



Digital Transformation: An Exploring Barriers and Challenges Practice of Artificial Intelligence in Manufacturing Firms in Malaysia

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ABSTRACT

Digital transformation has become very crucial in global market. Digital technologies have revolutionized the way industries operate, introducing the concept of “Industry 4.0” or the “smart factory”. Digital technologies have substantially transformed the business and society, bringing fundamental changes through the new emerging approaches of the circular and sharing economy. Artificial intelligence (AI) is now become an essential part in the manufacturing industry to enhance the performance and boost the demand and productivity in the manufacturing firms. There are some barriers and challenges face by the manufacturing firms in implementing the AI due to the infancy stage of AI in Malaysia such as lack of talent, lack of incentive and innovation. However, there are lack of studies were conducted on barriers and challenges of AI in the manufacturing sector especially in Malaysia. Therefore, the originality of this study is identifying the barriers and challenges in implementing AI. In this paper, managers from the manufacturing companies were selected as respondents based on Federal Manufacturing Malaysia Directory. The questionnaires are distributed to the respondents by using the online survey. A total of 93 questionnaires was collected with feedback rate, 23.3%. Descriptive analysis is used to identify the barriers and challenges. The highest level for barriers of AI is lack of talent. The highest level for challenges is no experts in company. This research provide input for manufacturing companies to improve the barriers and challenges for future improvement in implementing AI.

1. Introduction

Digital transformation has become very popular in recent years. Digital transformation or “digitalization” is “the integration of digital technologies into business processes”. As a consequence, these digital technologies increase the pace of change and lead to significant transformation in a number of industries. Digital technologies have revolutionized the way industries operate,

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introducing the concept of “Industry 4.0” or the “smart factory”. Digital technologies have substantially transformed the business and society, bringing fundamental changes through the new emerging approaches of the circular and sharing economy. Artificial intelligence (AI) is now become an important element in the manufacturing industry to increase and boost the performance of manufacturing firms. Malaysia manufacturing firms face barriers and challenges in implementing the AI due to the infancy stage of AI such as lack of talent, lack of incentive and innovation. However, there are lack of studies were conducted on barriers and challenges of AI in the manufacturing sector especially in Malaysia. Therefore, the originality of this study is to identify the barriers and challenges in implementing AI in Malaysia manufacturing industry [1,2].

Artificial intelligence is one of the crucial parts in digital transformation that is improving businesses business performance. Based on to the latest data by Research and Markets, AI is projected to achieve a annual growth rate of 52% by 2025 [3], indicating its fast growing in global market. AI is now being implemented in many sectors, such as security, services, healthcare, manufacturing, and education. Artificial intelligence (AI) is an intelligence which has function that human’s link with other human minds in learning process and solving the problem [3]. AI systems can perform actions such as controlling, learning, communication and decision making that replace human being to arrive the systematic methodology and solution to solve the given problem [4]. The goal of AI is to develop computers think and act as humans [5]. AI plays a vital role on developing, formalizing and disposing various machine learning algorithms for the industrial applications with the sustainable performance [6]. According to Malaysia Productivity Corporation (MPC), new technology can be used by manufacturers in industry 4.0 to increase productivity in manufacturing firms [7-9].

AI system have a major impact on the production demand and production growth [10]. All current AI have different methodologies and techniques for computational optimization such as traditional optimization for modeling, statistics based machine learning, experience based reinforcement learning and nature inspired evolutionary computation [11]. AI is an interoperable manufacturing process, integrated and adapted which correlates with algorithm in Big Data (BD), Internet of things (IoT), Internet of services (IoS), Industrial Automation, Cybersecurity (CS), Cloud Computing (CC) or Intelligent Robotics [12,13].

Manufacturing as a key sector to enhance the world economy. Malaysia’s production industrial had played an importance role to drive for the economy growth [14]. Nevertheless, there are some issues and problems had influenced the operation performance for those manufacturing industries who still adopt with traditional operations administration and maintenance compare to digitalization manufacturing [15]. According to Covid-19 pandemic, there were certain organizations had face on supply chain disturbances [16]. The weakness of supply chain had influence to organization operation performance [16]. A poor supply chain management system in organization caused fail in production output, losses profit, or uncertain waste. Thus, the imperfect of supply chain system can reduce organization performance [9,17]

2. Literature Review

2.1 Barriers of Artificial Intelligence

According to Li *et al.*, [10], there are two barriers in implementing the artificial intelligence system in the work processes which including sparse skills data and limited modelling. Davenport *et al.*, [18] discovers that the artificial intelligence in forecasting automation requires skills that help to keep the advancing technology in manufacturing. Besides that, according to Huang *et al.*, [3], limited of modelling in the developments of data mining, machine learning and artificial intelligence causing the barrier in implementing the artificial intelligence because machine learning has various

algorithms, methods and theories. Moreover, according to Davenport *et al.*, [18], technical become a barrier in implementing the AI system. Based on Schade [18], having a rich choice for AI implementation are useful and the resources might be reused, but in contrast, the AI system will be the burden of the organization if the application of technology is inappropriate. Moreover, according to Jakšič *et al.*, [19], the barriers in implementing the AI are technology innovation and risky [20]. Based on Jakšič *et al.*, [19], disruptive technologies can be drives to decrease in the productivity in the manufacturing firms, and it is become risky in data sharing with another devices. AI has the potential in increasing the productivity and demand in developed and developing countries [21,22]. Hence, based on previous research, four barriers of AI have been identified; (1) Skills; (2) Technology, (3) Limited of modelling and (4) Risky [23] as shown in Table 1.

Table 1
 Barriers of artificial intelligence

Barriers of Artificial intelligence	F. Ullah et al., [34]	M. R. Frank et al., [18]	Wuest et al., [24]	Schade [25]	Freq.
Skills	√	√			2
Technology	√		√	√	3
Limited of modelling		√	√		2
Risky	√				1

2.2 Challenges of Artificial Intelligence of AI

Artificial intelligence (AI) and machine learning in society and organization are important [26]. Organizations can create value and competitive advantage with the adoption of AI innovation [27]. The goal of AI is to improve the efficiency and effectiveness of the decision process, but due to the expensive adoption of AI, the AI process is disrupted [28]. So, there are challenges or obstacles face by manufacturing firm in implementing the AI system [29]. In Malaysia, many AI technologies are still at the infancy stage [30].

According to Ministry of International Trade and Industry (MITI) Malaysia, there are some challenges face by the industry 4.0 in manufacturing in Malaysia [31]. Firstly, there is lacking awareness with the concept of industry 4.0, in terms of opportunities and business model disruption especially SMEs [30,32]. They are unaware with the impact of industry 4.0 that have tremendous economic potential, and they might be left behind. According to [33], the level of ICT skills among 383 SME owners is poor and leads to the slow adoption of ICT. In addition, Hashim [33] discovers that the main reason for the slow adoption of ICT among SME in Malaysia is that they see the ICT is difficult to implement and rather choose the manual system [34].

Secondly, lack of incentives to incentivize company to move into the industry 4.0. According to MITI, company needs higher cost of adoption and longer payback period for the technology development and for the processes [35]. In this point of view, AI needs large amount of capital for the research and development, and this might be rejected by the management due to the cost outweigh and inability to see the importance of the benefits in the future when implementing the AI in the manufacturing processes [36].

The third challenges according to MITI is lack of talent and human capital particularly in the areas of robotics, IoT and AI. According to Rock [28], workers are lack of skills, training and less education

as the rapid progresses in industrial 4.0 and lead to the slow adoption of the AI in the company [7,37]. Besides that, lack of practices on the development and enrollment of AI causing the risk such as failures of machine, job replacement and loss of privacy of AI information [36]. Besides, according to Rock [28], AI based search method and lack of talent are the challenges of AI implementation because it is hard to gain the true insight for the problem and solution and thus disrupt the AI process [38]

Next, lack of integrated and digital approach for data gathering along the manufacturing is also the challenge. According to Brock *et al.*, [33] and Ahmad *et al.*, [39], the challenges facing during the implementation of AI in manufacturing firm is machines drive in incorrect manner that causing the computer programmed to do the wrong things and thus disrupt the work process and decrease the productivity in the manufacturing firms. Therefore, according to Mosteanu [40], the challenges of AI implementation are cost, technology and cyber security. Based on Mosteanu [40], high cost is needed in developing the smart technology due to its maintenance and lack of privacy in the data sharing [32]. Table 2 shows the past research on the challenges of AI where the most challenges were studied by the researchers.

Table 2
 Challenges of artificial intelligence

Challenges of AI	Aisyah <i>et al.</i> , [41]	Phil [42]	Firdaus, et al., [20]	Abduljabbar <i>et al.</i> , [43]	Chowdhury and Sadek [44]	Freq.
Innovation			√	√	√	3
Cost	√	√		√	√	4
Lack of talent	√		√		√	3
Capital	√	√	√			3
Cyber security	√			√		2

3. Research Methodology

A seven-point Likert scale have been applied in the instrument for collecting data. The instrument has been validated by the experts [23]. Based on Federation of Malaysian Manufacturers (FMM) and the foreign companies' directory list in Malaysia, 400 companies have been selected with sample random sampling for final survey [45]. The target respondents are manager involving in production. Finally, 93 response with 23.3% response rate, have been received for further analysis [46]. Seven-point Likert scale is used for collecting data. The question is rated from 1 to 7 which representing the very strongly agree to very strongly disagree.

Descriptive analysis is used to analyzed data. Descriptive analysis is a method of organize, summarize and present the data to become informative. Descriptive analysis is used in this research to calculate the frequency distribution, average and percentage distribution. Therefore, there are two sets of descriptive measure which are central tendency and variability. Measurement of central tendency is applied in this research to address a single piece of information, while the variability is used to measure the difference between the set of value [47,48]

4. Result

Table 3 shows the Cronbach's Alpha Coefficient to be higher than the average of 0.7 [34]. This makes all the question in the questionnaire to be reliable. The questionnaire surveys was distributed by using simple random sampling method [49].

Table 3
 Reliability test for Barrier and Challenges

	No. of questions	Cronbach's Alpha Coefficient
Barrier of AI	10	0.693
Challenges of AI	10	0.705

The mean and standard deviation result is shown in Table 4 to identify the level of barriers of AI in manufacturing firm. Based on the result, the highest mean is falling to the lack of talent and skills in data analysis statement which is 3.6129 [50]. It is noted that lack of skills and talent is the top barrier because AI in forecasting automation requires the skills data that help to keep the advancing technology in the manufacturing production [18]. However, the lowest mean of the barriers of AI implementation is 2.85 for the statement "AI implementation affects privacy concern and risk in manufacturing firm. According to Zhou, Liu, and Zhou [8], AI system protects the privacy issue such as the information security. Hence, the total mean value of barriers of AI is 3.1290 in which the mean score had fallen between the range of 3.01 to 5.00 which is considered at medium level.

Table 4
 Descriptive of Barrier

Barrier	Mean	Rank
Lack of technology	3.1935	2
Application of technology is inappropriate.	2.8817	4
Limited of modelling of data mining and machine learning	3.1075	3
AI implementation affects privacy concern and risk	2.8495	5
Lack of talent and skills in data analysis.	3.6129	1

Table 5
 Descriptive of challenges

Barrier	Mean	Rank
Lack of cost	3.09	5
Lack of practices on development of AI causing the loss of privacy of AI information.	3.50	2
Lack of capital for research and development of AI causing the manufacturing processes	3.32	4
There are no AI experts in company.	4.13	1
Lack of creativity and innovation on AI implementation.	3.48	3

The mean and standard deviation result is shown in Table 5 to identify level of challenges of AI in manufacturing firm. Based on the result, the highest mean is 4.1290 for statement "there is no AI expert in company", Paschen *et al.*, [27] stated that the workers are lack of skills and training as the

rapid growth of the Industrial 4.0 and lead to the slow adoption of the AI in company. In contrast, the lowest mean for challenges of artificial intelligence is 3.09 for statement "lack of cost to implement artificial intelligence in company. Thus, the total mean of the challenges of AI is 3.5032 which the mean score had fallen between the range of 3.01 to 5.00 and is stated at medium level.

5. Discussion and Conclusion

Based on the result that has been carried out, the descriptive analysis is used to achieve the research question. Questionnaire has distributed to 93 respondents. There are five elements in the AI implementation which including analytics technology, big data, cloud, domain knowhow and evidence. Among these five elements, the Cloud has the highest mean which is 3.2634 which shows the moderate central tendency level.

Based on the result that has been carried out, the level of barriers of AI implementation has been overview. There are five items constructed with the barriers of AI. Therefore, the highest mean is falling to the lack of skills and talent which the mean value is 3.612. In this point of view, this barrier is considered at the moderate central tendency level. Therefore, the result of challenges of AI has been carried out. There are five items constructed with the challenges of AI. Hence, the highest mean is 4.1290 for the statement challenge is considered as moderate central tendency level.

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