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EFFECTIVE USE OF ARTIFICIAL INTELLIGENCE BY MALAYSIAN MANUFACTURING FIRMS TO ENABLE SUSTAINABILITY 4.0

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ABSTRACT

This project is to propose Malaysian industrial companies' excellent application of machine learning assists with Green 4.0. It will provide business analytic methodologies, industry 4.0 concept and sustainability 4.0. This will be illustrated through the problem statements of lacking research and technologies of effective use in AI for Malaysia manufacturers, the accuracy of resources supply in sustainability 4.0 and the issue of faults detection in the high speed of changing machine operating environments. The research aims to investigate the relationship between effective use of adopting business analytics in the manufacturing industry. Thus, the secondary objective is to learn about the model including innovation, enterprise, and Ecological. Framework can facilitate the performance of Manufacturing Firms. The purpose is to interpret the implementation of business analytic ultimately affects the overall performance of the organization. and creating a feasible framework. Model interpreted according to an effective use theory and business analytic to form theoretical framework in advancing accuracy and reliability of manufacturing process using PLS-SEM solutions after collecting data through develop a Google survey form to reduce iterations of complicated data, predict and enhance complexity of performance, and differentiate the day-to-day human behaviour. In this project, Fornell-Larker parameters are used to test the measurement algorithm for the research's discriminant validity. 380 valid questionnaires returned back and conducted the calculation of the algorithm's assessment to constructs' validity and realibility assessment, discriminant validity using HTMT and Fornell-Larker approaches. Variance inflation factor analysis and hypothesis testing analysis evaluated for determine variables affecting business analytics adoption for further research study about suggestions and direction of industrial sector.

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CHAPTER 1 Introduction

Project Background

The project is mainly focusing on industry 4.0, sustainability 4.0 and machine learning of manufacturing are presented to analyze Malaysian industrial companies' successful deployment of artificial intelligence to ensure longevity 4.0 and motivation boosted in the research in establishing more potentials to advance process optimization and manufacturing in aspects of automation, production and waste reduction since our contributions to the field of sustainability 4.0 are to discuss the proposed theory of effective use and implementation framework of TOE (Technological, Organizational and Environmental) for firm performance and adoption of business analytic.

Introduction

The sustainable processes and activities are included in the sustainable manufacturing firms at every level of production which are product, process, and system. With effective use serving as the linchpin through which reduction are started at the beginning of the source from systems, it gain the potential to be a crucial and primitive theory with meaning and inference for research and practice which is to expand further in reused recuperating, waste disposal, re-purposing, re-manufacturing, and refurbishing[1]. With the aim of minimizing costs, the link of green AI to Industry 4.0 becomes a significant solution source in future to connect the relationship among manufacturing firms and environment. Thus, more efforts are needed in the starting point the lifespan phase of an item by composing an innovative capacity for product design according to the consideration of sustainability and environment. In the aim of developing manufacturing processes to enable sustainability 4.0, many manufacturing firms begin to use various digital technologies with the advancements in automation, data and innovation are being employed for improving flexibility in manufacturing process to increase the growth and competitiveness of the work environment.

Malaysia manufacturing firms are focusing on hiring the employees with the knowledge of experts from the private and public sectors on sustainable using 4.0 innovation and try to reach a sustainable production by concerning the environment issues such as changing of climate and the resource depletion. Digitization gives a new viewpoint to industry 4.0 since manufacturing is still under the growing of critical evaluation from consumers, business partners and employees to progress steps of sustainability, then, the productivity increase lead to a lower production cost, higher profit and market competitiveness increase due to green development of product and design using R's technologies[2-4]. Through green AI, it enables us to reduce pollution effectively and efficiently by reducing the waste and emissions of carbon[5-7]. Manufacturers try to replace the traditional energy source into a renewable source via calculation and audit process based on performance data and response collected in enhancing the process of sustainable products in order to balance and merge a business with environmental concerns and resource management. This paper intends to discuss and explore the Malaysian industrial companies' a productive utilisation of machine learning to ensure longevity 4.0.

1.1 Problem Statement and Motivation

1.1.2 Industry 4.0

The fourth industrial revolution is a brand-new idea to provide and update an industrial environment for artificial intelligence, interoperability and automation of manufacturing according to innovative capabilities and technological innovations to interact and obtain information and data. For Malaysia, the new idea of Industry 4.0 becomes a challenge to implement since Malaysia manufacturing firms, especially small and mid-size enterprises (SMEs) lack artificial intelligence related to the infrastructures, industries and expertise to reach the target of cost reduction effectively and to solve the resource depletion. Since Malaysia is still considered as a developing country and it is not a technology-producing country, barriers of achieving Industry 4.0 faced due to unclarity and uncertainty towards the estimation and implementation of manufacturing businesses even though Malaysia had proposed and launched the Malaysia Federal Manufacturing 4.0 Strategy for SMEs to boost the growth of manufacturing businesses[8].

Expensive and excessive investment costs would hinder rather than help progress as the investment cost might be higher than the prediction and estimation of an organizational growth and lead to an economic deficiency[8]. SMEs could not bear high investment costs especially in the machine sector like IT maintenance, infrastructure and the costs for IT staff and technical skill training. Funding and cost implication are essential and critical to be included into the estimation and prediction to make sure the return gained while launching the initial state of Industry 4.0 such as consultation of business process re-engineering, re-evaluation of information and communication technologies and infrastructures and facilities to update an advanced system[9]. Thus, the huge amount of money needed increases the risk of financial challenges for manufacturers to move from the transition from commerce to the fourth industrial revolution.

1.1.3 Sustainability 4.0

Sustainability 4.0 is achieved as the rise of the idea of the fourth industrial revolution began to take shape and reach sustainable industrialization and a smart digital environment by integrating the physical and digitization into new technologies. However, although sustainability 4.0 is believed as the aspects of social system such as job diversification, a secure job environment and automation manufacturers, Malaysia is not only facing the issues of climate change and pollution, but the critical challenges of power sector of Malaysia which is to make sure the safety and accuracy of reliableness in supplying energy and diversity energy resources in order to launch a sustainable manufacturing development processes so that it could catalyse the industrialization in economic development since there would be more than one options of energy sources[11]. Hence, green AI application is considered as one of the reasonable solutions to solve the issues of energy supplies and environment concerns effectively and efficiently to reduce the adverse effects to the environment.

1.2 Motivation

The aim of the thesis is to propose the way of utilising intelligent machines effectively in Malaysian production and analyze the issues and solutions by integrating AI for business analytic adoption so it enables Sustainability 4.0 and provides more opportunities and improvement in process optimization and manufacturing in aspects of automation, production and waste reduction. A comprehensive view of classifying effective use methods is critical to avoid more faults detected and time waste processes to have a highly understanding of industrial areas for further development of sustainability 4.0.

1.3 Research Objectives

The research aims to investigate the relationship between effective use of adopting business analytics in the manufacturing industry. Thus, the secondary objective is to seek to comprehend the manner in which TOE (Technological, Operational and Ecological) adaptation. Framework can facilitate the performance of Manufacturing Firms. Third, the goal and purposes of this project is to investigate the manner in applying business analytic ultimately affects the overall performance of the organization. and creating a feasible framework.

1.4 Project Scope and Direction

Three scope decisions are described to keep the initial study viable and to concentrate on the fundamental claims of the proposed theory instead of concentrating on fewer significant features. Firstly, to ensure its efficient utilization, theory of effective use initially takes into account two measures which are acquisition of knowledge and adaptation by highlighting the demanding nature of the tasks involved in comprehension and adaption of effective use and TOE framework. Secondly, the research project centred on fundamental cognitive acts rather than additional ones, and on primary impacts rather than secondary effects in order to produce a feasible model. The way comprehending an organizational structure necessitates understanding its depictions, external organization, and its internal organization. The comprehensive structure for understanding as a whole and allow the particular aspect acquisition for further study. Thirdly, this study prioritizes larger main connections compared to subsidiary interactions for optimum usages. Innovative application hypothesis and TOE framework argues particularly that each characteristics and factors can influence both efficacy and productivity, but certain consequences are main while others are minor. Hence, the main impacts are focused to make sure an enhanced evaluation.

The research conducted puts each of these arguments for examination. The circumstances is originally adopted as supplied and avoided criticism views in order to validate the research accurately. Certain interactions are reconstructed to reevaluate theory of effective use and TOE research model as overall after discussing the manner in which new information discovered in the subsequent sections of the study.

1.5 Contributions

An overall overview of effective use theory based on TOE research framework is provided in the research survey in speeding up the process of decision-making to adopt business analytic in Industry 4.0 due to limited automation found. The issues of expensive investment and inappropriate use of human resources are faced by manufacturing firms under the requirement to train employees efficiently using conventional software diagnostic tools. However, the traditional ways are unable to be used on preliminary fault detection in adjusting and fitting to dynamical threat sources and studying the new classes of data threat from huge amounts of manufacturing data, Moreover, external sources (human errors or DDOS attack) might lead to faults occurring. In this survey research, solutions of machine learning in the area of human machine interface and information technology security are stated.

- To establish and expand the theory of effective use in TOE framework.
- A comprehensive learning to clearly describe, quantify, and discuss the significance and potential solution for adoption of business analytic.
- Assisting management in understanding how to use BA Adoption more effectively in application to improve firm performance.

1.6 Report Organization

This report is divided into seven chapters, each of which plays a specific part in outlining the thorough framework of the investigation. The problem statement, project background, motivation, scope, objectives, contribution, and organisational structure are all covered in Chapter 1's introduction. In Chapter 2, the literature review digs into earlier studies and frameworks in order to glean insights for the analysis of pertinent elements. The development of the research framework, in particular the Business Analytics Adoption Framework, is the subject of Chapter 3. Practical information on creating and executing an evaluation system is provided in Chapter 4. Data analysis and outcomes are reported in Chapter 5 while they are critically evaluated in Chapter 6. The report is concluded in Chapter 7, which also addresses the study's flaws and suggests possible future options.

CHAPTER 2

Literature Reviews

2.1 Business Analytic Adoption

Big Data, which is defined as enormous quantities of data that exhibit traits such as diversity, acceleration, and quantity, has increased as a result of technological and digital tool improvement[12]. The various data types that conventional systems cannot handle, the pace at which data is produced and analysed, and the sizeable volume of data that businesses acquire all carry substantial knowledge. As some studies concentrate on data attributes while others place an emphasis on the process, tools, and methodologies for data analysis, there are differences in the features of Statistics in large data in the term of BDA. Because of the distinctive characteristics of Big Data, businesses must use data analysis methods to derive information from it because they are not anymore practical.

Numerous research projects have examined how medium-sized companies (SMEs) use big data analytics (BDA)[12]. These investigations concentrated on the organisational, mechanical, and cultural variables that influence the implementation of BDA and found the effects of BA on the effectiveness of projects and the efficacy of Investigations into the acceptance of BDA are being carried out in a number of nations, notably Nigeria, Iran, Korea, Lebanon, Malaysia, and the United States[12]. The findings imply that support from top executives, previous expertise in IT, outside assistance, perceived value and convenience of use, as well as the perceived utility and simplicity of use of BDAs, all influence their adoption. BDA adoption has been shown to enhance the effectiveness of projects, overall competitiveness, and the accomplishments of SMEs. Throughout COVID-19 in the country of Malaysia, Loh and Teoh concentrated on encouraging embrace of the BDA while identifying the key technical aspects that foster acknowledgment[12]. The estimated value and usability of BDAs have been shown to have a substantial impact on implementation in small and medium-sized businesses by Parson's research carried out in the United States of America. According to Mikalef et al.'s investigation on how BDA adoption affected

Norwegian enterprises' overall competitiveness, promotion and innovation proved to be beneficial.

2.2 Effective utilisation of Principle

The scheme aims to encourage ongoing research in the notion of optimum usage. Aspects needed in evaluating via this theory including dimensions represent the structures which comprise up the approach, interactions are the regulations governing how the components communicate, limitations that determine the accuracy of framework, an organization implies are somewhat regions of the model's boundaries that deviate from the rest of the structure, the proposals are in fact the factual affirmations of the approach, research findings variables have been the criteria used to estimate the significance of a component and the concept is divided into a number of viable facts in a hypothesis that can be verified [13].

The concept emphasizes on efficient utilization, which can be described as exploiting the structure in an approach that advances its intended purposes. Deep, surface, and physical are the computerized structures for communication and association which the efficient utilization is defined in accordance with depiction theory to examine functionality, effectiveness and data value[13].

In effective use theory, the capacity that an individual is able to utilize the framework's information without being obstructed by its external appearance or internal components is known as transparent interaction. Furthermore, the rate that the individual acquires depictions via the architecture which accurately convey the depicted field is known as representational fidelity. Informed action is considered as a level when an individual responds on the accurate indications they receive through the framework in order to enhance perceive themselves.The effective use concept establishes on the idea that people may enhance their capability to utilize technologies

effectively and that accomplishing thus may possess an impact on their productivity[13].

2.3 Manufacturing Sustainability

The global attention to environmental impacts have boosted the trend of finding green technologies and effective use of artificial intelligence to enhance the side of competitiveness in expanding sustainability 4.0. Sustainable manufacturing is gradually noticed as an important element for products' life cycle due to the responsibilities of engineers to adverse environmental concerns. It motivates manufacturers to search for environmentally friendly resources by including social resources which are human, capital and natural so the internal part of industrial components are linked with sensors, actuators, and Internet connections. Data exchange and converse decrease downtime and make the maintenance process become more secure, effective and flexible after assisted by technology used in checking and re-engineering. Through utilizing replication of sustainable natural cycles, energy supply of ancillary equipment is more crucial than the centre process. Negative impacts of the environment decrease since energy and natural resources are sustained via constantly optimizing and enhancing the manufacturing procedures and operations. This helps to secure the safety of staff, society and products[14].

2.4 Previous works on existing framework

Table I. Existing Solutions

Author(s)	Theory	Context	Factors	Short description
(Chatterjee et al., 2021)	Integrated TAM-TOE model	● A study on the the development of Industrial 4.0 within the possible context of digital production is influenced by external factors technical, and cultural variables. ● The research context would include the use of integrating expanded The Technology Acceptance Framework (TAM)-TOE and the Tech-Organization-Environment (TOE) architecture to analyse the implementation of Industry 4.0 and	**TAM (Technology Acceptance Model) frameworks.** TAM-based technological variables ● perceived ease of use ● perceived usefulness **TOE (Technological, Organizational and Environmental)** Components at the administrative and within levels ● Institutional preparedness ● Institutional skill	● Assessments of 340 workers from small, medium-sized, and big organizations were used to obtain data and for the study. ● The findings demonstrated that all associations were relevant within the model of industrial and goods enterprises, with the exception of those relating to The impact of supplier assistance, institutional availability, and suitability on customer satisfaction.

		validate the theoretical framework.	• Administrative difficulty • Adaptability factors related to the exterior setting, an advantage • Competitiveness • Alliance assistance	• The research further demonstrated that this type of adoption is influenced by leadership support.
(Kinkel et al., 2022)	TOE Framework	• This study intends to look into the variables affecting the implementation of novel technologies within manufacturing sector. • Used for identifying the management, digital, and socioeconomic factors necessary for the implementation of artificial intelligence (AI) in the industry of manufacture. The conditions for industrial AI adoption	**TOE (Technological, Organizational and Environmental)** Organizational • Company Size • Competitive factor • R&D intensity • Digital skills.	• The study was developed on an international questionnaire of 665 firms from manufacturing sector. • The major variables have the biggest effects on adopting AI in industrial indicated in the findings are technological knowledge, organization scale, and intensity of research and development.

		are measured using a standardised survey, and the outcomes are organised into TOE model.	Technological Internal Technological ● Product complexity. ● Batch size External Task Environment ● Industrial sector ● Country	● According to the study related to variables in orientation, organisations based on research, knowledge and service have been more likely to integrate AI technologies at both sectors of domestic and overseas production.
(Nam et al., 2019)	● TOE Framework ● Diffusion Theory	● The study discusses and analyses innovation diffusion theory to demonstrate how crucial it is to comprehend how technical innovation is adopted as a succession of procedures.	**TOE (Technological, Organizational and Environmental)** ● Technological ● Facilities for information storage A	● The digital, business, and ecosystem viewpoints have been utilized to explore variables influencing the implementation of novel technologies at organizational scale using the model established by the

		• The three stages of Business acceptance - integration, start-up, and acceptance—are emphasized. • The paper examines the consequences of different variables on each phase and highlights the importance of taking The invention spread hypothesis and the structure known as the TOE into consideration.	• Administration of integrity Organizational • Institutional constraint • Standardization of statistics Environment • Rivalry level • Federal backing **Innovation diffusion theory** • Initiation, • Adoption,	TOE. • TOE framework integrated with The spreading of revolutionary ideas and establishment theory to better understand the decision of IT adoption. • Tested with 170 Korean firms since a survey developed to intepret framework and assumptions on business analytics. • The overall composition of the companies that participated in the survey according to size, manufacturing classification, and employment status

			• Assimilation. Control variables • **Firm size** • **Firm type**	
(Chaubey & Sahoo, 2021)	Assimilation of business intelligent	• The research model isbased on top layer concept and theoretical frameworks. • Institutional theory is used to explore the integration of technological diversity. • The model attempts to extend previous work on ERP assimilation using institutional theory to research the integration of Business	• The integration of comprehensive quality administration and business resource planning is substantially impacted by organisational forces. Institutional isomorphism • coercive pressure • normative pressure • mimetic pressure. Top leader commitment	• To analyses BI assimilation via developing an analytical structure for clarifying BI assimilation that depends on concepts of institutional and upper echelon. • Data gathering via survey form from 174 representatives in Indian automotive component- making companies and the findings state that pressures (normative and

		Intelligence. ● BI is suggested to be assimilated as required in response to outside factors (institutional pressures). The study approach pinpoints the causes of BI assimilation and presents the findings of the study.	● Acceptance ● Routinization (RO) ● BI assimilation (BI-ASM)	mimetic) have a substantial impact on top managers' commitment to Business Intelligent efforts. It turns and influences how well Business Intelligent is assimilated via acceptance and routinization.
(Nam et al., 2019)	Theory of effective use	● to offer perspectives on operationalization and assessment of productive utilisation through survey research and an analysis of the nomological validity of effective usage with personal effect. ● This research intends to foster the concept of optimal usage and assist operators in determining where	**first-order reflective-second order formative construct** ● Transparent interaction ● Representational fidelity ● Informed action.	● Three aspects in theory mentioned in factors are studied in structure of first-order reflective-second order formative. ● More than 12,000 workers across 17 divisions in Australia participated the survey in a sizable higher education institution via implementing an enterprise system

		improvements of information system should be made in aspects of expenditure.		updated several times which is Oracle Financials. ● Participants including certain senior-level users using the system to complete and conduct operational tasks related to finance.

2.4.1 The factors elicited from the previous studies

Table II. Factors

Theory	Factors	Weakness
TAM-TOE model	1. Perceived efficiency 2. Perceived value 3. Managerial skills 4. Flexibility of the company structure 5. Managing uniformity 6. Operational preparedness 7. Edge over rivals 8. Affiliate cooperation	● The complicated cultural and corporate factors that can influence the integration of technology have not been entirely taken into account by the TAM-TOE model because it focuses exclusively on individual-level concerns. ● The framework fails to specifically tackle problems with authority, governance, and opposition within companies, which can greatly affect the efficacy of initiatives for implementing new technologies. ● The framework presupposes a linear relationship between variables, which may simplify the complicated connection between a person's, a company's, and the environment.The approach neglects to take into consideration ethnic differences in the adoption of innovation, which

		may restrict its application in some circumstances.
TOE Framework	1. Company Size 2. Competitive factor 3. The scope of research and development 4. Digital skills. 5. Novelty of the good. 6. The quantity of batches 7. Industrial sector 8. Nation	● Lack of attention to particular aspects as although the TOE model considers an extensive variety of factors, it might not go into sufficient depth on particular variables that could have an influence on how well technology is adopted. ● Insufficient consideration of organizational elements due to it does not account for all organizational aspects that can influence the adoption of technology, such as culture and leadership. ● Insufficient consideration of external elements since it may neglect to account for all external factors, such as shifts in markets and financial situations, which can have an impact on the adoption of technology.
● Innovation Diffusion Theory ● TOE Framework	1. Data infrastructure 2. Data quality management 3. Managerial obstacle 4. Analytics centralization 5. Competition intensity 6. Government support	● The framework is complicated, which can make it challenging to use in practise because It requires considerable effort and knowledge to determine and evaluate all the important components. ● The importance of individual elements, such as user opinions or societal implications, in the adaptation and assimilation process is not made

	7. Initiation, 8. Adoption, 9. Assimilation.	clear by the model. ● The approach does not account for outside factors that might affect innovation, such as financial or technological developments.
Institutional isomorphism	1. coercive pressure 2. normative pressure 3. mimetic pressure. 4. Acceptance 5. Routinization (RO) 6. BI assimilation (BI-ASM)	● concentrates excessively on how external variables influence how organisations behave while ignoring the authority and inner workings of similar organisations. ● considers that organisations are not engaged participants who could oppose or adjust to institutional demands, but rather passive recipients of external influences. ● eliminates the need to take into account the potential that institutional forces could be in conflict with one another or with different organisational targets or purposes.
Effective Use Theory	1. Transparent interaction 2. Representational fidelity	● It might overlook the consequences of additional factors which might impact how tech is used, like company culture or physical limitations.

	3. Informed action.	• It doesn't offer a clear framework for dealing with problems involving user resistance or slow acceptance of technology. • It might not apply to all forms of technological devices because some might be intrinsically more challenging to use or effectively portray than others.

CHAPTER 3

Proposed Method/Approach

3.1 Formulation of a research framework

To adopt technologies of business analytic in manufacturing companies, a theoretical frameworks designed to use as a foundation in determining which factors affect the adoption as well as the attitude of the organization. The proposed framework in this research based on theory of optimal utilise, which includes educated decision-making, reliable data, and open communication, as well as TOE (Technological, Organizational and Environmental) framework since it is one of the most comprehensive models for analyzing how innovation is adopted in firms to have deep understanding into a whole company instead of individual level in order to embrace novel technologies by obtaining details from TOE framework[19]. An organizational readiness assessment is considered as a formal appraisal for company to navigate a substantial shift in enhancing firm performance and saving corporate reputation to prevent high-profile failure for joining a incomplete project.

The organization component of framework posits that organizational readiness to change is a crucial factor of the successful BA adoption. This readiness is influenced by several factors, including innovation valence,the availability of assets, computer science, intellectual, ethnic, tactical, and collaboration-related capabilities. Under environment, external pressures, specifically mimetic pressure and coercive pressure, are one of the variables could influence and adopt an organization's business analytic. The framework's final section, "Decision Performance," presents the argument that implementing a business analytic will directly affect a number of aspects of an organization's performance, including its decision making process.

Through navigating and predicting hypotheses of the framework and implementation of BA, a comprehensive view and understanding of the intricate interactions between technology, organization, environment, and business performance is provided in the context of BA adoption .

Figure I. Business Analytics Adoption Framework

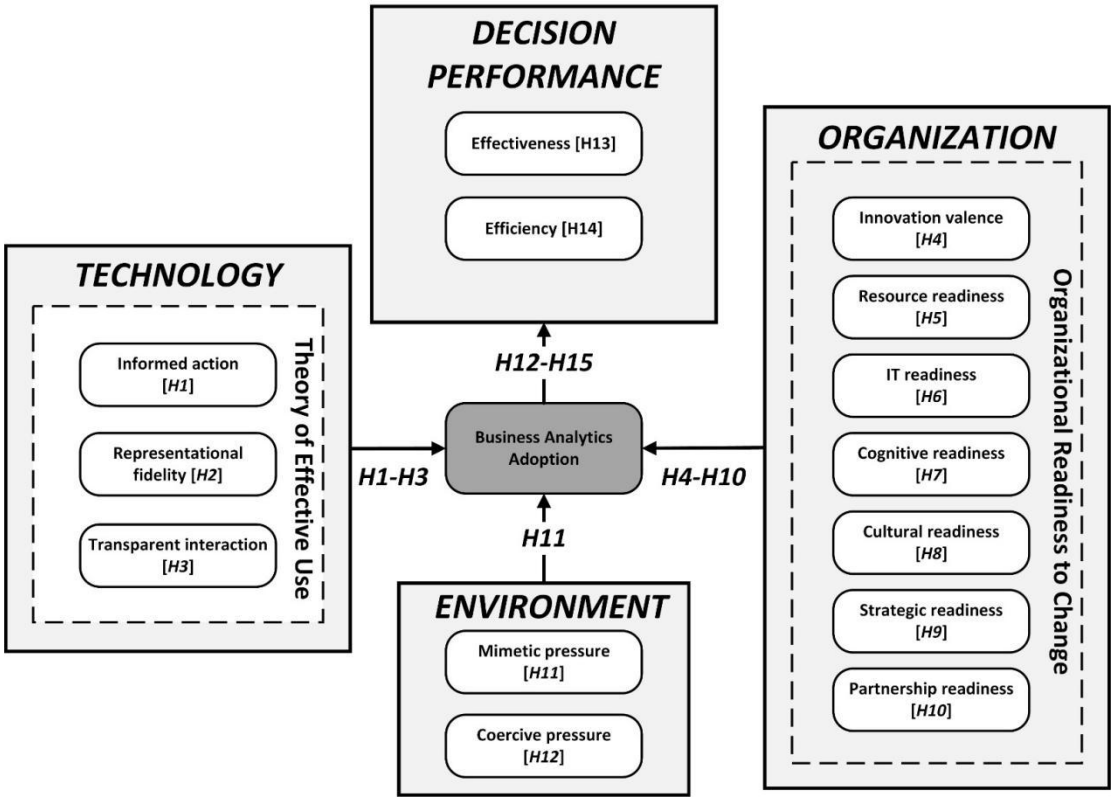

Table III. Constructs Definition of Items

Construct	Definition	Items	Source
Informed action	The level of how an individual utilizes data or results generated by the computer system to enhance their productivity on the job.	INA1	(Trieu et al., 2022)
		INA2	
		INA3	
		INA4	
Representational fidelity	The amount that an individual receives depictions of precisely conveying the field of the framework via engagement	RPF1	(Trieu et al., 2022)
		RPF2	
		RPF3	
		RPF4	
Transparent interaction	The level at which an individual has access to a device's depictions without being hampered by its external appearance or structural characteristics	TRI1	(Trieu et al., 2022)
		TRI2	
		TRI3	
		TRI4	
Innovation valence	Key indicators of innovation valence include employee behaviour, motivation, and ability to adopt or implement enhancements, particularly in the context of digitization.	INV1	(Hussain & Papastathopoulos, 2022)
		INV2	
		INV3	
		INV4	
Resource readiness	The capacity of a firm's resources—including its individuals, commercial, and technological innovations assets—to embrace and sustain the transformations caused by new technologies.	RSR1	(Hussain & Papastathopoulos, 2022)
		RSR2	
		RSR3	
		RSR4	
IT readiness	The reliability and adaptability of the hardware and software and staff	ITR1	(Hussain & Papastathopoulos,
		ITR2	

	skills are key considerations for the digital change.	ITR3 ITR4	2022)
Cognitive readiness	The ability to manage organisational change cognitively requires the expertise and skills needed, flexible socioeconomic status, employee growth, and teamwork.	CGR1 CGR2 CGR3 CGR4	(Hussain & Papastathopoulos, 2022)
Cultural readiness	It addresses how flexible or difficult a work environment is to adapt to in the age of technology which includes leadership, and assistance, and an innovation-friendly culture demands the right company foundation, regulations, and reward setup.	CLR1 CLR2 CLR3 CLR4	(Hussain & Papastathopoulos, 2022)
Strategic readiness	A comprehensive plan for digitization that takes into account the advantages that have been possessed, such as data modification, simplicity, and enhanced interaction with long-term objectives.	STR1 STR2 STR3 STR4 STR5	(Hussain & Papastathopoulos, 2022)
Partnership readiness	Establishing confidence and integrity among logistics stakeholders while providing accurate data is necessary for partnership readiness.	PTR1 PTR2 PTR3 PTR4	(Hussain & Papastathopoulos, 2022)
Mimetic pressure	Estimated achievement by sustainable business analytic-adopting rivals, manufacturers, and clients	MMP1 MMP2 MMP3 MMP4 MMP5	(Gholami et al., 2013)

Coercive pressure	Government agencies, prominent clients, and manufacturers' push.	COP1	(Gholami et al., 2013)
		COP2	
		COP3	
		COP4	
Decision effectiveness	The level at which an individual has accomplished the objectives associated with the execution of the decision-making job that was carried out employing the technology.	DFV1	(Nam et al., 2019)
		DFV2	
		DFV3	
		DFV4	
Decision efficiency	The degree to which objectives of the execution of decisions are achieved with a particular amount of input data like labour or duration.	DFC1	(Nam et al., 2019)
		DFC2	
		DFC3	
		DFC4	
Business analytics adoption	The procedure of integrating business analytics tools, methodologies, and practises within the decision-making procedures in order to improve company efficiency.	BBA1	(Lutfi et al., 2022)
		BBA2	
		BBA3	

3.1.1 Technology

Transparent interaction refers to a user's seamless access to representations in a system of Business Intelligent since the interface of system and physical framework do not obstruct it[20]. Term of hierarchical is used in the relationship to implement effective use and divide it into components that interact and affect with one another such as layouts for users and associated hardware. Users are able to perceive and perform actions due to the sensory and physical alternatives provided by surfaces and architecture. For example, data input by highlighting required fields with an asterisk(*) and placing fields accordingly could provide users instructions on what information to enter and how to enter it. Data accuracy in data input increases in enhancing the transparent interaction to result into a more accurate representation of the domain to which the data is related by the system[13].

H1-H2: Transparent interaction positively influences representational fidelity.

Effectiveness of human beings increases in acquiring representations that accurately reflect the domain to assist the process of decision making. According to the concept that representational fidelity influences informed action positively, users tend to make well-informed assumptions and take proactive steps when they can access representations that are accurate to their field of study to have better understanding the they are dealing with, identify relevant information, and examine different alternatives[13].

H2-H3: Representational fidelity positively influences informed action.

3.1.2 Organization

One of the factor need to be considered in business adoption is innovation valence. For the adoption of business analytic, change readiness is crucial at both individual and institutional phases since it is considered as personal dedication and willingness to adapt and change is referred to as their "change valance." The concept of change valence expanded to innovation valance in studying three categorization which are the employees' attitudes, motivation, and empowerment for technological advancement and examining the rate at whether a staff member displays an optimistic viewpoint towards the adoption of business analytic by using innovative technology. The accuracy of adoption business analytic will increase as the value of innovation rises[23].

H4: The use of economic analytics and innovation valance are strongly associated.

Theory of readiness is important for companies to evaluate theoretical framework for technology advancement in handling complicated modifications productively. When modifications are deemed required and the company possesses the relevant skills, companies absorb, integrate, and utilize technology. The concept of "resource readiness" focuses on the significance of adaptability in a the flexibility of each company to adjust and reorganize for technological advancement. Financial, human resources and technology are categorized in the resources for the implementation of technological advancement. For instance, in a framework of a company, human resource (e.g.administration and expert expertise in information technology) is necessary to encourage the adoption of Digital advances while in tangible resources (e.g. hardware), intangible resources (e.g, client-centricity, partnership, and expertise capabilities) effectively established and standardized to launch innovative technologies.[24]

H5: The acceptance for enterprise analytics is positively impacted by resource adequacy.

IT readiness is defined as the ability for a company's intelligent technology's infrastructure in order to enhance innovative technology. The capability of computer technology to create novel solutions is impacted by a business structure's reliability. For having greater tactical adaptability, firms leverage innovative technology by complementing their fundamental strengths to foster development as well as enhance efficiency[23].

H6: The implementation of company statistics has been helped by the IT availability.

The potential of a firm's intellectual property to foster digital technology and adoption of business analytic is known as cognitive readiness. The expertise, capacity, and responsiveness of personnel are critical for the foundation of of computerized entrepreneurship by completing necessary obligations in term of individual and enterprise structure[23].

H7: The widespread use of corporate analytics is enhanced by cognitive security.

The basic principles of a business is significant which is cultural readiness in order to advance business analytic.Vital corporate environments that encourage development exist in enterprises likes Apple, Microsoft, Google, and Facebook. Based on the research, the company of Apple created an environment that encourages invention to booster the digital technology and is frequently stated to become the greatest entrepreneurship of the world. Companies that focus on progress in an activity is compelled by data is crucial for top management to make decision in aspect of business analytic. There was an intense culture of data in a web-based business where data was viewed as being as crucial as water[23].

H8: The general acceptance of company analytics is boosted by ethnic preparedness.

Under strategic readiness, it is defined as a collection of administrative responsibilities for adoption in business analytic. Information of conveying a course of procedure and rules offered by strategic readiness to enforce the field of information technology. Ineffective initiatives for innovation frequently occur since it has the issues with assumptions and a lack of grasp of the specifics. Hence, ease of understanding, ongoing improvement, and engagement with long-term objectives are essential for sustainable innovation in technology. Companies must implement innovative application research strategies that highlight the possibility aspect in order to investigate viable potentials of artificial intelligent business [25].

H9: The widespread implementation of company data analytics has been benefited by strategic capability.

The capacity of an institution to collaborate with third parties in promoting technological advancement is referred to as partnership readiness. Companies look to an excessive number of partnerships for aid in technological development, involving manufacturers, experts in aspect of both software and equipment companies, and especially consumers and clients that are significant in adoption of business analytic. Assistance from collaborators enables staff to build their expertise and integrate innovative technologies such artificial intelligence by exchanging knowledge to foster performance of innovative technology[15].

H10: The implementation of company data analysis has been beneficially influenced by collaboration preparedness.

3.1.3 Environment

Expected outcome of performance is not achieved if organizations do not respond quickly to combat institutional influences. A theory on the more substantial and durable components of a society is known as institutional theory which includes mimetic pressures and coercive pressures. Coercive pressures such as restrictions, state industrial and trade regulations, influence from business associations, and regulation from government agencies. Organizations face mimetic pressure due to unpredictable scenario when businesses respond to response to inside as well as exterior surroundings. To adopt business analytic in ensuring sustainability, it is crucial for organizations to implement institutional theory to deal with issues of internal and external environment[26].

Under mimetic pressure, competitiveness for greater accuracy in job performance causes mimetic pressure. Organizations react sensitively to rivals' operation by implementing business analytic adoption. Government agencies and investors under intense mimetic pressure to force business adoption of cutting-edge sustainability practices and innovations by enhancing AI technologies or any resources to gain competitive advantages from branches of global corporations that are owned by abroad. For instances, companies faces with a lack of clarity or inconsistency about the goals or innovation strategy during the pandemic of COVID-19, mimetic pressure are urged to use for top management to make commitment to examine internal and external environment[18].

H11: Mimetic pressure and the embrace of enterprise analytics are positively related.

Companies have to comply with various sustainability norms and standards due to coercive pressure from outside parties including federal agencies and nonprofit companies in order to influence an organization's conservation policies and rules and regulations. The sustainable development of enterprises has been discovered to be influenced by coercive pressures since the governing authority enforces certain laws as being obligatory and required. Each company will face harsh penalties if they do not abide by this legislation. Adoption of business analytic implemented to gain funding and approval from the government, enhance their contribution to the environment, and boost their public image[18].

H12: Coercive pressure and the acceptance of business data analysis are positively correlated.

3.1.4 Decision Performance

Under environmental, since there are variations in features of goods, manufacturing procedures, and technical situations, an organization's manufacturing industry might have an impact on how technologies are implemented. Research in the past indicated that the implementation and application of artificial intelligence varied by manufacturing, particularly innovative companies and the automobile manufacturing leading the way of adoption in business analytic. The scale of the manufacturing sector appears to have an optimistic effect on development as well. Besides, The process and level of innovation adaptation can be influenced by conditions peculiar to a given nation such as legislation and governmental aid, the standard of the establishments, socioeconomic variables, and the accessibility of trained employees[27].

The theory of effective use, or TEU, proposes that using deliberate activities can increase the effectiveness of making decisions. The extent to which a choice accomplishes its stated aims is commonly referred to as decision-making effectiveness in the area of business insights. It is generally accepted that decision-making processes founded on data and analysis have a higher chance of success than those based only on experience or intuition. This is a cornerstone for studies on supporting choices and enterprise intelligence. Marketing executives, for example, can make more informed choices regarding the price of goods by taking their clients' capacity to make payments into consideration and utilising information gathered from enterprise intelligence[20]. Therefore, we conclude the following:

H13: Effective decision-making and informed choices are closely related.

It's crucial for maintaining open communication among customers and the business analyst in order to increase the efficacy of decision-making for implementation. Individuals have to be able to swiftly obtain data, integrate it efficiently, and engage with results. Individuals' choice-making process is slowed down when they encounter difficulties in transparent interaction. A hypothesis is developed that inadequate levels of transparent interaction are going to have an adverse effect on their efficacy in making choices. This results in the development of H13:

H14: Efficiency decision-making and transparent interaction are closely related.

3.2 Research Method

The methods used for gathering and analyzing data from studies are determined by the research method. Due to its analytical traits, logical worldview, and the requirement for determining key variables impacting the adoption of business analytic in investigating successful implementing innovations of Malaysian industrial sector for fostering sustainability industry 4.0, the method of quantitative evaluation was chosen for the work project. This method tries to pinpoint the key variables that influence business analysis and how it impacts the academic results using tested concepts and frameworks. Since the TOE framework and theory of effective use are complicated and existing hypotheses have been placed to the test over a long period of time, the research modified current models rather than developing new ones. Therefore, to build a prototype utilising previous ideas and research, test its relevance to business analytic, and refine it. When examining an extensive sample quickly, quantitative research techniques like survey responses are ideal since they improve prospective comprehension, offer higher accuracy, and produce repeatable results.

Gathering, evaluating, and interpreting data are each component of the research process. The present investigation applies a positivist theoretical framework and a statistical method for evaluating assumptions generated by the conceptual framework through a survey made up of questionnaires. A method called structural equation modelling (SEM) applying with partial least-squares modelling (PLS) is used to evaluate the findings while considering the study theories[28]. PLS-SEM was selected as it is able to be used to analyse complicated simulations, discover factors that influence the implementation of enterprise analytical training, and place the fewest constraints on how data is distributed, number of samples, and scales of evaluation. The research project that involves a method with two stages that includes an estimation model as well as a model of structure is conducted using SmartPLS 3[28].

3. 3 Planning

3.3.1 To explore and analyze research

In order to establish the range of issues, inquiries into the study, and goals following an extensive study analysis, researcher initially investigates data in the research design. The structure of the research effort is created by eliciting conceptual model, hypotheses and factors that are crucial to answering the project's objectives.

3.3.2 To develop and verify the survey

To establish the set of questions via google form that is able to be utilized for the questionnaire development process in the subsequent stage by determining the intended audience who has experience with manufacturing aspects, choosing a handful of participants (a sample) from a wider sample to determine or foresee data regarding the wider population (sampling strategy), and generating a questionnaire with an emphasis on implementing and verifying the study framework established in the previous section. The procedure involves defining the questionnaire approach to design, eliminating the variance of common methods and outlining the data gathering goals.

Validation questionnaire to refine the variables and get rid of any that were unclear, as well as to examine the data and face validity assessments to boost the effectiveness of the assessment algorithm. The following stage includes a number of qualitative and statistical assessments in order to enhance and eliminate unreliable elements of the first questionnaire.

Furthermore, the amount of certainty that indicates a measuring device contains adequate items for assessing a concept is known as content validity. Specialists in the industry assessed the content validity of the survey for the purpose of this research to confirm its correctness. Specialists were recruited to evaluate the questionnaire's components using this method, which is frequently used to ensure the reliability of the content.

While carrying out an in-depth evaluation, a measuring tool must first undergo a pilot test to verify its accuracy and dependability. The ideas are assessed for internal coherency, index reliability, convergent validity, and discriminant accuracy while being tested reflectively. In order to evaluate reliability, the research applies a composite reliability approach. To evaluate convergent validity, external loadings of indicators and the mean variance obtained are used. With the use of cross-loading and the Fronell-Larcker criterion, discriminant validity is determined. The outcomes of the pilot project are presented in Section 4.

3.3.3 To collect and interpret data

The process of gathering and analyzing data is essential for carrying out surveys, analyzing data, and completing modules. A distribution of 50 questionnaires was made to the manufacturing companies. As the targeted sampling approach was determined to be appropriate for this research, only those participants who had experience with business analytics were selected when the survey was distributed.

The collected data had been evaluated quantitatively via techniques of partial least squares (PLS) and structural equation modelling (SEM). The following factors have been applied throughout the PLS assessment to evaluate the organizational simulation's interpretive influence which are the factor of variance inflation, the important of path coefficients, effect size and predictive relevance[28].

3.3.4 Perform the Modelling Process and theoretical report

In the final stage of the evaluation phase, the proposed framework was modified using the physical evaluation's findings as well as the quantitative system's discoveries. The proposed ideas were evaluated in accordance with the findings after related and insignificant correlations were found. The research was developed using the findings and the final version of the framework. The conclusive report was written throughout this stage, which involved analyzing and interpreting the data gathered throughout the other stages. The core function is to explain its findings in an understandable and succinct way. Developing and organizing citations were done using Microsoft Word 2013 as a completed report was the outcome of this phase.

CHAPTER 4

Preliminary Work

4.1. Reduce standard procedures variation

The objective of this research was to reduce variation in common methods (CMV) while gathering statistics. For certain equal comprehension of the information, the idea of theoretically effective usage in business analytic adoption developed. In order to minimize prejudicial views and provide reliable outcomes, the questionnaires were created to be brief, easy to understand, and precise in their structure. To make the survey simpler for respondents and ensure against participant bias, queries have been organized into uniform groups and arranged in a sequence that was chosen at random. The strategy lowered the CMV and produced outstanding suggestions.

4.2. Construct an evaluation framework

The research's primary objective is to create a precise description of measuring framework that is both effective and trustworthy for the analysis's structures that have been previously identified in the previous research. It is crucial during the earliest stages of their scope advancement, noting earlier studies that have emphasized the detrimental effects of a vague construction. The link between the concepts and the accompanying variables is defined by the measuring framework. Analytical or constructive structures, as well as in term of measurement which are single-item ang multiple-item, can be used to evaluate the variables. For the purposes of the present research, demographic parameters were measured using single-item metrics, while additional variables were measured using multiple-item variables comprising a minimum of four measurable indications. Formative constructs are multi-dimensional and cannot be quantified by reflective measures, whereas reactive concepts indicate only one field with interchangeable elements.

Choosing a measurement model :-

Table IV. Measuring Model

	Standard	Selection
a)	A reflective indicator's and a construct's logical order	(i) the reflecting indicator follows the construct: reflective (ii) the construct derives from the following indicators: formative
b)	Does the construct represent a characteristic that explains the indications, or is it more likely to encompass all of various indicators?	(i) characteristic: reflective (ii) combine all variables: formative
c)	Does the indication indicate the construct's effects or its roots?	(i) effects: reflective (ii) If roots: formative
d)	Item alterations will occasionally be uniform across all items, presuming the items are all identically encrypted, if the trait's evaluation alters.	(i) true: reflective (ii)false: formative
e)	Sequence of association for an indicator is between the notion and the index.	(i) true: reflective (ii)false: formative

The levels—variables that were modified from inputs that had gone through validation—are scales. The measurement variables are changed as a way to figure out the widespread usage of evaluation in business within an overall context of the study. The table below displays the enhanced measures that were used in this investigation.

Table V. Construct and Refined Items

Construct	Measurement Model	Items	Refined item	Source
Informed action	Reflective	INA1	I make use of the relevant information to generate particular advice as well as alternatives.	(Trieu et al., 2022)
		INA2	I utilize useful data in enhancing my job performance and giving suggestion or making choices.	
		INA3	I use good pieces of information to detect difficulties, build clarification, and carry out alternatives in my job.	
		INA4	I leverage key parts of the data to make informed decisions and recommendations.	
Representational fidelity	Reflective	RPF1	I receive enough reliable information about the real world from BA Adoption.	(Trieu et al., 2022)
		RPF2	I receive latest news from BA Adoption about the actual world.	
		RPF3	I am given clear enough knowledge about the real world via BA Adoption.	
		RPF4	The knowledge I learn about the real world via BA Adoption accurately reflects what is taking place there.	

Transparent interaction	Reflective	TRI1	Through the interface of the BA system, I have no difficulty getting the data/information I require.	(Trieu et al., 2022)
		TRI2	I feel the data analysis and visualisation features of the software are simple to use to obtain the knowledge I want.	
		TRI3	I can quickly retrieve the information or data I need using the BA system.	
		TRI4	I have trouble connecting to the software in order to obtain the info or knowledge I require.	
Innovation valence	Reflective	INV1	Our organization encourages new ideas and experimentation.	(Hussain & Papastathopoulos, 2022)
		INV2	Our organization values creativity and innovative thinking.	
		INV3	Our organization is willing to take risks in pursuit of innovation.	
		INV4	Overall, our organization has a positive attitude towards innovation.	
Resource readiness	Reflective	RSR1	Our organization have sufficient financial resources to support the implementation of new business analytic tools and technologies	(Hussain & Papastathopoulos, 2022)
		RSR2	Our organization have sufficient human resources (e.g., skilled personnel, experts) to support the implementation of new business analytic tools and technologies.	
		RSR3	Our organization have sufficient IT infrastructure resources (e.g.,	

			hardware, software, networks) to support the implementation of new business analytic tools and technologies.	
		RSR4	Overall, our company is adaptable when it comes to assigning the right amount of capital required for breakthroughs within its Technological business.	
IT readiness	Reflective	ITR1	Our organization's business processes are secure and durable.	(Hussain & Papastathopoulos, 2022)
		ITR2	Our organization has access to a variety of innovative technologies (e.g. Google Docs, Microsoft 365) to encourage innovation.	
		ITR3	Our organization has strong responsiveness of the IT and IS teams when it comes to addressing technical issues and resolving problems.	
		ITR4	Overall, the stability, availability, and reliability of IT and IS in our organization is strong for facilitating innovations.	
Cognitive readiness	Reflective	CGR1	Our workers are equipped with essential knowledge (e.g., technological, operational, and managerial procedures) to effectively implement innovations in the area of business analytics.	(Hussain & Papastathopoulos, 2022)
		CGR2	Our workers are confident possess the essental skills to implement innovations related to business analytics.	
		CGR3	Our workers are adaptable and able to adjust to new innovations in	

			the area of business analytics.	
		CGR4	Overall, workers have the high ability to implement innovations related to business analytics.	
Cultural readiness	Reflective	CLR1	Our company values innovation and encourages employees to suggest new ideas related to business analytics.	(Hussain & Papastathopoulos, 2022)
		CLR2	Our company 's leadership supports the adoption of business analytics as part of its overall decision-making strategy.	
		CLR3	Our company operate appropriate risk analyses before using IT to support innovations.	
		CLR4	Overall, our company has a strong culture that encourages innovation in the IT industry.	
Strategic readiness	Reflective	STR1	I feel that the IT portfolio is in keeping around the objectives of strategy established by the company.	(Hussain & Papastathopoulos, 2022)
		STR2	I have high awareness of the strategic goals of the company that are related to using the IT portfolio to drive innovation.	
		STR3	Our company review and adjust its strategic goals frequently to accommodate new technology and innovation opportunities.	
		STR4	Employees encouraged to share innovative ideas that align with the organization's strategic goals.	

		STR5	Overall, our company's strategic goals are clearly stated, pertinent, and well communicated when it comes to utilising the IT portfolio for innovation.	
Partnership readiness	Reflective	PTR1	Our company collaborate with suppliers for software to facilitate innovations.	(Hussain & Papastathopoulos, 2022)
		PTR2	Our company involve managerial experts in innovation projects.	
		PTR3	Our company has a long-term collaborative approach with software vendors, managerial experts, and suppliers/vendors to facilitate innovations.	
		PTR4	Overall, the quality of relationships between my company and its suppliers/vendors is high in terms of facilitating innovations.	
Mimetic pressure	Reflective	MMP1	Our company have a clear strategy for incorporating environmentally sustainable practices into its business analytics processes.	(Gholami et al., 2013)
		MMP2	I agree that companies similar to yours who have adopted Green AI have experienced financial benefits.	
		MMP3	In our company's logistics process management, customers perceive those who have adopted Green AI favorably.	
		MMP4	Our company have adopted Green AI and experienced financial	

			benefits within the logistics process management.	
		MMP5	Overall, I agree that adopting Green AI is beneficial for company's environmental goals and financial success.	
Coercive pressure	Reflective	COP1	Our company is under significant pressure from current and anticipated environmental regulations to adopt Green AI.	(Gholami et al., 2013)
		COP2	Our suppliers are exerting pressure on our company to adopt Green AI.	
		COP3	Our major customers are exerting pressure on our company to adopt Green AI.	
		COP4	Overall, our company feels compelled to adopt Green AI due to external pressures.	
Decision efficiency	Reflective	DFV1	The business analytic tools I use help me make decisions more efficiently.	(Gholami et al., 2013)
		DFV2	The adoption of business analytics has improved my decision-making process.	
		DFV3	The insights provided by business analytics are relevant and useful for making efficient decisions.	
		DFV4	I feel more confident in my decisions when I use business analytics to inform them.	

Decision effectiveness	Reflective	DFC1	Business analytics help me to make decisions effectively that contribute to achieving the goals set by my company	(Nam et al., 2019)
		DFC2	My decisions based on business analytics have proven successful in facilitating my business for accomplishing its objectives.	
		DFC3	I can use business analytics to make decisions that contribute to achieving the anticipated metrics for success (KPIs) in my company.	
		DFC4	My decisions based on business analytics have been effective in achieving the KPIs expected by my company.	
Business analytics adoption	Reflective	BBA1	Our company aims for execution business analytic adoption.	(Lutfi et al., 2022)
		BBA2	Future plans for our company include using BD on a continuous basis.	
		BBA3	Our company is committed to encouraging companies to implement BD.	

Items were selected from existing studies to measure constructs such as theory of effective use, TOE framework and business analytic towards adoption The items had been implemented to fit the context previous works, which focuses on using business analytic adoption.

The declaration that "all constructs are reflective" denotes that the constructs measured in this study are regarded as latent, which means they are not realisable through direct observation but can only be deduced from detectable indications, such as responses to questions. Reflective constructions are assessed using indicators that are presumptively influenced by the construct under study, and respondent answers to the indicators are taken to represent a reflection of the respondents' fundamental views or opinions..

A Likert rating system of five was used to elicit opinions how much they agreed or disagreed with every argument in order to evaluate these constructs. In other words, a statement pertaining to the construct being measured was presented to the respondents. A rating system that covers totally concurring to profoundly opposing was employed to determine the extent of consensus dissatisfaction or satisfaction. Based on thesurvey research, the Likert scale is a popular scale that allows researchers to quantify the degree of intensity along with the direction of opinions or views.

Finally, after creating the survey, it must be tested for validity and reliability using the right assessment methods. Validity is the extent to which a measurement tool assesses the data it is meant to measure, whereas reliability is the consistency and stability of the tool through time and across many samples. A reflective concept can be tested for its reliability and validity using a variety of assessment methodologies, which must be carefully chosen and deployed based on the methodology of the study and the situation.

4.3. Evaluate the survey's data

Through a series of pre-tests that use both quantitative and qualitative techniques to improve and eliminate inferior items from the first questionnaires, the survey's questionnaire is evaluated. The main goals of this phase are to improve the face and content validity of the assessment model as well as further develop the items in order to remove any ambiguous ones. According to the pilot research, content validity was checked to ensure the survey's accuracy and validity. The comprehensiveness, suitableness, and phrases of the survey responses are reviewed to determine the relationship between measurement items and constructs, and provided suggestions. The assessment components of the intent to use construct were adjusted to represent users' intentions to adopt business analytic practices based on their feedback.

4.4. Gather data using pilot survey method

A pilot survey that simulated the execution of the primary research investigation was undertaken on a small sample of the surveyed demographic in order to refine the questionnaire. This pilot questionnaire was designed to evaluate any problems with the queries, procedure, or form design. The second stage of the study's methodological structure, which called for the distribution of surveys and the analysis of the data gathered, was followed in conducting it. The primary goals of the pilot poll were to test the practicability of the proposed major research and figure out whether any modifications were required. To fix any faults and enhance the tool, the created survey (Appendix A) was put to the test.

The researcher provided 65 questionnaires that were printed and distributed to people with experience in the manufacturing industry in Kampar, Malaysia, where they were residing during the course of the research, in order to minimise the duration and costs involved with data collection during the pilot study. 50 valid replies were eventually gathered and used for the pilot evaluation.

4.5. Assessment of Validity and Reliability

With PLS-SEM methods and SmartPLS 3.0 applications, the accuracy and dependability of the research instrument that was constructed were evaluated. Table 4.5 displays the findings of the validity and reliability analysis of the pilot research.

Table VI. Constructs Validity and Reliability

Construct	Items	Outer loading	Cronbach's alpha	Composite reliability	AVE
Informed action	INA1	0.770	0.775	0.790	0.566
	INA2	0.754			
	INA3	0.753			
	INA4	0.669			
Representational fidelity	RPF1	0.728	0.780	0.815	0.615
	RPF2	0.606			
	RPF3	0.868			
	RPF4	0.811			
Transparent interaction	TRI1	0.618	0.735	0.766	0.558
	TRI2	0.747			
	TRI3	0.780			
	TRI4	0.715			
Innovation valence	INV1	0.865	0.795	0.825	0.601
	INV2	0.638			
	INV3	0.892			
	INV4	0.720			
Resource readiness	RSR1	0.801	0.803	0.844	0.655
	RSR2	0.892			
	RSR3	0.624			
	RSR4	0.878			
IT readiness	ITR1	0.671	0.788	0.801	0.603
	ITR2	0.819			

	ITR3	0.778			
	ITR4	0.749			
Cognitive readiness	CGR1	0.712	0.781	0.803	0.611
	CGR2	0.840			
	CGR3	0.890			
	CGR4	0.680			
Cultural readiness	CLR1	0.710	0.720	0.780	0.577
	CLR2	0.773			
	CLR3	0.732			
	CLR4	0.854			
Strategic readiness	STR1	0.738	0.800	0.823	0.636
	STR2	0.841			
	STR3	0.835			
	STR4	0.810			
	STR5	0.636			
Partnership readiness	PTR1	0.716	0.720	0.758	0.588
	PTR2	0.629			
	PTR3	0.719			
	PTR4	0.758			
Mimetic pressure	MMP1	0.793	0.765	0.799	0.573
	MMP2	0.718			
	MMP3	0.875			
	MMP4	0.824			
	MMP5	0.623			
Coercive pressure	COP1	0.747	0.766	0.801	0.602
	COP2	0.608			
	COP3	0.823			
	COP4	0.760			
Decision effectiveness	DFV1	0.712	0.711	0.768	0.588
	DFV2	0.685			
	DFV3	0.787			
	DFV4	0.735			

Decision efficiency	DFC1	0.775	0.725	0.777	0.578
	DFC2	0.648			
	DFC3	0.790			
	DFC4	0.742			
Business analytics adoption	BBA1	0.790	0.803	0.833	0.677
	BBA2	0.872			
	BBA3	0.806			

⁂ PLS-SEM settings based on the Hair et al. (2013): path weighting for inner weight estimation; standardized data for prameter (Mean 0, Var 1); highest iteration set to 300; abortion criteria set to 1.0E-5

[a] CR = Composite Reliability, AVE = Average Variance Extracted

** 0.4 < item loading < 0.7, excuting the evaluation of removing item according to consideration of AVE and accuracy.

Refer to statistical data above, except for 12 items, each instrumentation of outer loading able to achieve more than threshold value of 0.7. The PLS method has been repeated for the indicator items INA4, RPF2, INV2, INV2, RSR3, ITR1, STR5, PTR2, MMP5, COP2, DFV2, and DFC2 that had outer loadings below the threshold value in order to examine the effects of indicator deletion on the values of AVE and composite reliability. An item should be eliminated if doing so results in a rise in the AVE and composite reliability scores. Therefore, after applying the PLS method, the outcomes showed that removing all 12 elements raised the AVE and composite reliability values. All of the remaining 45 items were significantly more than the threshold demand after these 12 indicator items had been eliminated.

Table VII Deletion of identified indicator items

Construct	Items	Outer loading	Cronbach's alpha	Composite reliability	AVE
Informed action	INA1	0.770	0.775	0.790	0.566
	INA2	0.754			
	INA3	0.753			
Representational fidelity	RPF1	0.728	0.780	0.815	0.615
	RPF3	0.868			
	RPF4	0.811			
Transparent interaction	TRI2	0.747	0.735	0.766	0.558
	TRI3	0.780			
	TRI4	0.715			
Innovation valence	INV1	0.865	0.795	0.825	0.601
	INV3	0.892			
	INV4	0.720			
Resource readiness	RSR1	0.801	0.803	0.844	0.655
	RSR2	0.892			
	RSR4	0.878			
IT readiness	ITR2	0.819	0.788	0.801	0.603
	ITR3	0.778			
	ITR4	0.749			
Cognitive readiness	CGR1	0.712	0.781	0.803	0.611
	CGR2	0.840			
	CGR3	0.890			
	CGR4	0.680			
Cultural readiness	CLR1	0.710	0.720	0.780	0.577
	CLR2	0.773			
	CLR3	0.732			
	CLR4	0.854			
Strategic readiness	STR1	0.738	0.800	0.823	0.636
	STR2	0.841			

	STR3	0.835			
	STR4	0.810			
Partnership readiness	PTR1	0.716	0.720	0.758	0.588
	PTR3	0.719			
	PTR4	0.758			
Mimetic pressure	MMP1	0.793	0.765	0.799	0.573
	MMP2	0.718			
	MMP3	0.875			
	MMP4	0.824			
Coercive pressure	COP1	0.747	0.766	0.801	0.602
	COP3	0.823			
	COP4	0.760			
Decision effectiveness	DFV1	0.712	0.711	0.768	0.588
	DFV3	0.787			
	DFV4	0.735			
Decision efficiency	DFC1	0.775	0.725	0.777	0.578
	DFC3	0.790			
	DFC4	0.742			
Business analytics adoption	BBA1	0.790	0.803	0.833	0.677
	BBA2	0.872			
	BBA3	0.806			

⁂ PLS-SEM settings based on the Hair et al. (2013): path weighting for inner weight estimation; standardized data for data metric (Mean 0, Var 1); maximum iteration set to 300; abortion criteria set to 1.0E-5

[a] CR = Composite Reliability, AVE = Average Variance Extracted

* if the value of item loading is more than 0.4 and less than 0.7, analyse the impact of item deletion on the values of AVE and composite reliability

Fornell-Larker parameters are used to test the measurement algorithm for the research's discriminant validity. The Fornell-Larker criterion values are shown in the table as supporting data for the discriminant validity of the items. In Appendix A, questionnaire's final version developed.

Table VIII. Discriminant Validiy using Fornell-Larcker

	BBA	CGR	CLR	COP	DFC	DFV	INA	INV	ITR	MMP	PTR	RPF	RSR	STR	TRI
BBA	0.642														
CGR	0.25	0.531													
CLR	0.271	-0.057	0.467												
COP	0.259	0.121	-0.142	0.535											
DFC	0.373	0.038	-0.057	0.000	0.494										
DFV	0.367	-0.112	-0.069	-0.075	-0.003	0.503									
INA	0.23	0.069	-0.1	-0.262	0.221	0.122	0.482								
INV	0.158	0.027	-0.278	-0.129	-0.033	0.293	0.071	0.504							
ITR	0.53	-0.079	0.286	-0.212	-0.258	-0.142	0.049	-0.116	0.521						
MMP	0.221	0.08	-0.08	-0.09	0.281	-0.051	0.253	-0.033	-0.138	0.528					
PTR	0.275	-0.051	0.012	-0.025	0.184	0.197	0.35	0.024	-0.192	0.286	0.572				
RPF	0.335	-0.118	-0.16	0.2	0.234	0.161	0.134	0.119	-0.237	0.151	0.163	0.524			
RSR	0.423	0.16	-0.034	0.001	-0.205	-0.371	-0.144	0.096	0.304	-0.189	-0.09	-0.025	0.559		
STR	0.452	-0.053	0.13	0.148	-0.157	-0.336	-0.17	-0.187	0.287	-0.221	-0.117	-0.165	0.187	0.427	
TRI	0.117	0.05	-0.036	0.199	-0.047	0.142	0.086	-0.128	-0.001	-0.043	0.079	0.118	0.007	0.183	0.546

CHAPTER 5

Experiment / Simulation

5.1 Criteria

Using a three-item scale developed from previous research, the desire of Malaysian manufacturing companies to use green information technology made possible by machine learning is evaluated. For instance, one issue questioned their position on incorporating sustainability practices according to artificial intelligence throughout their business. To measure the business analytic within these companies using a five-item scale based on prior research. An example question assessed the support for the adoption of business analytic and artificial intelligent sustainability measures the company aims for execution business analytic adoption. Examining how senior industrial company workers evaluate behavioral management. This was accomplished by modifying research-proven items into questionnaires that inquired about staff's views of potential barriers to applying artificial intelligence (AI) sustainability initiatives in their regular jobs. Every evaluation were calculated utilizing a 5-point Likert scale, where "1" stood for significant disagreement and "5" for significant agreement. According to the research's aims on investigating the relationship between effective use of adopting business analytic in the manufacturing industry for sustainability, participants were chosen based on their stated participation in Intelligence-driven environmental initiatives within Malaysian industries [29].

5.2 Sampling and Data Gathering

According to a set of criteria, respondents were selected for the research because of their knowledge of using sustainable information technology in their regular jobs, including c-level executives, senior managers, and decision-makers at various levels. Using Cohen's approach and striving for a statistical significance level of 80%, the the necessary sample size is calculated. A total of 600 questionnaires were initially delivered to participants for data-gathering purposes. Then, 538 of these surveys were successfully retrieved. 380 of the returned surveys satisfied the requirements for validity and were used in the analysis. Due to insufficient responses or non-compliance with the standards of the research, the remaining questionnaires were not included in the study.

5.3 Updated Questionnaire

The amended survey is intended to gather demographic data and determine how respondents' organizations feel about innovation in the production sector. Age, gender, company size, manufacturing sector, principal role, previous work experience, knowledge of artificial intelligence, familiarity with the concepts of sustainability, and mindsets regarding development are all covered throughout the nine sections.

Table IX Updated Respondents' Bio

		Frequency
Age	25-35	Respondents choose an age group from a list of alternatives.
	36-45	
	46-55	
	56-65	
	More than 65-year-old	
Gender	Male	The respondents state how they identify as a male or a female.
	Female	
Company size	Small	Respondents specify a certain

	Medium	amount of revenue for their company's operations, choosing from options including Small (Less than RM 1 million), Medium (RM 1 million to RM 50 million), and Large (More than RM 50 million).
	Big	
Manufacturing sector	Electronics and Electrical Equipment	Respondents are asked to identify the company's main sector of production.
	Automotive and Transportation Equipment	
	Textiles and Apparel	
	Machinery and Equipment	
	Chemicals and Pharmaceuticals	
	Food and Beverage	
	Others	
Primary role	Senior Management/Executive (e.g., CEO, CFO, CTO)	The purpose of this part is to identify the respondents' main position within the organizations they work for.
	Operations/Production Manager	
	IT/Technology Manager	
	Research & Development Manager	
	Sustainability Manager	
	Other	
Working	Less than 1 year	The respondents describe their

experience	1-5 years	employment history in the industrial sector, with options ranging from Less than 1 year to More than 10 years.
	6-10 years	
	More than 10 years	
Familiarity with AI	Very familiar	The respondents rate how well-versed they are in artificial intelligence (AI) tools.
	Somewhat familiar	
	Not familiar at all	
Familiarity with sustainability concepts	Very familiar	Respondents rate their proficiency with industrial sustainability strategies.
	Somewhat familiar	
	Not familiar at all	
Organization's attitude towards innovation	Highly innovative and open to change	Respondents describe the perspective of their company regarding development.
	Somewhat innovative with cautious approach	
	Generally resistant to change and innovation	

5.4 Demography Results

Age:

The age distribution of respondents is as follows: 4.74% were in the 25-35 age group, 40% were in the 36-45 range, 32.11% were in the 46-55 range, 21.05% were in the 56-65 range, and 2.11% were over 65 years old.

Gender:

Male respondents made up a substantial majority (70.26%), while female respondents made up 29.74%.

Company Size:

Regarding the size of the companies represented by respondents, 79.21% were from medium-sized firms, 13.95% were from large firms, and 6.84% were from small companies based on revenue.

Manufacturing Sector:

The manufacturing sectors in which respondents primarily operated were diverse: 43.42% from the food and beverage sector, 20.26% from machinery and equipment, 17.37% from automotive and transportation equipment, 5.53% from chemicals and pharmaceuticals, 4.47% from textiles and apparel, 3.68% from electronics and electrical equipment, and 5.26% from other sectors.

Primary Role:

Respondents held various roles within their organizations, including 27.89% in senior management/executive positions, 25.79% as IT/Technology Managers, 22.89% in Research & Development Management, 10.79% as Sustainability Managers, and smaller percentages in other roles.

Years of Experience:

Experience levels in the manufacturing industry varied, with 46.05% having more than 10 years of experience, 29.47% with 6-10 years, 21.58% with 1-5 years, and 2.89% with less than 1 year of experience.

Familiarity with AI Technologies:

A significant portion of respondents reported being somewhat familiar (68.68%) with AI technologies, while 31.32% claimed to be very familiar. None of the respondents indicated being not familiar at all.

Familiarity with Sustainability Concepts:

In terms of familiarity with sustainability concepts in the manufacturing context, 65.53% reported being somewhat familiar, 20.53% were very familiar, and 13.95% were not familiar at all.

Organization's Attitude towards Innovation:

Organizations exhibited varying attitudes towards innovation among respondents: 64.47% described their organizations as somewhat innovative with a cautious

approach, 23.95% indicated they were highly innovative and open to change, and 11.58% noted their organizations were generally resistant to change and innovation.

The study's research gives a thorough assessment of the respondents' perspectives concerning innovation and their demographic features inside manufacturing companies. The results provide insightful information about the make-up of the sample, the degree of expertise with artificial intelligence and sustainability concepts, and organizational attitudes towards development. These findings could assist the production sector's planning process and subsequent studies.

Table X Demograph Results

		Frequency	Percent (%)
Age	25-35	18	4.74
	36-45	152	40.00
	46-55	122	32.11
	56-65	80	21.05
	More than 65-year-old	8	2.11
Gender	Male	267	70.26
	Female	113	29.74
Company size	Small	26	6.84
	Medium	301	79.21
	Big	53	13.95
Manufacturing sector	Electronics and Electrical Equipment	14	3.68
	Automotive and Transportation Equipment	66	17.37
	Textiles and Apparel	17	4.47
	Machinery and Equipment	77	20.26
	Chemicals and Pharmaceuticals	21	5.53
	Food and Beverage	165	43.42

	Others	20	5.26
Primary role	Senior Management/Executive (e.g., CEO, CFO, CTO)	106	27.89
	Operations/Production Manager	29	7.63
	IT/Technology Manager	98	25.79
	Research & Development Manager	87	22.89
	Sustainability Manager	41	10.79
	Other	19	5.00
Working experience	Less than 1 year	11	2.89
	1-5 years	82	21.58
	6-10 years	112	29.47
	More than 10 years	175	46.05
Familiarity with AI	Very familiar	119	31.32
	Somewhat familiar	261	68.68
	Not familiar at all	0	0.00
Familiarity with sustainability concepts	Very familiar	78	20.53
	Somewhat familiar	249	65.53
	Not familiar at all	53	13.95
Organization's attitude towards innovation	Highly innovative and open to change	91	23.95
	Somewhat innovative with cautious approach	245	64.47
	Generally resistant to change and innovation	44	11.58

5.5 Data Analysis

With the help of the SmartPLS 3.0 programme, we used the partial least squares structural equation modelling (PLS-SEM) technique to analyse the information gathered and evaluate the response form that was created as well as the associated hypotheses. We implemented a two-stage analytical methodology in accordance with Joseph F. Hair and Hult's which is in year 2016 suggestion. It is significant to point out that the PLS-SEM approach does not presume data normality, necessitating the use of the bootstrapping procedure, as recommended by Joe F. Hair et al. which is year 2011, to determine the significance of path coefficients. In order to ensure accurate statistical evaluations of the study's constructs, we used the bootstrapping technique in this study to carefully test the hypotheses that were proposed[29].

5.6 Analysis and results

5.6.1 The Calculation of the Algorithm's Assessment

Using the method suggested by Hair et al. in year 2013 for the models that were produced reflectively, the validity and reliability of the measurement model in the current study were assessed in this section.

Tables XI to XI II provide the findings of the evaluation of the evaluation of the model's validity and reliability. These tables give a thorough summary of the assessment results, attesting to the thoughtful design of the questionnaire and the suitability of the obtained data for further investigation. This emphasizes how solid and reliable the measuring model is.

5.6.2 Constructs' Validity and Reliability Assessment

Several factors were examined in the evaluation of concept reliability and validity, particularly outer loadings, composite reliability (CR), and average variance extracted (AVE). Overall, the ideas presented in the current research have high accuracy and validity, which suggests an accurate estimation approach. The statistics demonstrate the study's analytical strictness, boosting optimism regarding any findings made using these concepts. An additional study, nevertheless, could benefit from additional refining or prospective assessment of criteria for conceptualizations with outer loadings or AVE values that exceed the appropriate threshold.

Outer Loadings

The association between the unobserved variable and its corresponding indicators is shown by the outer loadings. A number above 0.7 is typically regarded as acceptable, meaning that the indicator combines greater variability with the item than is erroneous. Business analytics adoption, coercive pressure, and informed action are three constructs that have high outer loadings, with values often above 0.8, showing a strong link between these constructs and the corresponding elements. Few constructions have outer loadings that are slightly higher than 0.7, indicating a substantial link to their components. Examples are IT Readiness and Partnership Readiness.

Composite Reliability

Composite Reliability is a metric used to assess a construct's inner consistency. Values of 0.7 or higher are typically considered to show strong accuracy. The Composite Reliability of every item provided is larger than 0.7, and most of them—such as the adoption of business analytics and coercive pressure—exceed 0.9. This demonstrates a high level of internal coherence for these frameworks, thereby reiterating the validity of the assessment items.

Average Variance Extracted

A construct's variance capture is compared against the variation in value caused by measurement mistakes using the Average Variance Extracted method. A score higher than 0.5 is considered appropriate, indicating that the concept typically accounts for over fifty percent of the variability of its variables. The Average Variance Extracted values of many constructs, including business analytic adoption, decision performance effectiveness, and informed action, are powerful and all exceed the 0.7 threshold. This emphasizes how clearly the signs they provide describe these entities. Several measurements, such as IT readiness and cultural readiness, float near the lower boundary of appropriateness (nearly 0.5). This implies that although models still account for greater variation than the measurement error indicates, there could be a possibility for each of these structures to be substantially improved across additional studies.

Table XI Constructs' Validity and Realibility Assessment

CONSTRUCT	ITEM	OUTER LOADING	COMPOSITE RELIABILITY	AVE
BUSINESS ANALYTICS ADOPTION	BAA1	0.884	0.915	0.782
	BAA2	0.871		
	BAA3	0.897		
COGNITIVE READINESS	CGR1	0.861	0.880	0.647
	CGR2	0.799		
	CGR3	0.769		
	CGR4	0.787		
CULTURAL READINESS	CLR1	0.793	0.850	0.587
	CLR2	0.735		
	CLR3	0.737		
	CLR4	0.799		
COERCIVE PRESSURE	COP1	0.884	0.921	0.796
	COP3	0.890		
	COP4	0.902		
DECISION PERFORMANCE	DFC1	0.847	0.873	0.697

EFFICIENCY	DFC3	0.804		
	DFC4	0.853		
DECISION PERFORMANCE EFFECTIVENESS	DFV1	0.853	0.907	0.765
	DFV3	0.873		
	DFV4	0.897		
INFORMED ACTION	INA1	0.905	0.925	0.804
	INA2	0.885		
	INA3	0.900		
INNOVATION VALENCE	INV1	0.890	0.908	0.767
	INV3	0.873		
	INV4	0.864		
IT READINESS	ITR2	0.734	0.777	0.537
	ITR3	0.746		
	ITR4	0.719		
MIMETIC PRESSURE	MMP1	0.875	0.918	0.737
	MMP2	0.815		
	MMP3	0.880		
	MMP4	0.862		
PARTNERSHIP READINESS	PTR1	0.745	0.773	0.531
	PTR3	0.701		
	PTR4	0.740		
REPRESENTATIONAL FIDELITY	RPF1	0.852	0.880	0.710
	RPF3	0.818		
	RPF4	0.857		
RESOURCE READINESS	RSR1	0.844	0.851	0.655
	RSR2	0.803		
	RSR4	0.780		
STRATEGIC READINESS	STR1	0.814	0.868	0.622
	STR2	0.767		
	STR3	0.752		
	STR4	0.818		
TRANSPARENT INTERACTION	TRI2	0.821	0.860	0.673

	TRI3	0.846		
	TRI4	0.794		

5.6.3 Discriminant Validity using HTMT

Table XII shows the results of the Heterotrait-Monotrait (HTMT) ratio of correlations used to evaluate discriminant validity. The degree to which an assumption differs from other variables in identical models is referred to as discriminant validity. A comprehensive assessment of discriminant validity is provided by the HTMT standard, which determines whether or not each combination of hidden factors can be distinguished from one another. Figures under 0.85 are frequently regarded as suggestive of appropriate discriminant validity when evaluating discriminant validity using the HTMT, indicating that the assumptions are distinctive. Figures around 1 or above the 0.85 threshold may indicate possible overlapping among the components and demand for additional research.

The HTMT value for Business Analytics Adoption (BAA) and Transparent Interaction (TRI) is 0.855, which is quite near the 0.85 cutoff point. This suggests that although there is a distinction between validity, there is merely a slight difference between both of these assumptions. The distinction between these two conceptions may be investigated more thoroughly in additional studies. An HTMT variable of 0.881 is displayed by Cognitive Readiness (CGR) and Transparent Interaction (TRI), exceeding the standard criterion. The terms and symptoms for these variables might require examination by academics in order to ensure they are truly recording distinctive terms, as this shows a large overlap. With a HTMT variable of 0.627, items like Coercive Pressure (COP) and Cultural Readiness (CLR) demonstrate appropriate validity for discrimination, indicating that the aforementioned concepts have distinct characteristics in the theoretical framework. The HTMT values of Informed Action (INA) and Innovation Valence (INV) share a similarity at 0.680, which further emphasizes the uniqueness within the overall framework.

A good deal of the simulation's variables demonstrate acceptable discriminant validity, which reinforces its mathematical foundation's integrity. Nevertheless, some pairings of constructs could require detailed examination to identify potential improvement, especially those whose HTMT values are close to or above the 0.85 standard. The accuracy and simplicity of the study's outcomes and suggestions could be improved by drawing sharper contrasts across comparable variables.

XII Discriminant Validity using HTMT

	BAA	CGR	CLR	COP	DFC	DFV	INA	INV	ITR	MMP	PTR	RPF	RSR	STR	TRI
BUSINESS ANALYTICS ADOPTION															
COGNITIVE READINESS	0.825														
CULTURAL READINESS	0.722	0.777													
COERCIVE PRESSURE	0.678	0.638	0.627												
DECISION PERFORMANCE EFFICIENCY	0.667	0.718	0.727	0.683											
DECISION PERFORMANCE EFFECTIVENESS	0.620	0.669	0.585	0.659	0.800										
INFORMED ACTION	0.779	0.745	0.728	0.674	0.663	0.684									
INNOVATION VALENCE	0.745	0.731	0.665	0.660	0.614	0.562	0.680								
IT READINESS	0.824	0.742	0.706	0.719	0.714	0.705	0.786	0.730							
MIMETIC PRESSURE	0.818	0.809	0.775	0.720	0.765	0.719	0.819	0.675	0.831						
PARTNERSHIP READINESS	0.685	0.650	0.694	0.591	0.623	0.638	0.677	0.662	0.739	0.683					
REPRESENTATIONAL FIDELITY	0.733	0.712	0.653	0.606	0.646	0.600	0.660	0.598	0.618	0.678	0.600				
RESOURCE READINESS	0.740	0.711	0.683	0.726	0.736	0.718	0.793	0.693	0.724	0.778	0.718	0.626			
STRATEGIC READINESS	0.809	0.782	0.638	0.716	0.632	0.679	0.776	0.749	0.755	0.819	0.734	0.680	0.808		
TRANSPARENT INTERACTION	0.855	0.881	0.745	0.760	0.730	0.703	0.755	0.777	0.809	0.820	0.779	0.791	0.805	0.807	

5.6.4 Discriminant validity using Fornell-Larcker

Table XIII uses the criteria developed by Fornell-Larcker to evaluate the validity of discrimination. A construct's discriminant validity establishes whether it is separate from other concepts used in identical models. By examining a construct's associations to different items (off-diagonal values) and its square root of average variance extracted (AVE) (diagonal values), the Fornell-Larcker criterion assesses discriminant validity. For the Fornell-Larcker method to work well in demonstrating discriminant validity, a construct's square root of its AVE (found on the diagonal) should be greater than its highest correlation with any other factor (seen in the off-diagonal values).

The square root of AVE for Business Analytics Adoption (BAA) is 0.884 (diagonal). The association is stronger than any of the other dimensions it has been correlated with (off-diagonal correlations like 0.693 with Cognitive Readiness, 0.594 with Cultural Readiness, etc.). This suggests that BAA's discriminant validity is acceptable. AVE's square root value for Cognitive Readiness (CGR) is 0.805. Furthermore, this figure is higher than the highest correlation it has with other constructs (e.g., 0.693 with BAA). The discriminant validity of the CGR is therefore proven. The association between Transparent Interaction (TRI) and Cognitive Readiness (CGR) is 0.694, despite TRI having a square root of an AVE score of 0.820. The discriminant validity between these two notions is minor, despite being appropriate, given that this correlation is very similar to the diagonal value. With a diagonal value of 0.858, Mimetic Pressure (MMP) shows an analogous finding. It has a very low (0.713) association with BAA. Even if it satisfies the criteria, this can nevertheless necessitate a few modifications.

Reliability regarding the system's disparities across variables is increased because the algorithm's variables mostly satisfy the Fornell-Larcker criterion for discriminant validity. A few variables that have correlations that are nearly at the diagonal call for caution in assessment and could possibly be worth more research. The stability of the study's ideas is highlighted, and the underlying theoretical basis of the study is strengthened via strong discriminant validity.

Table XIII Discriminant Validity using Fornell-Larcker

	BAA	CGR	CLR	COP	DFC	DFV	INA	INV	ITR	MMP	PTR	RPF	RSR	STR	TRI
BUSINESS ANALYTICS ADOPTION	0.884														
COGNITIVE READINESS	0.693	0.805													
CULTURAL READINESS	0.594	0.618	0.766												
COERCIVE PRESSURE	0.589	0.541	0.520	0.892											
DECISION PERFORMANCE EFFICIENCY	0.548	0.575	0.565	0.565	0.835										
DECISION PERFORMANCE EFFECTIVENESS	0.536	0.559	0.484	0.570	0.651	0.875									
INFORMED ACTION	0.680	0.633	0.607	0.591	0.552	0.600	0.897								
INNOVATION VALENCE	0.637	0.610	0.540	0.569	0.501	0.480	0.587	0.876							
IT READINESS	0.577	0.506	0.471	0.507	0.476	0.494	0.557	0.507	0.733						
MIMETIC PRESSURE	0.713	0.689	0.646	0.632	0.636	0.627	0.723	0.585	0.588	0.858					
PARTNERSHIP READINESS	0.481	0.445	0.471	0.414	0.416	0.448	0.480	0.460	0.418	0.484	0.729				
REPRESENTATIONAL FIDELITY	0.608	0.575	0.514	0.505	0.510	0.496	0.552	0.493	0.414	0.567	0.404	0.843			
RESOURCE READINESS	0.591	0.554	0.525	0.583	0.560	0.574	0.640	0.548	0.470	0.629	0.466	0.480	0.809		
STRATEGIC READINESS	0.675	0.636	0.513	0.602	0.505	0.567	0.653	0.619	0.511	0.691	0.492	0.547	0.624	0.789	
TRANSPARENT INTERACTION	0.693	0.694	0.574	0.618	0.562	0.569	0.618	0.624	0.531	0.672	0.513	0.616	0.603	0.632	0.820

5.6.5 Variance Inflation Factor Analysis

Table XV displays a thorough investigation of the correlations throughout various concepts utilizing the variance inflation factor (VIF) and hypothesis testing as two kinds of statistical techniques.

Variance Inflation Factor (VIF) Analysis:

VIF is a tool for identifying the existence and extent of multicollinearity among a group of variables that predict outcomes. Outcomes tend to be impacted by multicollinearity, which decreases their reliability. A VIF with a value of 1 implies the absence of multicollinearity. In general, VIF readings ranging from one to five have been considered appropriate. According to the threshold applied in the specific field in question, VIF values that are larger than 5 or 10 imply a high degree of multicollinearity that might prove troublesome. The VIF values for each of the stated variables leading to the implementation of company analytics range from 1.000 to 3.307. There are no significant concerns about multicollinearity for any prediction in the predictive framework because each of the values are under 5.

The use of business analytics while taking into account its impact on Decision Performance Effectiveness and Efficiency results in a VIF of 1.000, suggesting that there is no inflation of variance due to multicollinearity. With a VIF of 3.307, Mimetic Pressure obtains the highest possible value. Although it is the highest possible score, it is nevertheless considerably below an acceptable level of 5 or 10, indicating that multicollinearity does not seem to be a major issue. Partnership Readiness has the lowest possible VIF value, 1.557, implying that it is the weakest correlated with the remaining variables.

Hypothesis Testing Analysis:

The extent, orientation, and statistically significant nature of the correlations connecting the ideas are evaluated in the following section. Criteria: The strength and direction of the association are indicated by the path coefficient (β). The t-value evaluates the importance of the association. More convincing proof opposing the null hypothesis is often indicated by a higher t-value. The p-value reveals the likelihood that the association was just a coincidence. Lower p-values are preferable, and the standard significance levels are 0.05, 0.01, and 0.001.

Business Analytics Adoption -> Decision Performance:

Efficiency and effectiveness both exhibit a substantial positive correlation with the implementation of company analytic. The connection's magnitude and trend are indicated by the beta coefficients, which have values of 0.548 and 0.536, respectively. It demonstrates the fact that there is a proportional improvement of around 0.54 units in both Decision Performance Efficiency and Effectiveness for each unit of rising in Business Analytics Adoption.

Factors Affecting the Acceptance of Business Analytics

- Cognitive Readiness: With an average path parameter of 0.143, it indicates a positive correlation. This association is considered statistically significant, provided the significance p-value level is 0.009 (below the 0.01 threshold).
- Cultural Readiness and Coercive Pressure: Both of these variables have extremely low beta coefficients and large p-values, which suggest that their association with business analytics adoption is unstable and statistically negligible.
- Informed Action and Innovative Valence: With coefficients just around 0.1, both show positive effects on the adoption of business analytics. The fact that each of their p-values are less than 0.05 indicates that these correlations are highly probable but only moderately strong.

- IT Readiness: Has a coefficient of 0.100 and indicates a positive impact. It is highly likely that this impact exists, with a p-value of 0.017.
- Mimetic Pressure: With a coefficient of 0.140 and a p-value of 0.003, which is exceptionally important, this hypothesis has a significant positive correlation with business analytics usage.
- Partnership Readiness and Resource Readiness: Strong p-values and low beta coefficients indicate there is no statistically significant relationship between the two variables.
- Representational Fidelity, Strategic Readiness, and Transparent Interaction: With coefficients fluctuating between 0.115 to 0.128, all three of the variables show moderately positive effects on business analytics implementation. They are deemed significant because their p-values are less than 0.05.

The findings provide important fresh data about the variables affecting business analytics adoption. While some constructs, such as Cognitive Readiness and Informed Action, strongly influence the adoption of business analytics, others, such as Cultural Readiness and Coercive Pressure, possess less of an impact. The lack of multicollinearity and the substantial correlations identified during hypothesis testing point to a model that is both solid and well-defined. The results can help organisations and authorities identify which areas are crucial to concentrate on for advancing the implementation of commercial statistics.

Table XV Variance Inflation Factor Analysis

	VIF
Business analytics adoption → decision performance efficiency	1.000
Business analytics adoption → decision performance effectiveness	1.000
Cognitive readiness → business analytics adoption	2.679
Cultural readiness → business analytics adoption	2.112
Coercive pressure → business analytics adoption	2.128
Informed action → business analytics adoption	2.755
Innovative valence → business analytics adoption	2.154
IT readiness → business analytics adoption	1.740
Mimetic pressure → business analytics adoption	3.307
Partnership readiness → business analytics adoption	1.557
Representational fidelity → business analytics adoption	1.868
Resource readiness → business analytics adoption	2.175
Strategic readiness → business analytics adoption	2.623
Transparent interaction → business analytics adoption	2.854

Hypotheses	R^2	β	M	STDEV	t-value	p-value	Result
Business analytics adoption → decision performance efficiency	0.301	0.548	0.548	0.044	12.371	0.000***	Accepted
Business analytics adoption → decision performance effectiveness	0.287	0.536	0.535	0.048	11.051	0.000***	Accepted
Cognitive readiness → business analytics adoption	0.676	0.143	0.141	0.060	2.387	0.009**	Accepted

Cultural readiness → business analytics adoption		0.034	0.033	0.046	0.743	0.229	Rejected
Coercive pressure → business analytics adoption		0.007	0.004	0.057	0.121	0.452	Rejected
Informed action → business analytics adoption		0.111	0.117	0.065	1.726	0.042*	Accepted
Innovative valence → business analytics adoption		0.109	0.105	0.065	1.678	0.047*	Accepted
IT readiness → business analytics adoption		0.100	0.102	0.047	2.115	0.017*	Accepted
Mimetic pressure → business analytics adoption		0.140	0.137	0.051	2.766	0.003**	Accepted
Partnership readiness → business analytics adoption		0.010	0.011	0.043	0.222	0.412	Rejected
Representational fidelity → business analytics adoption		0.115	0.115	0.049	2.333	0.010*	Accepted
Resource readiness → business analytics adoption		0.014	0.014	0.047	0.303	0.381	Rejected
Strategic readiness → business analytics adoption		0.118	0.118	0.061	1.925	0.027*	Accepted
Transparent interaction →		0.128	0.129	0.059	2.184	0.015*	Accepted

business analytics adoption							
Notes: β: path coefficient M: sample mean STDEV: standard deviation * Significance level of 0.05 ** Significance level of 0.01 *** Significance level of 0.001							

CHAPTER 6

System Evaluation And Discussion

Using perspectives that encompassed different hypotheses and models, multiple research studies examined the manner in which to alter individual negative attitudes towards the natural world[29]. According to the findings of the aforementioned research, the most significant and crucial investors are younger people [29]. The current generation is burdened by previous as well as current neglect. The younger generation is seen as a strong force for altering behaviour. An acute grasp of the application of computational intelligence (AI) is necessary given the modern industrial scenery, particularly in the context of Sustainability 4.0. Our thorough research study sheds important light on the complexities of business data analytics development and its cascading impacts on processes for making decisions, eventually impacting sustainability metrics, in the framework of Malaysian industrial companies.

6.1 Discriminant Validity

A strong discriminant validity across the concepts we developed was clearly confirmed using the HTMT and Fornell-Larcker assessments. This verification not only confirms the theoretical integrity of the research project but also guarantees that each and every theory adequately conveys its purposeful distinctiveness, preventing intellectual overlapping. Generating meaningful and unique judgements from information has been rendered possible by this essential capability. A comparable HTMT value of 0.680 is shared by Informed Action (INA) and Innovation Valence (INV), which emphasises the distinctive characteristics within the overall framework.

6.2 Multicollinearity Constraints

The Variance Inflation Factor (VIF) results confirmed that multicollinearity is not a concern. Even with significant inflation, the greatest calculated VIF was just 3.307, indicating that each independent variable's influence remained distinct. Given that a limit of 10 is generally accepted, this demonstrates the accuracy of the regression models.

6.3 Influence of Analytics for Business Usage

The significant impact of data analytics deployment on transaction execution metrics—both in terms of efficiency and effectiveness—is strongly highlighted by our statistics. This emphasizes the importance of artificial intelligence and sophisticated data analysis for Malaysian manufacturers who support environmentalism. Obviously, the business analytics implementation serves as the foundation for global sustainability-oriented initiatives rather than only for improvements in operations.

6.4 Examining the Root Causes

When assessing the causes of business analytics adoption, an intricate framework becomes clear. Factors including cognitive preparedness, reasoned action, and strategic readiness stand out as significant determinants. These two factors—cognitive readiness and mimetic pressure—emerged as important incentives. According to the aforementioned, businesses that are more mentally ready to embrace emerging innovations and those that are affected by coworkers or opponents are inclined to employ business data analysis. In contrast, the results revealed low associations among cultural readiness and coercive pressure, indicating that although interior organizational culture and exterior coercive pressures could be regarded as potential catalysts, they might not be the most significant variables in the Malaysian atmosphere. The crucial nature of additional influences, such as Informed Action, Innovative Valence, and IT Readiness, likewise revealed. This underscores how crucial it is to comprehend the practical advantages of artificial intelligence, the generally accepted worth of advances, and the significance for possessing the required computer systems.

6.5 Prospects and the Upcoming Forecast

The road ahead for Malaysian businesses pursuing Sustainability 4.0 is complicated. Even if artificial intelligence and company data analysis are unquestionably situated at the centre of attention, acceptance is influenced by a variety of variables that go beyond technologies. The importance of factors like strategy coordination, cognitive readiness, and creating a culture of open communication cannot be overstated. Additionally, the unanticipated non-significance of particular traits creates opportunities for greater, more reflective investigation. It raises concerns over the distinctive organisational structure of Malaysian industrial companies. Are there geographic variations that reduce the relevance of some commonly recognized variables? Or does the nexus between environmental responsibility and artificial intelligence suggest an alternative paradigm?

The importance of artificial intelligence is clear as Sustainability 4.0 develops as an inspiration for Malaysian businesses. The article clarifies the varied aspects of this voyage, providing a tactical road map and crucial inquiries for further investigation. According to what has been discovered, the path to achieving environmental sustainability via intelligent machines involves both organisational intricacies, strategic vision, and human readiness in addition to innovation.

6.6 Concluding Remark

This study highlights the critical role artificial intelligence (AI) plays in encouraging sustainability in Malaysia's industrial industry. The interaction between the widespread use of innovation and Sustainability 4.0 is shown to be intricate, with factors ranging from the cognitive to the tactical determining what happens next. Although the innovation has a global reach, Malaysian conditions heavily influence how it is used in practice. The paper offers important perspectives at a critical moment in the business's digital rebirth and offers an outline of actions for both commercially interested parties and the government. In the final analysis, integrating intelligent machines with environmental responsibility reflects not only a business necessity but also an aspiration for the prospects of environmentally friendly production.

CHAPTER 7

7.1 Conclusion

In conclusion, this research study has investigated that the variables impacting statistical analysis implementation within enterprises. The study found that effective use, environmental readiness, organizational readiness and decision perdormance are significant predictors of business analytics adoption. Additionally, data quality management, managerial obstacles, and analytics centralization were found to be significant barriers to adoption. The variables which are getting affected via details given are extended in the investigation according to the collection of published work about business analytics adoption, which can help organizations in making informed decisions regarding the implementation of such systems. The findings also have practical implications for managers, as they highlight the importance of addressing organizational readiness and data quality management in order to facilitate successful adoption of business analytics. Overall, the study underscores the importance of understanding the complex interplay of external variables, enterprises or technical aspects via the adoption of business analytics. Further research in this area can build on these findings to explore additional factors and develop more comprehensive models of adoption.

The present research extensively examines the relationship between artificial intelligence (AI) and sustainability 4.0 in the Malaysian manufacturing industry. We discovered key characteristics that affect the effective use of computer vision in achieving long-term objectives using discriminant validity measures such as the Fornell-Larcker criterion, the heterotrait-monotrait ratio, and variance inflation factor analyses. The findings provide intriguing perspectives, illustrating that the technology's revolutionary influence on production goes beyond robotics and improved productivity. When properly included, autonomous technology also acts as an incentive for responsible corporate practises, which advances Sustainable development 4.0's overarching goals.

7.2 Recommendations

- Developing Machine Learning Readiness

Considering the importance of cognitive and IT readiness, production facilities ought to give priority to strengthening capacity activities, such as educational seminars and training sessions, to boost employees' knowledge of and skills with the use of artificial intelligence.

- Effective Autonomous Technology Deployment

Companies ought to centre the machine learning projects on vital decision-making procedures, especially those that have an impact on overall efficacy and productivity.

- Negotiating Environmental Impacts

Industries that produce goods should constantly evaluate towards recognised standards while also keeping up with legislative changes connected to automation and conservation, acknowledging the significant influence of coercive and mimetic influences.

- Consistent Assessment

Considering machine learning is developing quickly, businesses ought to set up inspection procedures to make sure their computerised intelligence initiatives are still in line with the big-picture environmental goals.

7.3 Limitations and Future Study

Although the investigation offers comprehensive knowledge of the Malaysian production sector, its conclusions could not possibly be transferable to all industries. A broader comprehension could be obtained by extending the current study to additional geographic or industrial contexts. The dynamic nature of robotics also offers a chance for long-term research that charts the development of machines and their impact on longevity.

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APPENDIX

Questionnaire

Effective use of Artificial Intelligence by Malaysian Manufacturing Firms to Enable Sustainability 4.0

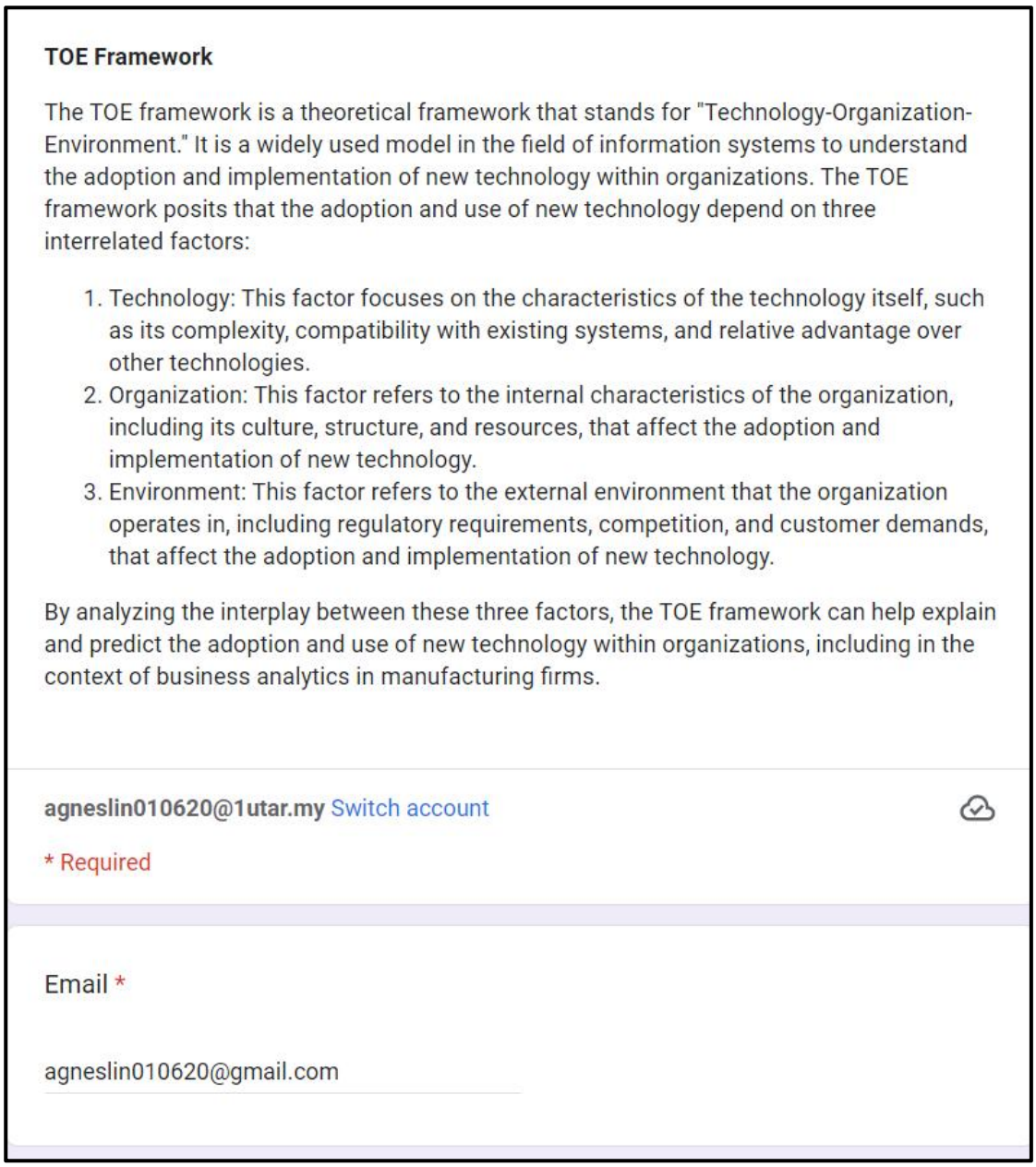
Dear Participant,

1. The study aims to investigate the relationship between effective use of adopting business analytics in the manufacturing industry.
2. The study seeks to understand how the adoption of TOE(Technological, Organizational and Environmental) Framework can facilitate the performance of Manufacturing Firms.
3. The study aims to investigate how the adoption of business analytic ultimately affects the overall performance of the organization.

Your voluntary engagement in the research and the confidentiality of your answers are both guaranteed. Please provide the most accurate response you are able to based on your particular viewpoints and exposures to each question. With the help of your feedbacks, we will be able to more thoroughly investigate the effective use of Artificial Intelligence by Malaysian Manufacturing Firms to Enable Sustainability 4.0.

Theory of Effective Use

The theory of effective use is a conceptual framework that aims to understand how individuals can effectively use information systems to achieve their goals. In the context of adopting business analytics in manufacturing firms, the theory of effective use can provide insights into how employees can use analytics tools to make better decisions and improve their performance. This may involve understanding the various dimensions of effective



TOE Framework

The TOE framework is a theoretical framework that stands for "Technology-Organization-Environment." It is a widely used model in the field of information systems to understand the adoption and implementation of new technology within organizations. The TOE framework posits that the adoption and use of new technology depend on three interrelated factors:

1. Technology: This factor focuses on the characteristics of the technology itself, such as its complexity, compatibility with existing systems, and relative advantage over other technologies.
2. Organization: This factor refers to the internal characteristics of the organization, including its culture, structure, and resources, that affect the adoption and implementation of new technology.
3. Environment: This factor refers to the external environment that the organization operates in, including regulatory requirements, competition, and customer demands, that affect the adoption and implementation of new technology.

By analyzing the interplay between these three factors, the TOE framework can help explain and predict the adoption and use of new technology within organizations, including in the context of business analytics in manufacturing firms.

agneslin010620@1utar.my Switch account

* Required

Email *

agneslin010620@gmail.com

The Respondents' Bios

What is your age?

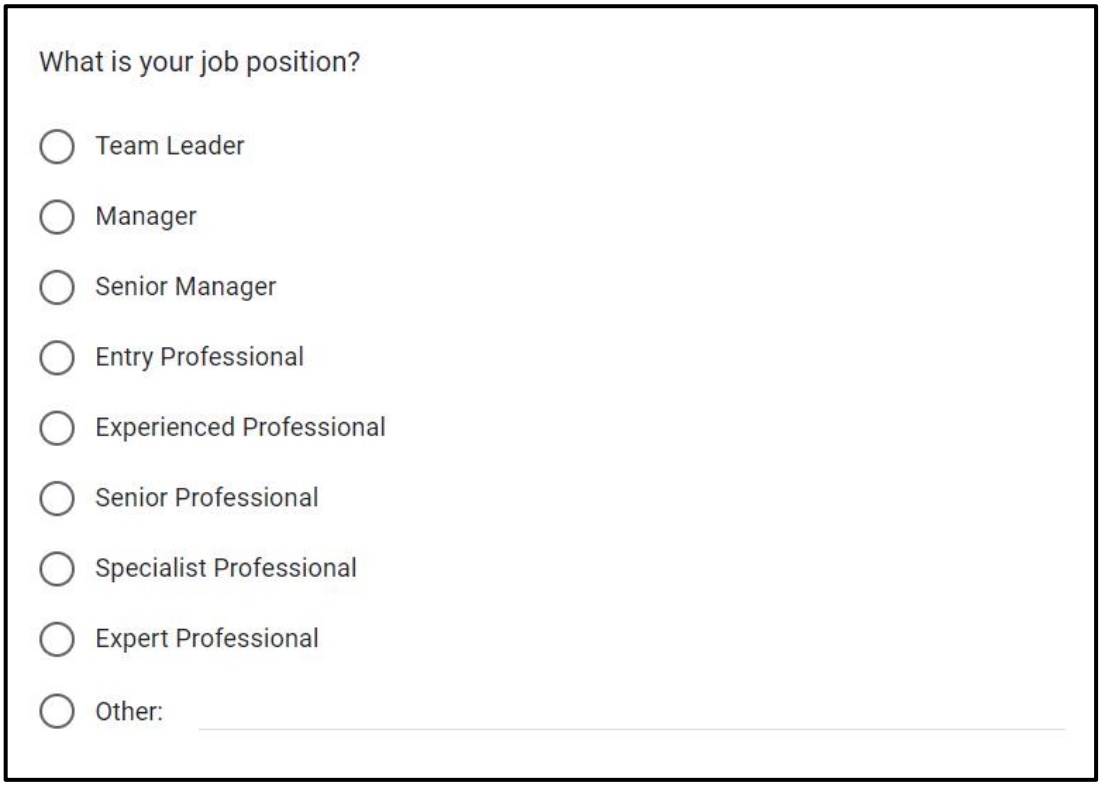
- ◯ Under 12 years old
- ◯ 12-17 years old
- ◯ 18-24 years old
- ◯ 25-34 years old
- ◯ 35-44 years old
- ◯ 45-54 years old
- ◯ 55-64 years old
- ◯ 65-74 years old
- ◯ 75 years or older

What gender do you identify as?

- ◯ Male
- ◯ Female
- ◯ Prefer not to say
- ◯ Other:

What is the highest degree or level of school you have completed?
If currently enrolled, highest degree received.

- ◯ No schooling completed
- ◯ Primary school
- ◯ Some secondary school, no diploma
- ◯ Secondary school graduate, diploma
- ◯ Some college credit, no degree
- ◯ Trade/technical/vocational training
- ◯ Polytechnic colleges, associate degree
- ◯ Bachelor's degree
- ◯ Master's degree
- ◯ Professional degree
- ◯ Doctorate degree
- ◯ Other: _____


What is your job position?

- ◯ Team Leader
- ◯ Manager
- ◯ Senior Manager
- ◯ Entry Professional
- ◯ Experienced Professional
- ◯ Senior Professional
- ◯ Specialist Professional
- ◯ Expert Professional
- ◯ Other: _____

What is your total work experience in the current organization?

- ◯ Less than 1 year
- ◯ 1-3 years
- ◯ 4-6 years
- ◯ 7-10 years
- ◯ More than 10 years

What is the approximate number of employees in your current organization?

- ◯ Less than 50
- ◯ 50-100
- ◯ 100-500
- ◯ 500-1000
- ◯ More than 1000

Updated Questionnaire (Demographic)

The Respondents' Bios

What is your age?

- ◯ 25-35 years old
- ◯ 36-45 years old
- ◯ 46-55 years old
- ◯ 56-65 years old
- ◯ More than 65-year-old

What gender do you identify as?

- ◯ Male
- ◯ Female

What is the size of your company in terms of revenue?

- ◯ Small (Less than RM 1 million)
- ◯ Medium (RM 1 million to RM 50 million)
- ◯ Large (More than RM 50 million)

Which manufacturing sector does your firm primarily operate in?

- ◯ Electronics and Electrical Equipment
- ◯ Automotive and Transportation Equipment
- ◯ Textiles and Apparel
- ◯ Machinery and Equipment
- ◯ Chemicals and Pharmaceuticals
- ◯ Food and Beverage
- ◯ Other:

What is your primary role within the organization?

- ◯ Senior Management/Executive (e.g., CEO, CFO, CTO)
- ◯ Operations/Production Manager
- ◯ IT/Technology Manager
- ◯ Research & Development Manager
- ◯ Sustainability Manager
- ◯ Other: _____

How many years of experience do you have in the manufacturing industry?

- ◯ Less than 1 year
- ◯ 1-5 years
- ◯ 6-10 years
- ◯ More than 10 years

How familiar are you with AI technologies?

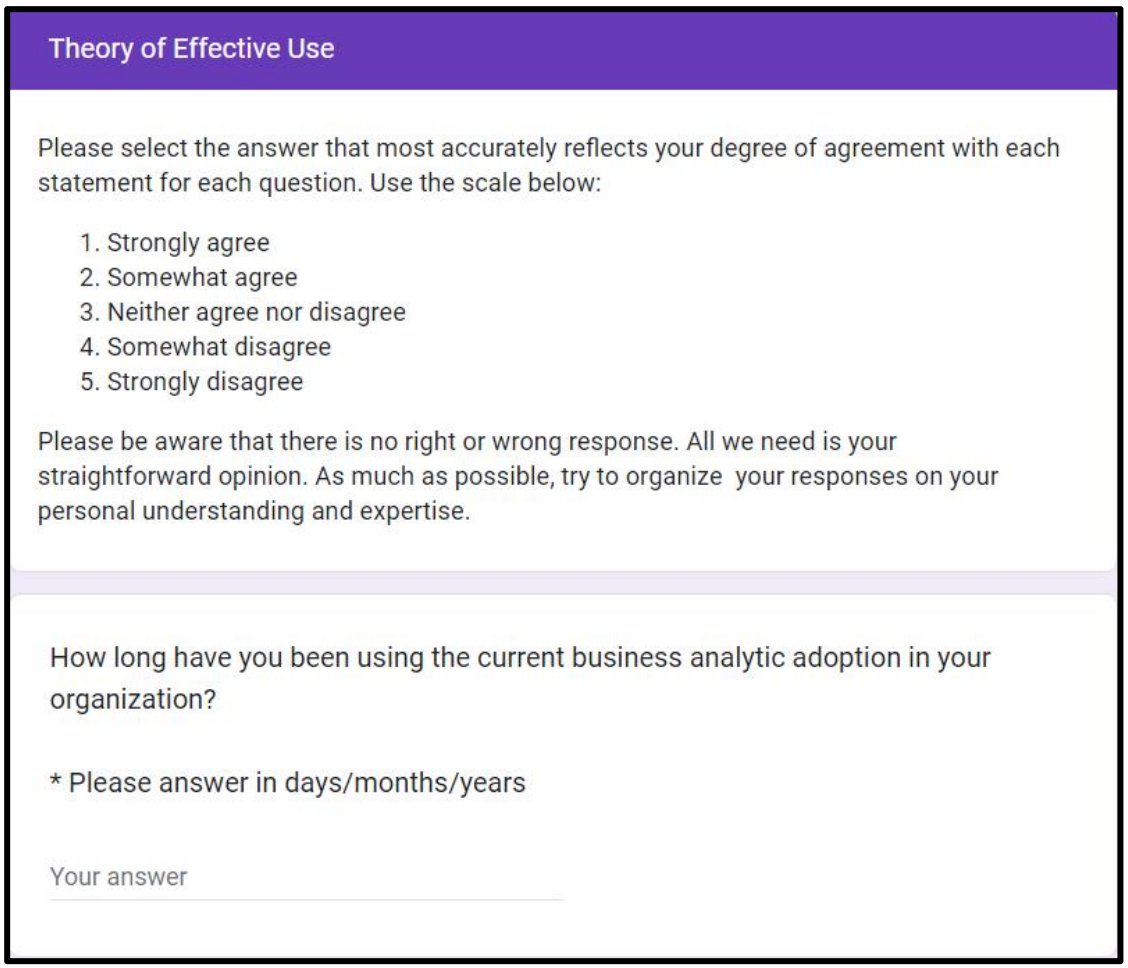
- ◯ Very familiar
- ◯ Somewhat familiar
- ◯ Not familiar at all

How familiar are you with sustainability concepts in the manufacturing context?

- ◯ Very familiar
- ◯ Somewhat familiar
- ◯ Not familiar at all

Which of the following best describes your organization's attitude towards innovation?

- ◯ Highly innovative and open to change
- ◯ Somewhat innovative with cautious approach
- ◯ Generally resistant to change and innovation



Theory of Effective Use

Please select the answer that most accurately reflects your degree of agreement with each statement for each question. Use the scale below:

1. Strongly agree
2. Somewhat agree
3. Neither agree nor disagree
4. Somewhat disagree
5. Strongly disagree

Please be aware that there is no right or wrong response. All we need is your straightforward opinion. As much as possible, try to organize your responses on your personal understanding and expertise.

How long have you been using the current business analytic adoption in your organization?

* Please answer in days/months/years

Your answer

To what extent do you agree or disagree with the following statements as how do you use information obtained from business analytics to make decisions or recommendations?

(Informed Action)

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I make use of the relevant information to generate particular advice as well as alternatives.	◯	◯	◯	◯	◯
I utilize useful data in enhancing my job performance and giving suggestion or making choices.	◯	◯	◯	◯	◯
I use good pieces of information to detect difficulties, build clarification, and carry out alternatives in my job.	◯	◯	◯	◯	◯

To what extent do you agree or disagree with the following statements as to obtain information from business analytics.

(Representational Fidelity)

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I receive enough reliable information about the real world from BA Adoption.	○	○	○	○	○
I am given clear enough knowledge about the real world via BA Adoption.	○	○	○	○	○
The knowledge I learn about the real world via BA Adoption accurately reflects what is taking place there.	○	○	○	○	○

To what extent do you agree or disagree with the following statements as to obtain information and knowledge easily from business analytics adoption in organization.

(Transparent Interaction)

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I feel the data analysis and visualisation features of the software are simple to use to obtain the knowledge I want.	○	○	○	○	○
I can quickly retrieve the information or data I need using the BA system.	○	○	○	○	○
I have trouble connecting to the software in order to obtain the info or knowledge I require.	○	○	○	○	○

Organization Readiness

Please select the answer that most accurately reflects your degree of agreement with each statement for each question. Use the scale below:

1. Strongly agree
2. Somewhat agree
3. Neither agree nor disagree
4. Somewhat disagree
5. Strongly disagree

Please be aware that there is no right or wrong response. All we need is your straightforward opinion. As much as possible, try to organize your responses on your personal understanding and expertise.

To what extent do you agree or disagree with the following statements regarding your organization's attitude towards **innovation**?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Our organization encourages new ideas and experimentation.	○	○	○	○	○
Our organization is willing to take risks in pursuit of innovation.	○	○	○	○	○
Overall, our organization has a positive attitude towards innovation.	○	○	○	○	○

To what extent do you agree or disagree with the following statements regarding your organization's attitude towards **resources**?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Our organization have sufficient financial resources to support the implementation of new business analytic tools and technologies	○	○	○	○	○
Our organization have sufficient human resources (e.g., skilled personnel, experts) to support the implementation of new business analytic tools and technologies.	○	○	○	○	○
Overall, our company is adaptable when it comes to assigning the right amount of capital required for breakthroughs within its Technological business.	○	○	○	○	○

To what extent do you agree or disagree with the following statements regarding your organization's attitude towards **IT readiness**?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Our organization has access to a variety of innovative technologies (e.g. Google Docs, Microsoft 365) to encourage innovation.	○	○	○	○	○
Our organization has strong responsiveness of the IT and IS teams when it comes to addressing technical issues and resolving problems.	○	○	○	○	○
Overall, the stability, availability, and reliability of IT and IS in our organization is strong for facilitating innovations.	○	○	○	○	○

To what extent do you agree or disagree with the following statements regarding your organization's attitude towards **cultural readiness**?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Our company values innovation and encourages employees to suggest new ideas related to business analytics.	◯	◯	◯	◯	◯
Our company 's leadership supports the adoption of business analytics as part of its overall decision-making strategy.	◯	◯	◯	◯	◯
Our company operate appropriate risk analyses before using IT to support innovations.	◯	◯	◯	◯	◯
Overall, our company has a strong culture that encourages innovation in the IT industry.	◯	◯	◯	◯	◯

To what extent do you agree or disagree with the following statements regarding your organization's attitude towards **strategic readiness**?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
I feel that the IT portfolio is aligned with the strategic goals of the company.	○	○	○	○	○
I have high awareness of the strategic goals of the company that are related to using the IT portfolio to drive innovation.	○	○	○	○	○
Our company review and adjust its strategic goals frequently to accommodate new technology and innovation opportunities.	○	○	○	○	○
Employees encouraged to share innovative ideas that align with the organization's strategic goals.	○	○	○	○	○

To what extent do you agree or disagree with the following statements regarding your organization's attitude towards **partnership readiness**?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Our company collaborate with suppliers for software to facilitate innovations.	○	○	○	○	○
Our company has a long-term collaborative approach with software vendors, managerial experts, and suppliers/vendors to facilitate innovations.	○	○	○	○	○
Overall, the quality of relationships between my companyand its suppliers/vendors is high in terms of facilitating innovations.	○	○	○	○	○

Environment

Please select the answer that most accurately reflects your degree of agreement with each statement for each question. Use the scale below:

1. Strongly agree
2. Somewhat agree
3. Neither agree nor disagree
4. Somewhat disagree
5. Strongly disagree

Please be aware that there is no right or wrong response. All we need is your straightforward opinion. As much as possible, try to organize your responses on your personal understanding and expertise.

To what extent do you agree or disagree with the following statements regarding your organization's attitude towards **mimetic pressure**?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Our company have a clear strategy for incorporating environmentally sustainable practices into its business analytics processes.	○	○	○	○	○
I agree that companies similar to yours who have adopted Green AI have experienced financial benefits.	○	○	○	○	○
In our company's logistics process management, customers perceive those who have adopted Green AI favorably.	○	○	○	○	○
Our company have adopted Green AI and experienced financial benefits within the logistics process management.	○	○	○	○	○

To what extent do you agree or disagree with the following statements regarding your organization's attitude towards **coercive pressure**?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Our company is under significant pressure from current and anticipated environmental regulations to adopt Green AI.	○	○	○	○	○
Our major customers are exerting pressure on our company to adopt Green AI.	○	○	○	○	○
Overall, our company feels compelled to adopt Green AI due to external pressures.	○	○	○	○	○

Firm Performance

Please select the answer that most accurately reflects your degree of agreement with each statement for each question. Use the scale below:

1. Strongly agree
2. Somewhat agree
3. Neither agree nor disagree
4. Somewhat disagree
5. Strongly disagree

Please be aware that there is no right or wrong response. All we need is your straightforward opinion. As much as possible, try to organize your responses on your personal understanding and expertise.

To what extent do you agree or disagree with the following statements regarding on the decisions for which you have used the **Business Analytic Adoption**?

(Decision-Making Efficiency)

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
The business analytic tools I use help me make decisions more efficiently.	◯	◯	◯	◯	◯
The insights provided by business analytics are relevant and useful for making efficient decisions.	◯	◯	◯	◯	◯
I feel more confident in my decisions when I use business analytics to inform them.	◯	◯	◯	◯	◯

To what extent do you agree or disagree with the following statements regarding on the decisions for which you have used the **Business Analytic Adoption**?

(Decision-Making Effectiveness)

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Business analytics help me to make decisions effectively that contribute to achieving the goals set by my company	○	○	○	○	○
I can use business analytics to make decisions that contribute to achieving the anticipated metrics for success (KPIs) in my company.	○	○	○	○	○
My decisions based on business analytics have been effective in achieving the KPIs expected by my company.	○	○	○	○	○

Business Analytics Adoption

Please select the answer that most accurately reflects your degree of agreement with each statement for each question. Use the scale below:

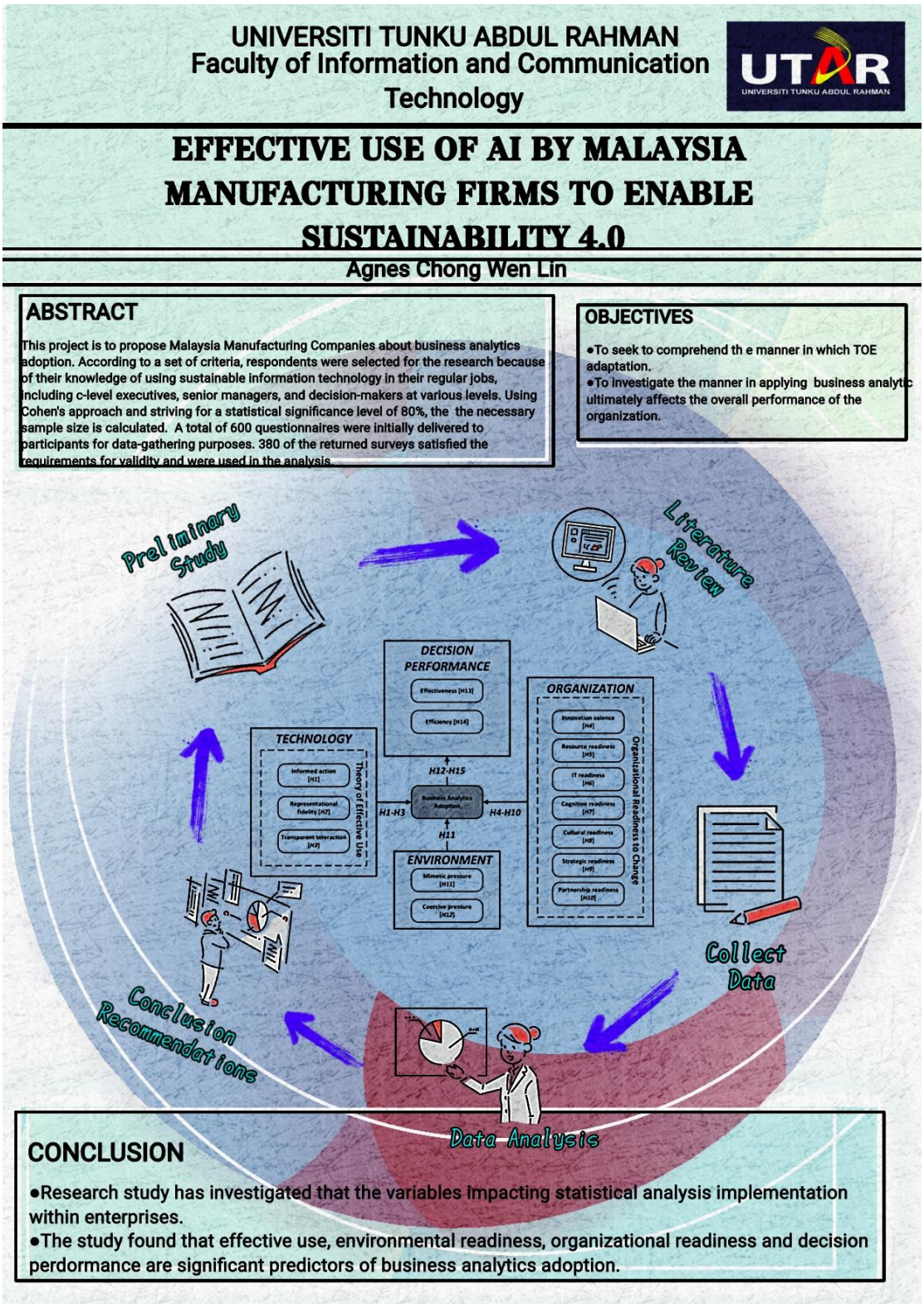
1. Strongly agree
2. Somewhat agree
3. Neither agree nor disagree
4. Somewhat disagree
5. Strongly disagree

Please be aware that there is no right or wrong response. All we need is your straightforward opinion. As much as possible, try to organize your responses on your personal understanding and expertise.

To what extent do you agree or disagree with the following statements regarding on using t**he Business Analytic Adoption**?

	Strongly agree	Somewhat agree	Neither agree nor disagree	Somewhat disagree	Strongly disagree
Our company aims for execution business analytic adoption	○	○	○	○	○
Future plans for our company include using BA adoption on a continuous basis	○	○	○	○	○
Our company is committed to encouraging companies to implement BA adoption.	○	○	○	○	○

POSTER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EFFECTIVE USE OF AI BY MALAYSIA MANUFACTURING FIRMS TO ENABLE SUSTAINABILITY 4.0
Agnes Chong Wen Lin
ABSTRACT
This project is to propose Malaysia Manufacturing Companies about business analytics adoption. According to a set of criteria, respondents were selected for the research because of their knowledge of using sustainable information technology in their regular jobs, including c-level executives, senior managers, and decision-makers at various levels. Using Cohen's approach and striving for a statistical significance level of 80%, the the necessary sample size is calculated. A total of 600 questionnaires were initially delivered to participants for data-gathering purposes. 380 of the returned surveys satisfied the requirements for validity and were used in the analysis.
OBJECTIVES
●To seek to comprehend th e manner in which TOE adaptation.
●To investigate the manner in applying business analytic ultimately affects the overall performance of the organization.
Preliminary Study
Literature Review
DECISION PERFORMANCE
Effectiveness [H13]
Efficiency [H14]
ORGANIZATION
Innovation valence [H4]
Resource readiness [H5]
IT readiness [H6]
Cognitive readiness [H7]
Cultural readiness [H8]
Strategic readiness [H9]
Partnership readiness [H10]
Organizational Readiness to Change
TECHNOLOGY
Informed action [H1]
Representational fidelity [H2]
Transparent interaction [H3]
Theory of Effective Use
H12-H15
H1-H3
Business Analytics Adoption
H4-H10
H11
ENVIRONMENT
Mimetic pressure [H11]
Coercive pressure [H12]
Collect Data
Conclusion Recommendations
Data Analysis
CONCLUSION
●Research study has investigated that the variables impacting statistical analysis implementation within enterprises.
●The study found that effective use, environmental readiness, organizational readiness and decision perdormance are significant predictors of business analytics adoption.

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: S2 Y4	**Study week no.: 10**
Student Name & ID: Agnes Chong Wen Lin 1801648	
Supervisor:Dr Mohammad Dalvi Esfahani	
Project Title:Effective use of Artificial Intelligence by Malaysian Manufacturing Firms to Enable Sustainbility 4.0	

1. WORK DONE

Doing data analysis via online to gain more existing solutions in conducting stimulation. Evaluate and create table to develop a research framework by expanding the theory of effective use and TOE model for adoption of business analytic.

2. WORK TO BE DONE

Update Google Survey form and start to gather data.

3. PROBLEMS ENCOUNTERED

Time to distinguish research paper is limited to read, examine, and summarize into main contents.

4. SELF EVALUATION OF THE PROGRESS

Good

Supervisor's signature

Student's signature

FINAL YEAR PROJECT WEEKLY REPORT

(Project II)

Trimester, Year: S2 Y4	**Study week no.: 12**
Student Name & ID:Agnes Chong Wen Lin 1801648	
Supervisor:Dr Mohammad Dalvi Esfahani	
Project Title:Effective use of Artificial Intelligence by Malaysian Manufacturing Firms to Enable Sustainbility 4.0	

1. WORK DONE

[Please write the details of the work done in the last fortnight.]

Do planning schedule. Update Google Survey form and start to gather data. Differentiate measurement items and conductCalculation of the Algorithm's Assessment.

2. WORK TO BE DONE

Write thesis writing in Chapter 5,6 and 7

3. PROBLEMS ENCOUNTERED

Growing pressure for positive results.

4. SELF EVALUATION OF THE PROGRESS

Good

Supervisor's signature

Student's signature

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PLAGIARISM CHECK RESULT

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY

Full Name(s) of Candidate(s)	Agnes Chong Wen Lin
ID Number(s)	1801648
Programme / Course	IB
Title of Final Year Project	Effective use of Artificial Intelligence by Malaysian Manufacturing Firms to Enable Sustainability 4.0

Similarity	**Supervisor's Comments (Compulsory if parameters of originality exceed the limits approved by UTAR)**
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Note: Supervisor/Candidate(s) is/are required to provide softcopy of full set of the originality report to Faculty/Institute

Based on the above results, I hereby declare that I am satisfied with the originality of the Final Year Project Report submitted by my student(s) as named above.

Signature of Supervisor

Name: Dr Mohammad Dalvi Esfahani

Date: September 14, 2023

Signature of Co-Supervisor

Name: _____

Date: _____

UNIVERSITI TUNKU ABDUL RAHMAN

FACULTY OF INFORMATION & COMMUNICATION TECHNOLOGY (KAMPAR CAMPUS)

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Student Id	1801648
Student Name	Agnes Chong Wen Lin
Supervisor Name	Dr Mohammad Dalvi Esfahani

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I, the author, have checked and confirmed all the items listed in the table are included in my report.

_____

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Date:September 14, 2023