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The Challenges of Industry 4.0 Technology Adoption in Texas Instruments Electronics in Melaka

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Abstract

Industry 4.0 refer to the convergence of operational technology and information to observe mechanisms in manufacturing and use data to make predictive, perfective, and adaptive decisions to reduce operational costs. Malaysia has less modern technology than other affluent countries. This is due to a lack of information and awareness of Industry 4.0. The annual report of TI shows that rapid technical advancement in markets may result in shorter product life cycles and lower average selling prices for the products. The operational success influenced in part by our capacity to invent, manufacture, and distribute new items in a timely and cost-effective manner. The objective of this study is to identify the challenges of Industry 4.0 technology adoption and investigate the strategies to improve the implementation of Industry 4.0 technology in Texas Instruments company in Melaka. This study has been used qualitative method (interview session) to gather data from targeted respondents which are manager and engineer in Texas Instrument company who implement Industry 4.0. Here, semi-structured interviews using Google Meet act as the main tool for collecting data. The findings in this research expose the company should be take time to understand or plan out the procedure of IR 4.0 technology and take time to implement due to most of machines are used in production. However, they able to experiment with specific Industry 4.0 technologies on more complicated tasks. Besides, this research is only conducted at one company only which is in the Texas Instrument Electronics company in Melaka, Malaysia. Future research can expand to other companies to obtain more accurate data.

1. Introduction

Industry 4.0 refer as the convergence of modern technology and internet is once again altering the industrial landscape (Lasi *et al.*, 2014). Every country's economy is dependent on the industrial sector, which is a significant driver of development and employment creation. Industry, which in this context is concerned with manufacturing, adds value by converting raw materials into completed items (Macdougall, 2014). The manufacturing industry may practically digitize the built-in sensing devices in all production components, goods, and equipment thanks to Industry 4.0. Digital analysis and data processing in ubiquitous systems with the blending of function and physical things are said to have the ability to change every industrial sector in the world.

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Industry 4.0 also refers to the next stage of the manufacturing sector's digitization, in which the Internet of Things (IoT) is expected to play a significant role in feeding information into it and adding value to the manufacturing industry to realize low-volume, high-mix production in a cost-effective manner. It also encompasses the administration and organization of the entire value chain process in the manufacturing business. To construct smarter factories, many groups have advocated for the Industrial Internet of Things and Industry 4.0 ideas (Hermann *et al.*, 2015). The goal of Industry 4.0, according to the extensive literature on the subject, is primarily to develop a smart factory in which products can find their own way through production and establish alternatives in the event of disruptions, as a technological foundation serving cyber-physical systems and the "Internet of Things and Services."

Industry 4.0 is terms that refer to the convergence of operational technology and information to observe mechanisms in manufacturing and use data to make predictive, perfective, and adaptive decisions to reduce operational costs (Jwo *et al.*, 2021). However, many academics agree that industrial improvements require time and include the four components outlined below, which are considered future manufacturing visions, including factory, business, product, and customer.

Texas Instrument Electronics Malaysia is an American technology business headquartered in Dallas, Texas, that designs and manufactures semiconductors and other integrated circuits for sale to electronics designers and manufacturers across the world. Therefore, Texas Instruments has tried to enhance the world by making electronics more accessible with semiconductors. They were innovating in the world's transition from vacuum tubes to transistors, and then to integrated circuits (ICs), and have been advancing IC technology and the ability to reliably manufacture ICs in huge quantities. Each generation of invention builds on the previous one to make technology smaller, more efficient, trustworthy, and affordable, allowing semiconductors to be utilized in electronics everywhere. This is known as Engineering Progress. Texas Instruments' goals of making electronics more affordable through semiconductors is still alive and well today, as we work with our clients to create new applications, particularly in the industrial and automotive sectors.

Malaysia has less modern technology than other affluent countries. This is due to a lack of information and awareness of Industry 4.0, as well as a lack of skills and standards. As a result of fixing this issue, Industry 4.0 has the potential to help local industries increase productivity, efficiency, and quality, as well as generate new skills and talents for workers. According to Rajnai, (2018) shown one of the issues that organizations facing implementation confront is finance for maintaining Industry 4.0 deployment. Another difficulty that SMEs face is high cost in machine components and IT infrastructures, not to mention the price of IT workers and technical training (Müller, 2018).

In line with previous global patterns, certain critical variables may have an influence on Malaysia's future prosperity and demand a long-term participation. Changes in global supply chains, such as ASEAN and manufacturing locations, rising labor prices, disruptive technologies for boosting productivity, and product quality all need Malaysian firms' creativity and investment in emerging technologies to remain competitive (Nurul *et al.*, 2021).

According to Annual report of Texas Instruments in 2022, rapid technical advancement in markets may result in shorter product life cycles and lower average selling prices for the products. However, Texas Instruments make significant investments in R&D to improve existing technology and products, develop new products to meet changing customer demands, and improve our production processes. In certain cases, Texas Instruments may not get a return or the expected return on an investment since they are often made before commercial viability can be proven. The objectives of this study are as the following:

i. To identify the challenges of Industry 4.0 technology adoption in Texas Instruments Melaka.
ii. To investigate the strategies to increase the implementation of Industry 4.0 technology in Texas Instruments Melaka.

The scope of this study is focusing on the manufacturing sector and will only be conducted at Malaysian manufacturing firms that have incorporated the industry 4.0 technology. This study has been used qualitative method (interview) to gather data from targeted respondents which are the mechanical engineer, and manager in manufacturing firm who implement Industry 4.0.

The Malaysian manufacturing enterprises that employ Industry 4.0 technologies will profit economically. Besides, the manufacturing firms can encourage mass production to optimize output and obtain a high degree of organizational collaboration. Furthermore, the corporate organization has shifted to a decentralized management structure, which allows for rapid and effective issue handling daily. When a company can leverage big data to produce values, it has an advantage in the market. In addition, Industry 4.0 helps governments foster an open, flexible, knowledge- and skill-based economy, promotes international trade, and improves the efficiency and efficacy of health and social care systems.

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2. Literature Review

2.1 Application of Industry 4.0 Technology

Industry 4.0 is defined as the digital revolution driven by linked technologies to create a cyber-physical organization (Rodríguez, 2021). According to Aiman *et al.*, (2016) study suggested Industry 4.0 technologies will be heavily industrial age, which will be referred to as Smart Factory or Smart Manufacturing. Furthermore, as the vision of Industry 4.0 is real-time digitization with value addition, it is regarded as revolutionary rather than evolutionary (Neugebauer *et al.*, 2016). Combining all these technologies and concepts, the consulting company called Boston Consulting Group (BCG) defined nine pillars of Industry 4.0 in 2016 (Sandner *et al.*, 2020).

2.1.1 Big Data and Analytics

The concept of big data refers to enormous, diversified, and complicated datasets that influence a company's strategic decision-making. The framework of Big Data could be summarized as data as a tool (solving conventional value chain problems with current capabilities), data as an industry (new enterprises and developing software solutions for managing big data), and as a strategy (building data resources by developing new innovative business models). Big data analytics is the process of analyzing enormous datasets to obtain information about consumer preferences, algorithms in case of correlations, trends, and other information. Big data analytics might be applied in a variety of domains, including defect prediction to minimize mistake probability, (Ji & Wang, 2017) and big data driven predictive algorithms to mitigate damage before it occurs (Seele, 2017). The capacity to manage big data provides organizations with a competitive advantage, which could help their operations, marketing, customer experience and other areas.

2.1.2 Robotics

With Industry 4.0, the use of more industrial robots in industries in increasing. Robots might be utilized in a variety of application such as manufacturing, shipping, distribution activities, and they could be managed remotely by people owing to the human robot collaboration. Several innovative robotics technologies such as Kuka LBR IIWA completes delicate duties in workplaces and collaborates with humans. This robot can learn from human colleagues and check, optimize and document work with the use of cloud systems (Aiman *et al.*, 2016).

2.1.3 Simulation

Simulation tools aid in production-related activities by establishing a more sustainable manufacturing environment. The digital tools used to create the manufacturing system, have the potential to self-configure. In increasingly competitive corporate environments, simulation provides modifications to complicated systems by planning the operations, having the knowledge and information, and making precise system estimations by utilising the engineering capacity (Weyer *et al.*, 2016). The strategic planning might be accomplished using simulation models that enable dynamic analysis of production systems using real-time data. Therefore, the system generates real-time optimization on operations (Uhlemann *et al.*, 2017).

2.1.4 System Integration

Vertical integration refers to the flexible and adaptable systems and the extent to which they are completely integrated with one another to achieve agility. Horizontal integration is concerned with the integrating partners within the SC. The industrial network gathers Big Data to enhance system performance and sends it to the cloud. The framework of the smart factory is created by this coordinating mechanism. Therefore, the manufacturing systems are built as self-organized structures that link all physical objects into one another through smart networks. Furthermore, cloud-based technologies allow vertical partners to interface with one another through common platforms. The product and process flows would be visualized.

2.1.5 Internet of Things (IoT)

IoT refers to the next technology revolution that provides solutions for computations, analytics, using cloud-based platforms. IoT's primary goal is to link the Internet by gathering data from physical objects. Computers or higher-level devices make operational decisions based on data collected (Rahman, 2018). The use of IoT makes company processes nimbler and more interconnected, resulting in a competitive advantage based on SC. Therefore, IoT capabilities of the firms, would be critical in the future, which are largely related with operational agility and effective decision making (Akhtar *et al.*, 2018).

2.1.6 Cloud Computing

Cloud computing (CC) provides several benefits to the ICT paradigm, including assisting SC to automate and integrate while also facilitating management and administration. It is a method of virtualizing resources and services as well as merging server-based system. CC refers to collections of IT resources that provide storage and processing capabilities in a virtual system while serving numerous users. There are three types of cloud computing models. Software as a Service provides access based on the customer purchase, such as ERP, Platforms as a Service where customer is allowed to access their cloud application such as software developers and Infrastructure as a Service provides fundamental activities such as storage capacities. The best-known examples of Cloud systems Google Drive offered by Google, Windows Azur by Microsoft, and Blue Cloud by IBM (Haug, 2016).

2.1.7 Additive Manufacturing

Additive Manufacturing, often known as 3D-Printing, refers the process of producing customized items to meet the needs of clients. The most typical strategy is to use a prototype an 3D printing technology to make small batches while benefiting from having less stock on hand and overproduction. Identifies aerospace companies that employ these approaches to minimize aircraft weight and raw materials use, such as titanium. Several top firms throughout the world invest in 3D printing activities such as Google, Motorola, and Apple to expedite continuous smart phones activities. The anticipated benefit is a decrease in lead times and manufacturing volume, as well as increased mass customization and agility (Conner, 2014).

2.1.8 Artificial Intelligence

Augmented reality is defined as the interactive technology that allows for harmony between the virtual world and its users while the virtual world is being used as the part of the real world. Google Glass, the world's first augmented reality glasses were released. Magic Leap was established in 2011, and it adapts to the human eye by translating the light field angle and depth (He *et al.*, 2017). This technology improves human-machine interaction, by allowing for remote control of maintenance chores and visual inspection of the humans. It could be employed in a variety of applications by mixing computer produced visuals with tangible objects. AR enables its users by leveraging sensor technologies to perform the certain tasks.

2.1.9 Cybersecurity

Another concern is cyber security, which could have a negative influence on corporate environment owing to the malicious aim of terrorist strikes. As a result, preventative remedies and defence systems are required to mitigate the harmful impacts of terrorist occurrences. Some technologies eliminate cyber terror assaults by analysing historical terror attacks through radiation control before new attacks begin. Furthermore, it is critical to build national defence systems and educate personnel to defend against cyber-attacks. Although cyber-war solutions may be costly for businesses, the projected overall cost would be low given the possible harmful impacts of cyber-attacks (Cho, 2017).

2.2 Challenges of Industry 4.0 Technology Adoption in Texas Instruments Melaka

Despite the possibilities, Industry 4.0 is fraught with challenges and takes place in a highly dynamic competitive environment (Porter, 2014). There are a few challenges that may face by Texas Instruments company in Melaka:

2.2.1 Competitiveness

Greater competitive dynamics and easier market entry of new competitors are among the most critical problems in the industry 4.0 era (Kiel *et al.*, 2017). Furthermore, digital connectivity includes data interchange and opening to a competitive market environment, resulting in transparent business ecosystems that are mostly supported by online platforms. In this aspect, businesses must deal with two challenges. For starters, openness exposes manufacturers to the risks of cyber-attacks and industrial espionage, as well as the issue of assuring data rights and access. Corporations that enforce platform standards risk eroding current companies' differentiators and forcing them out of the market (Zhou *et al.*, 2017). To confront these challenges, literature suggests that manufacturing businesses reflect on and methodically reinvent their current business strategy (Arnold, 2016).

Several studies have looked at the link between a competitive market environment and new technology adoption, but there is no agreement on whether it has a positive or negative influence. Implementing new technologies can have a positive influence on competitiveness since they give the opportunity to outperform competitors (Zhu, 2003).

2.2.2 Production

Adoption of Industry 4.0 must be adjusted to specific organizational and production situations, such as different production topologies or firm sizes (J. M. Müller, 2017). This is especially challenging if a corporation lacks the financial resources to undertake a greenfield approach. As a result, existing industrial and logistical systems will need to be upgraded (Erol *et al.*, 2016). In this regard, industrial manufacturers should avoid adopting Industry 4.0 in the form of separate applications.

Otherwise, synchronization and coordination with present manufacturing equipment and processes may result in high levels of complexity and cost, which can be especially challenging for SMEs (Müller, 2018). Several studies have already shown the significance of organizational characteristics including present system complexity (Chau, 1997), and integration (Grover, 1993) for the implementation of new manufacturing technologies.

2.2.3 Security

The success of Industry 4.0 adoption is dependent on security. The resilience of manufacturing processes is heavily dependent on manufacturing businesses' understanding of the current threat landscape and the security architecture in place to guard against threats. There are security issues associated with these application areas such as smart manufacturing, smart homes, transportation and warehousing, healthcare, retail and logistics, environmental monitoring, finance, and insurance.

Many organizations view cyber security as primarily a technological issue. Executives in both public and private companies are aware of the threat and do not want attackers to gain access to critical business information (Kaplan *et al.*, n.d.). In recent years, most large corporation have significantly improved their cyber security capabilities. With technological investments, millions of dollars have been spent to develop new strategies to reduce the risk of cyber-attacks in IT security.

2.2.4 Culture Change

According to Hofmann, (2017) shows that Industry 4.0 has an impact on business by changing how products are designed, manufactured, delivered, and paid for. As a result, human and technological resources are critical in making business decisions, and the culture is possessed by the individuals who are a part of said organization. Workers' cultural differences may have an impact on company effectiveness (Baumgartner & Weijters, n.d.) because diverse social groups coexist in these cultures, with members from various regions, generations, and socioeconomic groups (Kirkman, 2017).

As a result, culture is a predictor of organizational success because it can foster innovation, and flexibility in response to the uncertainty of its environment (Barczyk, 2019a). However, Industry 4.0 technologies have been associated with the development of essential activities and have been implemented in companies operating in a highly competitive global environment, rather than in emerging economies (Demeter, 2020). According to Mazali (2018), people's involvement in organizational transformation is linked to culture, digital society, and Industry 4.0. Workers can participate in operations of individualization of work and spread a culture that assigns responsibility to the individual at the expense of a collective identity.

2.3 Strategies to Increase the Implementation of Industry 4.0 Technology in Texas Instruments Melaka

2.3.1 Government

Government determine and put in place effective, simplified, and harmonized data, legislation, regulations, and compliance standards inside and across ministries and agencies. Government also collaborates with companies to ensure adequate data privacy rules are in place, including acceptable data management, ownership, and storage.

2.3.2 Organization

To achieve Industry 4.0 alignment, organizations must manage many internal and external aspects to increase economic value and build a lasting competitive advantage. Strategic alignment must be achieved at both the enterprise and departmental levels for organizations to manage all the multiple internal and external factors described in the preceding section strategically.

2.3.3 Media Social

Many concepts are related with Industry 4.0 including Embedded Systems, Internet of Things (IoT), and Cyber-Physical Systems. However, many firms are working on various parts of Industry 4.0, but there are four

prerequisites for industrial acceptance which are investment protection, stability, data privacy, and cybersecurity (Drath & Horch, 2014).

3. Methodology

3.1 Research Design

This research used a descriptive method by conducting interviews (qualitative) at Texas Instruments Electronics Company in Melaka. The interview will be performed in accordance with Google Meets' quality approach. The population in this study is manufacturing sector in Texas Instruments Melaka to investigate the challenges of Industry 4.0 adaptation technology. The top management in this company was interviewed which are mechanical engineer, and manager. Table 2 in Appendix B shows that a flow chart of research methodology.

3.2 Data Collection

For this study, data have been collected from two sources that are primary data and secondary data. The primary data in the research were two individuals who had overseen implementing Industry 4.0 had interviewed which are the engineer and manager. The secondary data includes published articles about Industry 4.0 technology and historical documents. Due to limitations during the pandemic, Google Meet seems to be the best approach for realization of this research.

3.3 Data Analysis

The interview process has three major stages that are introduction and entry, the main part of the interview and lastly, the exit. In the introduction and entry stage, the interviewer gets the approaches and authorization from the respondent. In addition, the interviewer managed to convince and get the cooperation from the respondent. The main part consists of the interviewer asking the question to the respondent and at the same time, the interviewer recording answers. The good interviewer knows when and how to use probes. The last stage is the exit. The interviewer thanks to the respondent and leaves.

4. Results and Discussion

4.1 Thematic Analysis

The data analysis process is best depicted as a spiral by traveling in analytic rings leading to a more centered circle (Castleberry, 2018). Throughout this key step of the research process, the researcher will gather analytical inferences from the data represented as codes and then themes. Even though the phases of data analysis are stated in a linear order, interpretation does not have to wait until the completion of the process. The researcher's interpretation should occur throughout the first three phases compiling, disassembling, and reassembling (Matowe, 2019).

4.2 Demographic of Respondents

The demographic of the respondents from the Texas Instruments Electronics in Melaka is represented in Table 1. R1 as a manager in semiconductor and manufacturing department and has 7 years of working experiences. Besides, R2 and R3 are the engineer in Texas Instruments company, as well as R2 has only 3 months of working experience and R3 has 2 years of working experiences. The background of respondents from the interview is shown in Table 1 in Appendix D. Their job experience and responsibilities will be included here.

Table 1 *Background of respondents*

Respondent	Position	Sector	Year of experience
R1	Manager	Semiconductor & manufacturing	7 years
R2	Manufacturing Product Engineer	Manufacturing	3 months
R3	Test Engineer	Semiconductor	2 years

4.3 The Adoption of Industry 4.0 Technology in Texas Instruments Melaka

Table 2 presents the results of the interviews performed about the implementation of Industry 4.0 technology. According to a survey of respondents, the company utilized the IR 4.0 technology in their company. The purpose

of this part is to collect respondents' ideas and perspectives on implementation of IR 4.0 technology in their company.

Table 2 *Response about the implementation of Industry 4.0*

Application	R1	R2	R3
IoT	✓	✓	✓
AI	✓	✓	
Cloud computing	✓	✓	
Robotics	✓	✓	✓
Big data and Analytics	✓	✓	✓
Simulation	✓	✓	
Cybersecurity	✓	✓	
Additive manufacturing	✓		✓
System integration	✓	✓	

Based on Table 2, R1 used all the IR4.0 technology in his department. As R1 mention in interview, IoT used to monitor quality and devices test throughout the manufacturing chain. Secondly, cloud computing enabled to store, analyze, and process the data of machine performance. Besides, one option is the design of chips for AI is to send constant signals or data to operator and used robotics is more efficient because of the tasks is repetitive. Other than that, big data used to offer essential performance information so that we can make critical decisions. R1 stated that simulation is important to schedule, precise equipment modelling, and industrial control. In addition, cybersecurity used to store and protected a significant data securely, as well as offer security fixes over the duration of the product's lifecycle. Furthermore, additive manufacturing used to automate testing includes quality control, equipment, and materials. Lastly, system integration involved combining existing; often diverse systems while giving the organizations with existing system machine usage.

Furthermore, R2 used all the IR4.0 technology in the manufacturing sector except additive manufacturing. This is because the materials used in additive manufacturing are significantly more expensive than those used in traditional production. However, R2 stated that IoT able to monitor probing performance on the tester and cloud computing can help to pull data of machine performance. In addition, implementation of AI robots is to send upcoming lots to operator. Robotic is the used of handler to test a thousand of IC units and simulation can provide simulator for debugging purposes. Other than that, big data provided databases of yield performance for each device. System integration can provide documentation of existing, or system machine used in the company.

Next is R3 as a test engineer, he in charge of electrical and computer engineering in their company. In the semiconductor sector, R3 stated that he only implemented 4 of IR 4.0 technology in their company which were IoT, Robotic, Big Data, and Additive manufacturing. However, R3 had been used IoT for controlling the temperature. For robotic, AGV has been used to automated pick and placed arm. Other than that, big data as a production data storage and accession for past ten years and Additive manufacturing can automated test equipment to improves productivity and reduced factory lead times.

4.4 Challenges of Implementing Industry 4.0 Technology

To verify the difficulties and challenges of implementing IR4.0 technology in the Texas Instruments company. The researcher would like to identify the challenges that respondents have while implementing IR4.0 technology in the company. Based on an interview with two respondents, researchers identified the challenges that must be overcome when implementing IR 4.0 technology. The findings from the interviews concerning the challenges of IR 4.0 technology will be shown in Table 3.

Table 3 *Response about the challenges of Industry 4.0*

Challenges	R1	R2	R3
Competitiveness	✓	✓	✓
Production	✓	✓	✓
Security			
Culture change	✓		

Based on Table 3, the following are the main problems that must be resolved when implementing IR 4.0 technology. According to the data gathered, R1 has faced three challenges, while other two respondents are only faced two issues in their sector of Texas Instrument company. Firstly, R1 stated that we must take time to analyze a procedure to improve the company competitiveness in the timely way. Since the company implemented IR4.0 technology, most employees have had to learn to use it to increase output. Besides, IR4.0 technology is still in its infancy in Malaysia, so we still need time to implement because most of the equipment are employed in manufacturing, thus it can assist improve their productivity. For the issue of culture change, R1 stated that they need to take time to get used to the changes of culture because of the changes in a short period of time.

Furthermore, R2 believes that if IR 4.0 technology is used in the company, there will be few issues since Malaysia still a poor nation, not a developed country with advanced technology and many experts. Furthermore, IR 4.0 technologies are still in the process of being evaluated and is not yet stable. R2 stated that the company should be take time to understand or plan out the procedure of IR 4.0 technology and take time to implement due to most of machines are used in production.

According to R3, it is extremely difficult to coordinate the use of IR 4.0 technologies in a short period of time when the economy is unstable. R3 stated that ever since the implementation of IR 4.0 technology in the company, most of the workers are required to go for training and learn how to use these technologies. New workers have a hard time at the beginning to use the technology. Furthermore, the company need to overcome the limitation in increasing the number of test sites to improve their productivity

4.5 Strategies in Increasing the Implementation of Industry 4.0 Technology

Researchers conducted interviews with respondents in this part to assist them in determining the most legitimate and appropriate strategies for integrating IR 4.0 technology in their company. Table 4 displays the findings from the interviews regarding the strategies for increasing the implementation of IR 4.0 technology.

Table 4 *Strategies in increasing the implementation of Industry 4.0 technology*

Strategy	R1	R2	R3
Government			
Organizational/worker	✓	✓	✓
Media social/society	✓	✓	✓

The respondents in Table 4 have explained on each party should play their role to implement IR 4.0 technology in the Malaysian manufacturing industry. The purpose for every organizational to implement new reforms is to improve their productivity and quality of company. R1 stated that organization that can learn in real time from data can be more responsive and efficient. It also assists the company in lowering production risks, performing preventative maintenance, and developing products. Besides, the company utilize media social to stay up to date on the newest IR4.0 technology so that businesses can maintain and improve efficiency, as well as it can be used in train new employee.

Furthermore, R2 stated that IR 4.0 technology in Malaysia is still being evaluated and is not yet stable, so that Texas Instrument company may observe on how other companies are implementing the IR 4.0 technology and try to adapt to it in the short period. Besides, R1 agrees with the assertion that social media plays an important role in promoting IR 4.0 technology. This is due to keep up to date regarding new Industry 4.0 technology so the company can maintain and improve their productivity.

According to R2, transition to new testing platform with higher capability test equipment is one of the best strategies for increasing the implementation of Industry 4.0 technology is for the organization. This will allow the company reduce development costs and improving their performance. However, it will also improve process control and significantly reduce lead times. Furthermore, R2 also agrees that the social media can help to increase the implementing of IR 4.0 technology. The company may try to improve efficiency by utilizing information technology with Industry 4.0.

5. Conclusion

According to data analysis, R1 has faced three issues, and other two respondents have only faced two same challenges during implemented Industry 4.0 technology, including competitiveness and production challenges, as well as one more is culture change issue. According to Bal & Erkan, (2019), the report stated that among the 140 countries in competitiveness ranking, Malaysia has not placed in the top 10 places. It can say that Malaysia is not very skilled in mastering and implementing the industry 4.0 technology compared with other countries such as Singapore, Germany, and United States. Furthermore, global competitiveness analysis includes the basic

factors such as how countries conform to the globalisation, a sustainable increase in income and job opportunities for the unemployed, how efficient manufacturing factors are used, and how high quality and low-cost manufacturing companies are. The respondents in this study have been take time to understand and learn how to use these technologies effectively in the sector.

Next challenge is production challenge which faced by respondents when implement Industry 4.0 technology. According to Mohamed (2018), the skills and qualities of its personnel, such as problem-solving abilities, failure analysis, and the capacity to deal with rapid changes and whole new vocations, are difficult issues for businesses wanting to apply this new manner. However, they may test certain Industry 4.0 technologies on more complex tasks such as data collection, processing, and visualization during the manufacturing process. So that, the respondents in this study stated that they may take more time to implement to most of machine are used in production and limiting in increasing number of test sites.

Besides that, R1 stated that culture change will also one of the challenges in implementing IR 4.0 technology. According to Juhary (2020), the power relations between people and technology are altered by IR4.0 technology. According to a trend estimate for 2025 and beyond, 10% of people will wear Internet-connected apparel, more than 50% of home equipment will be Internet-connected, and 80% of the world's population would have Internet connection. However, R1 stated that the company had taken time to get used to the changes. Another two respondents are disagreeing that culture change as an issue for implement Industry 4.0 technology. Implementing Industry 4.0 requires changing the business culture. According to Veile *et al.* (2020) stated that management should begin cultural changes from the top down and act as a role model, leading by example and offering a clear vision. They suggest that to lessen the likelihood of internal resistances, business culture should be transformed slowly rather than drastically. However, a high degree of readiness to learn, creativity and idea creation, entrepreneurial attitude, and leadership are all characteristics of an Industry 4.0-adequate corporate culture. In this context, experts argue that corporate culture should always prioritize the consumer and his needs. Besides, culture influenced organizational performance because it encourages innovation, risk-taking, and flexibility in the face of environmental instability (Barczyk, 2019b). Furthermore, the challenge of culture change had no effect on the respondents' work performance.

Lastly, there have only one challenges that all respondents are not agree which are security. The success of Industry 4.0 adoption is dependent on security. The resilience of manufacturing processes is heavily dependent on manufacturing businesses' understanding of the current threat landscape and the security architecture in place to guard against threats. According to data analysis, the respondents disagree that the security as a challenge in their company because they are certified in all these areas and are well-versed in their production processes. It is important that all workers involved in the production process understand the security processes and see security as a priority rather than a feature. Furthermore, the danger of a centralized control system reduced by using decentralized systems. According to Bodkhe *et al.* (2020), the database authority has centralized control over the security necessary for all users to get access. The blockchain saved data and constructs structural data storage, making the network more secure.

The final objective of this study is to investigate the strategies to increase the implementation of Industry 4.0 technology in Texas Instruments Melaka. According to Evanthia K. (2020), governments that fail to implement appropriate long-term policies will harm their economies. When other economies are accelerating, their unwillingness to adjust to the new reality will lead to a reduction in competitiveness, a decrease in revenue, and an increase in spending, with the possibility of bankruptcy increasing. Based on the interview, respondents disagree that the government can help to increase the implementation of Industry 4.0 technology because the company does not rely much on government support.

Therefore, researchers think that everyone is adequately taught and exposed to the notion of these technologies, Industry 4.0 technology will improve in the industry. All parties must carry out their responsibilities. Starting with the educational level even though transition to new testing platform with higher capability test equipment. Besides, they gave individuals at all levels a clear knowledge of the benefits of this technology, and maybe a day everyone will be capable of adapting to it. As respondents said that "observe how other company are implementing the IR 4.0 technology and try to adapt to it."

Besides that, the respondents agree that media social can improved the implementation of Industry 4.0 technology in the Texas Instrument company in Melaka, Malaysia. According to Yilmaz *et al.* (2017), Mobile devices and social media are part of Industry 4. 0 because the production process is transferring to actual integrity, that will develop in accordance management and control systems more flexible. Based on the interview, the respondents stated that social media keep up to data regarding new Industry 4.0 technology so the company can maintain and increased their productivity and tried to improve efficiency by utilizing information technology with IR 4.0 technology.

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Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: ***study conception and design:*** *Lim Wey Nan, Siti Norziah Ismail;* ***data collection:*** *Lim Wey Nan;* ***analysis and interpretation of results:*** *Lim Wey Nan, Siti Norziah Ismail;* ***draft manuscript preparation:*** *Lim Wey Nan, Siti Norziah Ismail. All authors reviewed the results and approved the final version of the manuscript.*

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