sustainability goals. With regards to this, the companies need to develop important mechanisms for measuring KPIs, evaluation of important trends and recognition of improvement areas. This can empower the organizations to engage in improved decision-making along with crucial course corrections (Popovič *et al*., 2018).

With the inclusion of these recommendations, companies can leverage the potential of data-driven useful insights to progress sustainability agendas and thus improve their operational efficiency.

2.8 Conceptual Framework

A conceptual framework is identified to be an important theoretical framework that offers a structured as well as systematic overview of major concepts and assumptions supporting a research study (Ravitch & Riggan, 2016). In this regard, conceptual framework

for the current review has been prepared for the heading, benefits and opportunities of using big data analytics and BI for sustainability initiatives as below:

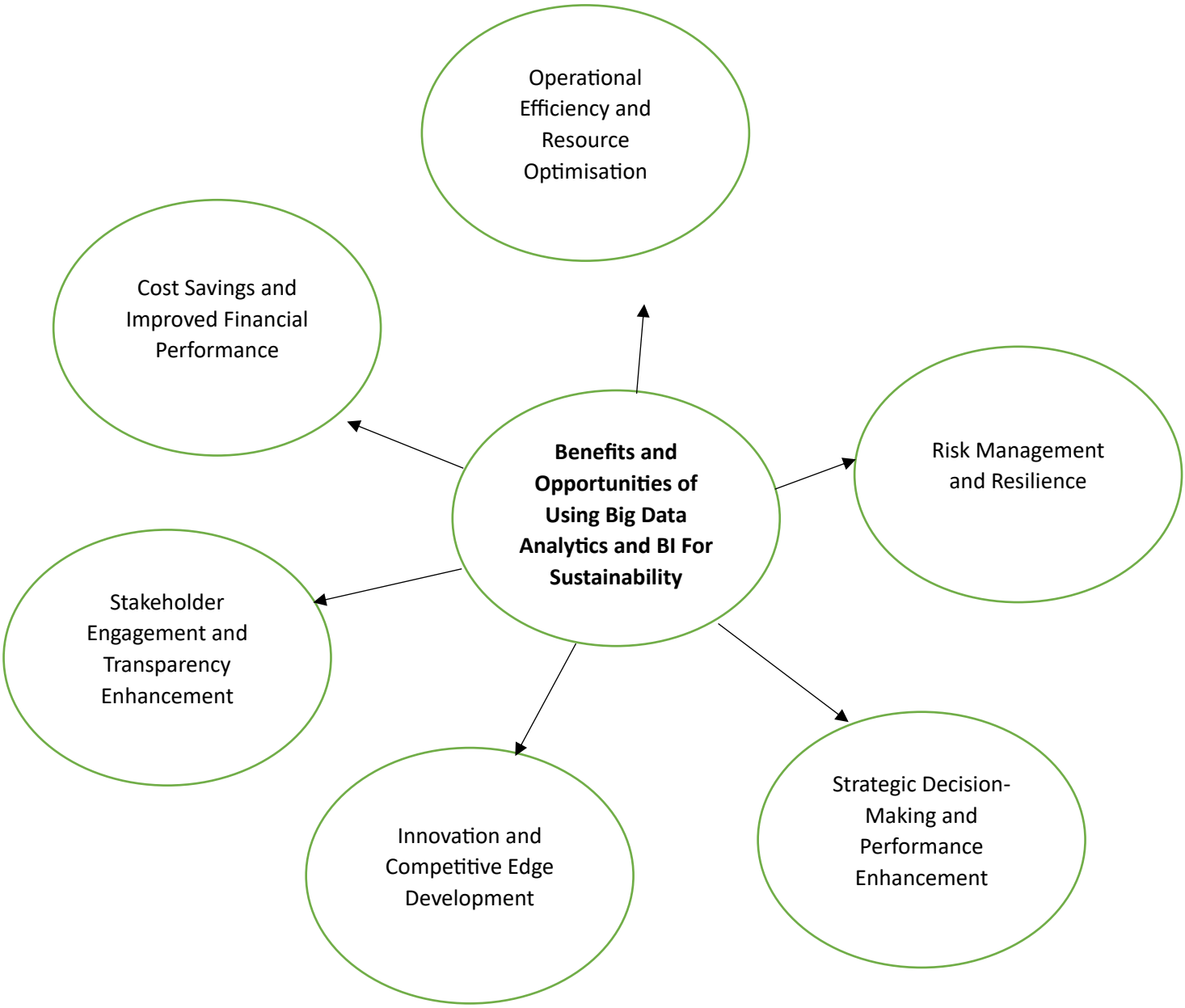

Figure 1: Conceptual Framework (Self-Made)

2.9 Literature Gap and Summary

Although there is a increased amount of literature available on exploration of the inclusion of big data analytics and BI in case of sustainability practices; however, there is a considerable gap in offering integrative recommendations particularly customized for organizations looking to utilize these technologies for attaining sustainability. There is also limited direction on managing core issues like data privacy, organizational culture management and effective stakeholder management which are necessary for successful application. In this regard, the literature review aims to overcome this gap by analyzing existing knowledge and justifiable recommendations to provide guidance to the organizations in using these aspects for attaining sustainability.

Overall, it can be summarized that the integration of data analytics and BI in sustainability frameworks consist of huge potential for organizations to manage environmental, social and economic challenges along with maintaining a competitive edge and encouraging long-term viability. The organizations are hugely identifying the significance of utilizing important data-driven insights to engage in sustainability innovation as seen in the increased adoption of big data and BI by them across varying industries. However, the successful integration demands the inclusion of a strategic approach in alignment with the organizational objectives, technological abilities and enhanced stakeholder engagement.

The benefits and opportunities of leveraging big data and BI for attainment of sustainability are multifaceted due to which the organizations are making increased use of data-driven insights to progress. The best practices for this integration stresses significance of designing clear strategies and making increased investments in infrastructure abilities. Overall, the possible benefits of using big data analytics and BI outweigh the potential risks involved in

it which can be implemented successfully by following useful recommendations for fostering a culture of innovation.

Chapter 3: Research Questions

Research questions formulate the base of the research because of its provision of direction and explanation of research scope. It thereby offers important guidance to the researcher in identifying a specific research problem or area that can derive important findings. Further, research questions are basically designed to address potential gaps found in the existing knowledge about a specific research topic or engage in examining different dimensions of the chosen subject area for the study. To find out the utilisation of big data analytics and BI in organisations, the below set of questions are designed for the current research:

RQ 1: How are the organisations making use of data analytics and BI tools to advance in their sustainability goals?

1.1 What types of initiatives are used by the organisations to advance their sustainability initiatives?

1.2 How are organizations including data analytics and BI to drive sustainability strategies?

1.3 Which specific tools of data analytics and BI are used by the organisations for sustainability initiatives in the organisations?

RQ 2: What are the potential benefits of including big data analytics and BI in organisations' sustainability initiatives?

2.1 How do organisations expect big data analytics and BI to result in improving their knowledge of sustainability challenges?

2.2 In which ways do the organisations expect these technologies enhance the effectiveness of the sustainability programs?

2.3 How do organisations measure the impact of big data analytics and BI tools on their overall sustainability outcomes?

RQ 3: What are the main challenges and barriers witnessed by organisations during the adoption of big data analytics and BI for sustainability purposes?

3.1 Which technological challenges are faced by organisations in using these technologies for sustainability initiatives?

3.2 How does the lack of technical infrastructure impact the successful application of big data analytics and BI in sustainability initiatives?

3.3 What regulatory and ethical considerations are witnessed while using these technologies for sustainability and how to address them?

RQ 4: What are some of the best practices and strategies in place for the inclusion of big data analytics and BI in the current sustainability frameworks?

4.1 How do organisations align their sustainability objectives with their efforts for data analytics and BI?

4.2 What processes are required to identify the most suitable strategies for the integration of data analytics and BI for sustainability initiatives?

4.3 How do organisations encourage cross-cultural collaboration between different teams to drive continuous improvement?

RQ 5: How can organisations utilise insights from big data analytics and BI to design useful set of recommendations to manage sustainability challenges?

5.1 How do organisations use data-driven insights to design actionable strategies to manage sustainability challenges?

5.2 How do the organisations manage the challenges of data privacy and security to leverage the use of these aspects?

Chapter 4: Research Methodology

4.1 Introduction

This chapter on methodology focuses on providing vital information on the data collection method and the justification for the various elements used in order to collect data and develop findings for the research study. In the current study survey technique is implemented in order to gather data and generate results about the use of big data and business intelligence for ensuring organisational sustainability. The essentials of the methodology utilised in the research are set in the methodological framework provided by Saunders to sustain a reasonable flow in the methodological elements (Snyder, 2019). The emphasis of the methodology segment is to deliver appropriate explanation of the methodological instrument utilised along with giving benefits and limits of the present technique implemented. Moreover, the additional selections in all the elements of methodology are also registered in the chapter in order to deliver appropriate details on the selections offered and the motive for choosing a specific type of methodological element in the study.

4.2 Research Model

In order to maintain a logical flow in methodological elements, Saunders' Onion Model is used that help in maintaining a logical flow in the methodological elements (Saunders, Lewis and Thornhill, 2019). The model has several layers such as philosophy or paradigm, approach, design, time horizon, choice and strategies. Thus, the model of Saunders' is used in the research study in order to align all the elements of the methodology systematically (Mardiana, 2020). The below figure describes Saunders' model as follows:

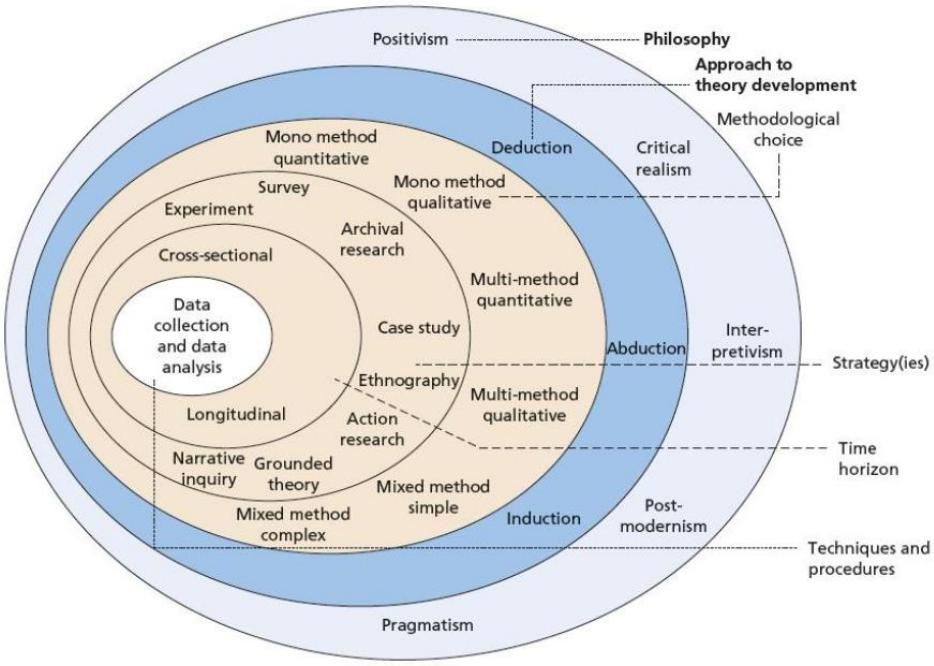

Figure: Research Onion Model

Source: (Mardiana, 2020)

4.3 Research Philosophy

Research philosophy consists outermost layer of Saunder's onion model and represents the most important element of the methodology as it represents values, beliefs and ethics. It provides details of the faith that helped a researcher in the collection of data and carrying out the research study. There are several types of philosophies available for a research study such as positivism, interpretivism, realism and pragmatism. The use of positivism helps researchers in the exploration of social reality with the help of reason and observation. Therefore, in the context of the current research study, the philosophy of positivism is applied as there is a need for exploration of social reality on the sustainability of the business by observation and collection of primary data with the help of a survey. The use of positivist philosophy also aligns with the application of statistical operations by the collection of

objective data that is used in the research study to develop the findings (Park, Konge & Artino Jr, 2020).

The use of positivist philosophy also helps in providing a definite structure to the research study as the procedure and rules can be drafted in the starting phase of conducting a research study. It has the objective of evaluating the universal principles and laws that are applicable to the various types of populations. On the other hand, the use of positivism philosophy also poses a limitation in that it is unable to provide subjective inferences regarding the topic of the study which is one of the major elements that can cause issues in the development of results (Alharahsheh & Pius, 2020). In order to overcome the limitation of lack of subjective inference the findings of the objective will be compared and contrasted with the subjective findings in the literature review chapter in order to include subjective inferences in the study. Furthermore, the use of positivism philosophy provides the benefits of making the findings general along with ensuring replicability due to which it is applied in the current research study.

4.4 Research Approach

The second element in the Saunders' onion model is the research approach which is the process that assists a researcher in the collection, analysis and extraction of the information for the purpose of deriving meaningful insights applicable to the research study from the collected data. It provides details of the steps included in the data collection, making assumptions and analysis of the data. There are several types of data collection approaches available such as abductive, inductive and deductive. The use of the inductive approach is made in the case of dealing with subjective information that is broad in nature and used for theory development. In opposition to this, the use of a deductive approach is made in order to collect objective data for the purpose of testing existing theory (Azungah, 2018). Thus, in the current research

study objective data is collected due to which the application of deductive approach is suitable.

In the deductive approach, the collection of data from a large number of sources is possible due to which the selection of the deductive approach is made. It is also suitable for the collection of quantitative data due to which it is applied in the research study. In addition to this, it is also suitable for the purpose of establishing a cause-and-effect relationship between the variables of the research study and this research is required to determine a cause-and-effect relationship between the use of big data and business intelligence in the process of ensuring business sustainability due to which deductive approach is suitable for the research study. However, the use of the deductive approach provides a limitation in that it is less flexible and subjective inferences are difficult to obtain (Pearse, 2019). In order to overcome the limitation a plan for the research stages is made in advance and executed to avoid issues at a later stage of time.

4.5 Research Choice

In Saunders' onion model of research, choice is a vital element that is placed in the third position in the model. It provides information regarding the type of data that is collected in a research study. There are several types of choices available such as mono-method and mixed-method. In the current research study, the mono-method is used in order to explore the impact of Big data and business intelligence on organisational sustainability. the mono-method is selected as it is a focused and consistent approach for the purpose of data collection. It provides the advantage of eliminating additional complexities that arise in research due to the collection of various types of data from different data collection methods. In the current research study, a mono-quantitative choice is selected for the purpose of data collection.

4.6 Research Design

The next element in the model of Saunders' is research design which helps in developing a better understanding of the research issue. In the context of the research study, there are several types of research designs available such as exploratory, explanatory, descriptive and experimental. In context to the current research study exploratory research study is used in order to include background information for the purpose of defining the research problem (Nattrass, 2020). It provides a high level of flexibility in order to provide details on the data collection and exploration of the problem. It helps in narrowing down the issues and exploration of the various types of factors associated with the research study. However, it provides limitations of lack of standardised analysis and the use of outdated information that can cause a threat to the authenticity of the results. In order to eliminate the limitation, the primary data collected is highly updated and standard rules and protocols are used in the process of data collection and analysis to maintain standards in the research study (Thomas & Lawal, 2020). It also helps in the evaluation of a large amount of data that can be used for the purpose of analysis and development of reliable results.

4.7 Research method

The research method is also one of the important elements of the Saunders' Onion model as it provides details regarding the method used for the purpose of data collection. In the current research study, primary data is used in order to collect the latest and highly updated information as the data is collected from the people experiencing the social phenomena. In addition to this, the use of secondary information poses a limitation of the context of the data collection and the study is different from the current study which can cause a mismatch in the results due to which secondary data is avoided in the research study (Cerar, Nell & Reiche, 2021). Moreover, the data collected is quantitative in nature in order to provide numerical and objective responses. The use of qualitative data is performed in the case of collecting subjective

data that is not the case in the research study due to which it is avoided in the research study. In the research, the survey method is used for the purpose of collecting quantitative data from the participants as it is capable of providing numerical data that is objective in nature. The collection of objective data through surveys also provides the advantage of applying statistical operations to data (Ahmad *et al*., 2019).

4.8 Time Horizon

It is also a vital part in the research to deliver evidence on the time period in which the information is collected. There are several kinds of time horizons are utilised in researches such as longitudinal and cross-sectional time horizons. The longitudinal time horizon is used in the process in which the data is collected over a large period of time. In opposite to this, in cross-sectional time horizon includes a collection of data at a single interval of time which is used in the current research study. The use of a cross-sectional time horizon provides several advantages such as being inexpensive, quick and helpful in providing information regarding various variables related to the research study without making the process complex (Spector, 2019). In addition to this, the topic of the study is an exploration of the effect of big data and business intelligence in organisational sustainability due to which the use of a cross-sectional time horizon is suitable as a collection of data at a single instance of time is required and there is no need for collecting historical data for the exploration of the topic.

4.9 Data Collection Method

The data collection method is the most important element in the methodology of a research study. In relation to the current research study, the data is collected with the help of a survey method in order to take advantage of collecting the data from a large audience and generation of objective responses that can be evaluated with the help of statistical operations. In the current research study, the executives from technical teams of the business operated in the United Kingdom (UK) are selected for the purpose of collecting data from the

participants. In the first step, the various types of companies such as small-sized, idle and large-sized companies operating in the UK are identified in order to include diversified information and viewpoints. Technical executives of those companies are mailed the information about the research and a consent form having all the required information about the research study. The participants who fill out the form and send it back to the researcher are sent the questionnaire for the survey. In the process of developing of survey questionnaire, Google Forms is used It is a free tool for conducting surveys and provides data in the form of Excel that can be edited easily. It is mentioned in the survey that the participants who wanted to skip a question or leave the survey can do this at any point in time.

4.10 Sampling Technique and Sample Size

In a research study, the sampling strategy is a crucial element as it helps in the selection of the sample population that will provide valuable insights that will form the basis for a research study. It is a difficult and complex process to collect data from all the companies operating in the UK due to which a portion of the population is studied with the help of an appropriate sampling strategy. In a current research study, a random sampling strategy is used in which the companies and the technical executives are selected randomly. The use of a random sampling strategy provides the advantage of making an equal probability of selection for each individual in the population in order to prevent bias from the research study (Noor, Tajik & Golzar, 2022). In addition to this, the selection of an appropriate sample is also vital in a research study as a selection of a sample that is too small is unable to provide suitable insights that represent the whole population. On the other hand, the inclusion of a large population can also lead to increased complexities in a research study. Therefore. In the research study, an appropriate number of 150 participants is selected for the research study which is sufficient to provide insights on the topic. A sample size of 150 technical executives of the companies operating in the UK were surveyed to provide data for the study.

4.11 Development of Survey Instrument

The survey instrument is developed with the help of considering variables and factors that are highlighted in the section of the literature review. The instrument identified various types of factors such as independent, dependent and moderate that are used in the process of data collection. A 5-point Likert scale is used in order to develop a questionnaire for the survey to maintain consistency in the questions and provide meaningful responses. The questionnaire for the survey includes demographic information to collect information on the general characteristics of the population and variable-specific data of the study.

Table: Variables for survey

S. No.	Variables	Authors
1	**Adoption of Big Data and Business Intelligence Tools**	(Jeble *et al*., 2018)
2	**Operational Efficiency and Resource Optimisation**	(Akter *et al*., 2018)
3	**Risk Management and Resilience**	(Bahrami & Shokouhyar, 2020)
4	**Strategic Decision-Making and Performance Enhancement**	(Williams, 2016)

5	**Cost Savings and Improved Financial Performance**	(Charles *et al.,* 2023)

4.12 Data Analysis

Data analysis is a vital process as in this step the results are generated from the raw data that provides meaningful insights regarding the topic of the study. In relation to the current research study, statistical methods are used for the purpose of analysing the quantitative data. The data analysis methods utilised in the study are inferential analysis, descriptive analysis and predictive analysis. Descriptive analysis is utilised to deliver information of the vital figures of the data including mean, median, variance and standard deviation (Kemp *et al*., 2018). It also utilises correlation analysis to check the existence of a relationship between the variables. A cause-and-effect relationship is also recognized between the variables by using regression analysis. The tool used for the drive of directing analysis is SPSS which has numerous statistical tests that can be used for the data.

4.13 Reliability and Validity

The generation of reliable and valid outcomes are important for a study and it can be achieved by confirming constancy in the data. In order to confirm the reliability of the outcomes Cronbach's Alpha test is used which assist in defining internal uniformity among the variables. They are measured by variance and covariance between the variables. The value of covariance is high in contrast to variance in the situation of reliability of variables. Moreover, constructive validity is shadowed in the study to ensure that the variables are able to reproduce the theory of phenomena for which they are developed (Sürücü & Maslakçi, 2020).

4.14 Ethical Consideration

In a research study, it is vital to follow all the ethical obligations and avoid harming anyone and violating ethical norms in the process of conducting a research study. In the research study, various types of ethical issues are considered at every stage. The issue of integrity is considered seriously and valid consent is taken before recruiting participants for the study. All the participants are sent a consent from that they send back to the researcher and survey questionnaires are sent to those participants only who fill out the consent form and send it back. Moreover, the right to withdraw is provided to all the participants and it is clearly mentioned that they can withdraw their participation or skip any question at any time of the survey. In addition to this, the researcher also tried to reduce bias on the basis of demographic variables and due to this reason, the data was collected from a wide audience. The factor of confidentiality, anonymity and privacy is considered as the personal information of the participants will not be published under any circumstances (Kang & Hwang, 2023). The data of the research is stored in password password-protected file in the computer of the researcher. The data of the research will be destroyed after 4 years of completion. Furthermore, guidelines of government, University and various Data protection laws are also followed in the research study.

4.15 Summary of Research

On the basis of the overall discussion, it can be summarised that various types of methodological elements are used in order to collect data and develop findings. Positivism philosophy, deductive approach, exploratory research design and cross-sectional time horizon are used for the purpose of collecting data with the help of surveys from technical executives of companies in the UK.

Chapter 5: Findings, Results and Analysis

5.1 Introduction

5.2 Reliability Analysis

Table 2: Reliability Statistics

Reliability Statistics	
Cronbach's Alpha	N of Items
.794	9

In a research study, the reliability of the variables is vital to determine in order to develop valid findings. In order to know the reliability of the data Cronbach's Alpha method is applied in which the value of the coefficient should be above 0.7 to show the internal consistency of the variable. In relation to the research study, the value of the coefficient is 0.794 which suggests internal consistency and reliable findings.

5.3 Descriptive Statistics

Table 3: Descriptive Statistics

Descriptive Statistics												
	N	Range	Minimum	Maximum	Mean		Std. Deviation	Variance	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
Gender	150	2	1	3	1.54	.049	.598	.357	.608	.198	-.556	.394
Age	150	4	1	5	3.18	.073	.890	.793	-.536	.198	.495	.394
Years of work experience	150	4	1	5	3.54	.074	.902	.814	-.732	.198	.640	.394
Increase in use of use of Big Data and Business Intelligence Tools	150	4	1	5	2.08	.092	1.126	1.269	1.012	.198	.197	.394
Big Data and Business Intelligence are essential for ensuring the sustainability of organizations	150	4	1	5	1.93	.085	1.047	1.096	1.308	.198	1.210	.394
Big Data and Business Intelligence is challenging to work with the current system	150	4	1	5	2.23	.105	1.286	1.653	.911	.198	-.321	.394
Big Data and Business Intelligence solutions can improve	150	4	1	5	2.12	.095	1.164	1.355	1.006	.198	.147	.394

operational efficiency												
Big Data and business intelligence tools are effective in optimising resource allocation	150	4	1	5	1.95	.089	1.095	1.199	1.337	.198	1.180	.394
Big Data and Business Intelligence can enhance risk management practices within your organization to mitigate potential threats	150	4	1	5	2.36	.111	1.362	1.856	.743	.198	-.740	.394
Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions	150	4	1	5	1.99	.092	1.129	1.275	1.274	.198	.911	.394
Big Data and Business Intelligence can lead to	150	4	1	5	1.97	.088	1.083	1.173	1.255	.198	.964	.394

informed decisions												
Big Data and Business Intelligence is providing your organisation with a competitive edge	150	4	1	5	2.34	.110	1.345	1.810	.749	.198	-.686	.394
Big Data and Business Intelligence can lead to cost savings	150	4	1	5	2.03	.091	1.111	1.234	1.197	.198	.744	.394
Big Data and Business Intelligence pose a huge positive impact on the performance	150	4	1	5	2.39	.109	1.341	1.797	.688	.198	-.770	.394
Valid N (listwise)	150											

The table of descriptive statistics suggests that the total number of participants in the survey was 150. Moreover, the table also suggests that there is no missing value in the data and all the variables were responded by the participants. The mean value of the variable year of experience is 3.54 with a standard deviation of 0.902 suggesting that the participants have adequate level of experience for providing responses regarding the use of big data in their organisation.

Inferential Statistics

Table 4: Gender

Gender					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	77	51.3	51.3	51.3
	Female	65	43.3	43.3	94.7
	Others	8	5.3	5.3	100.0
	Total	150	100.0	100.0	

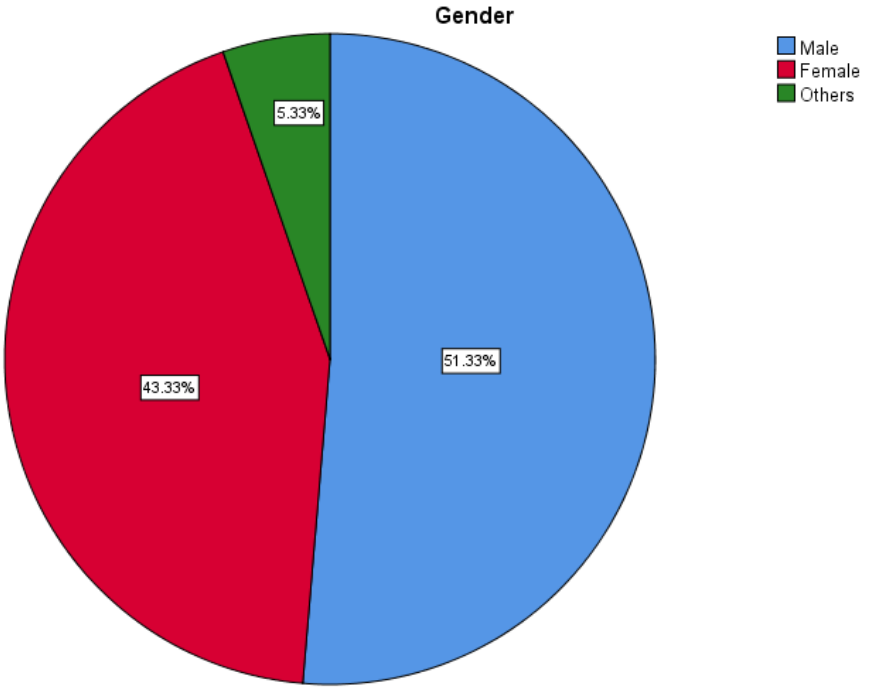

Chart 1: Gender

In relation to the variable of gender, it is evaluated that the percentage of male participants in the study is 51.33% and females is 43.33%. Moreover, the percentage of the participants selecting the other option in the gender question is 5.33%. It suggests that the participants male and female is nearly equal in the survey and there is versatility in the audience.

Table 5: Age

Age					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	20-25 years	9	6.0	6.0	6.0
	26-35 years	15	10.0	10.0	16.0
	36-45 years	72	48.0	48.0	64.0
	46-55 years	48	32.0	32.0	96.0

	55 years and above	6	4.0	4.0	100.0
	Total	150	100.0	100.0	

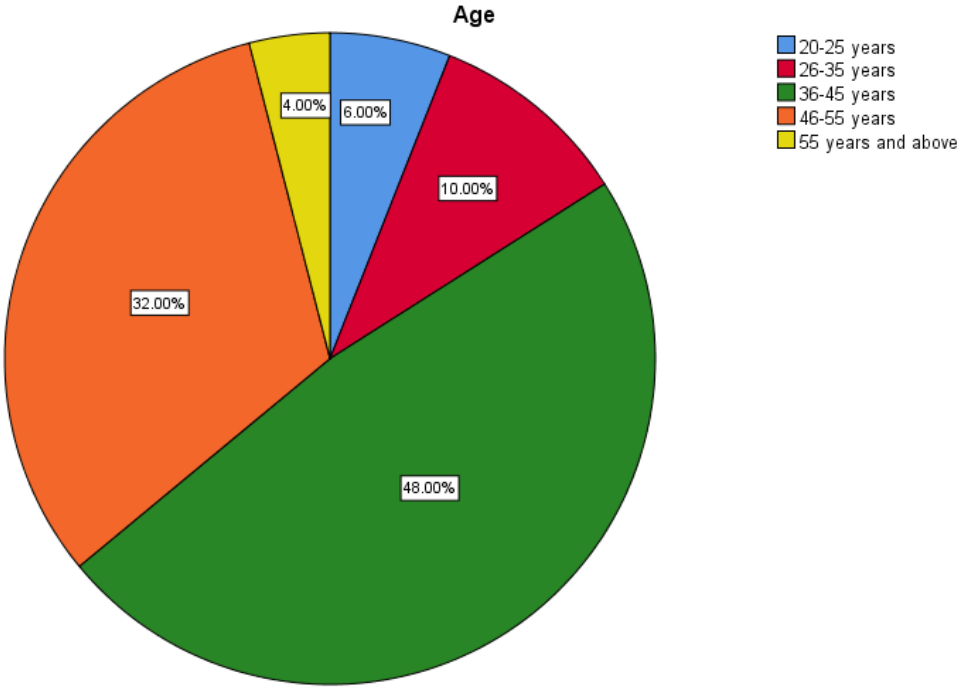

Chart 2: Age

In relation to the question of age it is evaluated that a majority of the participants belong to the age group of 36-45 years with a total percentage of 18% and the people belonging to the age group of 46-55 years are 32%. The data suggested that the majority of the participants are in the middle years of their age.

Table 6: Years of work experience

Years of work experience					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-5 years	5	3.3	3.3	3.3
	6-10 years	12	8.0	8.0	11.3

	11-15 years	45	30.0	30.0	41.3
	16-20 years	73	48.7	48.7	90.0
	21 years and above	15	10.0	10.0	100.0
	Total	150	100.0	100.0	

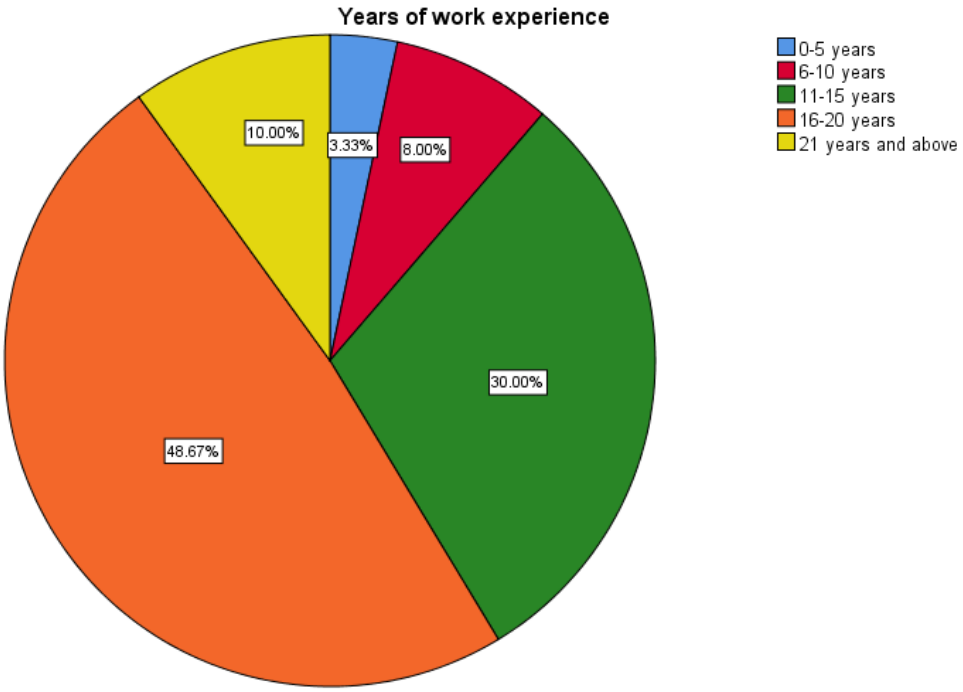

Chart 3: Years of work experience

In accordance with the question of the year of experience, it is evaluated that a majority of the participants have 16-20 years of experience which is 48.67% of the total. Thus, the data suggests that the participants have enough working experience and are able to answer the questions properly.

Table 7: Increase in use of use of Big Data and Business Intelligence Tools

Increase in use of use of Big Data and Business Intelligence Tools				
	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Strongly agree	54	36.0	36.0	36.0
	Agree	59	39.3	39.3	75.3
	Neutral	14	9.3	9.3	84.7
	Disagree	17	11.3	11.3	96.0
	Strongly disagree	6	4.0	4.0	100.0
	Total	150	100.0	100.0	

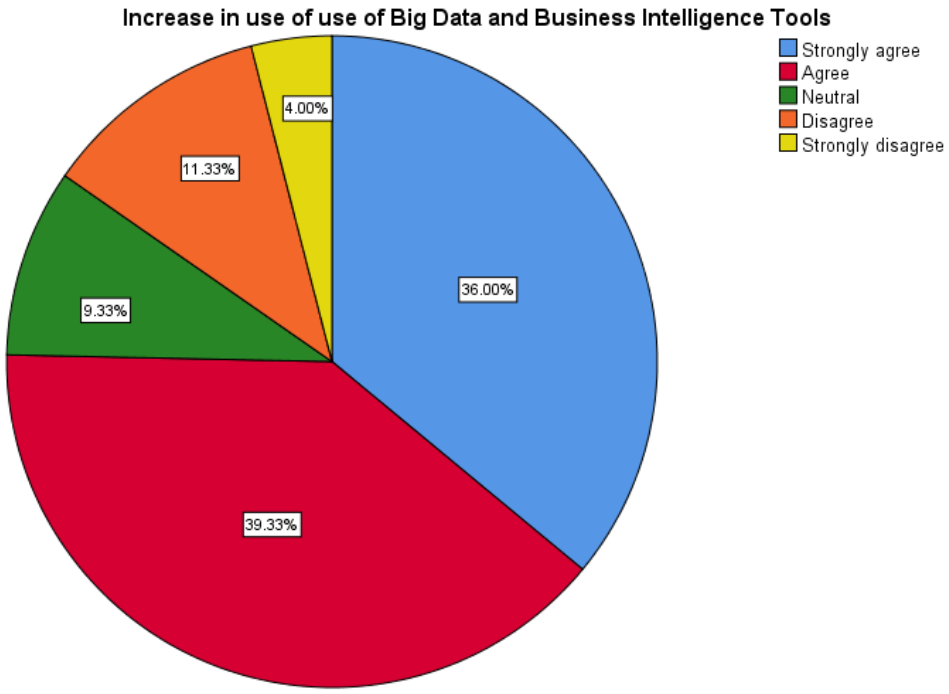

Chart 4: Increase in use of use of Big Data and Business Intelligence Tools

In relation to the question of increase in big data and business intelligence tools in working of an organisation a majority of 39.33% of the participants agreed with the statement and 36.00% of the participants strongly agreed with the statement. Therefore, it can be evaluated that the use of big data and business intelligence has increased in recent times.

Table 8: Big Data and Business Intelligence are essential for ensuring the sustainability of organizations

Big Data and Business Intelligence are essential for ensuring the sustainability of organizations					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	59	39.3	39.3	39.3
	Agree	65	43.3	43.3	82.7
	Neutral	8	5.3	5.3	88.0
	Disagree	13	8.7	8.7	96.7
	Strongly disagree	5	3.3	3.3	100.0
	Total	150	100.0	100.0	

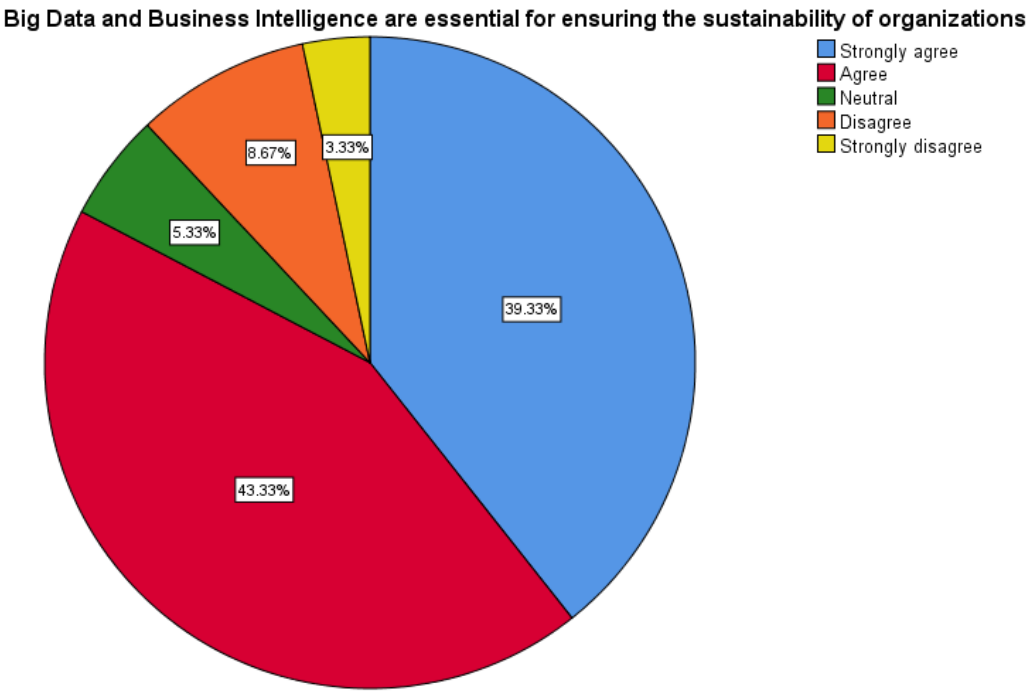

Chart 5: Big Data and Business Intelligence are essential for ensuring the sustainability of organizations

In accordance with the question of the essentiality of big data in the sustainability of an organisation, a majority of 43.33% of the participants agreed with the statement and 39.33% strongly agreed. However, the percentage of participants who opted for the neutral option is 5.33%, disagree is 6.67% and strongly disagree is 3.33%. Thus, it is inferred that the use of business intelligence and big data is vital for the sustainability of an organisation.

Table 9: Big Data and Business Intelligence is challenging to work with the current system

Big Data and Business Intelligence is challenging to work with the current system					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	53	35.3	35.3	35.3
	Agree	54	36.0	36.0	71.3
	Neutral	12	8.0	8.0	79.3
	Disagree	18	12.0	12.0	91.3
	Strongly disagree	13	8.7	8.7	100.0
	Total	150	100.0	100.0	

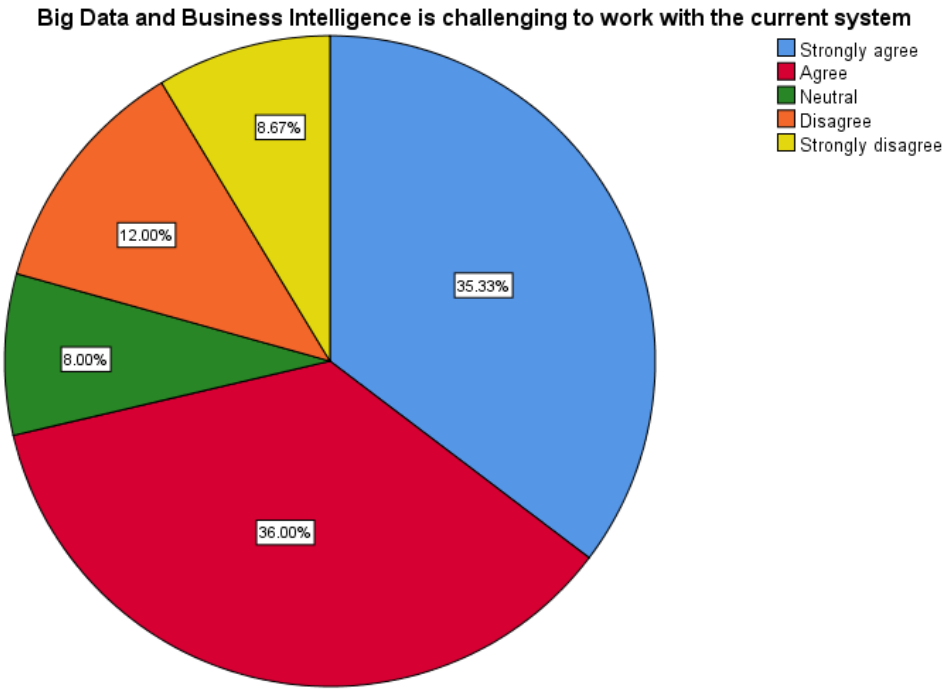

Chart 6: Big Data and Business Intelligence is challenging to work with the current system

In relation to the question asked it is challenging to work with big data in the current working of an organisation a majority of 36% of the participants agreed with the statement and 35.33% strongly agreed with the statement. Thus, it can be evaluated that the integration of business intelligence and big data poses challenges in the current working of an organisation.

Table 10: Big Data and Business Intelligence solutions can improve operational efficiency

Big Data and Business Intelligence solutions can improve operational efficiency					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	53	35.3	35.3	35.3
	Agree	58	38.7	38.7	74.0
	Neutral	15	10.0	10.0	84.0
	Disagree	16	10.7	10.7	94.7

	Strongly disagree	8	5.3	5.3	100.0
	Total	150	100.0	100.0	

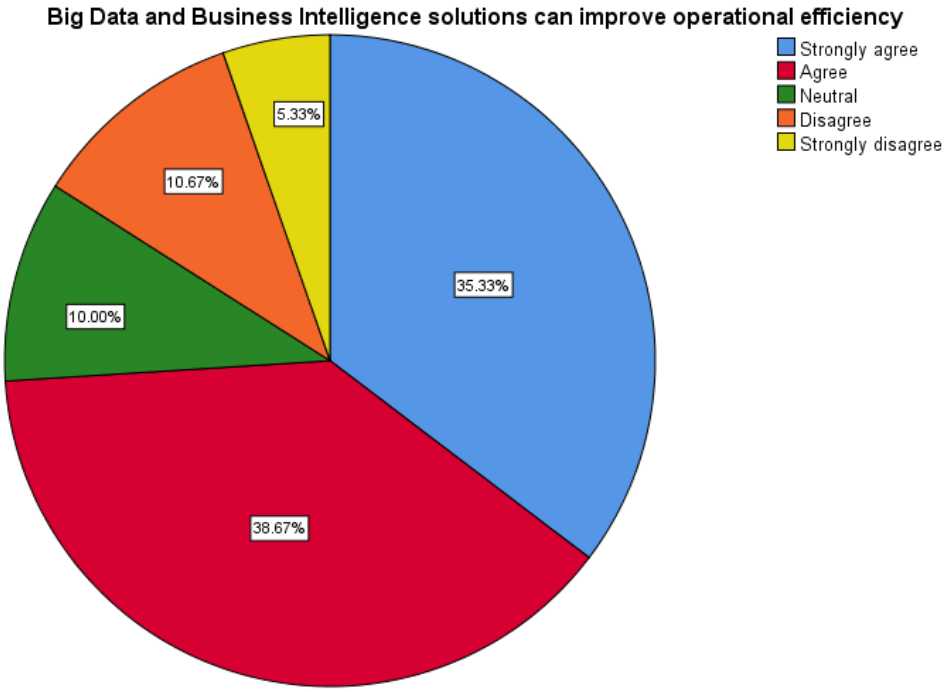

Chart 7: Big Data and Business Intelligence solutions can improve operational efficiency

In relation to the question of increase in operational efficiency by using big data a majority of 38.67% of the participants agreed with the statement and 35.33% strongly agreed with the statement. Thus, it can be inferred that the use of big data can improve operational efficiency.

Table 11: Big Data and business intelligence tools are effective in optimising resource allocation

Big Data and business intelligence tools are effective in optimising resource allocation				
	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Strongly agree	60	40.0	40.0	40.0
	Agree	63	42.0	42.0	82.0
	Neutral	8	5.3	5.3	87.3
	Disagree	12	8.0	8.0	95.3
	Strongly disagree	7	4.7	4.7	100.0
	Total	150	100.0	100.0	

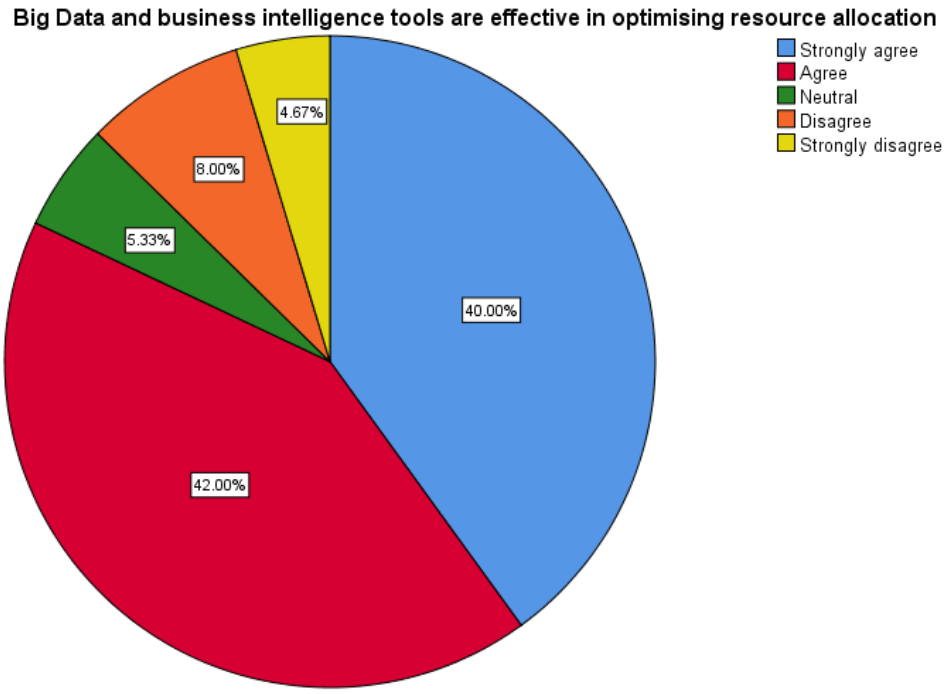

Chart 8: Big Data and business intelligence tools are effective in optimising resource allocation

In relation to the question asked on the efficiency of big data tools in optimising resource allocation, a majority of the participants agreed with the statement and 40% of the participants strongly agreed with the statement. Thus it is evaluated that the use of big data helps in optimising resource allocation.

Table 12: Big Data and Business Intelligence can enhance risk management practices within your organization to mitigate potential threats

Big Data and Business Intelligence can enhance risk management practices within your organization to mitigate potential threats					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	50	33.3	33.3	33.3
	Agree	50	33.3	33.3	66.7
	Neutral	13	8.7	8.7	75.3
	Disagree	20	13.3	13.3	88.7
	Strongly disagree	17	11.3	11.3	100.0
	Total	150	100.0	100.0	

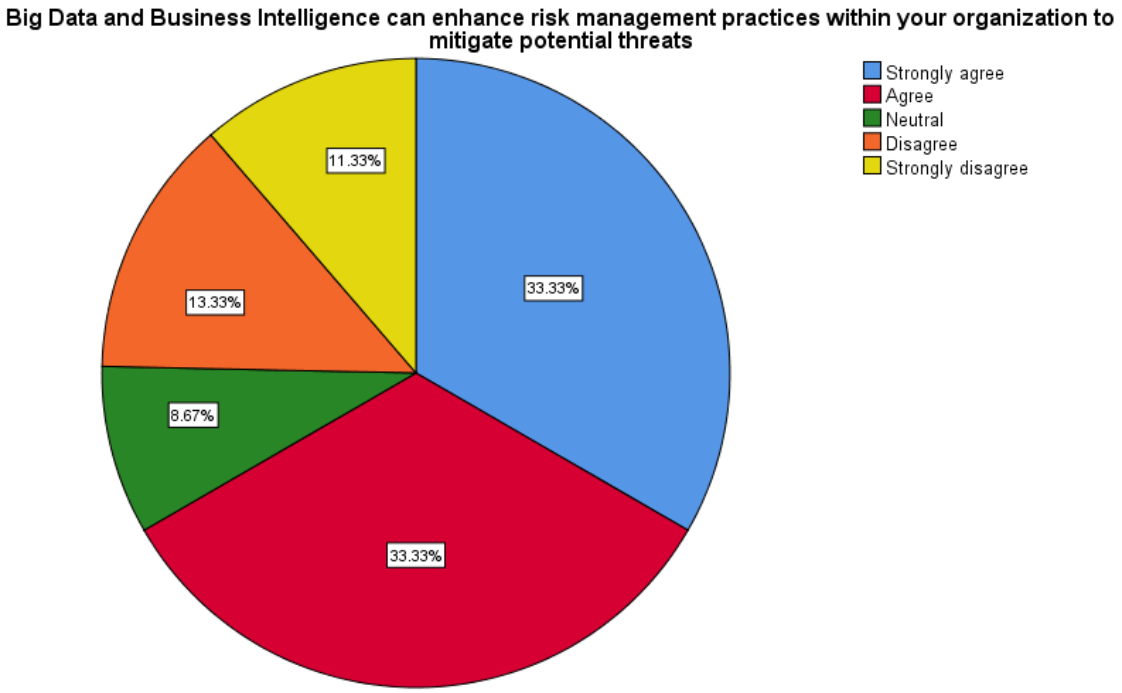

Chart 9: Big Data and Business Intelligence can enhance risk management practices within your organization to mitigate potential threats

In relation to the question asked on improvement in risk management practices by the use of big data a total of 33.33% agreed with the statement. It can be evaluated that big data helps in enhancing risk management practices.

Table 13: Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions

Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	60	40.0	40.0	40.0
	Agree	60	40.0	40.0	80.0
	Neutral	10	6.7	6.7	86.7
	Disagree	12	8.0	8.0	94.7
	Strongly disagree	8	5.3	5.3	100.0
	Total	150	100.0	100.0	

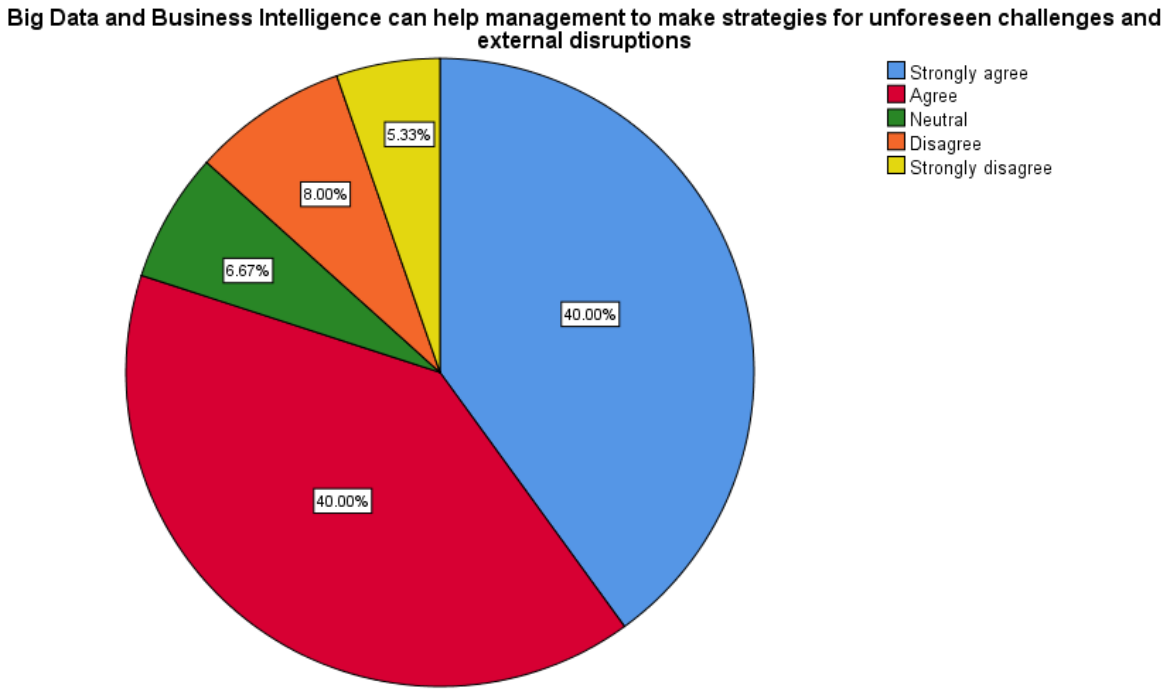

Chart 10: Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions

In accordance with the question asked on the use of big data in helping management for making strategies towards unforeseen challenges a majority of 40% of the participants agreed and the same percentage of the participants strongly agreed with the statement.

Table 14: Big Data and Business Intelligence can lead to informed decisions

Big Data and Business Intelligence can lead to informed decisions					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	59	39.3	39.3	39.3
	Agree	62	41.3	41.3	80.7
	Neutral	10	6.7	6.7	87.3
	Disagree	13	8.7	8.7	96.0
	Strongly disagree	6	4.0	4.0	100.0

	Total	150	100.0	100.0	

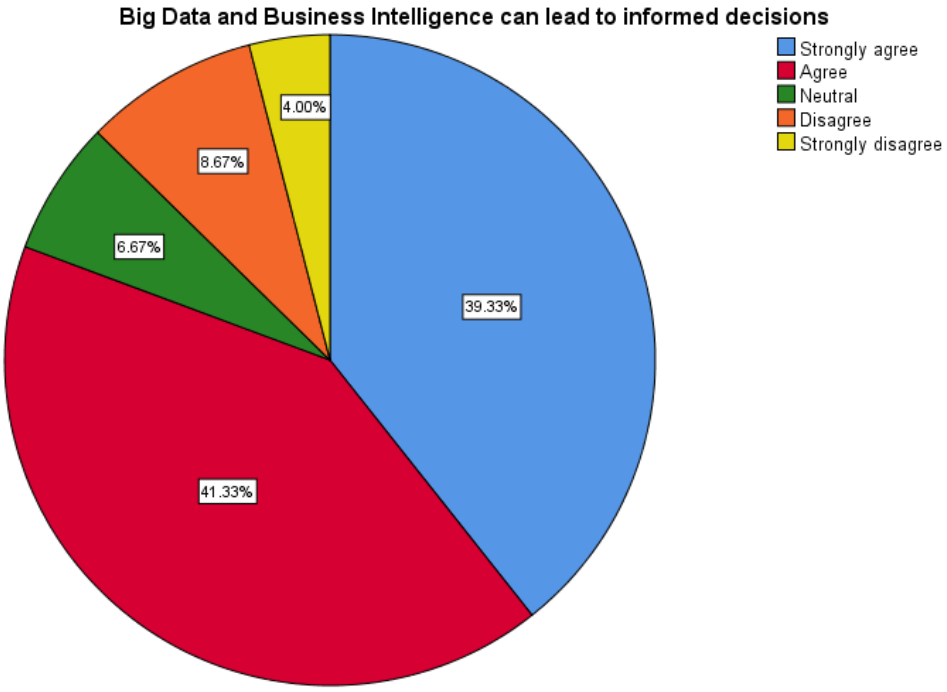

Chart 11: Big Data and Business Intelligence can lead to informed decisions

In relation to the question of big data can lead to informed decisions it is evaluated that 41.33% of the participants agreed with the statement. Thus, it is evaluated that use of big data can lead to informed decisions.

Table 15: Big Data and Business Intelligence is providing your organisation with a competitive edge

Big Data and Business Intelligence is providing your organisation with a competitive edge					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	51	34.0	34.0	34.0
	Agree	48	32.0	32.0	66.0
	Neutral	16	10.7	10.7	76.7

	Disagree	19	12.7	12.7	89.3
	Strongly disagree	16	10.7	10.7	100.0
	Total	150	100.0	100.0	

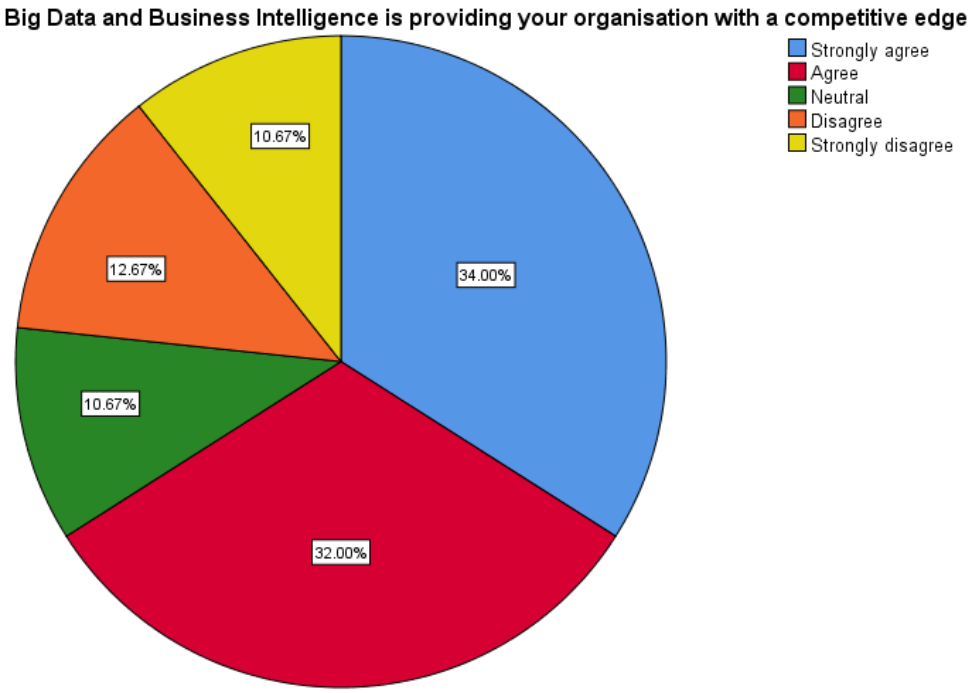

Chart 12: Big Data and Business Intelligence is providing your organisation with a competitive edge

In concern with the question asked on the use of big data providing a competitive edge a majority of 34% of the participants strongly agreed with the statement and 32% agreed with the statement. Therefore, it is evaluated that the use of big data provides a competitive edge to an organisation.

Table 16: Big Data and Business Intelligence can lead to cost savings

Big Data and Business Intelligence can lead to cost savings				
	Frequency	Percent	Valid Percent	Cumulative Percent

Valid	Strongly agree	55	36.7	36.7	36.7
	Agree	64	42.7	42.7	79.3
	Neutral	10	6.7	6.7	86.0
	Disagree	14	9.3	9.3	95.3
	Strongly disagree	7	4.7	4.7	100.0
	Total	150	100.0	100.0	

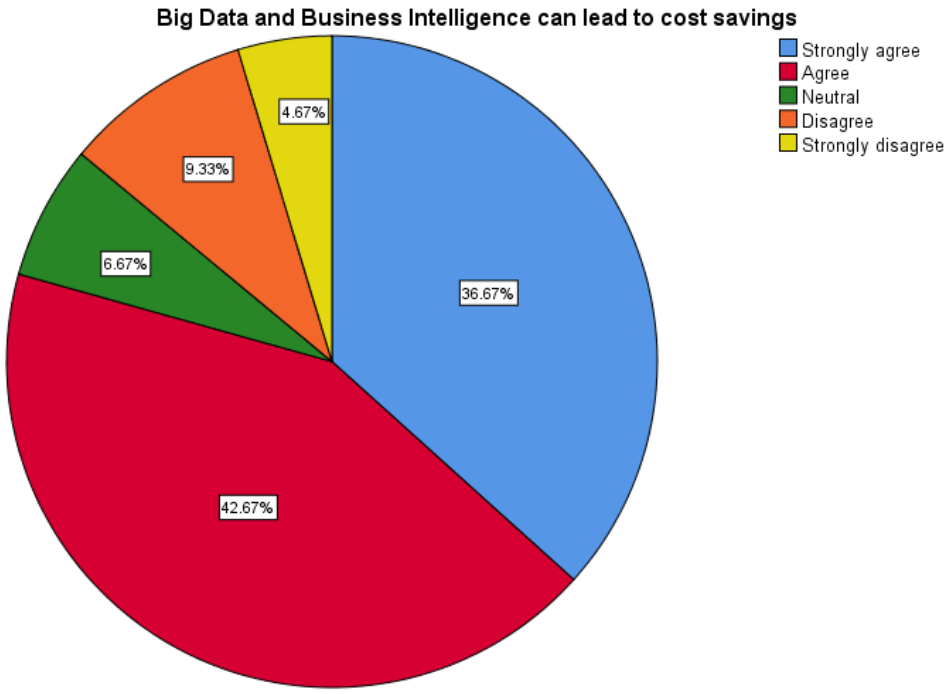

Chart 13: Big Data and Business Intelligence can lead to cost savings

In concern with the question of the use of big data results in cost saving a majority of 42.67% of the participants agreed with the statement and 36.67% strongly agreed with the statement. Thus, it can be evaluated that the use of big data can lead to cost savings in an organisation.

Table 17: Big Data and Business Intelligence pose a huge positive impact on the performance

Big Data and Business Intelligence pose a huge positive impact on the performance					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	47	31.3	31.3	31.3
	Agree	50	33.3	33.3	64.7
	Neutral	16	10.7	10.7	75.3
	Disagree	21	14.0	14.0	89.3
	Strongly disagree	16	10.7	10.7	100.0
	Total	150	100.0	100.0	

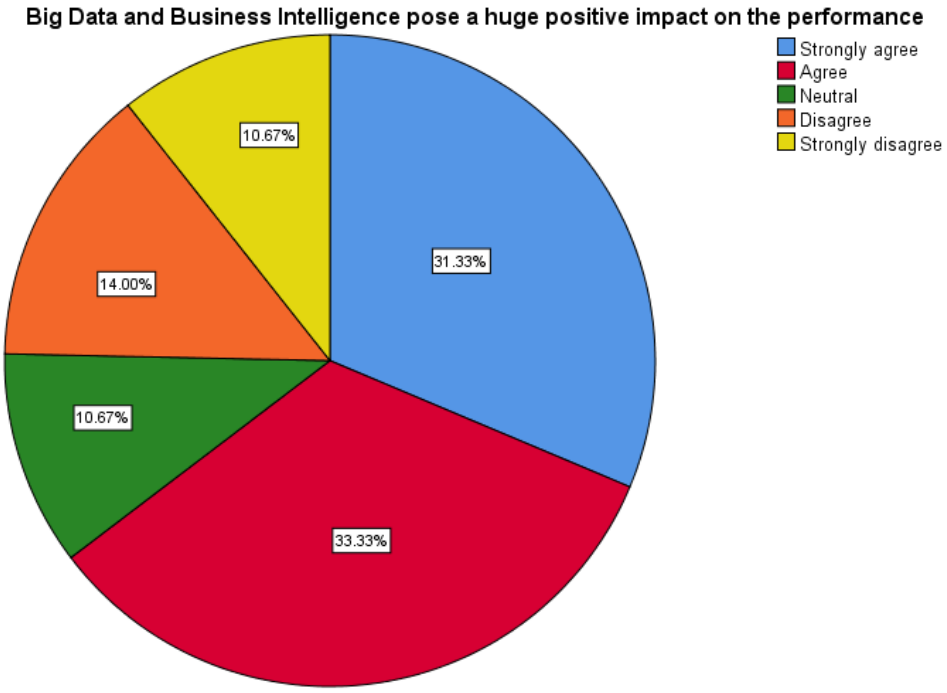

Chart 14: Big Data and Business Intelligence pose a huge positive impact on the performance

In relation to the question asked on the positive impact of big data on the performance of an organisation a majority of 33.33% of the participants agreed with the statement.

However, 14% disagreed and 10.67% of the participants strongly disagreed with the statement. Therefore, the positive impact of big data is observed on the performance of an organisation.

Table 18: Data Security Challenge

Data Security Challenge					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly agree	47	31.3	31.3	31.3
	Agree	56	37.3	37.3	68.7
	Neutral	16	10.7	10.7	79.3
	Disagree	20	13.3	13.3	92.7
	Strongly disagree	11	7.3	7.3	100.0
	Total	150	100.0	100.0	

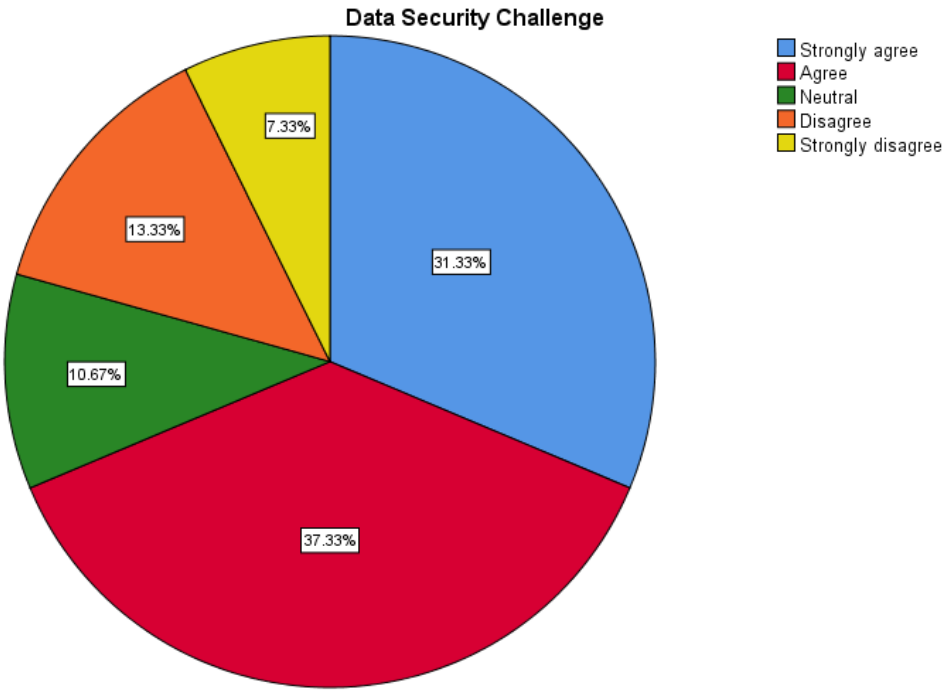

Chart 15: Data Security Challenge

In concern to the challenges of using big data, a majority of 37.37% of the participants agreed that data security is a major challenge and 10.67% of the participants opted for a neutral response in related to the question.

Correlation analysis

Table 19: Correlation analysis

Correlations												
		Increase in use of use of Big Data and Business Intelligence Tools	Big Data and Business Intelligence are essential for ensuring the sustainability of organizations	Big Data and Business Intelligence is challenging to work with the current system	Big Data and Business Intelligence solutions can improve operational efficiency	Big Data and business intelligence tools are effective in optimising resource allocation	Big Data and Business Intelligence can enhance risk management practices within your organization to mitigate potential threats	Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions	Big Data and Business Intelligence can lead to informed decisions	Big Data and Business Intelligence is providing your organisation with a competitive edge	Big Data and Business Intelligence can lead to cost savings	Big Data and Business Intelligence pose a huge positive impact on the performance
Increase in use of use of Big Data and Business Intelligence Tools	Pearson Correlation	1	-.047	-.054	.935**	-.079	-.050	-.121	.002	-.102	-.082	.215**
	Sig. (2-tailed)		.571	.509	.000	.339	.547	.142	.979	.213	.317	.008
	N	150	150	150	150	150	150	150	150	150	150	150
Big Data and Business Intelligence are essential for ensuring the sustainability of organizations	Pearson Correlation	-.047	1	.046	-.010	.893**	.064	.879**	.832**	.064	.890**	-.005
	Sig. (2-tailed)	.571		.575	.904	.000	.437	.000	.000	.438	.000	.951
	N	150	150	150	150	150	150	150	150	150	150	150
Big Data and Business	Pearson Correlation	-.054	.046	1	-.072	.036	.892**	.025	-.009	.910**	.005	-.083

Intelligence is challenging to work with the current system	Sig. (2-tailed)	.509	.575		.380	.660	.000	.759	.913	.000	.950	.311
	N	150	150	150	150	150	150	150	150	150	150	150
Big Data and Business Intelligence solutions can improve operational efficiency	Pearson Correlation	.935**	-.010	-.072	1	.031	-.061	-.045	.019	-.116	-.023	.275**
	Sig. (2-tailed)	.000	.904	.380		.709	.456	.587	.816	.157	.778	.001
	N	150	150	150	150	150	150	150	150	150	150	150
Big Data and business intelligence tools are effective in optimising resource allocation	Pearson Correlation	-.079	.893**	.036	.031	1	.047	.895**	.768**	.093	.889**	.008
	Sig. (2-tailed)	.339	.000	.660	.709		.565	.000	.000	.258	.000	.922
	N	150	150	150	150	150	150	150	150	150	150	150
Big Data and Business Intelligence can enhance risk management practices within your organization to mitigate potential threats	Pearson Correlation	-.050	.064	.892**	-.061	.047	1	.003	.040	.819**	.056	-.060
	Sig. (2-tailed)	.547	.437	.000	.456	.565		.970	.627	.000	.498	.468
	N	150	150	150	150	150	150	150	150	150	150	150

Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions	Pearson Correlation	-.121	.879**	.025	-.045	.895**	.003	1	.729**	.100	.851**	-.032
	Sig. (2-tailed)	.142	.000	.759	.587	.000	.970		.000	.222	.000	.698
	N	150	150	150	150	150	150	150	150	150	150	150
Big Data and Business Intelligence can lead to informed decisions	Pearson Correlation	.002	.832**	-.009	.019	.768**	.040	.729**	1	-.006	.765**	.009
	Sig. (2-tailed)	.979	.000	.913	.816	.000	.627	.000		.942	.000	.912
	N	150	150	150	150	150	150	150	150	150	150	150
Big Data and Business Intelligence is providing your organisation with a competitive edge	Pearson Correlation	-.102	.064	.910**	-.116	.093	.819**	.100	-.006	1	.084	-.037
	Sig. (2-tailed)	.213	.438	.000	.157	.258	.000	.222	.942		.308	.649
	N	150	150	150	150	150	150	150	150	150	150	150
Big Data and Business Intelligence can lead to cost savings	Pearson Correlation	-.082	.890**	.005	-.023	.889**	.056	.851**	.765**	.084	1	-.025
	Sig. (2-tailed)	.317	.000	.950	.778	.000	.498	.000	.000	.308		.760
	N	150	150	150	150	150	150	150	150	150	150	150
Big Data and Business	Pearson Correlation	.215**	-.005	-.083	.275**	.008	-.060	-.032	.009	-.037	-.025	1

Intelligence pose a huge positive impact on the performance	Sig. (2-tailed)	.008	.951	.311	.001	.922	.468	.698	.912	.649	.760	
	N	150	150	150	150	150	150	150	150	150	150	150
**. Correlation is significant at the 0.01 level (2-tailed).												

It is evaluated that the factor of increase in the use of big data and business intelligence is highly correlated with the improvement in the efficiency by the use of big data with the value of correlation as 0.935. The factor of improving the sustainability of an organisation is highly related to the variable of resource allocation with the value of correlation as 0.893.

Regression Analysis

Table 20: Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.941[a]	.886	.883	.359

a. Predictors: (Constant), Big Data and Business Intelligence can lead to cost savings, Big Data and Business Intelligence can lead to informed decisions , Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions, Big Data and business intelligence tools are effective in optimising resource allocation

The value of r square for the regression model is 0.886 with the standard error of estimate as 0.359 which suggests that the 88.6% of the variable Big Data and Business Intelligence are essential for ensuring the sustainability of organizations can be predicted by independent variables that are Big Data and business intelligence tools are effective in optimising resource allocation, Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions and Big Data and Business Intelligence can lead to cost savings.

Table 21: ANOVA

ANOVA[a]						
Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	144.688	4	36.172	281.300	.000[b]
	Residual	18.645	145	.129		
	Total	163.333	149			
a. Dependent Variable: Big Data and Business Intelligence are essential for ensuring the sustainability of organizations						
b. Predictors: (Constant), Big Data and Business Intelligence can lead to cost savings, Big Data and Business Intelligence can lead to informed decisions , Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions, Big Data and business intelligence tools are effective in optimising resource allocation						

The table of ANOVA indicates that the effect of the use of big data leads to cost saving, informed decisions and carter unforeseen challenges observed on the sustainability of an organization as the values are (F(4,145)= 281.300, p=0.0, r2=0.886).

Table 22: Coefficients

Coefficients[a]					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

1	(Constant)	.022	.064		.345	.731
	Big Data and business intelligence tools are effective in optimising resource allocation	.184	.073	.193	2.515	.013
	Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions	.247	.061	.266	4.064	.000
	Big Data and Business Intelligence can lead to informed decisions	.265	.044	.274	5.986	.000
	Big Data and Business Intelligence can lead to cost savings	.266	.062	.282	4.291	.000
a. Dependent Variable: Big Data and Business Intelligence are essential for ensuring the sustainability of organizations						

Table of coefficient provides details of the values through which use of big data can improve sustainability of an organization can be predicted. Big Data and Business Intelligence can lead to cost savings has coefficient of 0.266 with p-value 0.0, Big Data and Business Intelligence can lead to informed decisions has coefficient of 0.265 with p-value 0.0 , Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions has coefficient value 0.247 and p-value 0.0, Big Data and business intelligence tools are effective in optimising resource allocation has coefficient value as 0.184 and p-value 0.013.

The equation of regression is as follow:

Big Data and Business Intelligence are essential for ensuring the sustainability of organizations = 0.022+ 0.266* Big Data and Business Intelligence can lead to cost savings+ 0.265* Big Data and Business Intelligence can lead to informed decisions+ 0.247* Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions +0.184* Big Data and business intelligence tools are effective in optimising resource allocation

Chapter 5: Discussion

The purpose of this study is to investigate the use of business intelligence and big data approaches to the process of achieving organizational sustainability. In addition to examining its application, the research also discusses about other significant features, such as its advantages, challenges, and various approaches to its implementation, as well as some suggestions. distinct objectives were established in order to accomplish this all-encompassing goal, and each of these objectives specifically tackles a distinct area that needs to be accomplished through this research. This study seeks to assess the current reception and utilization of big data analytics and business intelligence technologies for sustainability initiatives in enterprises. It aims to achieve this goal through a particular research undertaking. These findings concur with those of the main report which established that organizations have increased their use of Big Data and Business Intelligence Tools in various operational areas.

The secondary results showed that such systems allow for effective decision making, optimization of resource allocation as well as innovation thus leading to sustainable future eventually realizing the importance of these technologies required for achieving this aim. In addition it was found that among other things they are able to improve decision-making processes based on data about what should be done next towards sustainability while showing how much value can be added by them at different stages of doing business where jah and Nweke (2019) state businesses can employ advanced analytics methods which collect diverse environmental impact information supply chain operations knowledge stakeholder involvement details so as come up with useful deductions from these data. In addition to this, the primary results also show a focus on the significance of Big Data and Business Intelligence in terms of safeguarding the long-term viability of enterprises. In the meanwhile, research has shown that these technologies have the ability to bring about a transformation that might be beneficial in terms of fostering creativity and establishing a culture that is centered on the

pursuit of continuous improvement. It is possible for businesses to discover chances to develop sustainable business models and offers by doing an analysis of market trends, shifting client preferences, and developing technological capabilities. In addition to this, the findings of a study that examined the current adoption of Big Data and Business Intelligence indicate that today's business environment for organizational sustainability is moving towards big data analytics and business intelligence (BI) has been used. This is primarily due to the need to address environmental and social governance challenges in order to maintain a competitive edge. Every company is recognizing the importance of having a strong understanding of many data-driven technologies.

In order to gather, handle and analyse massive volumes of information from various sources including social media platforms and Internet-enabled devices, organizations are investing in data infrastructure and analytics capabilities. This provides businesses with access to up-to-date details about environmental footprints, energy consumption patterns among other sustainability indicators (Popovič et al., 2018). Similarly, according to the literature reviewed; actionable insights have been unearthed by means of advanced analytic techniques which involve machine learning as well as natural language processing thereby leading to better strategic planning formulation coupled with performance optimization while at the same time discovering avenues for efficiency improvement towards sustainable practices. The move towards comprehensive sustainability reporting that integrates significant sustainability metrics along with key performance indicators (KPIs) into their reporting frameworks based on global industry standards is one example showing how big data analytics and business intelligence can be used for sustainability (Ghavami, 2018). Consequently this leads to increased transparency about organizational sustainability performance levels from a customer's perspective hence promoting engagement among stakeholders. It becomes utmost necessary to handle related with data quality, data privacy and culture within the organisation. In order to

ensure a positive trend towards data-driven decision making, which can assist in the management of complex sustainability concerns, businesses need to embrace common standards and foster collaboration among various industries.

Following this, in light of the second research objective, which investigates the advantages and disadvantages associated with the implementation of big data and business intelligence for sustainability initiatives, there have been a variety of perspectives presented in both the primary findings and the literature. The results of the survey suggest that implementing Big Data and Business Intelligence solutions can improve operational efficiency in your organization. Interestingly, the literature also indicates that by conducting an analysis of diverse data sets that concentrate on energy utilization, waste collection, and utilization of important resources, businesses are able to identify any type of inefficiency and streamline processes in order to reduce their environmental footprint. There are instances in which businesses are utilizing predictive analysis to effectively optimize their production schedules, which ultimately results in cost reductions across the board. Also, it has been shown that using analytics and large data tools is an efficient method for distribution of the resources within company. In alignment to this, secondary sources reveals that companies can track their progress and measure their performance by adding sustainability measures to their KPIs, compared to industry standards (Chiang et al., 2018).

In addition to this, result from survey stresses upon the value of using big data and business intelligence to attain competitive advantage. Evidences showcases that technology encourages innovation and improves managerial decision making. In support with this, the secondary research demonstrates that firms have a tremendous ability to identify new revenue streams with the use of Big Data and Business Intelligence that would result in quick achievement of sustainability objectives. This is majorly of significant market trends as well as current technologies that are being used and asked for. Organisations are able to build trust with

stakeholders, including investors, employees, external communities, and customers, by utilizing interactive dashboards in conjunction with visualization tools and important stakeholder feedback mechanisms. This allows the companies to fulfil their responsibility to these stakeholders. In spite of all of these obstacles, it is of the utmost importance to acknowledge that these technologies call for a significant commitment to a variety of aspects, including investments in the development of technological infrastructure and increased human capital (Bachmann et al., 2020).

Beyond these benefits and drawbacks, the study moves on toward accomplishing its third objective, which is to assess best practices and approaches for incorporating business intelligence and big data analytics into current sustainability frameworks. The findings of the survey indicate that there is a requirement for a strategic approach, as well as the engagement of stakeholders and the development of technological capabilities, all of which, when combined, would be of assistance in the successful implementation of big data analytics and business intelligence technology. Even the viewpoints are supported by secondary sources. The literature stresses that organizations can enhance the effectiveness of this method by aligning their practices with the organization's goals and priorities. To make sure that the data analytics efforts are aligned with strategic goals, it is necessary to analyse sustainability targets, data needs, and key performance indicators (KPIs). In addition to optimizing their data analytics, organizations can allocate initiatives to reduce their carbon footprint and manage their social impact, they suggest that existing sustainability programs should be supported by investing in robust data infrastructure and analytics skills. This includes implementing appropriate data governance frameworks, implementing great data storage solutions, and training employees in data analytics (Bachmann et al., 2020). Moving forward, the last objective is addressed by providing insights and recommendations to organizations to encourage them to use big data analytics and business intelligence to implement sustainable practices role. Within this context,

the primary findings highlight the importance of establishing a robust data infrastructure, developing the skills necessary for analysis, and continuously monitoring and evaluating sustainability performance. These are all important elements of achieving sustainability goals and ensuring continuous improvement. Accordingly, the secondary evidences also suggests investment in large-scale data storage solutions and analytics tools to effectively store, manage and analyse critical sustainability information and create a culture highly data-based to drive positive organizational change and innovate on sustainability -Has the potential to encourage practice development (Jagathisaperumal et al., 2021).

Most businesses focus exclusively on the financial goals that align most businesses. However, a second set of studies has shown that it is not enough for professionals to consider only non-updated financial information. Discussion of the need for multi-dimensional performance measurement systems like Balanced Scorecard purely emphasised upon the need for financial and non-financial systems to be part of the business information system emphasize. Although, it has been argued that companies using balanced scorecards are concerned with delivering traditional financial returns or shareholder wealth rather than just focusing upon measuring the importance of corporate social responsibility (CSR) and the sustainable development objectives. Although, these arguments fail in consideration of the premise that sustainability could be incorporated into the existing four lanes. The rationale for the scorecard is to link project goals and plans to its management decisions, and the argument here is that companies should include sustainability goals in their plans where possible as well help in the effective implementation of BI technology. Encouraging data literacy among employees, as well as identifying and identifying businesses that use data analytics for sustainability purposes can also be successful in driving positive change. Moreover, increased productivity between business units and stakeholders is essential to better integrate big data and business intelligence into sustainability practices. In addition, sustainability performance

needs to be continuously monitored and evaluated in order to continuously improve and progress towards achievable development goals (Popovič et al., 2018).

Chapter 6: Conclusion

This study delved into Big Data and Business Intelligence related to organizational dynamics, and shed light on the use of big data analytics and business intelligence tools, their benefits, challenges, best practices for implementation, strategies practical and suggestions. This study uses positivism philosophy, deductive techniques, exploratory research design and cross-sectional time horizons through a survey of UK engineering executives. The survey accomplished its objectives with two questions, the first of which explored best practices and strategies for integrating big data analytics and business intelligence into existing sustainability initiatives. In this context, it was decided that the integration of big data analytics and business intelligence (BI) into existing sustainability programs was an important step for companies working to deliver improve decision-making, resource allocation and innovation to achieve sustainable building. The use of this technology enables effective decision-making processes driven by cross-platform data, contributing significantly to efforts to promote sustainable development.

Additionally, it has explored the business intelligence capabilities of big data analytics so that organizations can use advanced analytics techniques to collect a wide range of information about the environment, supply chain operations and consumers role of communication to drive sustainability activities And it is critical to implement Furthermore, to fully exploit the promise of this technology, companies must invest in data management and analytics skills to collect , analyse and evaluate huge amounts of data from different sources and use techniques such as machine learning and natural language processing to uncover actionable insights. This leads to improvements in strategic planning, efficiencies, and improved performance for sustainable practices.

In addition to this, it was found that incorporating sustainable metrics and key performance indicators (KPIs) into reporting systems increased transparency for stakeholders,

which in turn encouraged communication and encourage confidence. KPIs are one of the key tools organizations use to drive accountability and measure progress towards their goals. To implement KPIs effectively, the organization needs to identify which KPIs have the greatest impact, activate KPIs to drive performance improvements by implementing them across the organization to ensure that the KPIs have consistent application , and monitor progress (make adjustments as needed). They provide a common language for internal teams and external stakeholders, providing a clear and measurable way to measure progress and achievement in projects. Altough, the promise of effective data-driven decisions requires addressing barriers such as data quality, privacy concerns, work culture Methodology, stakeholder engagement, and technology developing skills are all important components of integrating big data analytics and business intelligence into sustainability planning Efforts to minimize and manage social impact were categorized should be, and organizations should invest in robust data management and analytics skills.

Furthermore, in the second research question, the challenges and barriers that organizations face when trying to use big data and business intelligence for sustainability initiatives are explored. However, companies face obstacles and hurdles in this journey. For example, the complexity and fragmentation of data sources, in addition to data quality, consistency and compliance problems, pose major obstacles to the effective use of data Furthermore, data-driven approaches to sustainability are further complicated by cultural conflicts within organizations, as well as external barriers related to regulatory barriers and changing market dynamics and demand because of all the time. Despite these challenges, relationship research sheds light on the significantly positive impact of business intelligence and data analytics on operational efficiency, resource efficiency, risk management, and informed decision-making. It is possible for companies to develop sustainable practices and improve overall performance in a rapidly changing environment if they overcome these

obstacles and effectively harness the power of business intelligence and data analytics through effective implementation that.

Considering all limitations, it is recommended that the organization needs to define a clear sustainability policy in line with business objectives and stakeholder expectations First of all, it is important that companies delivers a clear and integrated development strategy, aligned with stakeholder expectations and business objectives. This framework should identify some goals and objectives for sustainable development, as well as provide a strategy for the effective use of big data analytics and business intelligence in corporate sustainability planning Second two, companies to effectively integrate big data analytics and business intelligence solutions into their development practices need development to be made top-priority When it comes to acquiring, storing and testing key data sustainability requires investing in scalable data storage solutions and critical analytics tools.

This helps avoid potential problems associated with infrastructure availability, which could lead to data loss or security risks. Finally, a culture that places greater emphasis on data is necessary to bring about constructive organizational change and encourage innovation in environmentally irresponsible practices. This is the process of basing decisions and strategies on data analysis based solely on intuition or observation. Data-driven decision-making is common in a data culture, where data is the foundation for strategy and planning. A great example of this pillar in action comes from Allianz, who, through their data upgrade program, were able to save 1.9 hours per week for each highly skilled employee To ensure a successful data culture, everyone involved must is able to access data parties within the organization. This means that data is shared freely, with adequate protections for privacy and security, and employees at all levels are encouraged to use the data in their roles. Encourage data literacy among employees at all levels of the organization, and organizations should encourage decisions informed by data collection and analysis Additionally, solicit and reward services

that use data analytics role for sustainable development goals to encourage further adoption of these technologies. This can be achieved by identifying and rewarding businesses that use data analytics.

Personal Reflection

The experience of performing research studies on the topic of the impact of big data and business intelligence on sustainability of the organisations is exciting and an enhancer of knowledge. The whole process helped me develop a knowledge base regarding the concept of big data and business intelligence and their use in the contemporary business environment. I learned about various theoretical concepts and their application in the research study. I also learned about various types of statistical concepts such as descriptive and inferential statistics and their interpretations. The research study also helped in developing the knowledge base regarding various types of methodological tools used in a study as I learned about the sampling techniques, research design, philosophy, approach and choice. I also learned the way of presenting various elements of research and maintaining a logical flow in various elements of the research study.

The process of conducting a research study also helped me develop inferences regarding the ethical considerations and obligations that should be followed in a research study and while collecting primary data. It also helped me develop my communication skills and I learned the formal way of presenting things. I wrote various steps of the research study that helped me learn my communication skills which is a vital element in achieving success in the academic and professional world. I also developed confidence regarding various aspects of a research study as I was nervous initially regarding what would happen and the research study helped me in developing confidence that will help me in my professional work. I also improved my critical thinking skills during the process of conducting a research study. The critical thinking skills developed in the research will help in performing tasks in the professional world.

The research study also developed my technical skills as I used several tools such as SPSS as I used them in my study. I also developed internet searching skills in the research study as I had to search various things especially while conducting literature research. Internet

searching skills and technical skills will help me in future in improving academic performance and performing work in the professional world. Moreover, I also developed time management skills while performing the research study as I had to manage time and submit the research by the due deadline. Initially due to the wrong estimation of the time I lagged behind the timeline I developed initially due to which I had to redevelop the timeline and perform each task as per it which provided me with knowledge of time management. Overall, the experience of performing research was an enhancer of skills and knowledge for me and these things will surely help me in performing my tasks effectively.

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Appendices

Appendix A: Survey Questionnaire

Dear participants,

Thank You for participating in the survey on the topic of Big Data and Business Intelligence for Organizational Sustainability. Your insights will help in providing data on the ways businesses use Big-data and Data-driven strategies to ensure the sustainability of their business and long-term success.

Business sustainability refers to the strategic management of a company's economic, environmental, and social impact in a manner that ensures long-term viability and resilience. In the current business landscape, the effective use of big data to gain a competitive edge. With the help of the survey, we delve into the challenges, and current practice opportunities in the field.

Your views and insights will help us in developing an understanding of the topic and guide us in suggesting necessary strategies. The researcher wants to assure you that all the insights and information provided by you will be used solely for research purposes and confidentiality of the data will be maintained.

Thank you for your contribution to the study.

Regards

Demographic Questions

Question 1: What is your gender?

(a) Male

(b) Female

(c) Others

Question 2: What is your age?

(a) 20-25 years

(b) 26-35 years

(c) 36-45 years

(d) 46-55 years

(e) 55 years and above

Question 3: What total years of work experience do you have?

(a) 0-5 years

(b) 6-10 years

(c) 11-15 years

(d) 16-20 years

(e) 21 years and above

Specific Questions

Adoption of Big Data and Business Intelligence Tools

Question 4: Do you agree that the use of Big Data and Business Intelligence Tools increased in your organisation?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

Question 5: Do you agree that Big Data and Business Intelligence are essential for ensuring the sustainability of organizations?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

Question 6: Do you agree that the use of Big Data and Business Intelligence is challenging to work with the current system of your organisation?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

Operational Efficiency and Resource Optimisation

Question 7: To what extent do you agree that implementing Big Data and Business Intelligence solutions can improve operational efficiency in your organization?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

Question 8: Do you agree that Big data and business intelligence tools are effective in optimising resource allocation in your organisation?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

Risk Management and Resilience

Question 9: Do you agree that the use of Big Data and Business Intelligence can enhance risk management practices within your organization to mitigate potential threats?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

Question 10: Do you agree that the use of Big Data and Business Intelligence can help management to make strategies for unforeseen challenges and external disruptions?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

Strategic Decision-Making and Performance Enhancement

Question 11: Do you agree that Big Data and Business Intelligence can lead to informed decisions in your organisation?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

Question 12: Do you believe that Big Data and Business Intelligence is providing your organisation with a competitive edge?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

Cost Savings and Improved Financial Performance

Question 13: Do you believe that the use of Big Data and Business Intelligence can lead to cost savings in your organisation?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

Question 14: Do you think that the use of Big Data and Business Intelligence pose a huge positive impact on the performance of your organisation?

(a) Strongly agree

(b) Agree

(c) Neutral

(d) Disagree

(e) Strongly disagree

National College of Ireland

Human Participants Ethical Review Application Form

All parts of the below form must be completed. However in certain cases where sections are not relevant to the proposed study, clearly mark NA in the box provided.

Part A: Title of Project and Contact Information

Name

Prathamesh Sainath Khandare

Student Number (if applicable)

x22136126

Email

prathameshkhandare907@gmail.com

Status:

Undergraduate □
Postgraduate ☑
Staff □

Supervisor (if applicable)

Victor Del Rosal

Title of Research Project

Big data and business intelligence for organizational sustainability.

Category into which the proposed research falls (see guidelines)

Research Category A (yes)
Research Category B □
Research Category C □

Have you read the NCI Ethical Guidelines for Research with Human Participants?

Yes (yes)
No □

Please indicate any other ethical guidelines or codes of conduct you have consulted

N/A

Has this research been submitted to any other research ethics committee?

Yes □
No (No)

If yes please provide details, and the outcomes of this process, if applicable:

N/A

Is this research supported by any form of research funding?

Yes □
No (yes)

If yes please provide details, and indicate whether any restrictions exist on the freedom of the researcher to publish the results:

N/A

Part B: Research Proposal

Briefly outline the following information (not more than 200 words in any section).

Proposed starting date and duration of project

September 2023 to May 2024

The rationale for the project

I have chosen this project because big data and business intelligence for organizational sustainability in a college setting is to explore the potential benefits and applications of utilizing large-scale data analysis and intelligent systems to enhance the sustainability practices and outcomes of organizations. By leveraging big data analytics and business intelligence techniques, this project aims to identify patterns, trends, and insights from extensive data sets to inform decision-making processes and improve organizational sustainability performance. The project's goal is to contribute to the advancement of knowledge in this field, provide practical recommendations for organizations, and equip college students with valuable skills and knowledge in utilizing data-driven approaches for sustainable business practices.

The research aims and objectives

The research aims and objectives in the study would be: 1.How are organizations currently using big data analytics and business intelligence for sustainability initiatives? 2.What are the potential benefits of utilizing big data analytics and business intelligence for organizational sustainability? 3.What are the main challenges and barriers faced by organizations in implementing these technologies for sustainability? 5.How can organizations effectively align big data analytics and business intelligence with their sustainability goals and strategies?

The research design

The research design for the college project on big data and business intelligence for organizational sustainability will involve a mixed-methods approach. Quantitative data will be collected through surveys and analysis of existing organizational data to identify trends and patterns related to sustainability practices and outcomes. This research design will enable a comprehensive understanding of the complex relationship between big data, business intelligence, and organizational sustainability. The findings will contribute to both academic knowledge and practical applications in promoting sustainable practices within organizations. Exploratory research design is used in the research study.

The research sample and sample size
Please indicate the sample size and your justification of this sample size. Describe the age range of participants, and whether they belong to medical groups (those currently receiving medical treatment, those not in remission from previous medical treatment, those recruited because of a previous medical condition, healthy controls recruited for a medical study) or clinical groups (those undergoing non-medical treatment such as counselling, psychoanalysis, in treatment centres, rehabilitation centres, or similar, or those with a DSM disorder diagnosis).

The research sample would include both large firms and small to medium-sized enterprises (SMEs) from various industries. The sample size would be determined by the research objectives and the available resources. A reasonable sample size would be between 100 and 500 firms, allowing for a thorough examination of the interaction between big data, business intelligence, and organizational sustainability. To guarantee that the findings are transferable across settings, the sample should be representative of many sectors and regions. To achieve a balanced representation of organizations in the study, sampling strategies should be carefully considered.

If the study involves a MEDICAL or CLINICAL group, the following details are required:

a) **Do you have approval from a hospital/medical/specialist ethics committee?**
   If YES, please append the letter of approval. Also required is a letter from a clinically responsible authority at the host institution, supporting the study, detailing the support mechanisms in place for individuals who may become distressed as a result of participating in the study, and the potential risk to participants.
   If NO, please detail why this approval cannot or has not been saught.
b) **Does the study impact on participant's medical condition, wellbeing, or health?**
   If YES, please append a letter of approval from a specialist ethics committee.
   If NO, please give a detailed explanation about why you do not expect there to be an impact on medical condition, wellbeing, or health.

The nature of any proposed pilot study. Pilot studies are usually required if a) a new intervention is being used, b) a new questionnaire, scale or item is being used, or c) established interventions or questionnaires, scales or items are being used on a new population. If no such study is planned, explain why it is not necessary.

A pilot study may not be necessary if there are no new interventions, questionnaires, scales, or items being introduced

The methods of data analysis. Give details here of the analytic process (e.g. the statistical procedures planned if quantitative, and the approach taken if qualitative. It is not sufficient to name the software to be used).

Statistical methods are used for the purpose of analysing the quantitative data. The data analysis techniques used in the research are inferential analysis, descriptive analysis, graphical analysis and predictive analysis. In these techniques' graphs, charts, descriptive statistics, correlation and regression analysis are used to develop meaningful insights from data. A cause-and-effect relationship is also established between the variables with the help of regression analysis. The tool utilised for the purpose of conducting analysis is SPSS which has several statistical tests used for the data.

Study Procedure

Please give as detailed an account as possible of a participant's likely experience in engaging with the study, from point of first learning about the study, to study completion. State how long project participation is likely to take, and whether participants will be offered breaks. Please attach all questionnaires, interview schedules, scales, surveys, and demographic questions, etc. in the Appendix.

1.How will participants initially learn about the study and its purpose?

2.What will be the format of the recruitment materials, such as advertisements or emails, used to inform participants about the study?

3.Will participants be provided with a detailed explanation of the study procedures and their expected involvement?

4.How long is the anticipated duration of project participation for each participant?

5.Will participants be offered any breaks or intervals during their engagement with the study?

6.Are there any specific activities or tasks that participants will be required to complete during the study?

7.How will participants be guided through the completion of questionnaires, interview schedules, scales, surveys, and demographic questions?

8.Will participants have the option to seek clarification or ask questions regarding any aspect of the study?

9.What measures will be in place to ensure the confidentiality and privacy of participants' responses and personal information?

10.Can participants expect any follow-up communication or debriefing after completing their involvement in the study?

Part C: Ethical Risk

Please identify any ethical issues or risks of harm or distress which may arise during the proposed research, and how you will address this risk. Here you need to consider the potential for physical risk, social risk (i.e. loss of social status, privacy, or reputation), outside of that expected in everyday life, and whether the participant is likely to feel distress as a result of taking part in the study. Debriefing sheets must be included in the appendix if required. These should detail the participant's right to withdraw from the study, the statutory limits upon confidentiality, and the obligations of the researcher in relation to Freedom of Information legislation. Debriefing sheets should also include details of helplines and avenues for receiving support in the event that participants become distressed as a result of their involvement in this study.

Ethical issues and risks of harm or distress in the proposed research on big data and business intelligence for organizational sustainability include potential breaches of privacy, loss of social status or reputation, and participant distress due to discussing challenges or failures. To address these risks, strict data protection measures will be implemented, participants will be assured of confidentiality, and sensitive information will be appropriately protected. Participants will have the right to withdraw from the study, statutory limits on confidentiality will be explained, and debriefing sheets will provide helpline and support information to address any distress. These measures aim to protect participants' well-being and ensure compliance with ethical guidelines.

Do the participants belong to any of the following vulnerable groups?
(Please tick all those involved).

- □ Children;
- □ The very elderly;
- □ People with an intellectual or learning disability
- □ Individuals or groups receiving help through the voluntary sector
- □ Those in a subordinate position to the researchers such as employees
- □ Other groups who might not understand the research and consent process
- □ Other vulnerable groups

How will the research participants in this study be selected, approached and recruited? From where will participants be recruited? If recruiting via an institution or organisation other than NCI please attach a letter of agreement from the host institution agreeing to host the study and circulate recruitment advertisements/email etc.

In general, I am going to generate link on the google form and the participants will be questioned via teams using student credentials.

What inclusion or exclusion criteria will be used?

Teacher and student mutually decide the sets of questions and only these two categories will be applicable for the question.

How will participants be informed of the nature of the study and participation?

Through clear and simple communication methods such as recruiting advertisements, emails, or informed consent forms, participants will be informed about the nature of the study and their participation. These documents will provide a brief explanation of the study's purpose, objectives, and expected participation, ensuring that participants understand exactly what their participation entails.

Does the study involve deception or the withholding of information? If so, provide justification for this decision.

The study does not involve deception or the withholding of information.

What procedures will be used to document the participants' consent to participate?

First, participants will be provided with a written informed consent form that outlines the purpose, procedures, potential risks, and confidentiality measures of the study. Second, participants will be asked to sign the consent form, indicating their voluntary participation and understanding of the study's requirements and implications

Can study participants withdraw at any time without penalty? If so, how will this be communicated to participants?

Yes, study participants will have the right to withdraw from the study at any time without facing any penalty or negative consequences. This will be clearly communicated to participants during the informed consent process, emphasizing their freedom to discontinue participation at any point without needing to provide a reason and without any impact on their relationship with the researcher or the organization they represent.

If vulnerable groups are participating, what special arrangements will be made to deal with issues of informed consent/assent?

No, vulnerable groups are participating.

Please include copies of any information letters, debriefing sheets, and consent forms with the application.

Part D: Confidentiality and Data Protection

Please indicate the form in which the data will be collected.

□ Identified ☑ Potentially Identifiable □ **De-Identified**

What arrangements are in place to ensure that the identity of participants is protected?

To protect participants' identities, strict measures will be put in place, such as hiding participant data, using secure storage systems with restricted access, and only reporting aggregated or separated to avoid identifying individual participants or organizations. Throughout the project, researchers will also follow strict confidentiality agreements and data protection standards.

Will any information about illegal behaviours be collected as part of the research process? If so, detail your consideration of how this information will be treated.

N/A

Please indicate any recording devices being used to collect data (e.g. audio/video).

In this study on big data and business intelligence for organizational sustainability, no recording devices will be employed to collect data. Without the requirement for audio or video recording, data will be obtained primarily through surveys, questionnaires, interviews, and analysis of existing organizational data.

Please describe the procedures for securing specific permission for the use of these recording devices in advance.

As no recording devices are being used in this study, there are no specific procedures for securing permission for their use. The focus of data collection will primarily be on surveys, questionnaires, interviews, and analysis of existing organizational data, for which appropriate permissions will be obtained from participants and relevant stakeholders in accordance with ethical guidelines.

Please indicate the form in which the data will be stored.

□ Identified □ Potentially Identifiable ☑ **De-Identified**

Who will have responsibility for the data generated by the research?

I will have the responsibility.

Is there a possibility that the data will be archived for secondary data analysis? If so, has this been included in the informed consent process? Also include information on how and where the data will be stored for secondary analytic purposes.

Yes, there is a chance that the study's data will be kept for secondary data analysis. This will be part of the informed consent procedure, and the data will be securely stored in a selected database with restricted access to ensure confidentiality and privacy throughout secondary analysis.

If not to be stored for secondary data analysis, will the data be stored for 5 years and then destroyed, in accordance with NCI policy?

☑ Yes □ No

Dissemination and Reporting

Please describe how the participants will be informed of dissemination and reporting (e.g. submission for examination, reporting, publications, presentations)?

They will be notified that the results may be reported in aggregate form advertisement on notice board presentation or included in reports, while protecting their identities and confidential information.

If any dissemination entails the use of audio, video and/or photographic records (including direct quotes), please describe how participants will be informed of this in advance.

They will be notified that the results may be reported in aggregate form advertisement on notice board presentation or included in reports, while protecting their identities and confidential information.

Part E: Signed Declaration

I confirm that I have read the NCI Ethical Guidelines for Research with Human Participants, and agree to abide by them in conducting this research. I also confirm that the information provided on this form is correct.

Signature of Applicant ___Prathamesh Khandare

Date **30/05/2023**

Signature of Supervisor (where appropriate):

Date **_____**

Any other information the committee should be aware of?

N/A