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Facilitating the Malaysian Manufacturing Sector in Readiness for Industry 4.0:
A Mediating Role of Organization Innovation

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ABSTRACT

The manufacturing sector of Malaysia is an essential part of its economic system. Malaysia holds a remarkable position in the global market through the exports of manufacturing products. However, this sector faces challenges such as organizational capability to innovate due to rapid technological and business environment changes in line with Industry 4.0. These challenges may prevent manufacturing firms from embracing Industry 4.0 and thriving in their businesses. Therefore, this research aims to identify the role of organizational practices such as knowledge-oriented leadership, electronic human resource management, and decentralized organization structure in support of organization innovation to prepare manufacturing firms for Industry 4.0. A quantitative method was applied to 218 samples collected from Malaysian manufacturing firms. The results of this research are interesting for keen researchers and helpful for decision-makers and practitioners to successfully pave the way for Industry 4.0 implementation in manufacturing firms by developing innovation capabilities.

KEYWORDS

Electronic Human Resource Management, Knowledge-Oriented Leadership, Organization Innovation, Organization Structure, Readiness for Industry 4.0

INTRODUCTION

The Gross Domestic Product (GDP) of most countries is depending on the contribution of their industries, especially by the manufacturing industry (MacDougall, 2014). However, due to fast shift in technological development, organizations are moving towards smart manufacturing, also known as Industry 4.0. The idea of advance or smart manufacturing is to deal with upcoming, digitally-enabled production systems. There is no doubt that such visionary concepts lead to technical and operational complexities in manufacturing processes at all levels of the organization and thus require

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continuous innovation (Erol et al., 2016). Industrial experts also suggested that Organization Innovation is an essential tool for manufacturing organizations (Hecklau, Galeitzke, Flachs, & Kohl, 2016). Manufacturing companies should build their innovation capabilities to tackle the instant issues that may appear during production processes. Innovation is also considered as imperative for improvement in the performance of manufacturing organizations. Not limited to that, it is also considered as a key driver for employment and development of the economy, while decreasing economic inequality.

An innovative organization emphasizes the novel production system for long-term survival (Palazzeschi, Bucci, & Fabio, 2018), which can only be achieved by adopting the technology. Organization Innovation and the adoption of new technology go hand in hand to effectively perform operations and add quality to a production system. However, innovation does not appear at its own, as the organizations have to adapt suitable organizational practices that support the development of Organization Innovation capabilities. Practices such as specific leadership style, human resource management, and suitable organization structure can help in the development of such capabilities (Mohelska & Sokolova, 2018). Knowledge Oriented Leadership and suitable organization structure are also influencing factors to change (Ghobakhloo, 2018; Gilchrist, 2018; Shamim et al., 2016). Knowledge Oriented Leaders are committed to facing any challenges, promoting innovation and managing new knowledge by treating challenges as the capital of the company. Whereas, Human Resource Management ensures the recruitment, learning and development of those employees that can embrace changes and promote creativity. While, Decentralized Organization Structure creates a favorable environment that foster Organization Innovation.

A few recent studies have emphasized on the technological aspect but did not consider the prompting practices that assist Organization Innovation in the epoch of Industry 4.0 (Shamim, Cang, Yu, & Li, 2016). Naqshbandi and Jasimuddin (2018) have also highlighted the lack of empirical research in Knowledge Oriented Leadership that focuses on Organization Innovation. The same gap in the literature is underlined by Mohelska and Sokolova (2018) that recommended further research on Knowledge Oriented Leadership and Decentralized Organization Structure due to the factors' importance in supporting organizational innovation to achieve effective implementation of Industry 4.0. A strategic approach to management is defined in this contribution. Therefore, the aim of this study is to focus on practices that are suitable to Organization Innovation for the transformation of Malaysian manufacturing sector in Industry 4.0.

LITERATURE REVIEW

Dynamic Capability Theory

1. Dynamic Capability Theory (DCT) states the ability of an organization in building competencies to cope with changes in a business environment (Teece, Pisano, & Shuen, 1997). DCT applies in the context of this research refers to the usage of appropriate practices to develop innovation capabilities. Thus, Knowledge Oriented Leadership enables Organization Innovation capability by encouraging, creating, sharing and applying new and important information to bring purposeful changes in outcomes (Mabey, Kulich & Lorenzi-Cioldi, 2012). Electronic Human Resource Management (E-HRM) supports the organization by encouraging the employees to continuously train and develop themselves, in addition to contributing to the dynamic business needs. Through appropriate practices, organizations can build competencies that will lead to organization innovation (capability) and achieve long-term goals (Paauwe & Boselie, 2005).

Readiness for Industry 4.0

Industry 4.0 is described as smart manufacturing and execution of Cyber-Physical Systems (CPS) for production, i.e. using the network of microcomputers and connecting the machines to value chain. Moreover, it is also described as highly customized items with value addition to actual product and service, besides being an efficient and effective supply chain (Shamim et al., 2016). The Readiness

for Industry 4.0 is the ability to capitalize on production opportunities, mitigate risks and challenges, followed by being resilient and agile in response to unknown shocks (WEF & Kearney, 2018, p5)." According to Botha (2018), the Readiness for Industry 4.0 is having enough capabilities to embrace industry 4.0, also meaning that an organization has the capacity and capability to meet the speed of change.

Knowledge Oriented Leadership

Leadership is important for organizations as it impacts their performance (Nguyen & Mohamed, 2011). It defines a clear control strategy toward the workers and encourages them to follow the leader in accomplishing the organization's objectives (Ribière & Sitar, 2003). Leadership in knowledge organizations is particularly appropriate when the workers understand the leader as active and motivated to assist in knowledge and innovative based actions. The type of leadership style that is based on a mixture of transformational and transactional leadership styles, along with communication and motivational elements is known as Knowledge Oriented Leadership. It also includes knowledge creation, transfer, storage, and its application" (Donate, Pablo, & Jesús, 2015, p2). Those who practice Knowledge Oriented Leadership are often more successful than those who do not. However, the idea of a Knowledge Oriented Leader is not well established (Mohsenabad & Azadehdel, 2016).

Electronic Human Resource Management (E-HRM)

The performance of any organization and competitiveness is dependent on how the employees are being managed. The concept of electronic activities regarding the employee's management is known as Electronic Human Resource Management (E-HRM) (Armstrong & Taylor, 2020). E-HRM is an application of information technology specifically designed for human resources management practices. E-HRM enables easier and more convenient internal and external interactions within the organization or between the employees and employers. These interactions include E-Recruitment and selection, E-communication, E-Learning, as well as for E-Performance Appraisal purposes. So, in simple words, E-HRM is the use of web-technology-based channels to perform standard HR operations such as strategies, policies, and practices in the organization. More broadly, E-HRM is the planning and application of information systems for networking and support of HR activities (Bondarouk, Parry, Emma, Furtmueller, Elfi, 2017). It highly influences the performance of an organization through functions like E-Recruitment & Selection, E-Communication, E-Learning & Development, and E-Performance Appraisal (Becker, 2013).

E-HRM has the potential to transform traditional HRM practices completely. For example, from an E-Communication perspective, the employees from geographically dispersed locations can work together in virtual teams using e-mails, SMS, calls, and videos. Under the E-Recruitment function, employers can post job openings online for candidates to apply for and conduct online interviews. With E-Learning and development, E-HRM provides easier opportunities of learning and access to policy updates, salary and bonus information, and includes other benefits. Hence, E-HRM emerges as a solution that can respond to fast change (Shobaki et al., 2017).

Decentralized Organization Structure

Organization structure can be defined as the coordination between the individuals and team within an organization, to complete interdependent tasks and accomplish organizational goals and objectives. The organization structure support different processes and functions for effective execution (Burton, & Obel, 2018). The organizational structure of any organization can be categorized into two types; centralized or decentralized. In centralized organizations, a single person such as the CEO or the executive body makes decisions that drive innovation. In addition, in many cases, a department is created to monitor and control the processes pertaining to innovation management. On the other hand, in decentralized organizations, all the employees have a say in the planning and implementation of the new innovative process (Ahmady, Mehrpour & Nikooravesh, 2016). In the current study, the objective

is to identify the impact of Decentralized Organization Structure on Organization Innovation in the current era and context of Industry 4.0. Industry 4.0 is all about changes and technology. Therefore, Decentralized Organization Structure is more suitable to forms autonomy that leads to the free flow of information and freedom that enhances creativity.

Organization Innovation

"Organization Innovation is conceived as a means of changing an organization, either as a response to changes in the external environment or as a pre-emptive action to influence the environment. Hence, it includes new product or new technology" (Baregheh, Rowley & Sambrook, 2009, p1326). The production processes are becoming highly complex in an era of digitalization and with the introduction of a boundary-less business environment. Organizations are confronting numerous challenges that are emerged due to new concepts and rapid changes. The markets are becoming more and more volatile because of the challenges such as the changes in customer expectations and the demands for new and customized products. To fulfil the market requirements, innovation in a production system is vital for developing organizational capacity and flexibility.

Hypotheses Development

Knowledge Oriented Leadership and Organization Innovation

Modern organizations are often affected by increasing complexity and turbulence business environment, so the ability to gain and maintain competitive advantages lies in the innovation and leadership (Sheng, 2017). Leadership involves the inculcation of extraordinary potential in the individuals who fail to exhibit such qualities (Rohn, 2014), whereas organization innovation can be defined as the creation and application of knowledge to bring about new methods in an organization's practices in either operations or external relations (Slezdik, 2013).

New business processes are dynamic and complex, with much manual routine labour is being replaced by knowledge worker that requires a high level of expertise and skillsets. Hence, Knowledge Oriented Leadership becomes an asset to an organization, and it is difficult to be substituted during the innovation and improvement process. According to Vafaie (2016), the purpose of innovation is to produce new knowledge to develop and determine the doable solutions for society. Using the knowledge, the leaders can capture, acquire, manage, and diffuse the ideas to produce and deliver distinctive and idiosyncratic solutions, products, and services.

Organization Innovation is highly dependent on knowledge and Knowledge Oriented Leadership. Knowledge oriented leadership create or assist in creating tools, platforms, and processes for converting general knowledge into specific knowledge, and subsequently plays a role in the innovation process. The importance of a Knowledge Oriented Leadership, with regards to innovation, is to focus on the organization systems and their capabilities while keeping in mind the structure and culture of the organization (Tuan, 2017). The leaders in this position have the vital task of establishing positive yet complex changes to meet the organization's goals. This means that they manipulate the domino effects of their will, as a small change can bring about a more significant change.

The significance of Knowledge Oriented Leadership for organization innovation is also confirmed by the findings of Kasemsap (2017). He stated that knowledge leaders, aids by their teams and networks, can provide the organizations with the opportunities to expand their competencies and field of expertise, to build a versatile set of capabilities. The teams with different skills and strategies create and use knowledge to bring about the organization's desired innovation including effective integration, acceptance or adoption of new technologies, centralized coordination, communication, and finally, functional platforms. Hence, the relationship between Knowledge Oriented Leadership and innovation in modern organizations is evolving, and smart economies are evident. Based on the above literature, the researcher can propose that:

H1: Knowledge Oriented Leadership has a positive relationship with Organization Innovation.

Electronic *Human Resource Management (E-HRM) and Organization Innovation*

E-HRM strategies have become increasingly essential to improve innovation using a knowledge repository for thousands of organizations worldwide. So, the stakeholders must set their E-HRM goals according to their organizations' requirements. These goals can include cost reduction, efficiency gains, service improvement and others. One of the most trending examples is the Covid-19 pandemic that has transformed innovation from a luxury to a need. E-HRM is now being put to the test, with thousands of businesses working from home together with various contingencies deployed by organizations. The continuity goal is clear for most organizations, and E-HRM is one of the essential elements in this period of survival.

Jonczyk (2015) stated that the modern development of an organization is based on the concept of innovativeness, while the human resource management is among the top prioritized areas in an organization, where innovation is ever-growing. Hence, this suggests that E-HRM is essential to the modern Organization Innovation, especially due to the age of digitalization, in which most of the traditional processes are being replaced or complemented with the daily emerging information technology. The impacts of information technology are evident and can be seen every day, even though we might not be notified about the changes. Information technology has been made various applications in different fields with indescribable prosperity and thus, its impact on human resources strategies are not different, and leads to the following hypothesis:

H2: Electronic Human Resource Management has a positive relationship with Organization Innovation.

Decentralized Organization Structure and Organization Innovation

The innovativeness of any organization is determined by the composition of its innovative activities. For instance, the structure of an organization influences the development of innovation inside an organization. A few empirical studies have discussed the structure of companies and their association with different levels of innovation (Arora, Belenzon, & Rios, 2014). However, these existing literature do not analyze the mechanism of Organization Innovation with the changes in the organization structure that are critical for an organization (Argyres, Rios, & Silverman, 2018). Moreover, the Decentralized Organization Structure has been argued to affect the Organization Innovation, but there are still limited empirical investigations being conducted on this matter.

In contrast, innovation is the emergence of a new idea, concept, or process. It is a crucial factor for organizational growth and a contributor that demonstrates an organization's competitive edge in the market. Organization and innovation have a complex relationship due to the contrast between the structural forms with the propensity to innovate (Geldes, Felzensztein, & Palacios-Fenech, 2017). Both of the terms may contradict each other, as the structures are meant to reconcile qualities like dynamism, flexibility, or technology adoption to maintain endurance, continuity, order, and stability. Additionally, innovation is usually a consequence of these qualities.

The relationship between organizational structure and innovation depends on whether the structure is centralized or decentralized. A decentralized structure may offer a wide range of choices and better quality of ideas, while a centralized structure may offer quicker implementation of decisions, due to a clear chain of command. A decentralized structure drives employee engagement, in addition to encourages the employees to share new ideas, opinions, and innovations that subsequently leads to a reward. Hence, the following hypothesis can be proposed:

H3: Decentralized Organization Structure has a positive relationship with Organization Innovation.

Organization Innovation and Readiness for Industry 4.0

The projects in Industry 4.0 are naturally described as a short period, but it does not mean that the organizations can ignore the long-run perspectives. As the rate of change in Industry 4.0 is high (Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014), so the innovation will not last for long. The innovation process should be a routine part of the organization. The new technological development has steered from adopting mechanical systems and the support to manufacturing procedures to today's highly computerized assembly lines in response to the current strong market demands and requirements. Under the Industry 4.0, the notable growth in Organization Innovation and adoption of IT has gradually influenced the consumers' perception of the product, process innovation and quality (Lee et al., 2014).

Industry 4.0 can produce amazing work opportunities for businesses with the support of innovation. In today's world, agility makes competitive. Using digital innovation such as artificial intelligence (AI), the companies can become more agile and even acts ahead of a speedy change in customer requirements and technology (Jones, 2017). Industry 4.0 is now more of a reality than a vision; it is already positioned to modify the ways people do business. According to the viewpoints of Stephan (2014), Industry 4.0 allows new business and value development models to resolve the downsides of today with the technological innovation of tomorrow (Buhr, 2017). Therefore, the success of Industry 4.0 is dependent on organizational innovation (Shamim et al., 2016). Hence, the Organization Innovation is considered essential for Industry 4.0 (Lasi, Fettke, Kemper, Feld, & Hoffmann, 2014). Based on the above discussion between the relationship of Organization Innovation and Readiness for Industry 4.0, the following hypothesis can be proposed:

H4: Organization Innovation has a positive relationship with the Readiness for Industry 4.0.

Knowledge Oriented Leadership and Readiness for Industry 4.0

With the emergence of Industry 4.0, business disruption took place rapidly. Therefore, the traditional styles of leadership could not fit in the context of Smart Manufacturing or Industry 4.0 (Peshawaria, 2018). Hence, this shift has enhanced the importance of knowledge-based leadership focus on the creation of knowledge and to solve current problems (Zakaria, Nasir, & Akhtar, 2019). Such leadership is linked to the system and can predict the forthcoming needs by applying the existing and new knowledge to tackle modern disruptions (Xu, David, & Kim, 2018).

Knowledge Oriented Leadership is the basic requirement of the organizations in Industry 4.0. It helps the organizations to implement technologies and to adapt by learning innovatively. To meet the expectancy of Industry 4.0, Knowledge Oriented Leadership has been constructed with a combination of transformational and transactional leadership. Moreover, the organizations are able to seek success through the application of knowledge management, with the integration of knowledge that is an integral part of Industry 4.0 (Žemaitis, 2014). Therefore, the hypothesis can be set as:

H5: Knowledge Oriented Leadership has a positive relationship with the Readiness for Industry 4.0.

Electronic Human Resource Management and Readiness for Industry 4.0

Industry 4.0 is referred to as an era of new technologies and digitalization. The idea has disrupted the traditional way of doing business. Similarly, the practices for managing human resources should also be digitalized to match the pace of Industry 4.0. Human Resource Management should be automated, with a focus on strategically leaving manual and repetitive tasks. The researcher believes that by applying E-HRM, the managers can be more focused on the strategic side of the business and do better decision-making that is helpful for the organizations' long-run (Ruël et al., 2004). The transformation of Human Resource Management can affect the Industry 4.0 directly. An organization can achieve a higher success level in Industry 4.0 adoption through digitalization in HRM (Sheehan,

Ellinger & Ellinger, 2014). Therefore, it is vital to align the HRM strategies (Sivathanu & Pillai, 2018) as technologies such as Smart Manufacturing and the Internet of Things that requires efficient HR procedures, including learning and development are applied. The literature above leads to the following hypothesis:

H6: Electronic Human Resource Management has a positive relationship with the Readiness for Industry 4.0.

Decentralized Organization Structure and Readiness for Industry 4.0

The organizations may encounter several challenges with the increase of digitization across business processes. The growing demand for customized products has led to more complexities and forces the organizations to apply structures that can foster change and faster decision making (Brettel, Friederichsen & Keller, 2014). The organization structure is important as it defines and controls the way of doing business. Decentralized Organization Structures are more aligned with the objectives of Industry 4.0. A decentralized system allows fast processes, quick decision making and foster creativity. Bauernhansl (2014) also believed that organizations should adopt the decentralized structure for smart production to manage the complexity of Industry 4.0. To prepare the manufacturing organizations for Industry 4.0, a decentralized structure is a backbone. It allows independence to a whole production system, enables the individuals to process information, proceeds to further actions and to work autonomously. The decentralized structure also permits the free flow of information to avoid any delay. Hence, it leads the organizations to the readiness for Industry 4.0 (Windt, Böse, & Philipp, 2008). Based on this discussion, it is hypothesized as:

H7: Decentralized Organization Structure positively affects the Readiness for Industry 4.0.

Mediating Role of Organization Innovation

Nowadays, the significance of innovation for the development of organization has been prompted by the increasing importance of knowledge in organizations. This is also due to the extensive level of knowledge management that is fundamental for enhancing innovation and ultimately preparing organizations for Industry 4.0 (Žemaitis, 2014). The organizations believe that the appointment of KOL can prepare the employees in focusing on innovation performance. They know the situations well and can build a favourable environment for promoting Organization Innovation. Moreover, Industry 4.0 also requires a leadership model that is suitable to achieve the organizations' strategic goals. The combination of transformational and transactional leadership and motivational elements helps the organizations meet the developmental goals and enhance the capacity in the current era (Donate & Pablo, 2015; Politis, 2001; Sivathanu & Pillai 2018).

On the other hand, Electronic Human is also vital for innovative organizations (Lau & Ngo, 2004). A positive relationship has been shown between the product and process innovation in an organization (Escribá-Carda, Canet-Giner & Balbastre-Benavent, 2014). To innovate and promote creativity, the organizations have to pay full attention by providing rewards to the employees that adopt innovation (Nam, Tuan, & Van, 2017). Organizations need to focus on E-HRM, spend more to digitize and to achieve a dynamic business environment for Industry 4.0. Besides, another factor "organization structure" that can facilitate change in an impactful manner. A decentralized structure is considered favourable for any innovative or technology-oriented organization. It permits the members to participate in decision-making and gives them a free hand in performing tasks (Dedahanov et al., 2017). With independence, the employees can be interested in discussion and activities that generate more new ideas and solutions, while enhancing performances in the innovative aspects of the organization (Pertusa-Ortega et al., 2010). Hence, a Decentralized Organization Structure is a solution to an innovative organization that facilitates the fast implementation of Industry 4.0 and complex processes

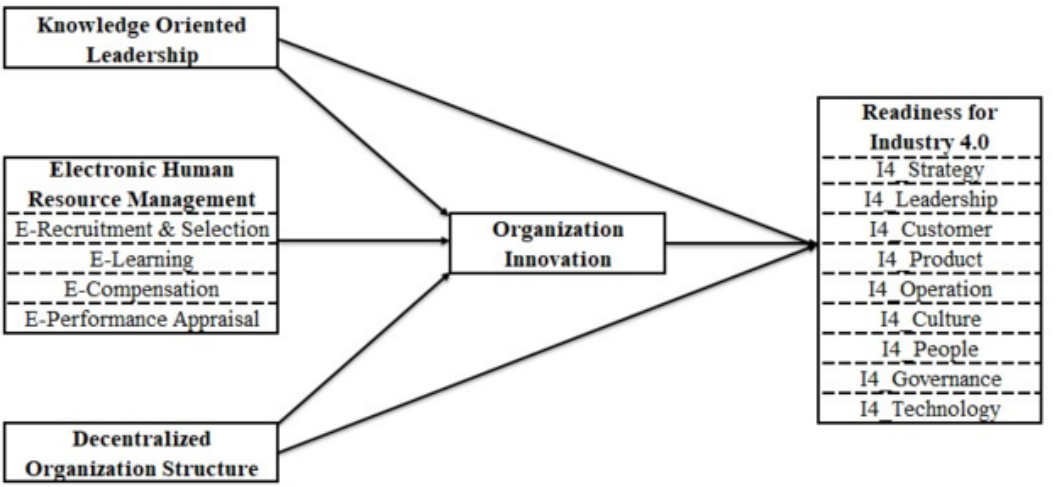
by offering decentralized, real-time solutions and adopting new technologies and processes with an open mind. Considering the above discussion, the following hypotheses can be formed:

H8a: Organization Innovation mediates the relationship between Knowledge Oriented Leadership and Readiness for Industry 4.0.
H8b: Organization Innovation mediates the relationship between Electronic Human Resource Management and Readiness for Industry 4.0.
H8c: Organization Innovation mediates the relationship between Decentralized Organization Structure and Readiness for Industry 4.0.

The pictorial view of hypotheses is presented below in the conceptual frameworks (Figure 1).

CONCEPTUAL FRAMEWORK

Figure 1. Conceptual framework with direct relationships



METHODOLOGY

Research Design

In line with the positivism philosophical view, this research followed the quantitative investigation for analysis and used a cross-sectional design for data collection. The quantitative study was used to analyze to analyze independent variables (i.e. Knowledge Oriented Leadership, E-Human Resource Management, and Decentralized Organization Structure) and dependent variable (i.e. Organization Innovation) numerically through the data collected from the questionnaires and by applying mathematical techniques using the SmartPLS 3 software.

Sampling Design and Procedures

The research population consisted of the manufacturing companies that are registered with the Federation of Malaysian Manufacturers [FMM] (2018). The FMM is considered as the representative of Malaysian manufacturers at national and international levels. The official Malaysian Investment

Development Authority [MIDA] 2018 has also endorsed the FMM as the official source of data regarding the manufacturing organizations in Malaysia. Only one individual from each organization was selected to respond to the questionnaire, as our unit of analysis was set as "organization". The respondents are mainly Owner, CEO, Director, General Manager, or Manager and were selected because they have significant experiences and supreme vision of the organization's activities. They also greatly influence the company performances and strategies (Bahari, Yunus & Yusof, 2018). Most of the organizations (approximately 82%) are located in Selangor, Johor, Penang, Kuala Lumpur and Perak, which are considered to be the industrial hub and were contacted through the e-mail and personal visits, through the lists provided by the Federation of Malaysian Manufacturers. A total number of 218 usable responses were received through the Simple Random Sampling technique and were considered sufficient for structured equation modelling, as suggested by Hair, Black, Babin, & Anderson (2010).

Questionnaire Design and Structure

A five-point Likert scale ranging from Strongly Disagree to Strongly Agree (closed-ended) was used to evaluate variables and measure each item. The total of six items for Knowledge Oriented Leadership was adopted from the study of Donate and Pablo (2015) were used to measure the role of leaders for implementing information and analysing workers on a basis of promoting learning and innovation (Bollinger & Smith, 2001). For the items of E-HRM, the scale was adapted from the study by Hooi (2006). Four dimensions (i.e. e-recruitment and selection, e-learning, e-compensation, and e-performance) were analyzed through 12 items for this concept.

Four items for Decentralized Organization Structure is adapted from Willem, Buelens and Jonghe (2007) to measure the flexibility of employees while making any decision. The items were later reverse coded to assess the decentralized structure of an organization. The 6 items for organizational innovation scale were adapted from García-Morales, Jiménez-Barrionuevo and Gutiérrez-Gutiérrez (2012) to analyses product and technological innovation. For readiness for Industry 4.0, measurement scale was adapted from the study of Schumacher, Erol, and Sihn, (2016). Nine dimensions including I4-Strategy, I4-Leadership, I4-Customer, I4-Products, I4-Operation, I4-Culture, I4-People, I4-Governance and I4-Technology are measured on 27 items. The questionnaire items are presented in (Appendix, Table 4).

RESULTS

This part offers the researchers insights into the demographic profile, while the measurement model with reliability and validity has been explained. Furthermore, the hypotheses and their explanations are discussed on the basis of a structural model.

Respondents' Demographic Profiles

About 46% of the respondents are female, and the rest 54% are male. Most of the respondents 30.6% are from the Selangor state, including 17.8% female and 12.8% male. This was followed by Perak and Kuala Lumpur, with 17.3% and 15%, respectively. It is also observed that most of the respondents 44.5% are holding the position of Senior Manager or Manager. Meanwhile, 39% of the respondents are Owner/CEO/Director/General Manager. This means that approximately 84% of the respondents are from a category involved with decision-making and know the organization's policies well. Seven percent of the respondents are more than 55 years old, whereas 69% of the respondents are from the age between 25 and 44 years. Majority respondents 76% are representative of local manufacturing organizations, whereas, 24% belong from foreign manufacturing organizations in Malaysia. The details are presented in (Table 1).

Table 1. Demographic summary of sample

Characteristics	Sample (n = 218)	
	Frequency	Percentage
Gender		
Male	117	54
Female	101	46
Job Status		
Executive	37	17
Owner/CEO/Director/General Manager	84	39
Senior Manager/Manager	97	44
Age Group		
25 to 34 years old	69	32
35 to 44 years old	81	37
45 to 54 years old	53	24
More than 54 years old	15	7
Company Type		
Local	165	76
Foreign	53	24

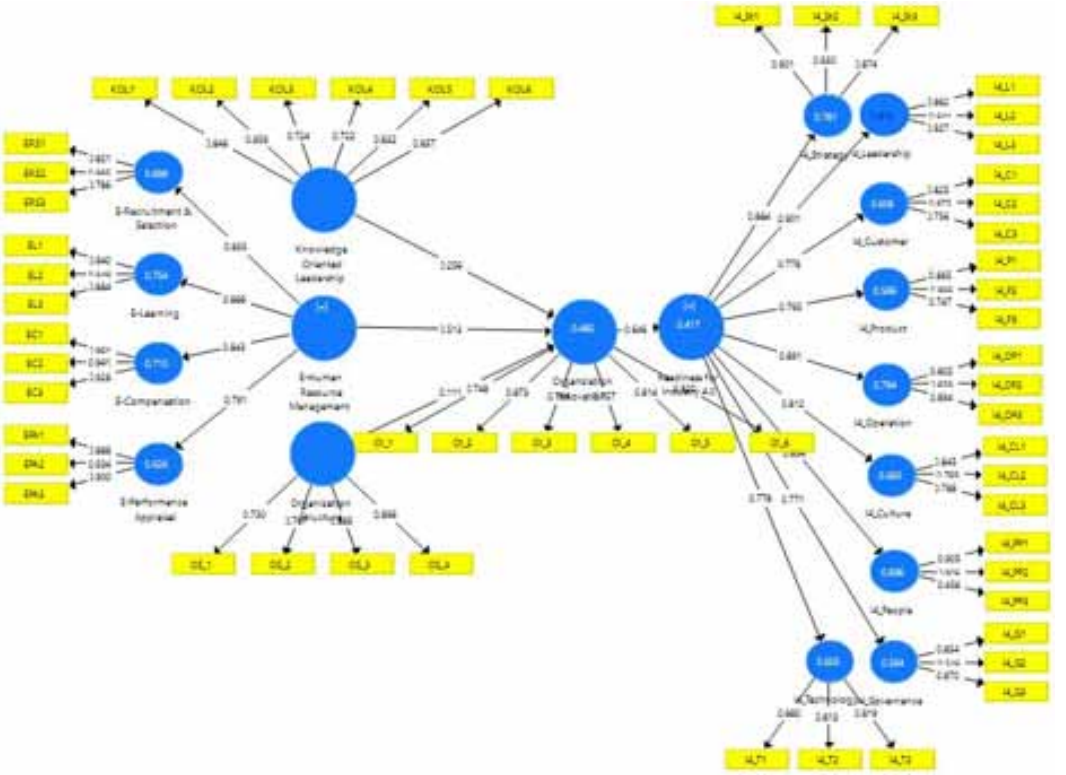
Assessment of Measurement Model

After filtering and cleaning the data, a total of 218 responses were finalized for Confirmatory Factor Analysis (CFA) through SmartPLS 3. This software was used because it provides better and more accurate results when a model has more than 50 items compared to the CBSEM software (Chin, 2010). Moreover, it has a higher potential (Afthanorhan, 2013) to measure the models effectively and is considered appropriate for examining the cause-effect relationship (Hair, Sarstedt, Ringle & Mena, 2012). For the purpose of validation, the items with factor loading values of more than 0.6 were retained (Hair, Celsi, Money, Samouel, & Page, 2011). All the item values were found to be more than 0.6. Therefore, no item was deleted, as shown in the measurement model assessment (Figure 2).

The validity and reliability tests were taken to generalize the findings of the analysis. First, construct validity was carried out to make sure that all the items are fit for the measurement of constructs. Every item in this study was inspected to check the factor loading value by making sure that the criteria of 0.6 and above are met, as suggested by Hair, Black, Babin, and Anderson (2010). The minimum value observed is of item I4_St2 is (0.659), while the maximum value of item EL2 is recorded (0.949) as presented in Appendix (Table 5). Moreover, the relevant values of factor loadings prove that all the values meet the criteria. Hence, no item was deleted.

Secondly, convergent validity was employed to check the significance of the measurement model. The values from the factor loadings, Cronbach's Alpha, convergent validity, and Average Variance Extracted were examined to check for random measurement error. The Cronbach's Alpha values were set higher than 0.70, as suggested by Hair, et al. (2010). On the other hand, the minimum value of 0.873 was observed for Decentralized Organization Structure (0.872), and the maximum value of 0.953 was observed for Readiness for Industry 4.0. Additionally, the AVE of higher than 0.5, has been achieved by all the variables. Hence, the items are converged with their respective factors. The highest AVE recorded for Organization Innovation (0.644), and the maximum was for E-Human Resource Management (0.962).

Figure 2. Measurement model assessment



Moreover, discriminant validity was also checked for any possibility of Multi-Collinearity problems. Each item was checked on the basis of factor loading and was also compared with the Average Variance Extracted (AVE) (Hair, et al., 2010). The values for AVE for all the variables are more than 0.5. Meanwhile, the diagonal values that are square root of AVE are larger than their respective vertical values as shown in (Table 2). For VIF, the value of less than 10 value is generally acceptable by applying the Hair et al. criteria. However, Rogerson (2001) recommended a maximum value of 5 and is easily fulfilled as the maximum value recorded is 2.071 between Knowledge Oriented Leadership and Organization Innovation. Therefore, as the discriminant validity criteria

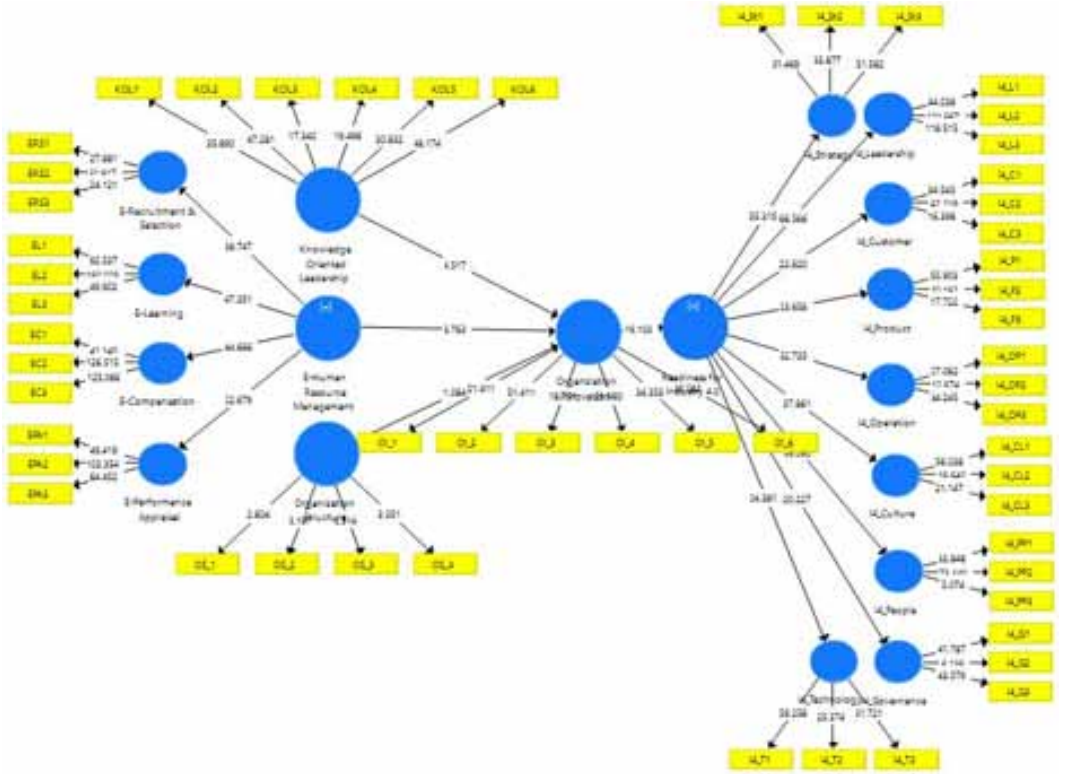
Table 2. Measurement model assessment

Construct Reliability and Validity				Discriminant Validity				
Variables	Alpha	CR	(AVE)	E-HRM	KOL	DOS	OI	Industry 4.0
E-HRM	0.927	0.883	0.962	0.834				
KOL	0.894	0.919	0.654	0.564	0.809			
DOS	0.872	0.893	0.679	0.658	0.546	0.802		
OI	0.889	0.915	0.644	-0.085	0.095	0.085	0.835	
Industry 4.0	0.953	0.881	0.823	0.807	0.588	0.648	-0.053	0.826

Note: E-HRM = Electronic Human Resource Management, KOL = Knowledge Oriented Leadership, DOS = Decentralized Organization Structure, OI = Organization Innovation, Industry I4.0= Readiness for Industry 4.0, Alpha = Cronbach's Alpha > 0.60 (Nunnally, 1978), Average Variance Extracted = AVE > 0.50 (Hair, Jr., 2006), Composite Reliability = CR > 0.70 (Fornell & Larcker, 1981).

have been met, the measurement model and variables are deemed reliable (Lamb, Wolfinbarger, Money, Samouel, & Page, 2015).

Figure 3. Structural model assessment – bootstrapping

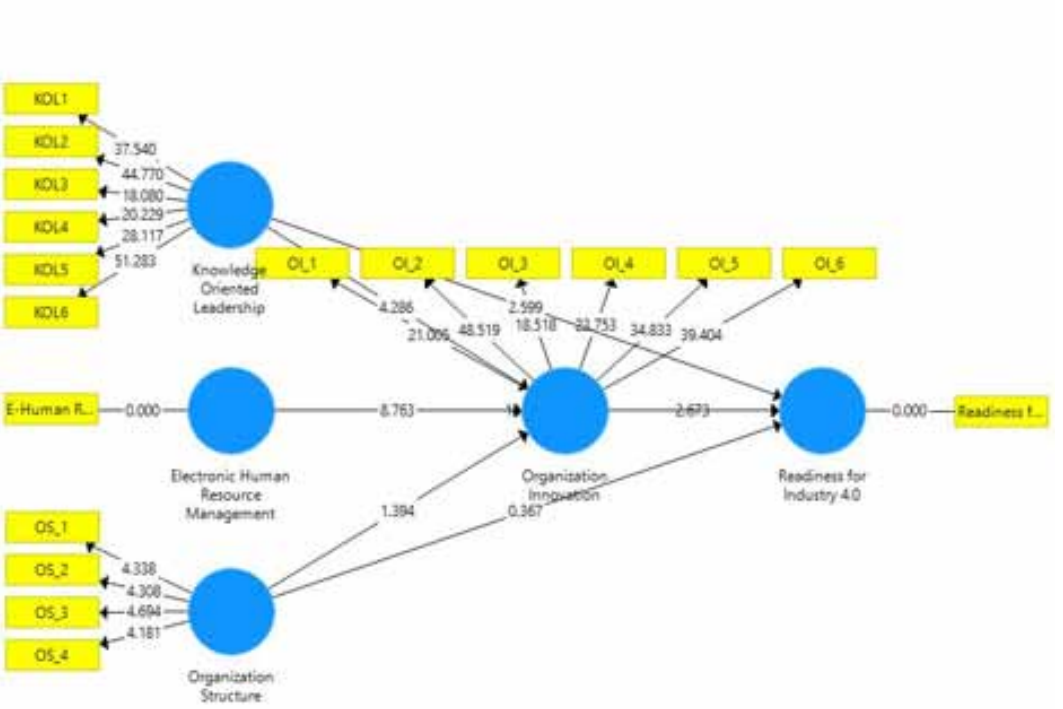


Assessment of Structural Model

The structural model was assessed in the second stage of analysis via 5000 resamples using bootstrapping. All the hypotheses were tested through the structural path model. As higher-order variables are involved in the current research, a two-stage approach was deployed to test the model through latent variables scores extracted to analyze the latent variables. The values for Coefficient of Determination for the Organization Innovation and Readiness for Industry 4.0 variables are found to be moderate (0.482) and substantial (0.783), respectively.

The seven main hypotheses were tested to achieve the objectives. The results of hypotheses H1, H2, H4, H5, and H6 are found to be accepted, with recorded P values of 4.286, 8.763, 2.673, 2.599, 14.833, respectively and exceeding the 1.96 thresholds for T-Statistics, while H3 and H7 show insignificant results with recorded P values of 1.394 and 0.367, respectively, and are lower than the required value. Additionally, the indirect effects were analyzed and results were presented in (Figure 3, Figure 4 and Table 3). The partial mediation has been shown in H8a (Electronic Human Resource Management ® Organization Innovation ® Readiness for Industry 4.0) and H8b (Knowledge Oriented Leadership ® Organization Innovation ® Readiness for Industry 4.0) having P-values of 2.114 and 2.542, respectively, while H8c (Decentralized Organization Structure ® Organization Innovation ® Readiness for Industry 4.0) shows no mediation with the recorded P-value of 1.214.

Figure 4. Structural model with latent variables scores



DISCUSSION

The number of studies on management practices to yield organizational innovation is increasing, mostly due to the practical and theoretical significances for organizations. Besides that, the prominence of Industry 4.0 has brought all the researchers and practitioners together, to explore the trending concept and to try to maximize their benefits. Among the different factors in the current study, practices such as Knowledge Oriented Leadership, E-Human Resource Management, and Decentralized Organization Structure were used to determine the support for organization's innovation and the preparedness for Industry 4.0.

Interesting results have been revealed and added a valuable input to the literature. The initial objectives were fulfilled by examining the relationship of Knowledge Oriented Leadership with Organization Innovation and Readiness for Industry 4.0. The results show that the Knowledge Oriented Leadership is significantly impacted by both the Organization Innovation and Readiness for Industry 4.0. According to Yahya and Goh (2002), a knowledge-based relationship can create innovation conditions for the organization. Moreover, innovation-based competitive advantage, knowledge creation, transfer and application (also includes in the KOL) are essential to develop new products (innovation) and to allow the organizations to become frontier (DeCarolis, & Deeds, 1999). Knowledge Oriented Leadership acts as a dynamic capability of the organization to emphasize continuous improvement in the organization by using tacit and explicit knowledge (Wang, & Ahmed, 2007).

The analysis supports that Knowledge Oriented Leadership style which is a combination of transformational and transactional leadership with additional motivational elements, is valuable to Organization Innovation performance (DeCarolis, & Deeds, 1999). This kind of leadership style helps the employees of organizations to believe that knowledge through research and development (innovation) is important for an advantage over competitors. Therefore, nowadays organizations are choosing to practice this leadership that has a combination of all the required innovation support

Table 3. Structural model assessment

Direct Relationships				
S. No.	**Relationships**	**T-Statistics**	**P-Value**	**Results**
H1	Knowledge Oriented Leadership -> Organization Innovation	4.286	0.000	Supported
H2	Electronic Human Resource Management -> Organization Innovation	8.763	0.000	Supported
H3	Decentralized Organization Structure -> Organization Innovation	1.394	0.164	Not Supported
H4	Organization Innovation -> Readiness for Industry 4.0	2.673	0.008	Supported
H5	Knowledge Oriented Leadership -> Readiness for Industry 4.0	2.599	0.009	Supported
H6	Electronic Human Resource Management -> Readiness for Industry 4.0	14.833	0.000	Supported
H7	Decentralized Organization Structure -> Readiness for Industry 4.0	0.367	0.713	Not Supported
Indirect Relationships				
H8a	Knowledge Oriented Leadership -> Organization Innovation -> Readiness for Industry 4.0	2.114	0.035	Partial Mediation
H8b	Electronic Human Resource Management -> Organization Innovation -> Readiness for Industry 4.0	2.542	0.011	Partial Mediation
H8c	Decentralized Organization Structure -> Organization Innovation -> Readiness for Industry 4.0	1.214	0.225	Not Supported

qualities. Moreover, with the advancement in technology due to Industry 4.0, the traditional styles of leadership are getting obsolete. Knowledge Oriented Leaders are capable to reevaluate the existing strategies and support organizations to adopt new technologies and new processes and prepare them for Industry 4.0 (Kolditz, Casas, & Strackhouse, 2017).

The research outcomes are really helpful for manufacturers while they are seeking ways to adopt the Industry 4.0 trends in a better way. It is now vital to improve the innovation performance of manufacturing organizations. Therefore, by deploying the Knowledge Oriented Leadership, organizations can integrate practices for the management of new advance knowledge that enrich their innovation capabilities. Such leaders can develop an innovative-friendly environment that assist exploration and exploitation practices. Moreover, they organize the teams in accordance with the trend and make it possible for organizations to unfold the values of Industry 4.0.

The other two hypotheses associated with E-HRM were investigated with Organization Innovation and Readiness for Industry 4.0. The significant relationship between both relationships is quite valuable for researchers and practitioners. By emphasizing E-HR practices, organizations can increase innovation as well as become ready for Industry 4.0. The results were consistent with the existing literature. For innovative organizations, a specific e-HRM strategy has to be applied to achieve organization performance (De-Leede & Looise, 2005).

Finding of this study offers managerial insight about E-HRM and Organization Innovation. As demonstrated by results that employees and their creativity are important for Organization Innovation. Therefore, e-HRM functions (e-recruitment & selection, e-learning & development, e-communication, and e-appraisal system) that are employee's management practices have good influences on Organization Innovation. Lin (2011) also explained that success in the adoption and implementation of Organization Innovation requires the coordination of all functions of e-HRM.

Besides, E-HRM is an essential tool that contributes to the readiness of Industry 4.0. With the digitization of Human Resource practices, the managers can focus strategically in line with the visionary aspect of Industry 4.0. The employees can avoid the repetitive tasks and operations become more effective along with real-time reporting. This speedy and efficient procedures can make organizations more capable for Industry 4.0 implementation. Moreover, the fare selection procedure of employees who have sound knowledge and expertise in Industry 4.0 is the main driver that can pave the way to the fourth industrial revolution. According to Poba-Nzaou, Galani, and Tchibozo, (2020), digital transformation in management practices is needed to meet the inherent challenges and grasp the opportunities of Industry 4.0. For example, the electronic way of providing training and development at their fingertips is a more effective way to facilitate the changes in the organizations.

Interestingly, the insignificant relationship of Decentralized Organization Structure with Organization Innovation and Readiness for Industry 4.0 is different from the proposition. It signifies that with a change in Decentralized Organization Structure, there will be no significant impact on Organization Innovation and Readiness for Industry 4.0. Previous studies reported the positive impact of decentralized structure on innovation and the negative relationship between centralized structure and Organization Innovation (Marín-Idárraga, & Cuartas, 2016). The Decentralized Organization Structure type provides an ease to the employees and makes them creative and allows the employees to show their efficiency towards Organization Innovation.

However, there are many reasons for this inconsequential response. Mainly, nowadays due to technologies and ease in business conditions, there are a lot of entrepreneurs who have registered as sole-proprietor or partnership organizations for doing businesses while single or two-persons doing manufacturing business without any structural influence may cause this insignificant result. Importantly, the current Covid-19 pandemic disruption, the organizations adopt technologies that help their employees to work beyond structural limitations. Therefore, our research results portrayed the same peripheral relationship of Decentralized Organization Structure with Organization Innovation and Readiness for Industry 4.0. The understanding of this research results will guide the stakeholders of manufacturing sectors to improve their directions. The gap filled in this research enables them to divert their efforts from Decentralized Organization Structure to Knowledge Oriented Leadership style and Electronic Human Resource Management for striding towards Industry 4.0.

Since all organizations are made up of employees so the vitality of leadership specifically knowledge-based and Human Resource Management is inevitable. Knowledge Oriented Leadership are able to promote the knowledge sharing culture, deploy knowledge that is linked to Industry 4.0 strategic goals, motivate employees to facilitate change, and lead by example to pave the way towards the Industry 4.0 journey. On the top, E-HRM facilitates in; industry 4.0 experts oriented recruitment and selection program, providing learning and development programs to the existing employees to adopt the change, compensating those who promote innovation and have adaptability, and allowing systematic real-time performance appraisal system that will help in embracing the Industry 4.0 with their full capacity.

The results of relationship between Organization Innovation and Readiness for Industry 4.0 states that higher level of innovation can help an organization to be more ready for Industry 4.0 implementation. In the current era of Industry 4.0, Organization Innovation is considered a lifeline (Guimaraes & Paranjape, 2019) and highly relevant for the Malaysian manufacturing organizations in preparing them for Industry 4.0. The noteworthy contribution of testing Organization Innovation as an antecedent of Readiness for Industry 4.0 is a lead for strategy-makers. While considering themselves the beneficiary of Industry 4.0, strategists should design manufacturing focused strategies so that organizations should improve the continuous innovation of their production process. Consequently, it will assist all stakeholders in reaping maximum benefits from Industry 4.0.

Lastly, the indirect effects of Organization Innovation were tested and found two partial mediation between Knowledge Oriented Leadership to Readiness for Industry 4.0 and Electronic Human Resource Management to Readiness for Industry 4.0 respectively. Contrarily to the indirect effect of

Organization Innovation between Decentralized Organization Structure and Readiness for Industry 4.0, which was found insignificant. The findings on role of Organization Innovation is a notable contribution that will broaden the horizon of researchers in context of Industry 4.0. Furthermore, the dual contribution of Organization Innovation can pace up the transformation to Industry 4.0. Besides, the support of Organization Innovation both directly and indirectly to Readiness for Industry 4.0 serve as a roadmap for Malaysian officials as well. These results have multiple offerings for the policy-makers including Ministry of Finance (MoF) while allocating the funds on Industry 4.0 projects, Ministry of Science Technology & Innovation (MOSTI) in initiating innovation based collaborative programs, and Ministry of Education (MOE) in motivating researchers through offering grants and scholarship for further research on Industry 4.0.

CONCLUSION

The empirical investigation has confirmed the prominence of practices (i.e. Knowledge Oriented Leadership, Electronic Human Resource Management, and Decentralized Organization Structure) that are required to adopt Innovation for the preparation of Industry 4.0. It also draws the interests of researcher on mediating role of Organization Innovation and will play an important role in setting the guidelines for the stakeholders to achieve new industry 4.0 policy goals.

Similar to the other researches, the current research also has some limitations. Initially, the present study has been performed on only the manufacturing sector of Malaysia, thus might be limited by its industry type, business processes, and market that are only related to manufacturing. Therefore, the findings could not be extrapolated to all the other industries. Consequently, this research offers the researchers an opportunity to conduct the same scale research to other industrial and other service sectors (e.g. automotive and education) to validate the results further. Nevertheless, the outcomes of this research are solely based on a quantitative investigation by using a closed-ended questionnaire for data collection. Therefore, additional remarks cannot be captured. To improve this limitation, the future study can be performed using a mixed-method approach to comprehend more information about "why" and "how" to adopt Industry 4.0 related technologies and processes from the organization representatives. Finally, other practices such as organizational culture can be added to determine the contribution towards Organization Innovation in the era of Industry 4.0.

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APPENDIX A.

Questionnaire Items
Knowledge Oriented Leadership Our company managers have been creating an environment for responsible behaviour among employees and teams. Our company managers assume the role of knowledge leaders as a mediator for sharing and applying knowledge. Our company managers promote learning from experience rather than work output. Our company managers behave as advisers, and controls are just an assessment of the accomplishment of objectives. Our company managers promote the acquisition of external knowledge. Our company managers reward employees who share and apply their knowledge.
Every matter in our company have to be referred to someone higher up for the final answer
Decentralized Organization Structure Every matter in our company has to be referred to someone higher up for the final answer. In our company, a person who wants to make a decision on his own is discouraged. In our company, any decision employees make needs higher management approval. In our company, no actions are performed until the higher management makes a decision.
Electronic Human Resource Management **Electronic Recruitment and Selection** Our company uses recruiting website/job board to identify potential candidates. Our company posts vacancies list on corporate website. Our company states that electronic recruitment initiatives are in our plans over the next 12 months.
Electronic Learning Training in our company is done through e-learning. Our company has e-learning platform. Our company has plans for implementing e-learning initiatives.
Electronic Compensation Our company has a form of online human resource service centre to handle inquiries of employees regarding compensation. Our company has facilities for their employees to view their pay-slip online. In our company, salary calculation is done through software.
Electronic Performance Appraisal In our company, employee performance evaluation is carried out electronically. In our company, employees' performance data is stored in a computer that can be used later for evaluation of employees. Our company uses performance appraisal software for evaluation purposes.
Organization Innovation Our company's emphasis is on developing new products. In our company, introduction of new products into the market increased in last 12 months. Our company has spent on new product development activities in last 12 months. New products of our company have been introduced for the first time in the market in last 12 months. Our company invested in developing proprietary technologies in last 12 months. Our company's emphasis is on technological innovation.
Readiness for Industry 4.0 **I4-Strategy** Our company is using a plan for the implementation of industry 4.0 activities. Our company has adopted a business model that is compatible with industry 4.0. Our company possesses adequate resources for the realization of industry 4.0.
I4-Leadership Our company managers are willing to face the challenges of industry 4.0 activities. Our company management possesses adequate competencies to face the challenges of industry 4.0 activities. In our company, central coordination for industry 4.0 is available.
I4-Customer Our company has digitalized sales and services. Our company analyses customer data for sales improvement. Our company customers are competent with Information and Communication Technology (ICT).
I4-Product It is possible to integrate products into other systems that are compatible with industry 4.0. Our company products have flexibility in their characteristics. Our company products are digitally compatible.
I4-Operation Our company has decentralized the process of operations. Our company encourages interdepartmental collaboration. Our company is adopting modeling and simulation methods in their operations.
I4-Culture Our company encourages open innovation (cross-company collaboration). Our company encourages knowledge sharing among employees. In our company, the employees value Information and Communication Technology (ICT).

continued on next page

Questionnaire Items
I4-People Our company employees are having high ICT competencies. Our company employees are open to accepting new technologies. Our company employees enjoy autonomy.
I4-Governance Our country business policies have suitable technology standards. Our country business laws protect the company's intellectual property. Our country business laws have adequate labour regulation for industry 4.0.
I4-Technology Our company has adopted Information and Communication Technology (ICT). Our company is utilizing mobile and related devices. Our company has integrated computers with machines and tools.

Item Loadings											
EC1	0.861	ERS1	0.821	I4_G1	0.854	I4_P1	0.865	I4_T1	0.88	OI_1	0.748
EC2	0.941	ERS2	0.885	I4_G2	0.546	I4_P2	0.866	I4_T2	0.813	OI_2	0.873
EC3	0.928	ERS3	0.786	I4_G3	0.870	I4_P3	0.747	I4_T3	0.819	OI_3	0.796
EL1	0.940	I4_C1	0.825	I4_L1	0.862	I4_PP1	0.905	KOL1	0.846	OI_4	0.757
EL2	0.949	I4_C2	0.875	I4_L2	0.941	I4_PP2	0.906	KOL2	0.859	OI_5	0.814
EL3	0.884	I4_C3	0.756	I4_L3	0.927	I4_PP3	0.456	KOL3	0.724	OI_6	0.820
EPA1	0.888	I4_CL1	0.845	I4_OP1	0.802	I4_St1	0.901	KOL4	0.722	OS_1	0.730
EPA2	0.934	I4_CL2	0.769	I4_OP2	0.659	I4_St2	0.930	KOL5	0.832	OS_2	0.767
EPA3	0.900	I4_CL3	0.788	I4_OP3	0.894	I4_St3	0.874	KOL6	0.857	OS_3	0.889
OS_3	0.896										

Note: EC = Electronic Compensation, EL = Electronic Learning, EPA = Electronic Performance Appraisal, ERS = Electronic Recruitment & Selection, I4_C = Industry 4.0 Customer, I4_CL = Industry 4.0 Culture, I4_G = Industry 4.0 Government, I4_L = Industry 4.0 Leadership, I4_OP = Industry 4.0 Operation, I4_P = Industry 4.0 Product, I4_PP = Industry 4.0 People, I4_St = Industry 4.0 Strategy, I4_T = Industry 4.0 Technology, KOL = Knowledge Oriented Leadership, OI = Organization Innovation, OS = Organization Structure.

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