

## An Exploratory Study and Impact of Digitalisation on Malaysian SMEs

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\*Corresponding  
author  
nhawani@sirim.my

Nurul Hawani Binti Mat Tuselim<sup>1,2</sup>, Suraya Binti Ya'acob<sup>2</sup>

<sup>1</sup>SIRIM Berhad

<sup>2</sup>Razak Faculty of Technology and Informatics, Universiti  
Teknologi Malaysia

nhawani@sirim.my, suraya.yaacob@utm.my

### Abstract

*Industry 4.0 (I4.0) is a term for the digital revolution in industrial production emerging from the comprehensive networking and computerisation of all areas of production. The changes arising from the digital revolution in the production and value creation process are radical and pose a real challenge to organisation. Small and medium businesses need to develop strategies in good time to exploit the new possibilities of digitisation, to improve established processes and develop new business models. Small and medium enterprises are constantly forming and fighting with the obstacles that market leaders face. As a result, new challenges must be discovered, and the existing worldwide pandemic must be addressed as soon as possible. It has been recognised that not only current organisational structures will not be suitable but the vision from top management, and as a result, digital transformation in industries and leadership has evolved. Through the eyes of tomorrow's leaders, we examined the idea of digitisation and its influence on Malaysian SMEs in this study. The study also suggested that adjustments are required to be made, such as more robust in IT strategic, developing innovative and creative solution, and improving IT infrastructure.*

**Keywords:** Industry 4.0, SMEs, readiness assessment, manufacturing, digitalisation

## 1. Introduction

Small and medium enterprises (SMEs) are playing significant contributions in the economic development with cutting-edge technologies are considered as a backbone of national economy [1]. They serve as a pillar of economic progress, bringing wealth to the people. With technological advancements and the new concept of I4.0, new infrastructure and workplace are created, inspiring people to come up with new and improved ideas and solutions. SMEs is confronted with a various challenge related to political and environmental changes, as well as technical improvements and security measures [2]. The concept of the I4.0 is a game-changer, and it was first mentioned in 2011, when the German government announced efforts to protect industry's competitiveness [3]. As a result, we can conclude that I4.0 which covers digitalisation and smart manufacturing, which is focused on innovation, creation, and acceptance of new technologies and need a strong IT infrastructure, are inextricably linked. Furthermore, recent I4.0 research has concentrated on the adoption of new and sophisticated technologies that have developed in the digitalisation era, and therefore how different organisations would accommodate and leverage these technologies. Previous research has frequently characterised the pillars of I4.0, concentrating mostly on the definition of the term

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\* Corresponding author. nhawani@sirim.my

and where it was established, rather than the impact and use of the technology itself [4].

## **2. SMEs Manufacturing**

Manufacturing companies, particularly SMEs, are struggling to implement I4.0 and reap the benefits of its promise to improve shop floor productivity. They frequently have no idea how to approach the I4.0 problem or how to begin introducing and implementing I4.0 concepts. Only a few studies expressly focus on assisting SMEs' evolutionary journey and paradigm shift toward "Smart Manufacturing" or "Digitalisation" or "Industry 4.0," according to their literature evaluation. Due to the constant growth of innovations and technology, SMEs frequently confront challenges in such creative processes. As a result, more research is needed to develop specific instruments and models for SMEs using I4.0 in their businesses and manufacturing plants. According to some researchers like Schroder and Sommer, the size of the company matters when it comes to implementing I4.0 [1] [5]. According to Sommer, the smaller the company, the more difficult it will be to gain from I4.0, and the more probable it will be to become a victim of it. For a numerous reason, including job creation, increased productivity, and poverty reduction, SMEs are considered as the economy's key driver [6]. In fact, SMEs are vital to enhancing socioeconomic development since they are the best players for encouraging innovation and long-term development strategies. According to De Carolis, SMEs play a critical role in innovation, which is classified as "increasing collective productivity, information exploitation, and breakthrough ideas"[7]. Similarly, it was agreed that SMEs rely greatly on their capacity to meet client demands and requirements to succeed in today's highly competitive business environment.

The second most important issue in the literature is SMEs and technology, particularly SMEs are the supplier of larger Multinational Enterprises (MNEs) in local markets [8]. SMEs incapable to become global players if they are facing higher barriers to entry in international operations and difficulty protecting their intellectual property rights. SMEs should solicit the help of larger corporations when invest in other countries. Entrepreneurs in Malaysia, particularly those in the SME sector, may boost economic growth by investing while also creating jobs for the locals [9]. In this instance, the government's primary job would be to assist entrepreneurs. Local banks and financial institutions can play an essential role by providing the necessary financial resources as well as consulting services [10]. SMEs improve innovation in any country, in sequence, increases productivity [11]. SMEs may also equip their employees with high-skilled experience who can compete in global and international economic developments, as well as potential hazards such as recession and economic catastrophe.

## **3. Managing digitalisation in Industry 4.0**

I4.0 is a term for the digital revolution in industrial production emerging from the comprehensive networking and computerization of all areas of production [12]. Science, technology, business, and politics are all collaborating to bring I4.0 to achievement. It entails a full restructuring of manufacturing processes, with workflows being transformed and synthesised into digital and decentralised processes. Inclusive digitisation for lower manufacturing costs, more resource

efficiency, and a more customer-oriented approach. New business models, innovative goods, and integrated new services must all be developed at the same time [13]. The future of machines will be shaped by internet-connected, self-controlled, and sensor-enabled industrial systems. Research shows that global organizations are developing applications that analyse digital industrial data, and in the future, production will involve robots and objects outfitted with sensors.

The industrial internet, also known as I4.0, is a network of machines, people, and data that will allow us to verify production efficiency throughout its entire life cycle [14]. Men, machines, and products would communicate with one another in the future, allowing the production process to self-organize. It is vital for the organisation, economy, and the country as a whole to understand how to deal with the changes that may occur as a result of the arrival of I4.0 and its applications. Hereof, it is worth noting that I4.0 publications in the software engineering discipline are still in their infancy, and it could be considered as an emerging topic. According to the SCOPUS search results, incremental papers in the topic of SMEs and manufacturing and I4.0 have been published since 2018 - 2021, which includes 263 papers in publications [15]. Also, the found literature at the date of the search leads to the hypothesis that the topic Industry 4.0 in SMEs manufacturing is of increasing importance for scholars in engineering and production research. Future I4.0 research should concentrate on all areas and management paradigms within any firm, such as open innovation and value co-creation [16]. Understanding how SMEs interact with I4.0 is critical because it will aid decision-makers and planners in aligning their strategies with the I4.0 concept.

#### **4. Methodology**

The exploratory research design was used to complete the current research, as it is more relevant and applicable when examining topics based on objectives [17]. In addition, a focus group is defined as a method of collecting primary data in research with the participation of 10 SMEs from the related field of the study [18]. The inclusion criteria for the companies are selected based on their application of Industry4WRD Readiness Assessment: 1) manufacturing and manufacturing related services sector (MRS), 2) valid registration and business licenses, 3) company has at least 60% local equality, and 4) in operation for more than 3 years. The companies were excluded if their main core business was not manufacturing. In this regard, it is worth noting that the focus of group discussion should be on the research area and issue. The interview session by the Readiness Assessor with selected SMEs is based on experience, opinion, and a variety of viewpoints on the subject. Focus group discussion, according to [19], is a method that is frequently employed in qualitative approaches and research. The major goal of this data gathering strategy is to develop and gain a thorough comprehension of the themes that result from a broad overview of digitalisation. The information is gathered from a select group of people who share comparable and common features. Expert top and middle management staff from various SMEs were chosen as participants in our focus group discussion for the current study.

This study is also reliant on secondary data by reviewing numerous articles related to the field of I4.0 in general and its impact on industries in general and its impact on SMEs Manufacturing or digitalisation in particular). When compared to main data, secondary data is more affordable and accessible. After reviewing

multiple articles, we were able to identify limitations of existing digitalisation and how a new approach can overcome those existing limitations.

## 5. Data Analysis and Discussion

The data were analysed using grounded theory. After transcribing the interview, the texts were coded using Atlas.Ti software. The coding process provided six main factors defining the impact of digitalisation on Malaysian SMEs. The main factor of SMEs digitisation is listed in Table 1. Meanwhile, the focus group responses are summarized in Table 2.

**Table 1. The main factor of SMEs digitalisation**

	Factor
1.	Industry 4.0
2.	Industrial 4.0 Enabling Technologies
3.	The Impact of I4.0 on Industries
4.	The Impact of I4.0 on SMEs
5.	Key Benefit of I4.0
6.	Key Benefit of I4.0 on SMEs

### 5.1. Industry 4.0

It is important to understand the previous three industrial revolutions that the world has endured from 1784 to present in order to better grasp the concept of I4.0. To summarise, the First Industrial Revolution (1784–1870) was marked by "the substitution of water/coal/steam power," with the commencement of the revolution occurring in Great Britain [20].

The second industrial revolution (1870-1969), which had seen massive advancements in steel, chemical, and electric generation, altered people's lifestyles [20]. Fuel production, including mass-produced consumption goods has been included. According to Stearns et al., computers, telecommunications, and electronics such as transistor and microprocessor were brought in the third industrial revolution (1970–2011).

Through two major inventions: automations and robots [21], high-level automation is integrated into the production process throughout this revolution. The Industry 4.0 or known as "Fourth Industrial Revolution" is the most current industrial revolution that the world is currently experiencing. I4.0, according to, is the consequence of the merging of exponential technologies such as Artificial Intelligence, Cloud Computing, Big Data, Internet of Things, Digitalisation and other similar technologies [22]. The key objective of I4.0, according to experts, is to ensure the existence of sustainable and competitive production while also improving living standards by generating and ensuring advances in social, economic, and environmental dimensions [23]. From the perspectives of government and business enterprises, the core notion of I4.0 revolves mostly upon manufacturing [24]. In fact, I4.0 may be described as an unprecedented integration of digital, economic, social, and biological domains in human life [25].

## 5.2. Industrial 4.0 Enabling Technologies

### 1. Big Data Analytic

Big Data Analytic is changing all part of our modern lives. Sensors, devices, video/audio, networks, log files, transactional applications, the web, and social media feeds are all major sources of big data [26]. A "big data environment" has progressively emerged in the manufacturing industry as a result of these circumstances.

### 2. Internet of Things (IoT)

The phrase Internet of Things (IoT) was originally introduced in 1999 [27], and it combines two concepts: the Internet and the Thing. Internet refers to the interconnected world network of computers whereas Thing refers to uniquely addressable physical devices (things) with functions such as identification, detection, actuation, and processing. These entities can also communicate and collaborate in order to achieve a common purpose.

### 3. Artificial Intelligence

Artificial intelligence (AI) based on machine learning (ML), and particularly deep learning (DL), is the fastest-growing trend in software development today, and in virtually every aspect of modern society. However, AI is still not widely used in many systems, particularly complicated and dependable ones. These are systems with basic components but complicated overall behaviour as a result of dependencies, competitions, relationships, or other sorts of interactions between components or between a system and its environment [28].

### 4. Augmented Reality (AR)

Augmented Reality (AR) is a computer graphic technique that involves the integration of a "virtual" object (CAD model, symbol, picture, or writing) to a real-time video stream of the external real environment. The hardware and software required to implement it are determined by the internal/external application, the complexity of the virtual scene to be added, the user's device, real-time, and the program's definition requirements [29].

### 5. Cyber Physical System

Cyber Physical System (CPS) can be described as the integration of computation, networking, and physical processes [30]. In reality, CPS is a collection of various systems of different type, with the ultimate objective of maintaining and managing all physical processes while also adapting to new situations and requirements based on feedback from prior physical processes.

## 5.3. The Impact of I4.0 on Industries

Soh and Connolly indicates that I4.0 has a significant impact on business regardless the type of industry [31]. For example, it is projected that I4.0-related technologies will enable completely new ways of "filling existing demands and considerably disrupting established industry value chains" in the supply chain industry. Furthermore, new technologies have the potential to influence concepts such as innovation, research and development, sales, and marketing, all of which can have an impact on a variety of aspects of business, including customer engagement and satisfaction, service delivery, production, and transparency.

Torrance and Staeritz attempt to examine the business models of the world's largest corporations and determine the amount of readiness to adapt to new technologies connected to I4.0 [32]. They discovered that as the world grows more digitalized, less than 10% of these firms have an economically sustainable business strategy. By 2030, it is expected that digital platform business models would be able to contribute approximately 30% of all economic operations. Chhetri et al. has also address the influence of I4.0 on supply chain and product lifecycle of the manufacturing system, in their research [33] where major changes will brought to the end-to-end digitalisation.

#### **5.4 The Impact of I4.0 on SMEs**

SMEs is a common word for small and medium sized businesses. The literature indicates a lack of a common definition of SMEs on a global scale [34]. This is due to the reality that different elements influence the definition of SMEs, including the number of employees, the size of the business or organisation that offers the definition, and the location of the definition proposed. In fact, a small firm or company that operates independently, where the owner of the enterprise is usually the same person and has a small market share [35]. However, SMEs could face two major challenges as a result of I4.0 and its enhanced applications and technology. These issues include a lack of a digital strategy, a lack of standards, and unprotected data [36].

#### **5.5 Key Benefits of I4.0**

Most of the production processes where goods and services were prepared and distributed to the target consumers were done semi-automated [37]. This indicates that human intervention is needed to complete the task. In today's world, the method of production has shifted from handwork to headwork, indicating that workers are now pursuing creativity, invention, and solutions using their thoughts rather than their hands. Digitalisation is seen as an important element of the manufacturing process [38]. As a result, businesses are now experiencing significant challenges in inspiring employees to enhance their human potential. The process to merge the application of Industry 4.0 concepts into practice in the entire manufacturing environment is complicated [39]. Hence, smart integrations transform the industrial environment into a smart and intelligent Industry 4.0 platform that ensures the company's long-term sustainability.

#### **5.6 Key Benefits of I4.0 on SMEs**

According to Muller and Voigt, the emergence of I4.0 has a significant impact on SMEs' competitiveness, attractiveness, productivity, client acquisition, and expansion [40]. According to the previous MDEC Chairman Datuk Wira Dr Hj Rais Hussin Mohamed Ariff, SMEs will gain a competitive edge by adopting I4.0-related technologies because they will add new competitive components [41]. SMEs will undoubtedly be able to attract young and talented staff if they adopt and invest in I4.0. By doing so, the company will be able to keep its employees, resulting in a lower talent turnover rate in SMEs.

#### **5.7 I4.0 in the Context of Malaysia**

October 31, 2018, Tun Dr Mahathir Mohamad has announced the country's National Policy on Industry 4.0, or Industry4WRD. The main focus of Industry4WRD is on digitally transforming our manufacturing industry and related services [42]. According to the Policy, Malaysia is envisioned as a strategic partner for "smart manufacturing," as well as a main destination for high-tech industries and a total solutions provider for the region's manufacturing sector. In the last five years, the manufacturing sector has played a significant role in driving Malaysia's economic growth [43], contributing for 23 percent of the country's GDP. The government targets a 51% average growth in the manufacturing sector between 2016 and 2020 as compared to an average of 4.8% in the five years preceding 2016. Recently, The 12th Malaysia Plan, the first major policy introduced by Malaysian Prime Minister YB Ismail Sabri Yaakob, forecasted an average annual GDP growth of 4.5 to 5.5 percent over the next five years [44], which experts describe as "sensible" after the country posted an average annual growth of 2.7 percent from 2016 to 2020 which is less than half of the previous plan's initial target of 5-6 percent. According to Alifah, Malaysia's economy has yet to fully recover after contracting by 5.6 percent last year, its worst year since the Asian financial crisis of 1998, and was driven down by the COVID-19 epidemic.

In the wake of the COVID-19 pandemic, the Malaysian government recognised this growth as a crucial driver to stimulate economic recovery. The government has been continuously promoting the nation's digital agenda through multiple policies and initiatives such as IndustryWRD Readiness Assessment [18], Malaysia 5.0 [41], MyDigital [45] and National 4IR [24]. However, all these terms are considered a niched concept which refers to the transformation that occurs within manufacturing through digitalisation and connected technologies [46]. Currently, it is one of the most debated and researched topics. Countries and business entities have directed their focus and effort towards understanding, cultivating, manipulating, and implementing the new approach to industrialisation [47][2][48].

**Table 2. Focus Group Responses**

Sector	Respondent & Location	Industry	Findings
Manufacturing	Company A (Perak)	Food and Beverage	<ul style="list-style-type: none"> <li>• Aware of I4.0</li> <li>• Challenges in technology &amp; security</li> <li>• Adapt changing to improve operations</li> </ul>
	Company B (Penang)	Injection Moulding	<ul style="list-style-type: none"> <li>• Little knowledge of I4.0</li> <li>• Challenges in IT competency</li> <li>• Willing to engage industry expert for training</li> </ul>
	Company C (Penang)	Electronic	<ul style="list-style-type: none"> <li>• Well-verse in I4.0</li> <li>• Have strength and abilities to train all level of IT</li> <li>• Advantage on production process</li> </ul>
	Company D (Selangor)	Cosmeceutical	<ul style="list-style-type: none"> <li>• Aware of I4.0</li> </ul>

			<ul style="list-style-type: none"> <li>• Challenges in competency &amp; security</li> <li>• Need short and long term digital strategies</li> </ul>
	Company F (Kedah)	Pharmaceutical	<ul style="list-style-type: none"> <li>• Aware of I4.0</li> <li>• Challenges in organisational structure</li> <li>• Adapt changing to improve operations</li> </ul>
	Company G (Penang)	Waste Manufacturing	<ul style="list-style-type: none"> <li>• Aware of I4.0</li> <li>• Challenges in empowerment tools and data access</li> <li>• Willing to adopt advanced technologies</li> </ul>
	Company H (Selangor)	Wearing Apparel	<ul style="list-style-type: none"> <li>• Aware of I4.0</li> <li>• Challenges in I4.0 related technologies</li> <li>• Willing to invest to achieve aims and objectives</li> </ul>
	Company I (Selangor)	Furniture Industry	<ul style="list-style-type: none"> <li>• Aware of I4.0</li> <li>• Challenges in I4.0 related technologies</li> <li>• Willing to invest to achieve aims and objectives</li> </ul>
MRS	Company E (Penang)	IT Services	<ul style="list-style-type: none"> <li>• Expert in I4.0</li> <li>• Challenges in IT infrastructure</li> <li>• Highlighted the beneficial of transformation</li> </ul>
	Company J	Industrial Equipment	<ul style="list-style-type: none"> <li>• Aware of I4.0</li> <li>• Challenges in financial and infrastructure</li> <li>• Agreed on the I4.0 benefits</li> </ul>

### Focus Group Responses:

Industry4WRD Readiness Assessment (RA) programme has been implemented starting 2019 until today by several Assessment Bodies (AB) that have been appointed by Ministry of International Trade and Industry to help industries assess their capabilities and readiness to adopt Industry 4.0 technologies and processes, using a pre-determined set of indicators to understand their present capabilities and gaps. SIRIM, which is one of the appointed ABs has started the pilot RA in 2018 with the strength of 42 Certified Assessor Researchers and Engineers so far. All RA assessments have gone through several phases of applications, assessment, interviews, factory visits up to the producing the full report. Therefore, the findings from the final report were analysed and presented. However, for this research study, ABs are not allowed to disclose the company's name due to confidentiality.

### Company A: Food and Beverage Industry

In a conversation with Mr A, he was aware of the I4.0, but he had limited information of previous industrial revolutions. He emphasised the relevance of



technology and current industry advances. They hold workshops and on-the-job trainings for their personnel from time to time. They expressed an interest in learning more about the I4.0 concept and the benefits it provides. He commented on some of the challenges they were having in their business as a result of technological improvements, as well as some of the security threats they were facing. He was quite eager in learning more about I4.0. They include all technology advancements that are relevant to their industry. They are willing to adapt to changes throughout time in order to improve their organization's success. Their organisational structure supports the company's mission and helps them meet their annual objectives. They adapt to changing circumstances and improve their operations. Mr. A attended few workshops related to I4.0 organized by MITI and MPC, however, he expressed to organize awareness of I4.0 for all its employees in near future.

### **Company B: Injection Moulding Industry**

In a conversation with Mr. B, the manager in charge, he claimed to know a little about the I4.0 concept but expressed a desire in learning more. They attempt to conduct training sessions for their staff from time to time to ensure that they are informed of how to use technology while also sharing their expertise with other colleagues. Mr. B is the company's oldest employee, and his experience make him a vital asset to the company. He also expressed a strong desire to learn more about the concept of I4.0 and how to get the most out of it. Mr. B expressed an interest in learning more about I4.0. He had a little understanding of the new paradigms and its benefits. In their current business, they were deploying innovative technological tools and applications. However, they discussed the workshop material and plan it with their employees once a month. Mr. B explained that they engage industry experts for these sessions and occasionally deploy their personnel to other locations for hands-on training. He also stated that while resources are sometimes a constraint, they attempt to manage within those restrictions. Mr. B expressed an interest in understanding more about I4.0. In conclusion, they expressed their full support and cooperation with their employees in enhancing the production process and overall performance of their organization.

### **Company C: Electronic Industry**

Mr. C was well-versed in the I4.0 and technological advancements in the industry over time when we spoke. He emphasised the significance of technology and the advancements in the IT and electronics industries. They help individuals strengthen their abilities and conduct training sessions for various levels of IT and Electrical and Electronics Engineering. They supply electrical and electronic devices, as well as provide troubleshooting and assembly services. He brought about some of the problems they were having in their company as a result of production and delivery delays. The supplier provides products in accordance with production and market demand. This can be difficult to survive in a small market with few resources. They did, however, have strong intentions to improve in the future. He emphasized about the advantages of using technology and the overall production process. Although the transition may take some time, I4.0 will have a significant influence. It will benefit not only SMEs but also larger businesses by lowering costs and increasing competitiveness.

**Company D: Cosmeceutical Industry**

Discussions with Director Mr. D were productive because he was involved in organising training and workshops for a variety of companies. He attended I4.0 awareness events and was well-informed on global revolutions. Mr. D expressed an interest in learning more about I4.0. In their trainings and workshops, they are currently employing technology tools and applications. Mr. D spoke on the company's future digital strategy as well as some cyber security concerns. Some challenges could include a lack of resources and technological readiness. Mr. D also expressed an interest in learning more about I4.0. It will have a good impact on both strategy and output. Finally, they discussed their short- and long-term strategies for implementing emerging technology and adhering to industry best practises in order to increase performance.

**Company E: IT Services**

Mr. E agreed that I4.0 is a merger of two primary sectors: the industrial sector and the information technology sector. I4.0, he asserted, is about creating more personalised products by merging the Artificial Intelligence and Big Data sectors. He also asserted this. He also agreed that there is a link between company growth and the implementation of I4.0-related technologies, but he asserted that this is subject to market demand. Mr. E pointed out that some challenges and difficulties might be raised due to the emergence of I4.0, such as current infrastructure, human resource readiness, market skills and demand, the variety in the paid effort, Inventory costs, Manufacturing costs, Logistical costs, Complexity costs, Quality costs, and Maintenance costs, as part of the discussion. He also addressed the issue of timeliness, stating that our problem is that we are currently focusing on the future when we should be focusing on the present. Mr. E agreed that once the I4.0's benefits are highlighted, the customer service experience will be improved, and client requirements will be met more readily.

**Company F: Pharmaceutical Industry**

Mrs. F claimed to be aware of the concept of I4.0 and the research that have been conducted on it. They will be holding a special seminar on key enabler technologies. They also suggested that I4.0 and digital transformation have anything in common. They believe that I4.0 will improve the organization's efficiency. Mrs. F highlighted certain challenges, such as organisational structure, thinking about the future rather than the present, financial resource waste, and rules and regulations that help with the transition to I4.0. They agreed that every effort should be made in order to achieve our aims and objectives.

**Company G: Waste Manufacturing**

Mrs. G agreed that I4.0 will lead to the adoption of more advanced technologies such as big data technologies. She also agreed that there is a high level of awareness about I4.0, and that there are some training programmes available on how to implement related technologies. She did mention the challenges and stated that all sectors must work together to improve empowerment tools and data access, rules and regulations, training programme costs, and human resource readiness. She noted that some advantages may include the use of new and modern machines in

production, which could save production time, and that everything would be more precise, allowing market needs to be addressed.

#### **Company H: Wearing Apparel Industry**

Mr. H, the Director agreed that I4.0 awareness is achieved through various conferences, training, and manufacturing. He predicted that I4.0 will have an impact on job automation and business efficiency. He agreed that the most significant challenges that a company can face as a result of the advent of I4.0-related technologies are the transitional phase and planning for the future. He agreed that every effort should be made in order to achieve our aims and objectives.

#### **Company I: Furniture Industry**

Mr. I believes that I4.0 is the digital revolution in the industrial sector, and that it will play a significant role in job automation in the future years. According to the difficulties discussed, Mr. I claims that the following are the difficulties and challenges that their company may face as a result of the emergence of I4.0: current technology infrastructure, organisational structure, availability of skilled workers, management lack of understanding of the strategic importance of I4.0, and employee readiness.

#### **Company J: Industrial Equipment**

Ms. J agreed that in the coming year, I4.0 would make a significant contribution to job automation. She also claimed that the current technology infrastructure for transitioning to I4.0 is inadequate, and that they are confronting a shortage of financial resources to make the transition. Furthermore, they are currently under pressure to work with I4.0 (e.g. from customers, suppliers, authorities etc.) Ms. J agreed that one of the benefits of implementing I4.0 is that it allows companies to meet customer requirements, among other factors.

### **4. Conclusion**

This research examined into the influence of Industry 4.0 on businesses in general and SMEs in particular. It also intended to assess I4.0 in the perspective of Malaysian SMEs. The researchers concluded with significant findings indicating that all companies should begin developing IT strategies to ensure that I4.0 concepts and related technologies are well adopted in order to improve the organization's performance in terms of competitive advantages, increased revenues, and profit. In Malaysia, the study revealed that digitalisation enables individuals to pursue innovative and creative solutions, allowing them to handle more complicated professions and responsibilities that will emerge as a result of I4.0. It should also be noted that the level of awareness among Malaysian SME owners is acceptable. They are aware of it, but it could be improved further. According to the findings, I4.0 has an impact on company growth. The present IT infrastructure is one of the most significant challenges that SMEs confront as a result of the introduction of I4.0. I4.0 also has various advantages, such as matching client needs and reducing production time.

In the future, empirical research might be undertaken to assess the level of awareness of I4.0 among key individuals and SMEs owners. Furthermore, the pain points, challenges, and opportunities of I4.0 could be analysed through the

viewpoint of SMEs. Finally, the role of I4.0 in boosting national economic diversification might be investigated, as it is one of the priorities in Malaysia's Shared Prosperity Vision 2030, which aspires to move the economy forward and generate economic opportunities and high-paying jobs for the *rakyat*. This vision will help Malaysia become a developed country by reducing economic inequalities across income categories, ethnic groupings, regions, and supply chains.

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## References

- [1] C. Schröder, *The Challenges of Industry 4.0 for Small Medium-sized Enterprise*. Friedrich-Ebert-Stiftung, 2016.
- [2] M. D. Lee, R. A. Djubair, and H. J. Ngu, "Sustainability Paradigm for Malaysian Manufacturing SMEs: An Operations Research Approach," *Int. J. Bus. Technopreneursh.*, vol. 7, no. 3, pp. 355–368, 2017.
- [3] K. Schwab, *The Fourth Industrial Revolution*. Encyclopædia Britannica, Inc.: Chicago, IL, USA, 2017.
- [4] N. Grufman and S. Lyons, "Exploring industry 4.0 A readiness assessment for SMEs," no. June, 2020, doi: 10.13140/RG.2.2.12170.08647.
- [5] L. Sommer, "Industrial revolution - Industry 4.0: Are German manufacturing SMEs the first victims of this revolution?," *J. Ind. Eng. Manag.*, vol. 8, no. 5, pp. 1512–1532, 2015, doi: 10.3926/jiem.1470.
- [6] S. Jayashree, C. A. Malarvizhi, and M. N. Hassan Reza, "The Impact of Organizational Readiness on IR 4.0 and Sustainability-A Theoretical Framework for SMEs in Malaysia," *Eurasian J. Anal. Chem.*, vol. 14, no. 1, pp. 209–215, 2019, [Online]. Available: <http://www.eurasianjournals.com/The-Impact-of-Organizational-Readiness-on-IR-4-0-and-Sustainability-A-Conceptual,112544,0,2.html>.
- [7] A. De Carolis, M. Macchi, E. Negri, and S. Terzi, "Guiding manufacturing companies towards digitalization," *2017 Int. Conf. Eng. Technol. Innov. Manag. Beyond 2020 New Challenges, New Approaches, ICE/ITMC 2017 - Proc.*, pp. 487–495, 2018, doi: 10.1109/ICE.2017.8279925.
- [8] M. S. Azam, "Diffusion of ICT and SME performance," *Adv. Bus. Mark. Purch.*, vol. 23A, pp. 7–290, 2015, doi: 10.1108/S1069-096420150000023005.
- [9] SIRIM, "SIRIM offers more technology expertise to Penang Industry." 2019, [Online]. Available: <internal-pdf://232.192.242.152/2019 SIRIM Engagement.pdf>.
- [10] F. Adilla, "SIRIM-Fraunhofer initiative for SMEs," *News Straits Times*, p. 2020, 2020.
- [11] NST, "SIRIM launches Technology and Market Radar for SMEs," *News Straits Times*, 2017.
- [12] B. Ślusarczyk, "INDUSTRY 4.0-ARE WE READY?," *POLISH J. Manag. Stud. Vol.17 No.1, 2018*, 2018, [Online]. Available: <internal-pdf://111.44.33.21/INDUSTRY 4.0 - ARE WE READY.pdf>.
- [13] A. Ustundag and E. Cevikcan, *Industry 4.0: Managing The Digital Transformation*, no. May, 2018.
- [14] PSDC, "Industry 4.0 : Small Medium Enterprise - Small & Winning Big Strategy." 2017, [Online]. Available: [internal-pdf://219.121.155.5/PSDC\\_Small\\_and\\_Winning\\_Big\\_Strategy.pdf](internal-pdf://219.121.155.5/PSDC_Small_and_Winning_Big_Strategy.pdf).
- [15] L. Gualtieri, I. Palomba, E. J. Wehrle, and R. Vidoni, *The Opportunities and Challenges of SME Manufacturing Automation: Safety and Ergonomics in Human-Robot Collaboration BT - Industry 4.0 for SMEs: Challenges, Opportunities and Requirements*. 2020.
- [16] D. Kiel, J. M. Müller, C. Arnold, and K. I. Voigt, "Sustainable industrial value creation: Benefits and challenges of industry 4.0," *Int. J. Innov. Manag.*, vol. 21, no. 8, Dec. 2017, doi: 10.1142/S1363919617400151.
- [17] Sage, "Learn to Use an Exploratory Sequential Mixed Method Design for Instrument Development," *SAGE Research Methods Datasets Part 2*. SAGE Publications, Ltd. , 2019, [Online]. Available: <internal-pdf://153.111.196.73/2019 Sage.pdf>.
- [18] Ministry Of International Trade and Industry, "Industry4WRD Readiness Assessment," *Minist. Int. Trade Ind.*, p. 12, 2018.
- [19] T. O.Nyumba, K. Wilson, C. J. Derrick, and N. Mukherjee, "The use of focus group discussion methodology: Insights from two decades of application in conservation," *Methods Ecol. Evol.*, vol. 9, no. 1, pp. 20–32, 2018, doi: 10.1111/2041-210X.12860.
- [20] P. N. Stearns, "The Industrial Revolution in World History." Routledge, New York, p. 330, 2013, doi: <https://doi.org/10.4324/9780429494475>.
- [21] J. Stentoft, K. W. Jensen, K. Philipsen, A. Haug, and K. W. J. Jan Stentoft Kristian Philipsen, Anders Haug, "Drivers and Barriers for Industry 4.0 Readiness and Practice: A SME Perspective with Empirical Evidence," *Proc. 52nd Hawaii Int. Conf. Syst. Sci.*, vol. 6, pp. 5155–5164, 2019, doi: 10.24251/hicss.2019.619.
- [22] J. Basl and C. Republic, "Companies on the Way to Industry 4.0 and their Readiness," *J. Syst. Integr.*, vol. 9, no. 3, pp. 3–6, 2018, doi: 10.20470/jsi.v9i3.351.
- [23] T. Stock and G. Seliger, "Opportunities of Sustainable Manufacturing in Industry 4.0," *Procedia CIRP*, vol. 40, pp. 536–541, 2016, doi: 10.1016/J.PROCIR.2016.01.129.
- [24] EPU, "National Fourth Industrial Revolution (4IR) Policy," 2021.
- [25] G. Li, Y. Hou, and A. Wu, "Fourth Industrial Revolution: technological drivers, impacts and coping methods,"

- Chinese Geogr. Sci.*, vol. 27, no. 4, pp. 626–637, 2017, doi: 10.1007/s11769-017-0890-x.
- [26] R. Y. Zhong, X. Xu, E. Klotz, and S. T. Newman, “Intelligent Manufacturing in the Context of Industry 4.0: A Review,” *Engineering*, vol. 3, no. 5, pp. 616–630, 2017, doi: 10.1016/J.ENG.2017.05.015.
- [27] R. C. Motta, K. M. De Oliveira, and G. H. Travassos, “On challenges in engineering IoT software systems,” *ACM Int. Conf. Proceeding Ser.*, no. December, pp. 42–51, 2018, doi: 10.1145/3266237.3266263.
- [28] H. Belani, M. Vukovic, and Z. Car, “Requirements engineering challenges in building ai-based complex systems,” *Proc. - 2019 IEEE 27th Int. Requir. Eng. Conf. Work. REW 2019*, pp. 252–255, 2019, doi: 10.1109/REW.2019.00051.
- [29] G. M. Santi, A. Ceruti, A. Liverani, and F. Osti, “Augmented Reality in Industry 4.0 and Future Innovation Programs,” *Technologies*, vol. 9, no. 2, p. 33, 2021, doi: 10.3390/technologies9020033.
- [30] K. Chukalov, “Horizontal and vertical integration, as a requirement for cyber-physical systems in the context of industry 4.0,” *Int. Sci. J. “Industry 4.0,”* vol. 2, no. 4, pp. 155–157, 2017, [Online]. Available: <http://www.plattform-i40.de/sites/>.
- [31] C. Soh and D. Connolly, “New Frontiers of Profit and Risk: The Fourth Industrial Revolution’s Impact on Business and Human Rights,” *New Polit. Econ.*, vol. 26, no. 1, pp. 168–185, 2021, doi: 10.1080/13563467.2020.1723514.
- [32] S. Torrance and F. Staeritz, “Is your business model fit for the Fourth Industrial Revolution?,” *World Econ. Forum*, 2019, [Online]. Available: <https://www.weforum.org/agenda/2019/01/is-your-business-model-fit-for-the-fourth-industrial-revolution/>.
- [33] S. R. Chhetri, S. Faezi, N. Rashid, and M. A. Al Faruque, “Manufacturing Supply Chain and Product Lifecycle Security in the Era of Industry 4.0,” *J. Hardw. Syst. Secur.*, vol. 2, no. 1, pp. 51–68, 2018, doi: 10.1007/s41635-017-0031-0.
- [34] H. M. Tahir, N. A. Razak, and F. Rentah, “The contributions of small and medium enterprises (SME’s) On Malaysian economic growth: A sectoral analysis,” in *Advances in Intelligent Systems and Computing*, 2018, vol. 739, pp. 704–711, doi: 10.1007/978-981-10-8612-0\_73.
- [35] Muhammad Khalique, Abu Hassan Md Isa, Jamal Abdul Nassir Shaari, and Adel Ageel, “Challenges faced by the Small and Medium Enterprises (SMEs) in Malaysia: An Intellectual Capital Perspective,” *Int. J. Curr. Res.*, vol. 3, no. 2010, pp. 398–401, 2011.
- [36] S. Mittal, M. A. Khan, D. Romero, and T. Wuest, “A critical review of smart manufacturing & Industry 4.0 maturity models: Implications for small and medium-sized enterprises (SMEs),” *J. Manuf. Syst.*, vol. 49, no. October, pp. 194–214, 2018, doi: 10.1016/j.jmsy.2018.10.005.
- [37] M. Travagioni, A. Ferazzoli, A. Petrillo, R. Cioffi, F. de Felice, and G. Piscitelli, “Digital manufacturing challenges through open innovation perspective,” *Procedia Manuf.*, vol. 42, pp. 165–172, 2020, doi: 10.1016/J.PROMFG.2020.02.066.
- [38] Z. Suleiman, D. Dikhanbayeva, S. Shaikholla, and A. Turkyilmaz, “Readiness Assessment of SMEs in Transitional Economies: Introduction of Industry 4.0,” *ACM Int. Conf. Proceeding Ser.*, no. January, pp. 8–13, 2021, doi: 10.1145/3447432.3447434.
- [39] Y. M. Ling, N. A. binti Abdul Hamid, and L. Te Chuan, “Is Malaysia ready for Industry 4.0? Issues and Challenges in Manufacturing Industry,” *Int. J. Integr. Eng.*, vol. 12, no. 7, pp. 134–150, 2020, doi: 10.30880/ijie.2020.12.07.016.
- [40] J. M. Müller and K. I. Voigt, “Sustainable Industrial Value Creation in SMEs: A Comparison between Industry 4.0 and Made in China 2025,” *Int. J. Precis. Eng. Manuf. - Green Technol.*, vol. 5, no. 5, pp. 659–670, 2018, doi: 10.1007/s40684-018-0056-z.
- [41] MDEC, “MALAYSIA 5.0: Ready To Reinvent Malaysia’s Digital Economy,” vol. Oct-Dec, no. 4, pp. 16–21, 2020.
- [42] MITI, “Industry4WRD National Policy on Industry 4.0,” Ministry of International Trade and Industry, 2018. [Online]. Available: [internal-pdf://245.109.90.224/Industry4WRD\\_Final.pdf](internal-pdf://245.109.90.224/Industry4WRD_Final.pdf).
- [43] F. Baharin, “Malaysia on the right path with Industry4WRD,” *Jurutera IEM Bul.*, no. July, pp. 6–10, 2019, [Online]. Available: <http://www.iemtc.com/asset/IEM-0417.pdf>.
- [44] A. Zainuddin, “Malaysia’s 5-Year Plan Sets Its Sights on High-Income Status by 2025,” *Dipl.*, p. 5, 2021, [Online]. Available: <https://thediplomat.com/2021/09/malysias-5-year-plan-sets-its-sights-on-high-income-status-by-2025/>.
- [45] EPU, “Malaysia Digital Economy Blueprint,” 2021.
- [46] A. Schumacher, T. Nemeth, and W. Sihn, “Roadmapping towards industrial digitalization based on an Industry 4.0 maturity model for manufacturing enterprises,” *Procedia CIRP*, vol. 79, pp. 409–414, 2019, doi: 10.1016/j.procir.2019.02.110.
- [47] S. Erol, A. Jäger, P. Hold, K. Ott, and W. Sihn, “Tangible Industry 4.0: A Scenario-Based Approach to Learning for the Future of Production,” *Procedia CIRP*, vol. 54, pp. 13–18, 2016, doi: 10.1016/J.PROCIR.2016.03.162.
- [48] J. M. Müller, O. Buliga, and K. I. Voigt, “Fortune favors the prepared: How SMEs approach business model innovations in Industry 4.0,” *Technol. Forecast. Soc. Change*, vol. 132, pp. 2–17, Jul. 2018, doi: 10.1016/J.TECHFORE.2017.12.019.