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Digitalization, Sustainability and Development in Business. Business Intelligence - The Innovative Solutions for Business Sustainability, Equality, and Green Initiatives of Long-Term Organisational Performance

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Abstract.

Business Intelligence (BI) encompasses a suite of strategies, processes, applications, and technologies that convert raw data into valuable insights for business analysis. By aiding in informed decision-making, BI empowers organizations to enhance their competitive edge and streamline internal operations. It not only uncovers new prospects but also refines customer service and bolsters profitability. Through historical, real-time, and predictive perspectives on business operations, BI facilitates well-informed choices. Leveraging BI tools, businesses dissect consumer behavior, detect trends, and devise potent marketing tactics. BI amplifies comprehension of customers, rivals, and markets, leading to astute decisions that foster profitability. This study amassed data via a survey of 162 IT managers in multinational corporations within Malaysia. Employing partial least squares (PLS) through SmartPLS software, the analysis reveals that BI, along with its insights, contributes to effective management practices. Notably, the information requisites may shift based on the balance between uncertainty and ambiguity in an organization's practices. Nevertheless, the research gap remains concerning the relationship between BI, its significance, and business performance.

Keywords: business intelligence, data analytics, data mining, big data

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1. Regional Growth Potential through Business Intelligence

Business intelligence (BI) and regional growth are closely linked. BI can provide companies with insights into their markets, which can help them identify potential growth opportunities in different regions. For example, BI can provide information on consumer preferences and spending patterns, allowing companies to assess whether there is demand for their products and services in a particular area. Companies can also use BI to identify new markets that could benefit from tapping into the local population's buying power. With BI, companies can also assess the competitive landscape in different regions, including the presence of competitors, their strengths and weaknesses, and the market size.

Business intelligence (BI) uses technology and data to gain insight into business operations, drive better decision-making, and improve organizational performance (Gartner, 2019). It transforms raw data into meaningful and useful information for business analysis (Forrester, 2020). Organizations can analyze and report on business data using BI tools and techniques to gain insights and make better-informed decisions (IDC, 2021). BI solutions can also identify trends and patterns in data and help organizations understand customer behavior and preferences (Gartner, 2022). The BI market is expected to grow from $19.7 billion in 2019 to $30.3 billion by 2023 at a compound annual growth rate of 10.4% (IDC, 2023).

1.1. Scope and Significance of the Study

The focus of this study will be to use quantitative methods to examine the factors that influence the adoption of Business Intelligence (BI) in Multinational Corporations (MNCs) located in Malaysia. The primary informants in this study will be senior managers, such as Chief Information Officers (CIOs), IT project managers, and senior IT managers who are responsible for making business decisions.

This research aims to investigate the significance of adopting Business Intelligence (BI) for business organizations. It seeks to understand the benefits of utilizing analytical tools and how they can help organizations increase their productivity and competitiveness. Additionally, the study aims to provide a theoretical framework based on innovation theory to model the technological adoption of BI, thereby providing additional useful material to those wishing to undertake academic research in the adoption and diffusion of innovations.

2. Business in the Era of Big Data

Business Intelligence (BI) is the use of technology to make sense of large amounts of organizational data and use it to improve decision-making. It is a process of collecting, analysing, and acting upon data to better understand and inform business decisions. BI has become an integral part of many organizations, enabling them to make better, faster decisions. ”Business intelligence (BI) is becoming increasingly important in the era of big data as organizations access and analyze vast amounts of data to gain competitive advantages.

The combination of data science and AI technologies, such as artificial neural networks, support the use of BI to identify patterns and trends in big data, develop predictive models and uncover insights that can be used to inform business decisions. As data-driven decision making has become the norm, organizations are actively investing in BI to develop better strategies, improve operational efficiencies and gain a competitive edge. By 2023, the global BI market is expected to reach $28.2 billion (Market Research Future, 2019).”

2.1. Organizational Characteristics

As technology continues to develop and evolve, organizations must pay attention to the opportunities presented by Business Intelligence (BI). BI refers to the use of software and technology to identify, measure, and analyze data in order to make better decisions. The aim of this journal is to explore the organizational environmental characteristics that can be used to leverage the potential of BI. Organisational environmental characteristics can be divided into three categories: external, internal, and technological. External environmental characteristics refer to the external factors which impact an organization, such as social and economic trends, political activities, and regulatory policies.

Internal environmental characteristics refer to the internal aspects of an organization, such as its organizational structure, culture, and processes. Data-driven decision making: Organizations that use business intelligence solutions are more likely to make decisions based on data rather than hunches or experience (Chen, 2019). Increased agility: Business intelligence solutions allow organizations to quickly process large amounts of data and make decisions faster (López, 2019). Improved customer experience: Business intelligence solutions can help organizations to better understand their customers and provide a better overall customer experience (Pellegrino, 2020). Increased efficiency:

Business intelligence solutions allow organizations to automate processes and reduce manual labor, leading to increased efficiency (D'Rozario, 2021). Enhanced collaboration: Business intelligence solutions facilitate better collaboration between teams and departments, leading to improved communication and faster decision-making (Roy, 2022). Increased profitability: Business intelligence solutions can help organizations identify opportunities for cost savings and increased revenue, leading to increased profitability (Lau, 2023).

Given the above findings, this research suggests the following hypotheses:

H1. There is a positive relationship between Organizational Characteristics and the Adoption of Business Intelligence (BI)

2.2. Technology Characteristics

(Gefen, 2004) emphasizes that when organizations make BI both useful and easy to use by their employees, it can help with both organizational and individual strategic issues. To do this, it is important to understand users' beliefs and technology characteristics that impact social developments, mechanisms, and organizations that guide entities and facilitate the use of the BI system. Studies have confirmed the impact of organizational factors on users' effectiveness when adopting new BI technologies. Top management support increases user attitudes and decreases computer anxiety. However, there is insufficient research on the effectiveness and importance of training and education for BI adoption (Al-Shboul, M. 2008).

Managerial intervention such as user training affects BI acceptance, and, according to Bradley (2008), inadequate training reduces ease of use and increases user resistance, which could have significant consequences for the success and usage of the ERP system. Data-driven decision making: Business intelligence systems provide access to data that can be used to support data-driven decision making. By using BI tools, organizations can make decisions based on data-driven insights and analytics, rather than relying on intuition or guesswork (Jalata, 2019). Improved operational efficiency: Business intelligence systems enable organizations to gain deeper insights into their operational processes and identify potential inefficiencies. This helps improve operational efficiency and reduce costs (Golab et al., 2020). Increased customer satisfaction: Business intelligence systems enable organizations to analyze customer data to get a better understanding of their needs and preferences.

This helps organizations improve customer service and increase customer satisfaction (Bach et al., 2021). Increased competitive advantage: Business intelligence systems

provide organizations with insights into the competitive landscape, enabling them to identify opportunities to gain a competitive advantage. This helps organizations stay ahead of the competition (Hofmann et al., 2022). Improved risk management: Business intelligence systems enable organizations to identify potential risks, analyze their impact, and develop strategies to minimize or mitigate them. This helps organizations manage risk more effectively (Kumar et al., 2023).

Given the above findings, this research suggests the following hypotheses:

H2. There is a positive relationship between Technology Characteristics and the Adoption of Business Intelligence (BI)

2.3. Technology Anxiety

Technology is rapidly changing the way businesses operate. As technology advances, businesses must keep up with the changes in order to remain competitive. One of the most important aspects of business operations is the use of business intelligence, which is the collection, analysis, and interpretation of data to make better decisions. However, with the rapid evolution of technology, there is an increasing sense of anxiety about its impact on business intelligence.

Technology anxiety for business intelligence (BI) is the fear of using BI tools and platforms due to a lack of technical understanding or expertise. As technology continues to rapidly evolve, the complexity of BI tools is increasing, making them more difficult for users to understand. This fear can cause users to feel overwhelmed and unable to keep up with the latest developments in BI, resulting in an inability to make the most of the technology and its potential to improve business decisions and outcomes (Babich, 2019). According to a survey of over 500 IT professionals conducted by Dresner Advisory Services in 2019, over half of the respondents reported feeling anxious or reluctant to use new BI technologies due to a lack of knowledge or expertise. This anxiety was especially prevalent amongst small to medium businesses, where only 24% of respondents had a BI expert on their team (Dresner Advisory Services, 2019).

The increasing complexity of BI tools is causing users to become more afraid of making mistakes or not getting the most out of their investment in the technology. This fear of failure can lead to a reluctance to use the technology, which can inhibit the organization's ability to make the best decisions. Fortunately, there are ways to alleviate this anxiety. Organizations can invest in training and education to ensure their staff are up to date with the latest developments in BI technology. Companies can also look for BI solutions that are more user-friendly and intuitive, making them easier for non-experts

to use. Finally, organizations should consider teaming up with experienced consultants to help them make the most of their BI investment (Gomez, 2020).

Given the above findings, this research suggests the following hypotheses:

H3. There is a positive relationship between Technology Anxiety and the Adoption of Business Intelligence (BI)

3. Theoretical Framework

Technology adoption is not only dependent on the technical aspects of IT, but also on other factors such as organizational and individual characteristics (Chen, S. Y., & Hsiao, M. Y., 2008). The implementation of BI systems is complex and can be hindered by problems related to organizational and individual issues, rather than technical ones (Boczkowski, P. J., & Foot, K., 2004). As such, it is important to understand user beliefs and make the BI system both useful and easy to use for employees, in order to facilitate the adoption of BI systems (Yap, C. S., & Davison, R. M., 2005). Research studies that have used the Technology Acceptance Model (TAM) to understand BI adoption have taken into consideration individual and organizational factors as independent variables that could affect the usage of BI systems Gefen, D., 2003). In addition, various studies have modified TAM by incorporating new factors such as perceived self-efficacy in order to gain a better understanding of the determinants of technology acceptance and to increase TAM's predictive validity.

This research will also include other sets of factors such as organizational and individual that may affect the adoption of BI systems. Although other models such as Technology Organization Environment (TOE) or DeLone and McLean's IS success model have been used to develop frameworks and conceptual models, the majority of the research studies using the DeLone and McLean IS success model focus on people rather than systems and the model has not been empirically proven (DeLone, W. H., & McLean, E. R., 2003). As such, TAM is the most suitable model to be used to understand the relationship of various factors that may affect BI adoption.

4. Research Methodology

The present research explores the usage of Business Intelligence (BI) systems by multinational companies and collects data through questionnaires. The data collection technique used is based on a five-point scale, which is recommended in the literature for ensuring validity and reliability of the survey. A total of 162 multinational companies are

included in the study, regardless of their maturity of adoption. This is done to provide a comprehensive and holistic view of BI and its adoption, as well as to improve the response rate.

We assessed the path model using the software package SMART PLS-SEM, version 3.0, which includes two stages of analysis: the measurement model and the structural model. The measurement model assesses the relationships between constructs and their associated indicators, while the structural model evaluates the relationships between the constructs of the path model (Tenenhaus, M., Vinzi, V. E., Chatelin, Y. M., & Lauro, C., 2005). We followed the PLS-SEM evaluation procedure shown in Figure 1.

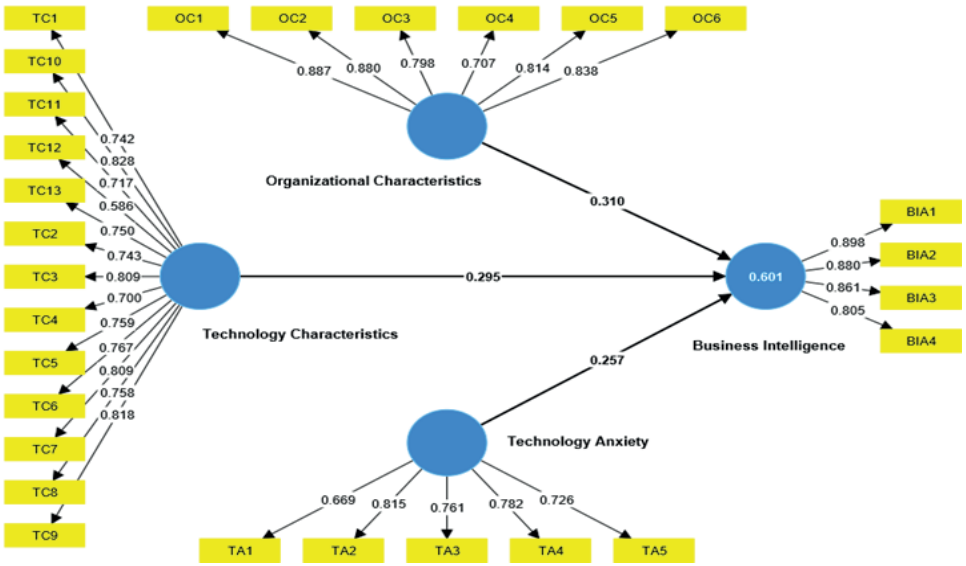

Figure 1: PLS Algorithm Path Diagram for the Research Model.

4.1. Convergent Validity

An examination of the measurement model is the first step of the evaluation process when using PLS-SEM. To assess the quality of the measurements, criteria such as reliability, internal consistency reliability (composite reliability), convergent validity, and discriminant validity are used. The traditional internal consistency measure is Cronbach's alpha, which can be supplemented with the composite reliability measure. The threshold for the composite reliability and Cronbach's alpha is 0.70, which indicates high internal consistency among items associated with its construct. Figure 1 and Table 1 show that all factor loadings are greater than 0.7, the AVE values for all the constructs are greater than 0.5, and the composite reliability and Cronbach's alpha for all constructs are higher than 0.70, demonstrating a satisfactory level of quality.

Table 1: Table captions should be placed above the tables.

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Business Intelligence	0.884	0.888	0.92	0.743
Organizational Characteristics	0.903	0.907	0.926	0.677
Technology Anxiety	0.809	0.837	0.866	0.566
Technology Characteristics	0.937	0.94	0.945	0.571

4.2. Discriminant Validity Analysis

The principle of discriminant validity asserts that items of different constructs should be divergent rather than convergent (Hair, J.F., Black, W.C., Babin, B.J. and Anderson, R.E., 2010). This implies that each construct should be unique, representing different theoretical concepts, and that the indicators of a construct should not be strongly correlated with items of other constructs. Two approaches for evaluating discriminant validity are the cross-loadings of items and the Fornell-Larcker criterion. The cross-loadings approach evaluates validity at the indicators' level, while the Fornell-Larcker criterion evaluates validity at the con-structs' level, requiring that "each construct's square root of the AVE should be higher than its correlation with any other construct" (Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M., 2017) as demonstrated in tables 2 and 3.

Table 2: Discriminant Validity Fornell & Larcker criterion.

	Business Intelligence	Organizational Characteristics	Technology Anxiety	Technology Characteristics
Business Intelligence	**0.862**			
Organizational Characteristics	0.714	**0.823**		
Technology Anxiety	0.662	0.668	**0.752**	
Technology Characteristics	0.712	0.787	0.672	**0.755**

4.3. Analysis of the Constructs

The structural model of this research consists of hypothesized relationships among its constructs, which reflect the theories and concepts that serve as the basis of the path model. Hair et al., 2017, states that the structural model analysis is used to test

Table 3: Discriminant Validity: Heterotrait-Monotrait Ratio.

	Business Intelligence	Organizational Characteristics	Technology Anxiety	Technology Characteristics
Business Intelligence				
Organizational Characteristics	0.788			
Technology Anxiety	0.757	0.749		
Technology Characteristics	0.770	0.847	0.758	

the hypotheses through these relationships, and the strength and significance of these relationships are evaluated in order to determine the predictive quality of the model. PLS bootstrapping with 5000 re-samples was adopted in this research to obtain stable estimates, and the T-Values and P-Values for each path coefficient were produced accordingly (Figure 2 and Table 4).

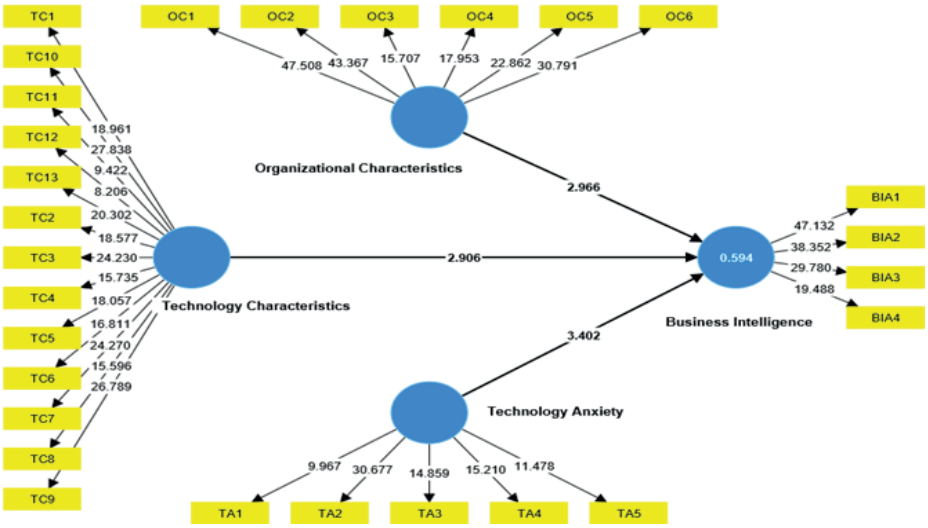

Figure 2: PLS Bootstrapping result.

Table 4: Bootstrapping result: Hypothesis Testing.

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
H1: OC -> BI	0.31	0.306	0.104	2.966	0.003
H2: TA -> BI	0.257	0.259	0.076	3.402	0.001
H3: TC -> BI	0.295	0.300	0.101	2.906	0.004

5. Discussion And Managerial Implication

Business intelligence is a skilled application in which the system is in charge of analysing data used by a company or organisation. Data used in BI greatly aids decision-making. To maximise its utility, the BI system works with useful data. A business intelligence system was created to provide new business intelligence solutions. BI encompasses a wide range of tools, applications, and methodologies that enable organisations to collect data from internal and external systems, prepare it for analysis, create reports, dashboards, and data visualisations, and run queries against that data.

The current research study's findings demonstrate that Technology Characteristics is a powerful construct that can be used to understand users' adoption of BI systems. Furthermore, this will help users understand the new system, reduce anxiety, improve their interaction with systems, eliminate any doubts about technology, and ultimately develop adequate perceptions about the system's use and, as a result, their adoption. Management support influences BI adoption, which is consistent with previous research. All indicated that management support has a strong and positive impact on BI system adoption.

6. Research Contribution

This study created a coherent model by combining factors that have been validated in various empirical studies and have a lot of support in the literature. It identifies those factors, verifies the variables, illustrates the differences between variables, and assesses the impact on BI system adoption. The study's findings confirm the importance of organisational and individual factors in influencing users' perceptions and acceptance of BI adoption. The empirical validation of the study measure for the factors investigated in the current and previous studies adds to the theoretical contribution by highlighting measurement and conceptual issues associated with the development of BI theories. As a result, this study adds to the theoretical understanding of how BI systems can be implemented.

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