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The Industrial Revolution 4.0

Readiness for Turbulence Business Challenges

Proceeding

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THE INDUSTRIAL REVOLUTION 4.0
Readiness for Turfplace Business Challenge

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Technological Innovation as A Key Strategy for Micro, Small and Medium Enterprises

Nungky Viana Feranita
Sekolah Tinggi Ilmu Administrasi
Pembangunan
Jln. Lumba-lumba No. 9 Jember
+6281234700771
nungky_viana@yahoo.com

ABSTRACT

One of the national priorities in program "Making Indonesia 4.0" is empowerment Micro, Small and Medium Enterprises (MSMEs) because MSMEs has a larger number of business units and labor compared to big business. Indonesian Government is committed to building an e-commerce platform for MSMEs and providing technology funding.

The purpose of this paper is to explore issues related to the importance of technological innovation for MSME in the form of e-commerce adoption in the face of industrial revolution 4.0. The method of analysis used literature study. This paper anticipates that human resources and infrastructure readiness levels will support MSME technological innovation.

To meet the challenges of the 4.0 industrial revolution, it is essential for MSMEs to consider activities related to education, learning and professional training. In addition, the success of the 4.0 industrial revolution will depend on the quality and reach of the infrastructure. Governments should create sustainable national strategies to invest in digital infrastructure through public and private funding.

Keywords : Strategy, Technological Innovation, e-commerce, MSMEs.

1. INTRODUCTION

The industrial revolution has entered the fourth generation characterized by a cyber-physical system. This system is form of human connectivity, machine and real time data. This term is known as the internet of things (IoT). The fourth industrial revolution builds on the digital revolution characterized by a much more ubiquitous internet and mobile, smaller and more powerful cheaper sensors, and artificial intelligence and machine learning (Schwab, 2016). In this revolution, emerging technologies and broad-based innovation are diffusing much faster and more widely than in previous ones, which continue to unfold in some parts of the world.

The term "Industrie 4.0" was created in 2011 originating from a project of the German government to promote the computerization and modernization of manufacturing (Kirner, 2017). Germany's success in developing its manufacturing industry through

technology inspires many countries in Asia including India, Thailand and Indonesia. The Industrial revolution is assumed contribute to more job creation as well as new technology-based investments. Therefore the Indonesian government established a roadmap under the name of Making Indonesia 4.0 focused on five major manufacturing sectors, such as food and beverage, textile and clothing, automotive, chemical, and electronics.

Indonesia establishes 10 national priorities for "Making Indonesia 4.0" whereby one of them is to empower Micro, Small and Medium Enterprises / MSMEs (Ministry of Industry of the Republic of Indonesia, 2018). MSMEs are selected because they are able to contribute to Indonesian economy. MSMEs have more business units than big enterprises. MSMEs also create more jobs than big enterprises. Table 1 below shows a comparison of the number of business units and labor.

Table 1. Comparison of Number of Business Unit and Labor of MSMEs and Big Business Year 2013

	MSMEs	Big Business	Total
Business Unit (unit)	57.895.721	5.066	57.900.787
Labor (person)	114.144.082	3.537.162	117.681.244

Source: Ministry of Cooperatives and SMEs of the Republic of Indonesia, 2018

Table 1 shows that 99.99% of business units in Indonesia are engaged in MSME sector and 96.99% of Indonesian labor work for MSMEs. The Government of Indonesia committed to support UMKM business actors by building an e-commerce platform for MSMEs, farmers and artisans, building technology centers to improve MSME access to

technology acquisitions, and providing mentoring support to drive innovation.

In Indonesia, the role of foreign direct investment is very important for MSMEs but limited to technology transfer from foreign countries to Indonesia (Tambunan, 2007). The common problem is many of MSMEs actors are still not familiar with technology

to develop their business. Whereas the utilization of these technologies have the potential to build MSMEs that have high competitiveness. Therefore, it is necessary the role of government agencies to provide training and assistance.

Technological innovation is a major driver of success in competition now. Advances in information technology also plays a role in increasing the pace of innovation. In relation to MSMEs in Indonesia, technological innovation is generally still inadequate, especially related to the provision of infrastructure and quality of human resources who run digital technology. Digital infrastructure owned by MSMEs is not sufficient and Indonesian labor working on MSMEs has a low productivity resulting in MSMEs in Indonesia left behind.

The purpose of this paper is to explore issues related to the importance of technological innovation for MSMEs in the face of industrial revolution 4.0. This paper anticipates that human resources and infrastructure readiness levels will support MSME technological innovation.

2. LITERATURE REVIEW

2.1 Industrial Revolution 4.0

The word "revolution" denotes sudden and radical changes. Revolution has occurred throughout history when new technologies and new ways of understanding the world triggered major changes in economic systems and social structures (Schwab, 2016). The agrarian revolution was followed by a series of industrial revolutions that began in the second half of the 18th century. According to Bloem *et al.* (2014), the industrial revolution is a concept and development that has fundamentally changed society and economy. The term "development" may seem to indicate some delays in the context of "revolution" which really signifies rapid and fundamental change, but there is no doubt that major changes take place in a relatively short period of time.

In Germany, the term "Industry 4.0" was created at the Hannover Exhibition in 2011 to illustrate how this will revolutionize the organization's global value chain. By allowing "smart factory", the fourth industrial revolution creates a world in which the physical and virtual systems of manufacturing globally work together with each other in a flexible way. This allows for the absolute customization of products and the creation of new operating models.

According to Schwab (2016), the fourth industrial revolution, however, is not only about smart and connected machines and systems. Its scope is much wider. Occurring simultaneously are waves of further breakthroughs in areas ranging from gene sequencing to nanotechnology, from renewables to quantum computing. It is the fusion of these technologies and their interaction across the physical, digital and biological domains that make the fourth industrial revolution fundamentally different from previous revolutions.

2.2 Strategic Management

A strategy is a set of related actions that managers need to improve their company's performance. Most companies, achieving superior performance relative to rivals is a major challenge. If corporate strategy produces superior performance, it is said to have a competitive advantage (Hill and Jones, 2008).

There are a number of definitions about strategic management. Strategic management is a set of decisions and fundamental actions made by top management and implemented by all levels of an organization in order to achieve the goals of the organization (Siagian, 2000). Hunger and Wheelen (2001) argue that strategic management is a set of managerial decisions and actions that determine the company's performance over the long term.

David (2009) argues that strategic management is the art and science of cross-functional 'formulations and implementations' of decisions used as a guide to action for human resources, finance, production, etc. So that the organization can achieve its objectives. These cross-functional decisions can be interpreted as strategies. Strategic management is a collection of decisions and actions that result in the formulation and implementation of strategies designed to achieve organizational goals (Pearce and Robinson, 2013).

From a variety of definitions or conclusions can be concluded that the strategic management for the company is a long-term plan based on the analysis and diagnosis of internal and external environment which further formulate the results of the analysis into a strategic decision which is a means to achieve the ultimate goal.

2.3 Technological Innovation

According to Fontana (2011), innovation is socially and economically successful because of the introduction new ways or new combinations of the old ways transforming inputs into output certain way that there is a major change in the ratio between the value of benefits and prices according to buyer and / or consumer perceptions. Meanwhile, according to Hatcher (2006), innovation is art. Innovation can not be learned. Innovation does not have a system or basic principles, only talented people can make it. Klatt and Hiebert (2001) define innovation as the creation of conditions for creativity and to apply the best ideas. Creativity is the process of generating new ideas.

Technological capability with reference to the opinion of some researchers can be defined as a company's ability to develop an existing technology into newer technologies in order that the company's products are in accordance with market demand, so as to produce products that are also in accordance with market demand (Abereijo *et al.* 2007). The ability of technology depends on the routine that helps the company develop new technology knowledge and produce new products (Song *et al.*, 2005).

In order for the company to survive and thrive in its industry, according to Caniels and Romijn (2001) it requires the capability to continue, adopt, reproduce,

adapt and improve its new technology to produce technological capabilities. But according to Caniels and Romijn (2001) above, most MSMEs do not have technological capabilities. This opinion of Caniels and Romijn (2001) seems to be slightly different from the opinions of Arnold and Thuriaux (1997) which states that there is essentially a hierarchy regarding the technological capabilities of MSMEs. The hierarchies in question are as follows.

- a. Black box.
In this level UMKM does not have the capacity to innovate.
- b. Grey box.
In this level UMKM has the minimum capability to perform adaptation based on the application.
- c. White box.
In this level, UMKM is able to increase incremental technology and its application.
- d. Unboxed.
In this level UMKM is able to develop significantly new variants or innovations.

In terms of technology capability with the type of company, Arnold and Thuriaux (1997) suggested four types of companies with regard to technological capabilities. The four types are as follows.

- a. Research performers, who have two features, namely has a research department or an equivalent, and is able to have a long-term view of technology capabilities.
- b. Technological competents, which has three features, which have many engineers, have

- c. Minimum-capability companies, which have three features, have one engineer, be able to adopt or adapt technological capability solutions, and need help to implement technology capabilities.
- d. Low-technology SMEs, which have three features, lack the technological capability, do not feel the need for technological capabilities, and have no actual need for technological capabilities.

In developing countries, a range of technological and innovation literature (referred to as technological capability approaches) involves the process of absorbing imported technologies in imperfect market systems (Wignaraja, 2003). The technological capability approach emphasizes the learning behind the limits of world technology in industrial newcomers while the perspective of a national innovation system is largely concerned with the generation of new products and processes at (or beyond) the boundaries of the world in advanced industrial countries. In addition, the technological capability approach demonstrates policies to address market imperfections for technological development while the perspective of a national innovation system provides a somewhat less emphasis on the normative issues associated with the innovation process. Figure 1 illustrates the development of technological capabilities.

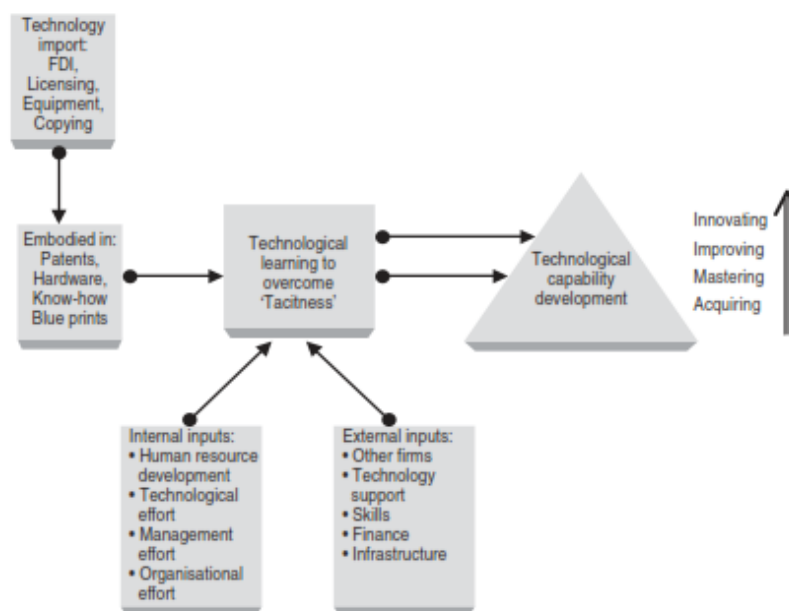


Figure 1. Development of Technology Capabilities

Source: Lall *et al.* (1994) in Wignaraja (2003)

Sutrisno (2011) states that technological innovations contain two meanings at once: (1) technical tools developed to improve the surroundings; (2) knowledge in using equipment and machinery to perform tasks more efficiently. Meanwhile, according to Schilling (2013), technological innovation is an

action to introduce a new tool, method, or material to be applied for commercial or practical purposes. Technological innovation has a number of important influences on society, including encouraging the increase of Gross Domestic Product (GDP), facilitating communication and increasing mobility,

and improving the ability of medical treatments. Technological innovation can also lead to negative externalities, including pollution, resource depletion, and other undesirable consequences of technological developments.

MSMEs control nearly 80 percent of business in developing countries and show the best hope to generate strong local and regional economies (Oyeyinka and Lal, 2006). However, MSMEs often tend to operate with outdated technology and are limited by low skills and finances and poor access to information. The emergence of new technologies in the form of e-commerce tools to provide a promise for MSMEs to revolutionize the way in which MSMEs implement production, innovation and marketing.

Turban (2010) defines e-commerce as the process of purchasing, selling, transferring, or exchanging products, services, and / or information through computer networks, most internet and intranet. Meanwhile, Tagliavini *et al.* (2001) argues that any economic activity carried out via the internet can be called e-commerce. Although the definition varies, it can be seen from the above definition that the use of Information and Communication Technology (ICT), especially internet technology, is a major component of e-commerce.

Antlova *et al.* (2011) argues that the implementation of ICT is one of the keys to the success of MSMEs in long term growth, rather than other competencies because ICTs help MSMEs become more successful and competitive. Olatokun and Kebonye (2010) found that the use of technology often used by MSMEs in Botswana is in the sales system (e-commerce). The main reason for the use of e-commerce technology is to achieve a competitive advantage. Similar to MSMEs in Botswana, Hinson (2006) found that MSMEs in Ghana are well aware

of internet usage. The internet is usually used for sending emails, promotions, and searching for information. e-commerce and other internet applications are able to provide great benefits to MSME exporters in Ghana.

2.4 Micro, Small and Medium Enterprises

In Indonesia, some institutions or agencies even provide the definition of Micro, Small and Medium Enterprises (MSMEs). Central Bureau of Statistics (Badan Pusat Statistik/BPS) provides the definition of MSME based on labor quantity for micro business has a workforce of less than 5 people, small businesses have a workforce of 5 to 19 people, while medium-sized enterprises have a workforce of 20 to 99 people.

On July 4, 2008, Law Number 20 Year 2008 on Micro, Small and Medium Enterprises was stipulated. The definition of MSMEs given by the Act is also different from the above definition. According to this Law, Micro Enterprises are productive businesses owned by natural persons and / or individual entities that meet the criteria of Micro Enterprises.

Small-scale business is a stand-alone productive economic enterprise, carried out by an individual or business entity It is not a subsidiary or not a branch of a company owned, controlled, or becomes part of either directly or indirectly from a Medium Business or a Large Business that meets the Business criteria Small. Medium Business is a stand-alone productive economic enterprise, conducted by an individual or business entity which is not a subsidiary or a branch of a company owned, controlled, or becomes part directly or indirectly with a Small Business or a Large Business that meets the Business criteria Medium.

Table 2. MSMEs Criteria by Assets and Turnover

Size of Business	Criteria	
	Assets	Turnover
Micro Enterprises	Maximum Rp 50 million	Maximum Rp 300 million
Small Enterprises	> Rp 50 million – Rp 500 million	> Rp 300 million – Rp 2,5 billion
Medium Enterprises	> Rp 500 million – Rp 10 billion	> Rp 2,5 billion – Rp 50 billion

Source: Law Number 20 Year 2008

3. METHODOLOGY

This paper uses library analysis method (library research) where data obtained from books and journals that have relation to the problem with study; therefore, it can be used as a reference. Library study aims to explore issues related to the importance of technological innovation for SMEs in the face of industrial revolution 4.0.

4. DISCUSSION

4.1 MSMEs in Indonesia

The MSME sector in Indonesia has proven to be robust, when the economic crisis of 1998, only the

MSME sector survived the collapse of the economy, while the larger sector was severely affected by the crisis (Afiah, 2009). There are at least four things that have made MSMEs able to survive the economic crisis of 1998 (Mudradjad Kuncoro in Bisnis Indonesia Daily on October 21, 2008). First, MSMEs have no external debt. Second, MSMEs do not have much debt to banks because they are considered *unbankable*. Third, MSMEs use local input. Fourth, many MSMEs are export-oriented. These four factors play an important role in improving the capabilities of MSMEs in Indonesia.

According to Lumbanraja (2011), developing countries including Indonesia have changed their

orientation by empowering MSME sector. It happens because the MSME sector plays an important role in supporting and strengthening the people's economy, which is expected to be able to realize and maintain national competitiveness and even at the global level. Developing countries are beginning to change their orientation when looking at experience in advanced industrial countries about the role and contribution of MSMEs in economic growth. It is not surprising that the MSME sector has been promoted and made the main agenda of Indonesia's economic development. In the national economic structure the role of MSMEs is no doubt. This can be seen from its contribution in the formation of national GDP which always increases until 2013 amounting to Rp 1,536,918.8 Billion (Ministry of Cooperatives and SMEs of the Republic of Indonesia, 2018).

Tambunan (2008) stated that MSMEs has also been recognized as having another important role in Indonesia as an engine for the development and growth of non-oil and gas exports, particularly in the manufacturing sector. This is in line with evidence in East and Southeast Asian countries such as South Korea, Taiwan, Hong Kong and Singapore, suggesting that the most successful cases of MSMEs development directly contribute to the trade and implementation of export-oriented strategies. The experience of these countries shows that MSMEs can compete effectively in domestic and international markets. Based on data from the Ministry of Cooperatives and SMEs (2018), in 2009 the value of SME exports created a role of 15.52% of total exports. In 2010, 14.31%, 14.92% in 2011, 12.77% in 2012 and 14.31% in 2013, respectively.

Data from Bank Indonesia (2015) shows that in terms of economic sector MSMEs which has the largest proportion of business units in agriculture, livestock, forestry and fishery (48.85%), followed by trade, hotel and restaurant sector (28.83%) as the second largest sector and manufacturing sector (6.41%) as the third largest sector. In manufacturing sector, MSMEs actors are involved primarily in simple traditional manufacturing activities such as wood products, including furniture, textiles, clothing, shoes, and food and beverages. Only a small fraction of the total MSMEs are involved in the production of machinery, production equipment, and automotive components. This industrial structure reflects the current technological capabilities of Indonesian MSMEs that have not been strong in producing products that use advanced technology.

4.2 Challenges for Indonesian SMEs in Industrial Revolution 4.0

Industrial Revolution 4.0 brings many opportunities and challenges for MSMEs in Indonesia. In relation to MSMEs, technological innovation is generally inadequate, so problem-solving and experimentation are done gradually and incrementally due to inadequate employee development programs and infrastructure support (Abereijo *et al.*, 2007).

MSMEs in Indonesia have not been strong in producing products that use advanced technology. The changes required fully implement the industrial

revolution 4.0; MSMEs in Indonesia are not easy. The emergence of new technologies in the form of e-commerce tools provides a promise for SMEs to revolutionize the way in which MSMEs implement production, innovation and marketing.

Rahayu and Day's research (2017) conducted on 292 MSMEs in Indonesia shows that the adoption of e-commerce by MSMEs in Indonesia is relatively new. Most of them have adopted this technology for less than 3 years, and only a few of them have adopted e-commerce for more than 5 years. The use of e-commerce technology by MSMEs in Indonesia varies from logistics and distribution, finance, purchasing and procurement, operations and production, marketing and after-sales services. However, the majority of them use the technology for marketing activities.

Furthermore, Rahayu and Day (2017) stated that the e-commerce adoption rate consists of four levels: e-mail, static website, interactive website, and e-commerce. There are six benefits of e-commerce for MSMEs in Indonesia: expanding market reach, increasing sales, increasing external communication, improving corporate image, increasing processing speed, and increasing employee productivity. Benefits realized by MSMEs tend to increase with the increasing level of e-commerce adoption. This condition can certainly be a consideration for MSME owners in adopting e-commerce and this will also be useful for MSME owners in deciding whether to move forward to the next stage or not.

The adoption of e-commerce by MSMEs in developing countries, especially in Indonesia, is still at a low level. Compared to MSMEs in developed countries, the level of e-commerce adoption by MSMEs in Indonesia lags far behind. This condition certainly has implications for the government to further improve their efforts by promoting effective programs and initiatives to foster the level of e-commerce adoption by Indonesian MSMEs.

Most MSMEs have difficulty adopting sophisticated ICTs. According to Kannabiran and Dharmalingam (2012), there are five sophisticated adopters of ICT adoption: perceived benefits, business environment awareness, ICT owner / CEO experience, enhancing customer information linkage and perceived competitive pressures. While the five obstacles to the adoption of sophisticated ICT are: lack of financial capacity, lack of ICT labor, small scale operation, lack of ICT infrastructure and lack of information security.

The data mentioned previously have proved so big role of MSMEs to Indonesian economy, even though MSMEs business does not always run smoothly, there are many obstacles and constraints both internal and external especially related to adoption of technology innovation in the form of e-commerce. One of the internal factors of human resources and one of the external factors is infrastructure.

4.3 Human Resources

Some of the obstacles that often arise in MSMEs in Indonesia related to human resources, among others:

1) Lack of knowledge about the latest production technology and how to run the quality control of the product; 2) The ability to read the market needs is still not sharp, so it has not been able to capture carefully the needs of the desired market; 3) Product marketing still relies on simple mouth to mouth marketing. It has not made social media or internet network as a marketing tool; 4) In terms of quantity, can not involve more manpower due to limited ability to pay; and 5) Because the owners of MSMEs are still often involved in technical issues, so less thinking about the goals or long-term strategic plan of its business.

The 4.0 industrial revolution requires changes in the nature of work and also in employee qualifications. According to Kirner (2017), education and qualifications are vital areas for the development of Industry 4.0 MSMEs in Indonesia. The availability of quality labor and the expansion of educational technology aspect towards this transformation will enable employees to cope with more complex processes expected in workplace. Industry 4.0 has promised many changes and of course comes with uncertainty. Therefore, to meet the current and future challenges that bring Industry 4.0, it is very important to consider activities related to professional education, learning and training.

4.4 Infrastructure

In relation to infrastructure, there are two main obstacles faced by MSMEs in Indonesia, namely: 1) Limited facilities and business infrastructure mainly related to technological tools; and 2) Most MSMEs use technology that is still simple.

There is widespread consensus that the success of the industrial revolution 4.0 will depend on the quality and reach of the infrastructure (Kirner, 2017). Particular attention is paid to digital infrastructure such as communication networks. Digitalization invades more areas of our lives so that there is more dependence on data just as we produce larger quantities. It is clear that any network must be built with the capacity to manage the ever-increasing volume of data and quality requirements.

It is urgent for the Indonesian government to create a sustainable national strategy to invest in digital infrastructure to serve current needs and also meet future demand. The government can increase investment in infrastructure through public and private funding. The government should also understand that there are striking differences not only in the ICTs used but also at the rate of adoption of new technologies between MSMEs and large businesses. These differences range from financial constraints to lack of complementary resources such as skilled labor.

5. CONCLUSION

The Industrial Revolution 4.0 is a great time to revitalize the manufacturing sector in Indonesia through the "Making Indonesia 4.0" program. It is because the share of GDP in the manufacturing sector will decline if nothing is done. One of the national

priorities is to empower 57.8 million MSMEs through technology. MSMEs in Indonesia tend to operate with outdated technology so that the government supports by building an e-commerce platform for MSMEs and provide technology funding.

The rate of adoption of e-commerce by MSMEs in Indonesia is relatively new and still at a low level. The majority of MSMEs use the technology for marketing activities. This condition certainly has implications for the government to further improve their efforts by promoting effective programs and initiatives to foster the level of e-commerce adoption by Indonesian MSMEs.

There are several obstacles related to the adoption of innovation technology in the form of e-commerce ie human resources and infrastructure. To meet the challenges of the 4.0 industrial revolution, it is essential for MSMEs to consider activities related to education, learning and professional training. In addition, the success of the 4.0 industrial revolution will depend on the quality and reach of the infrastructure. Governments should create sustainable national strategies to invest in digital infrastructure through public and private funding.

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