

TOE PERSPECTIVE: TECHNOLOGY ADOPTION BY SMEs IN FACING THE INDUSTRIAL REVOLUTION 4.0

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ABSTRACT

This study is an empirical review. This study is considered important with the increasing importance of technology for SMEs to be able to survive in an increasingly complex business environment, with the demands of the industrial revolution 4.0. Technology plays an important role in business activities carried out by all parties at all levels, including SMEs. The results of the review stated that SMEs that use technology, even though the technology is very simple, prove that they can face competition and are resistant to unpredictable business changes. SMEs with all its limitations, still have to think creatively and innovatively to take advantage of technology. Simple technology, for example by utilizing social media, provides opportunities for SMEs to expand market share, create collaboration, focus on consumer needs, establish effective communication with consumers, and other benefits.

Keywords: SMEs, industrial revolution 4.0, technology, business competitions, the advantage of technology.

INTRODUCTION

The concept of the industrial revolution 4.0 is a new reality in the modern economy, based on technological innovation and development, thereby significantly changing products and production systems including design, operational processes and services (Slusarczyk, 2018). The implementation of this concept has managerial consequences to focus on creating new business models. The core principles of the 4.0 industrial revolution are modularization, self-regulation and digital integration across all business functions, both internal and external. The industrial revolution is a strategic initiative of industrial transformation through digitization and exploitation of the potential for new technology (Rojko, 2017). That is, the industrial revolution facilitates actions to balance internal and external complexities by shifting traditional systems towards digitalization from control that was originally centralized to decentralized control (Prause, 2019).

The industrial revolution 4.0 encourages product innovation based on market observations by utilizing technology as an effort to integrate production processes across the value chain, value network and product lifecycle (Prause, 2019). The industrial revolution 4.0 is synonymous with IT implementation (Haseeb et al., 2019); (Slusarczyk, 2018). Not only applies to large companies, all business people, such as SMEs, must also take advantage of technology to be able to compete in the era of the industrial revolution 4.0. SMEs are very flexible in adapting technology and able to handle market niches, while large companies are slower in adapting even though they are supported by large capital (Nooteboom, 1994). This is due to the nature of SMEs which are more creative, innovative, and have high flexibility and are considered suitable or a good business platform for IT implementation.

IT adoption is the first use or acceptance of new technology or new products (Gangwar, Date, & Raoot, 2013). IT implementation is basically a continuum of innovation that organizations need to adopt, as a result of individual competence to understand and be willing to use technology (Guariglia, Liu, & Song, 2008). IT implementation is more about combining a series of digital technologies designed to collect, organize, store, process and communicate information from inside and outside the organization (Ritchie, et al., 2005).

The development of technology which is getting faster and easier to use should be able to trigger the high use of technology. The current reality is that the presence of technology is still not optimally used for SME operational activities (Nugroho et al., 2017). The availability of adequate technology as a tool for doing business is still not used by SMEs, because they are constrained by funding (Guariglia, Liu, & Song, 2008). Given that Small and medium enterprises (SMEs) are a type of business unit that plays a big role in influencing the economic conditions of the country (Nikmah et al., 2020), represent a model of economic development, which emphasizes a high contribution to domestic production and job creation (Uma, 2013), it is necessary for SMEs to implement IT so that they can survive in increasingly fierce business competition. Several previous studies have shown that IT implementation affects networking and internationalization efforts (Senik et al., 2011), influencing competitive advantage (Pavic et al., 2007); (Moghavvemi., 2012); (Teo & Pian, 2003), improve organizational performance (Chairoel et al., 2018); (Haseeb, et al., 2019), has an effect on managerial (Ritchie, et al., 2005). Therefore, it is important to study the challenges of IT adoption in the era of the 4.0 industrial revolution for SMEs to accelerate business progress.

LITERATURE REVIEW

The following section briefly describes the theory to provide a deeper understanding of IT implementation in SMEs in facing the challenges of the industrial revolution 4.0. The objectives of the 4.0 industrial revolution are to achieve operational effectiveness and efficiency, production optimization and automation across all lines (Thames & Schaefer, 2016); (Slusarczyk, 2018). Besides being related to the use of internet technology, the industrial revolution 4.0 is also one of the technical procedures for adding value and effective knowledge to management practices (Haseeb, et al., 2019). The industrial revolution 4.0 was originally a concept put forward by the German government for developing economic conditions (Vogel & Jumar, 2019). The industrial revolution 4.0 includes the application of technology, cloud-based big data, resource management planning activities, IoT and achieving products needed by consumers (Haseeb, et al., 2019). Following are the technological features of the 4.0 industrial revolution.

The industrial revolution 4.0 offers various industrial opportunities, such as real time data access, development of new skills, and achieving sustainable goals (Huang, Chicoma, & Huang, 2019). Real time data access eliminates one of the most difficult challenges ever, such as a lack of up-to-date information. Now, with real time data access, it can achieve sustainable performance because of reduced risk, efficiency of resources and increased social responsibility. In accordance with the objectives of the 4.0 industrial revolution: reducing waste, saving energy and resources and better working conditions (Müller, Kiel, & Voigt, 2018).

The industrial revolution 4.0 is described as Cyber-Physical Systems (CPS), which basically describes a group or collection of transformative technologies that manage interconnected systems between physical assets and computing capabilities (Nwaiwu, Duduci, & Chromjakova, 2019). CPS connects all devices to the internet, that is, it combines five functions: computing, communication, control, coordination and autonomy.

All the advantages that were conveyed in the era of the industrial revolution 4.0, may not be easily carried out by SMEs. As stated above, that the industrial revolution 4.0 is closely related to technology adoption, SMEs experience several obstacles for this process. Facing the industrial revolution 4.0 for SMEs requires a transition from zero or lowest levels or from those that previously did not exist, now they have to jump high to be able to adopt technology (Nwaiwu, Duduci, & Chromjakova, 2019). Requires a change in mindset, maturity of business models and ready for sustainable learning (Ganzarain & Errasti, 2016). There are three perspectives in understanding the importance of technology for SME business development (Ritchie & Brindley, 2005), which are described as follows:

SMEs must be open to technology adoption. It cannot be denied, SMEs by applying technology can survive more, have a competitive advantage, especially if they focus on the international market. The first stage, optimism has the potential to adapt to technology and carry out a continuous learning process. The second stage, begins to think about the benefits of the existence of technology. Starting to do some developments, such as the development of products and services, processes, systems, structures and human resources. The next stage, after building existing systems in the internal organization, begins to think about the externalities of the organization. Establish good relations with several parties, by making some adaptations, and starting to focus on being more effective and efficient in running the organization. The existence of technology is used to establish communications, transactions in a wider scope or lead to internationalization, where technology makes it easier for organizations to more easily predict the market, can immediately adapt to the internal and external environment, facilitate logistical matters, manage risk, and provide trust. to consumers and suppliers and other parties for business continuity.

IT adoption is explained by several theories and models, and in this study tries to parse IT adoption as an SME effort to survive in the era of the industrial revolution 4.0, using the TOE (Technology, Organization, Environment) model. TOE is a classic framework introduced by Tornatzky and Fleischer that explains and predicts technology / innovation adoption. This model contains three contexts: technology, organizational conditions and the industrial environment: (1) Technology describes the adoption of a set of internal and external company technologies including how they accept benefits, techniques and conformity to the organization, the complexity faced, the learning process, and trials. (2) Organizational conditions are described about the presence of top management support, organizational culture, and the complexity of the managerial structure. (3) The industrial environment relates

to operational support and constraints, such as competitive pressures, trading partners, socio-cultural issues, government support and supporting infrastructure, such as the presence of IT consultants. Implementation of IT measured by TOE in SMEs has been done a lot so that the variable has been tested several times.

Table 1. Review and categorization of articles

| Author and Year | Type of Study | IT Adoption | Focus and Influencing Factors | Methods | Data and Context |
|--|---------------|--------------------------------------|---|--|--|
| (Awa, Ukoha, & Emecheta, 2016) | Quantitative | ERP adoption | Analyze and test some of the internal and external capabilities of SMEs in adopting ERP (enterprises resources planning) | SEM-PLS | 373 SMEs owner in Nigeria |
| (Prause, 2019) | Quantitative | Technology adoption and digitalisasi | Analyze and test the internal capabilities of SMEs such as employee capabilities, organizational values / culture, owned infrastructure, experience, costs for adoption, management support, production systems, technology owned, organizational structure in adopting technology and digitizing | Regression analysis | 38 SMEs owner in Japan |
| (Effendi, Sugandini, & Istanto, 2020) | Quantitative | Social media adoption | Analyze and test the internal capabilities of the organization, existing technology and the conditions of the business environment faced in the selection of marketing media with social media | SEM | 250 SMEs owner in Yogyakarta Indonesia |
| (Eze et al., 2020) | Qualitative | DMD adoption | Explore the factors that influence the adoption of DMD (digital marketing devices) from a technology, organizational and business environment perspective | NVivo | 26 SMEs owner in Nigeria |
| (Matikiti, Mpinganjira, & Lombard, 2018) | Quantitative | Social media marketing adoption | Analyzing the factors that influence the behavior of using social media as a marketing tool | multiple regression analysis and one-way ANOVA | 150 SMEs owner in South Africa |

GENERALIZATION OF THE MAIN STATEMENTS

Attention to the growth and role of SMEs, especially in developing countries, is increasing. The government through banking institutions makes it easy for SMEs to get loans with easy procedures and low interest in an effort to help SMEs in terms of capital and optimization of resources (Kumar, 2017). In the era of the industrial revolution 4.0 and the Covid-19 pandemic, the challenge facing SMEs is the adoption of technology. If in the past they could still choose to run a business online or offline, current conditions have forced SMEs to be adaptive to online activities. Today's business cannot only rely on offline, it must involve online, so it can be said that technology adoption is important for SMEs (Chang & Hughes,

2012). But in reality, there are still many SMEs that are constrained by technology adoption. Many researchers have raised the constraints of SMEs in adopting technology, such as those related to the readiness or attitudes of SMEs owners (Astuti & Nasution, 2014); unable to invest in technology because they do not have funds and do not have competent human resources (Clear & Dickson, 2005), and other reasons. However, recent developments show an increase that SMEs have begun to adapt to technology, although its use is still limited.

This study tries to explore the concept of IT adoption with the TOE model in SMEs during the industrial revolution 4.0. To achieve this goal, five papers were used as discussion materials. The review paper was chosen as a method of analysis, to prove that the TOE model is able to provide clarity about IT adoption by SMEs as a result of the ongoing industrial revolution era 4.0.

RESULTS AND DISCUSSION

All studies give the same results that IT adoption is important for SMEs in the present and the future. The adoption of IT provides flexibility in the business activities carried out by SMEs. IT adoption does not have to be expensive, can be implemented simply, by optimizing the use of social media as business interactions between producers and consumers, incorporated in online applications, becoming part of the market place, are steps towards being online by SMEs.

Associated with the TOE model, proposed by Tornatzky and Fleiser's, where technological, organizational, and environmental factors are used as the basis for analyzing IT adoption by SMEs. The following describes the TOE model used by each researcher:

Table 2. TOE model used by each researcher

| T-O-E Factors | (Awa, Ukoha, & Emecheta, 2016) | (Prause, 2019) | (Effendi, Sugandini, & Istanto, 2020) | (Eze et al., 2020) | (Matikiti, Mpinganjira, & Lombard, 2018) |
|---------------|---|--|--|--|---|
| Technology | 1. Infrastructures 2. Technical know-how | 1. Relative advantage 2. Complexity 3. Compatibility 4. Cost | 1. Perceived relative advantage 2. Perceived complexity 3. Perceived compatibility | 1. Functional capability 2. Adaptive capability 3. Expandability | 1. Availability 2. Characteristics 3. Skilled personnel |
| Organization | 1. Perceived compatibility 2. Perceived values 3. Security 4. Scope of business operations 5. Demographic composition 6. Size of the firm 7. Subjective norms | 1. Top management support and championship 2. Satisfaction with existing systems 3. Organizational structure | 1. Employee skills 2. Cost perception 3. Top management support | 1. Collective understanding 2. Degree of partnership 3. Diversity of information | 1. Formal and informal linking structure 2. Communication process 3. Size 4. Slack |
| Environmental | 1. External support | 1. Market uncertainty | 1. Competitive advantage | 1. Quality service delivery | 1. Industry characteristic |

| | | | | |
|-------------------------------|---------------------|------------------------------|------------------------|--------------------------------------|
| 2. Competitive pressure | 2. Industry cluster | 2. Government support | 2. Customer fulfilment | 2. Market share |
| 3. Trading partners readiness | | 3. Environmental uncertainty | 3. Intense competition | 3. Technology support infrastructure |
| | | | | 4. Government role |

Based on the table above, the TOE model used to measure technology adoption in SMEs, there are several similarities in the measurement indicators. The results of the study (Awa, Ukoha, & Emecheta, 2016), are more directed at behavioral control according to the plan behavior theory (TPB). For the technology factor, SME owners can quickly understand the potential resources available as a step for innovation. Internet skills, the infrastructure available to be utilized, a willingness to learn, a willingness to spend time, it all depends on SMEs owners to be able to take steps easier as an effort to adopt technology. Meanwhile, organizational factors indicate that IT adoption is influenced by the heterogeneity of the group, experience, and educational background of the organization members that give rise to adoption behavior. Environmental factors, in this study highlighting the external environment can pose opportunities and threats for SMEs. Strategic position, operational effectiveness, market forces, proactive decisions, competitive pressures, regulations, have a significant impact on the adoption ability of an SME, while the readiness of partners does not have a significant effect as a consideration for SMEs in adopting technology.

Furthermore, research conducted by (Effendi, Sugandini, & Istanto, 2020), shows about the behavioral intention of SME owners to adopt online marketing media through social media. In the technological context, using statements of relative advantage, perceived complexity, and conformity with perceptions shows a positive influence on awareness to make social media an online marketing medium. This research was conducted during the Covid-19 pandemic, so that this relationship is getting stronger along with the increasing need for online business as a result of government policies to break the chain of spreading the virus, by issuing several policies to limit social activities. This has an impact on the limited space for producers to meet directly with consumers, so that the online method is deemed the most appropriate to continue to be able to carry out business activities.

The organization context states that social media provides opportunities for SMEs to continue operating in this pandemic. The emergence of social media made it easier for SMEs to find resources among the market domination by large companies. The use of social media is inexpensive, but it can make business activities easier, communication and response to consumers can be done quickly, and the distribution process can be done immediately. This means that the use of social media for SMEs provides benefits, namely reducing costs, increasing productivity, increasing system integration, providing a collaborative environment, and increasing competitiveness. Meanwhile, the environmental context explains, when SMEs adopt social media in running their business, it will be easier to gain a competitive advantage, as well as be more able to cope with uncertain market conditions. It is also stated in this context, if the government can provide financial assistance, resources, cooperative tax policies to SMEs, it will make it easier for SMEs to adopt technology.

Research conducted by (Eze, et al., 2020), gave the same results as the studies above. Technological factors, focus on functional capabilities, adaptive capabilities, and the suitability of new innovative technologies, do not deviate from existing technology, making it easier for SMEs to adopt technology. While the organizational factors in this study stated that if SMEs have a collective work culture, where each member depends on each other and

works well together, has colleagues who are able to provide stimuli for technology adoption, as well as easy access to information from various sources, then will make it easier for SMEs in the technology adoption process. The organization here is described internally and externally. It is believed that information obtained externally makes it easier for SMEs to consider technology adoption. The environment in this study is analyzed from various things, such as training programs are said to be necessary for SME owners to be able to care about the importance of technology adoption, then the analysis focuses on consumers, namely technology adoption as an effort to meet consumer needs, and technology adoption for SME long-term plans. namely to meet the needs of market expansion, face business competition, and diversify.

The last paper reviewed in this study was written (Matikiti, Mpinganjira, & Lombard, 2018). Still using the T-O-E model, this study measures the attitudes of UKM owners in adopting social media marketing decisions. The technology factor highlights the extent to which SMEs are willing to adopt technology. Being willing here includes the availability of infrastructure and the ability of SMEs to adopt technology. Meanwhile, organizational factors highlight the educational background of UKM owners. It is believed that the level of education affects one's perspective, size and experience of SMEs in carrying out business activities and can also make a consideration for adopting technology. Meanwhile, the environmental factor is more on external factors, namely government support, infrastructure that supports the technology adoption process, and the characteristics of the business environment. SMEs operating in remote areas and big cities will have different needs for technology adoption. SMEs in remote areas must adapt to existing public infrastructure before adopting technology. Otherwise, technology adoption will only waste money and provide no benefit to SMEs.

So far, several studies on technology adoption in SMEs confirm each other's research results. The focus on the T-O-E model, an indicator used as an analytical tool, makes a real contribution to the role of technology, organization and the environment in analyzing technology adoption for SMEs. The T-O-E model succeeds in providing a clear picture of both the internal and external factors of SMEs in considering technology adoption. The analytical tools offered by the T-O-E model explain thoroughly from various points of view. The behavioral point of view, based on the theory of plan behavior, shows that technology adoption is influenced by the level of awareness of SME owners on the importance of technology adoption in facing the challenges of the industrial revolution 4.0, the business environment, where several studies mention the level of competition and competitive advantage, seen from a sustainability point of view. business. Given that SMEs contribute greatly to the economy of a nation, this consideration must be taken into account. Likewise with the demands of the other 4.0 industrial revolution, that business is now synonymous with uncertain market conditions, so technology adoption is one way to minimize the risk of business failure. In the era of the industrial revolution 4.0, technology adoption is non-negotiable. Studies with the T-O-E model are still considered relevant to measure the ability of SMEs to adopt technology.

CONCLUSION

Based on theoretical explanations and empirical analysis, technology adoption by SMEs in facing the challenges of the industrial revolution can be measured by the T-O-E model. The technology factor provides an explanation of the ability of SMEs to adopt technology, the capabilities referred to include funding, internal infrastructure and personal capabilities.

Organizational factors provide an explanation of the organizational structure, work culture, support from top management, the desire to meet consumer needs and long-term plans for SMEs such as expansion, diversification and competitive advantage. Environmental factors, explaining the external conditions of SMEs that support technology adoption. The role of government, the availability of public infrastructure, the level of competition, and the characteristics of the business environment.

This study is important in line with the increasing importance of technology for SMEs to survive in an increasingly complex business environment, along with the demands of the 4.0 industrial revolution, namely technology plays an important role in business activities carried out by all parties at all levels, including SMEs. Even though SMEs with all their limitations, still have to think creatively and innovatively to take advantage of technology in carrying out their business activities. As stated above, the existence of technology does not have to be expensive investment, by utilizing social media as a marketing medium, provides many opportunities for SMEs to continue to grow amid increasingly fierce competition, can expand market share, create collaboration opportunities, and other benefits.

This research was not conducted by observation. This research is the result of reviewing several papers, and the number is not many. Review papers are only conducted on research conducted in a few countries. So this research is very limited, has not been able to provide results that are said to be valid about the adoption of technology in SMEs in responding to the challenges in the era of the industrial revolution 4.0, with analysis using the T-O-E model. It is hoped that further research can write articles as a result of field research with a wider range of research.

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