**INDONESIAN SMEs' ATTITUDE TOWARD INTERNET USAGE AS A PREREQUISITE OF INDUSTRY 4.0 TECHNOLOGY ADOPTION**

# **ABSTRACT**

Indonesia has been experiencing rapid economic growth over the past few years, driven by small and medium-sized enterprises (SMEs). However, with the advent of Industry 4.0 and the Internet of Things (IoT), SMEs must adapt and embrace new technologies to remain competitive. The changes directed scholars to study the adaptability and impact of those technologies on the organization’s efficiency; however, none has provided the roadmap for Indonesian SMEs to adopt Industry 4.0. Thus, the current research examines the preparedness of Indonesian SMEs’ adaptability to Industry 4.0 by analyzing the impact of SMEs’ capability and pillar enablers to use the internet as a prerequisite for adoption. The research uses secondary data named Sakernas with 215034 respondents. The structural equation modeling model was built based on SMEs’ capability, pillar enabler, and attitude to use the internet and was tested through computer software. The results show that both the SMEs' Capability (Number of Employees, Employee Education Level, and Revenue) and Pillar Enabler (Use of Digital Technology, Training, and Productivity) positively correlate with Internet use in communication and Promotion with a weight of 0.18 and 0.06 respectively while the P-value is below 0.001. Hence, Indonesian SMEs interested in stepping into the Industry 4.0 paradigm must eventually embrace the Internet first and then IoT to build the bridge to implement Industry 4.0.

KEYWORDS: Industry 4.0; Indonesia; SMEs; adoption; Use of the internet; IoT; structural equation modeling

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# **Introduction**

The arrival of Industry 4.0 radically changed manufacturing companies and other organizations. Industry is one of the main components of economies that produce goods and services that require continuous mechanical and automatic improvement. Since the beginning of production, the evolution named "the industrial revolution" has gradually contributed a lot, i.e., the invention of electricity with the first industrial revolution, mass production and scientific approach with the second, statistical-based decision, and the initiation of the internet, automation and spread of technology by the third industrial revolution (Lasi et al. 2014). Industry 4.0 is a new, advanced technology integrating humans, machines, and information(Bai, Li, and Xiao, 2022).

Industry 4.0 technologies such as the Internet of Things (IoT), cloud computing,3D printing, big data, and artificial intelligence (AI) have rapidly gained popularity and provided firms with more opportunities to upgrade their manufacturing facilities. Germany initially adopted those technologies in the manufacturing field that interconnected, communicated, analyzed, and used the information to drive further intelligent action back into the physical world(Kayembe and Nel 2019). Adapting those technologies led manufacturing to radical improvements. Industrial augmented reality connects employees and the digital environment. They can access and interact with digital information and objects in real time, performing tasks and

theyeeeeeeeee are working in the physical environment. This allows them to receive real-time guidance, training, and support and to collaborate more effectively with colleagues and machines. (Egger and Masood 2020; Masood and Egger 2020). The Industry 4.0 paradigm is concerned with improving existing products with advanced abilities, changing the process, strategy, and organization offerings, predicting maintenance, speeding up the service, and continuous improvement(Rassool and Dissanayake 2019). Many organizations understand the potential of Industry 4.0 in value-adding and are setting a strategic roadmap to embrace this paradigm(Rana and Rana 2020). Organizations or enterprises not planning to shift into this paradigm will lose the competition. At the same time, those already adopted Industry 4.0 have eventually leveraged their product quality, speed of service, and integration of customers into the production line from the design and reduction of cost and are still dominating the market(Goldfarb and Tucker 2019; Rana and Rana 2020).

Big organizations or multi-national enterprises (MNEs) fit socially and economically into the Industry 4.0 transition, while small and medium enterprises (SMEs) became the victims. The adaptability of this paradigm has been grounded by different factors, including the country’s development, the organization’s size, and geographical conditions. Hence, the topic has driven scholars to find the readiness of enterprises to embrace this paradigm. Existing scholars proved that highly economically developed countries and big organizations (MNEs) are primarily favorable to adopting Industry 4.0. On the other hand, the developing countries that follow face issues of quality, efficiency, and market competition (Masood and Sonntag 2020).

Even if Industry 4.0 is significant for SMEs, there were different challenges, including skills shortage, culture breaking, finances, time, and digital Infrastructure (Rodrigues et al. 2021)(Masood and Sonntag 2020). Due to the emergency of adopting Industry 4.0, some challenges led SMEs to step aside from the competition. The market competition grew daily, and a few SMEs, mainly those from developed countries, learned they might take risks with the competition. However, those in developing countries must find a proper way to adapt by splitting those technologies into different tranches. Industry 4.0 and internet use are intertwined. The Internet is the foundation for connecting devices, enabling data exchange, facilitating cloud computing, supporting artificial intelligence applications, and fostering collaboration within the industrial sector. That is why researchers claimed that Internet use and IoT would be the foundation for understanding Industry 4.0(Bai, Li, and Xiao 2022)(Parashar et al. 2023)(Lampropoulos, Siakas, and Anastasiadis 2019).

The fourth industrial revolution (Industry 4.0) is believed to have been sparked by the Internet of Things (IoT), and more especially by the Industrial Internet of Things (IIoT), as well as the digitization and automation of industrial manufacturing(Lampropoulos, Siakas, and Anastasiadis 2019). For small and medium enterprises (SMEs) that cannot financially support all Industry 4.0 technologies, evaluating the readiness of those aspects claimed to be the foundation of Industry 4.0 is more beneficial. The IoT is a cutting-edge technology that is expanding quickly and offers a wide range of services, functions, and applications in daily life. To connect the physical and digital worlds and enable "people and devices to be connected anytime, anywhere, with anything and with anyone," the Internet of Things (IoT) seeks to permeate our everyday surroundings and its items(Lampropoulos, Siakas, and Anastasiadis 2019).

Worldwide, SMEs are the leading economic growth of a country; for example, in Europe, they represent 90 % of registered companies (Masood and Sonntag 2020), and around 70% of Indonesian companies are SMEs(Mak. Indones. 2019). The MSME sector comprises nearly all of Indonesia's economy (99.99%)(Kurniawati et al. 2021). Given that manufacturing makes up around 18% of Indonesia's GDP, it is critical to hasten the adoption of new digital technology. According to a recent McKinsey report, digitization could boost Indonesia's economic production by $120 billion by 2025, with manufacturing accounting for around $34 billion. Hence, the owner must adopt current technology to accumulate the country’s profitability.

Indonesia has been experiencing rapid economic growth over the past few years, driven by small and medium-sized enterprises (SMEs). However, 90% of Indonesia's MSMEs still require conventional operations in the contemporary Industrial Era. 4.0 because it is difficult for MSME players to go from offline to online. To respond to this sustained and independent business and economic growth issue, the Ministry of Cooperatives and SMEs of the Republic of Indonesia has established several strategic initiatives to boost the competitiveness of SMEs and cooperatives(Kurniawati, Al Siddiq, and Idris 2020)(Kurniawati et al. 2021). Investment incentives for technology adoption have been promised, €400Mn in funding for cyber-physical systems, IoT, and other 4IR technology research(Ministry of Industry 2018).

The Government of Indonesia has set a roadmap to leverage Food and Beverages, Textile and clothing, Chemical, Electronics, and Automotive, which are the leading SMEs to GDP contribution and overall employment opportunities (Ministry of Industry 2018); on the one hand, some of them have already attempted this transition while others still struggling with the commitment to step in. so, it still controversial about what the challenges limit them to adopt Industry 4.0. Even if the Government provided incentive opportunities for SMEs to step up to implement Industry 4.0, there is still a need for a detailed roadmap on the requirements to establish Industry 4.0 technologies with low financial abilities.

Implementing Industry 4.0 technologies successfully needs a strong foundation, which is intense Internet usage and Internet of Things (IoT), to serve the relationship between those technologies. Since there is still limited research about Indonesian SMEs related to Industry 4.0, this study investigates the attitude toward Using the Internet. Hence, this study will ground the prior bases to adopt Industry 4.0 (Internet and IoT) as a smother of the roadmap for Indonesia's SMEs to implement Industry 4.0. The current study investigates the relationship between SMEs’ capability and pillar enablers to the use of the Internet to fill the research gap about the Internet’s role in embracing Industry 4.0. Based upon this research’s purpose, the following is the research question:

***What are the factors that are significantly affecting the adoption of the Internet in Indonesian SMEs?***

The rest of this research will be conducted as follows: The literature review is in the second section, the third is a methodology, the fourth is the results, the fourth is a Discussion, and the last is a conclusion and recommendation.

1. **Literature Review**

This part concerns the background of Industry 4.0 and IoT and will provide an overview of the methodology used and the contribution of the current study.

**Industry 4.0, Internet and IoT: Overview and Importance**

The three aspects are mainly crucial in technology because they are more correlated. The Internet allows access to global information and establishes a global electronic presence(Tan and Teo 1998). Digital transformation needs communication between worldwide information and intermediates between physical and electronic devices for better communication; for example, Artificial Intelligence (AI) requires the support of big data through the Internet’s connectivity, enabling the Internet of Things to serve the Industry 4.0 remaining technology. The Internet of Things is fundamental for gathering and distributing data via Internet-connected machinery and gadgets [12]. Industry 4.0 and IoT are revolutionizing the manufacturing environment in SMEs with never-before-seen potential to boost their growth and competitiveness. Industry 4.0 describes how cutting-edge technology like robotics, AI, and IoT are incorporated into industrial processes to create "smart factories" that maximize output and simplify supply chains (Nagy et al. 2018).

**Industry 4.0 and manufacturing**

The manufacturing process refers to the input, transformation, and output. Each part of manufacturing plays a crucial role in proceeding to the next step, especially the beginning stage (intake), which includes the supplier of raw materials, skills, machines, and information. After Germany adopted Industry 4.0 in 2011, the manufacturing production and development model saw significant changes due to the mobile Internet, cutting-edge apps, big data, industrial programmable controllers, and cloud computing. The Era gained popularity, and the USA and China stepped into this revolution to stay alert on market competition(Masood and Sonntag 2020)(Kuo, Shyu, and Ding 2019). Before Industry 4.0, there was the presence of three industrial processes, as illustrated in Fig.1

Collaborating with suppliers, producers, and merchants is essential to ensure the transparency and sustainability of the process and transportation of products and services for any organization in the field of manufacturing (Tjahjono et al. 2017). Artificial intelligence, the Internet of Things, advanced robotics, Big Data Analytics, and Cyber-physical systems transformed traditional supply chains into supply chain 4.0 to reduce inefficiency and lower cost while improving flexibility(Kurdi et al. 2023).

Understanding the supply chain through digitalization helps firms address changing customer needs, supply-side challenges, and unfulfilled expectations for increased efficiency. In conjunction with advanced forecasting methods, such as predictive analytics of both internal (like demand) and external (like market fluctuations, weather, school holidays, and construction indexes) data, A considerably more accurate forecast of customer demand is provided by machine-status data for spare parts requirements. Formerly, monthly projections were now weekly and daily for the most quickly changing products. The flexibility to respond and changes in demand have led to minimizing the planning cycle and fixed period. Automating both physical and planning and integrating the Internet has upgraded supply efficiency, and the unique customer demand has strengthened with inventory management (Alicke, Rexhausen, and Seyfert 2016).

Industry 4.0 and supply chain 4.0 in SMEs are still modest(Hopkins 2021). However, they play a significant role in the communication, flow, and efficiency of service and the quality of products; it depends on the company’s size and state, while big-sized companies and developed countries are most favorable to fit into this paradigm.

**Factors Driving the Adoption of Internet, Industry 4.0, and IoT**

In the existing scholars, the previous Authors mentioned different factors that are fundamental reasons SMEs stay behind in this paradigm transition. For example, in the UK, it has been found that financial knowledge, company size, time, and perceived benefits are the leading factors for SMEs adopting Industry 4.0 (Masood and Sonntag 2020). In Malaysia, the organization’s capabilities, SMEs’ institutional support, Firm size market factors, and perceived advantage were marked(Wong and Kee 2022). In Colombia, Opportunities in the market, labor issues, client demands, rivalry, and a high-quality image were summed into driving factors: Lack of expertise, finance, and skills grouped into facilitating factors, while technological difficulties, operator training, and leveraging their mindset, lack of appropriate people were identified as impeding factors(Rojas-Berrio et al. 2022). In six Central European regions, investment factors, social capital, Management support, and absorptive capacity are the limitations (Agostini and Nosella 2020).In Portugal, human resources, strategic planning, venture capital and creativity, networks/ partnerships, management capability, and financing are vital for SMEs implementing Industry 4.0 (Rodrigues et al. 2021). In Singapore, the annual revenue, type of firm, and number of employees influence Internet use.

Different regions experienced various factors enhancing the adaptability of Industry 4.0 and other digital transformation aspects. In Indonesia, only a few scholars generally discuss this topic. Norman has mentioned the Absence of digital culture and related skills, high capital, the Absence of digital framework, the absence of laws and regulations and support, and inadequate change administration in textile and clothing firms(Norman and Alamsjah 2020). M. Ushada, F. Trapsilawati, R. Amalia, et al. claimed that the perception of technology benefits is another limitation for food and beverage SME firms to adopt Industry 4.0 (Ushada et al. 2022). However, those two researchers analyzed the factors influencing the adoption of Industry 4.0 in SMEs and MNEs. Still, scholars need more research to study the preparatory stage of implementing Industry 4.0. For example, research examines the implementation of the Internet and the role of the Internet and IoT in transitioning from offline working methods to online. In this article, the factors influencing digital transition (Internet, Industry 4.0, IoT) are identified and evaluated to the attitude to Use the Internet to strengthen the roadmap to embrace this paradigm. This research needs structural equation modeling to formulate the hypothesis, and the results will contribute to the Indonesian SMEs' transition to Industry 4.0. Table 1 summarises the previous research from different countries, focusing on the research objective, research object, factors affecting digital growth (Use of Internet, Industry 4.0, IoT), government, and methodology. We can see that there needs to be more research about attitudes to adopting the Internet, especially in Indonesia.

## **Structural Equation Modeling**

The statistical method, structural equation modeling (SEM), examines the connections between latent and observable variables. It is a thorough method that looks at intricate causal links between variables by combining regression, path, and component analysis. By evaluating the fit between the predicted relationship and the observed data, SEM enables researchers to evaluate and improve theoretical models (Ullman and Bentler, The current research is more concerned with using the Internet as one enabler of Industry 4.0 implementation and the IoT, the vital communication enabler between the rest of those technologies. This research analyzes the relationship between “SMEs' capability and Pillar Enabler” and the use of the Internet to evaluate their contributions. Hence, this research will provide a roadmap for Indonesian SMEs to adopt Industry 4.0 by providing preparatory processes and requirements. The SEM framework can be utilized as a strategy or approach to finding the primary factors of why these firms stay behind in this paradigm and how much they correlate.

**3. Research design and methodologies**

## **Research design**

In this research, the literature review contributed to factors that might hinder adopting Industry 4.0 and the importance of using the Internet and IoT in transitioning to the Industry 4.0 paradigm. On the other hand, a survey was suggested to gather the correlation analysis, which was later found to meet the existing Sakernas data collected in 2022(Badan Pusat Statistik 2022). The data has a substantial advantage due to its large number, contributing to an accurate conclusion. The Directorate of Population and Labour Statistics, BPS– Statistics Indonesia, provides labor force data. In every province in Indonesia, it is conducted using The Natioverseesey (NLFS/Sakernas). The National Socio-Economic Survey (Susenas), the Intercensal Population Survey (SUPAS), and the Population Census (SP) are some more sources of information on the labor force. Apart from the extension of unemployment and employment status since 2001, the concepts and definitions used for the labor force data have been consistent across surveys and censuses conducted since 1976. [30].

The formation of the model was created into two phases. The first reviews the benefits and challenges of embracing the Industry 4.0 paradigm to contribute to the factors that might be obstacles or challenges to adopting the implementation of Industry 4.0 and an overview of the reason why SMEs could first embrace the use of the internet and IoT before they step into the whole Industry 4.0 paradigm. Research (Masood and Sonntag 2020), (Sriram and Vinodh 2021), (Rojas-Berrio et al. 2022), (Rassool and Dissanayake 2019), and (Ushada et al. 2022) mentioned financial aspects, which are more related to two indicators: Productivity and Use of Digital Technology. Research (Masood and Sonntag 2020),(Ghobakhloo et al. 2022), and (Rassool and Dissanayake 2019) also commonly mentioned knowledge constraints, specified as Education Level and Training in current research. In contrast, analysis (Masood and Sonntag 2020), (Wong and Kee 2022) and (Tan and Teo 1998) mentioned company size, which is assigned as Revenues and Number of Employees in the recent study. These factors influence the implementation of Industry 4.0 and the Internet at the same time because the Internet is one of those technologies offered by Industry 4.0; hence, current research emphasizes the Attitude to Use Internet due to the expectation of ease of use of Industry 4.0 technology once the Internet is well implemented.

The second was the choice of framework; in this phase, the structural equation modeling (SEM) model and hypothesis were developed. After completing the SEM model on the attitude to use the internet through several factors, secondary data named Sakernas was rescaled to be categorized in the same group. The applications of Statistics computer-based software were utilized to test the theories. The relationship between factors will be discussed in the data analysis part of this research.

**SEM hypothesis model**

Structural equation Modeling is chosen because of its capacity to gauge causal links between latent (unobserved) variables and quantify the amount of unexplained variance. SEM can also assess to what extent a conceptual model, including observable clues and fictitious constructs, explains or fits the gathered data. SEM is chosen over regression analysis because it is more adaptable. For example, other potential causes of the mediator and result, such as longitudinal, can be incorporated into the model along with numerous predictor factors, mediators, and outcome variables. Additionally, SEM is regarded as the analytical method for this article because of its knowledge regarding the level of fit for the complete model after adjusting for measurement error [31].

This model was developed based on the factors ascertained through the literature review summarized in Table. 1. Those articles mentioned in Table.1, insisted on the financial aspects, skills issues, and the firm characteristics as main factors; for example, the one in Singapore(Tan and Teo 1998), which is more specific for Internet adoption, claimed that types of Firms, Firm size, and Annual revenue influence Internet adoption. In this research, the company size refers to the Number of Employees and Revenues. Firm characteristics are replaced by financial aspects identified as Productivity and Use of Digital Technology. At the same time, knowledge constraints are taken as an additional selection to strengthen the attitude to Use the Internet, as several articles have mentioned it to be critical for digital transformation, and it is measured by two indicators: Education Level and Training. Hence, those indicators were then grouped into three latent variables (Pillar Enabler, Capability, and Attitude to Use the Internet). Pillar enabler (PE) is measured by Productivity, Training, and Use of Digital Technologies; SME Capability is determined by the Number of Employees, Education Level, and Revenue; and Attitude to Use the Internet, which is measured by Pillar Enabler, SME capability, Internet for Promotion, and Internet in Communication. 8 indicators and three latent variables compromise the SEM model. Those indicators were then matched with the questionnaire of Sakernas data 2022, where question number 6. a was selected to match the Education Level, 6.d to match the Training, 13. b, to match the Number of Employees, 15. c, for Productivity, 18. a, for the Use of Digital Technology, and 18. c for the Use of the Internet. On this basis, seven questions and 215034 respondents were obtained. The questionnaire can be seen in Fig. 3.

The analysis will be conducted through computer software to find the relationship between variables and test the hypothesis. Boxes or rectangles enclose the observed variables, and the latent variables are surrounded by circles or ellipses (i.e., Capability, Pillar Enabler, and Attitude to Use Internet). In theory, an element is the shared variation between a group of variables that have been observed. For instance, the Pillar Enabler factor represents the standard variable between productivity, training, and the use of digital technology. Lines connecting an object to a particular observable variable denote the connection between that measure and that factor. These correlations are regarded as factor loadings, and the variable's commonality estimate is the square of the factor loading. Smaller ellipses show that each observed variable measures something different from the factor that has been postulated, and they also enclose the measurement errors. A curved, double-headed line between two elements (Capability & Pillar Enabler) indicates they have shared variance or are correlated.

**Hypothesis**

The current research aims to study the influence between two latent variables, Pillar Enabler and Capability, on the Attitude to Use of the Internet. Hence, two hypotheses are generated as follows.

H1 Capability positively correlates with an Indonesian SME's attitude toward Internet use.

H2 Pillar enabler will positively correlate with an Indonesian SME's attitude toward Internet use.

Participants and Procedures

Small and medium-sized businesses (5–500 employees) owned by Indonesians make up the study's sample. Food, beverage, and textile SMEs were chosen due to their significant impact on employment and GDP. Only businesses that are either in the process of adopting Industry 4.0 or have not yet done so were chosen to ensure they have similar goals. On that basis, 215034 respondents were obtained. The respondents are the owners, who are directly in charge of the leadership of each targeted organization. Those data were selected from Sakernas data 2022.

**4. Results**

This section discusses the three latent variables and outlines the result and analysis obtained from the hypothesis test. The three latent variables are capability, Pillar Enabler, and Attitude to Use the Internet. Capacity in this research was identified by three measurable variables, which are Revenue, Number of Employees, and Education level; Pillar Enabler Identified by Use of Digital Technology, Training, and Productivity; Attitude to Use Internet identified by two variables, which are Internet in Communication and Internet for promotion. The model hypothesis was tested with Amos 22 software. During the hypothesis test, we experienced missing data, which affected the model’s fitness; the SPSS software solved the issue through Mean imputation, replacing missing values with the mean value of that variable across all other cases. This method assumes that the missing values are like the observed values on average. Finally, the result showed that the higher the SME is capable, the higher the Pillar Enabler and Attitude to Use the Internet significantly increase. Pillar Enabler is significant to the Attitude to Use the Internet.

The weights represent the influence of the indicator on the latent variable. In general, more vital causation is indicated by more substantial consequences. By calculating a p-value, the weights in the model can also be evaluated for statistical significance. The hypotheses presented in the technique can be tested using these. Fig. 6 displays the test results and the accept/reject decision. The importance of path coefficients is generally evaluated based on the p-value. In this study, a significance level of 1% is applied(Raoprasert and Islam 2010) [9]. The test result indicated that Both H1 and H2 are acceptable as valid hypotheses. Hence, the result suggests the following statement:

• The better the SMEs are capable of employment numbers, revenue, and employee education, the higher the significance of influencing Internet use.

• The more efficient Pillar Enabler (Use of Digital Technology, Training, and Productivity), the more significant Indonesian SMEs are to use the Internet.

The P-value indicated by three stars (\*\*\*) in Fig.6 for all variables is significant because it is below 0.001, taken as a reference for this research. However, we must look at Fig.7 for standardized Regression Weights to validate the Hypothesis and measurable variables’ contribution to the latent variables. The results indicated that both H1 and H2 are valid hypotheses, weighing 0.055 and 0.179, respectively. On the other hand, education level and number of employees were found to be more contributors to Capability, while Revenue is a moderate contributor. The use of Technology is more concerned with Pillar Enabler, while both Training and Productivity are reasonable contributors. Internet in Communication and Promotion is highly significant to the Attitude to Use the Internet.

**Limitations of this research**

During the process of this research, we encountered two measurement limitations.

1. The first limitation includes data issues that affected the model fit analysis.
2. The second limitation was the inability to add other indicators to be presented in the questionnaire; hence, the indicators were limited.

**5. Discussion**

The links between valuables, model fit, and hypothesis choices were tested using a structural equation model created by AMOS. A good-fitting model is accepted if the goodness-of-fit (GFI) ≥0.90(Hoare 1973), Tucker and Lewis’s index of fit index (TLI) ≥0.90, the Confirmatory appropriate index (CFT) ≥0.90, values around 1 indicating an excellent fit on any index (Shek and Yu 2014). In addition, an adequate fitting of≤ 0.05 suggests a model that fits well within the degrees of freedom. (Shek and Yu 2014). The fit indices for the model shown in Table 3 fell within the acceptable range: the goodness-of-fit (GFI) =0.993, TLI=0.936, CFI=0.961, and RMSEA = 0. 041. The model is accepted if the root means square error approximation (RMSEA) ≤ 0.05. A value

The squared multiple correlations are 0.06 for the Use of the Internet; this shows that Capability and Pillar Enabler account for a 6.0% variance in Internet use. The study evaluated how Capability and Pillar Enabler impact Internet use. The impact of Capability on Internet use is positive and significant (b= 0.057, t = 7.024, p <0.001). Hence, H1 is accepted. The impact of Pillar Enabler on the Use of the Internet is positive and significant (b= 0.178, t=12.500, p<0.001). Hence, H2 is accepted. Model fit indices and hypotheses are summed up in Table 3.

Table 3 indicates that the values of GFI, TLI, CFI, and RMSEA, which show the model, meet the requirement for the Model to fit; hence, we can conclude that the model works and both hypotheses are accepted.

**6. Conclusion and Recommendation**

This research used secondary data to test the weight correlation between the primary key factors influencing the acceptance of Industry 4.0 technologies, IoT, and the Attitude to Use the Internet in SME organizations because they share similarities and collaborations. The Internet is the intermediate of all technologies offered by Industry 4.0, and IoT enables smooth cooperation. The result indicated that the capability of those organizations referred to the number of employees, employees’ education level, and revenue, which highly influences the attitude to use the Internet in promotion and communication. On the other hand, it has also been found that the Pillar Enabler, which refers to the use of digital technology, training, and productivity, also positively correlates with Internet use. Hence, the Indonesian SMEs planning to implement the Industry 4.0 paradigm would better start implementing the internet, later the IoT, to leverage the corroboration of information and physical devices to provide a bridge for implementing Industry 4.0. So, they are recommended to improve employment in terms of the number and level of education and training methods for better understanding the concept of digitalization and improving the employee’s Attitude to break the culture and step up to the Fourth Industrial Revolution as they correlate with the Use of the Internet.

**Tables**

Table: Summary of the Factors Influencing SMEs Adopting Internet, Industry 4.0, and IoT Technologies

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| No | Author | Year | Research Objectives | Research Objects | Factors Affecting Digital Transition | Country | Methodology | |
|  | Tariq Masood, Paul Sonntag | 2020 | By examining the difficulties and rewards of implementing critical Industry 4.0 technologies in SMEs, this study seeks to bridge the gap between these companies and the existing Industry 4.0 technologies and assessment methodology, thereby promoting Industry 4.0 adoption. | SMEs | Financial, knowledge constraints, company size, time, company complexity, and benefits | UK | Quantitative | survey |
|  | Morteza Ghobakhloo, Mohammad Iranmanesh, Azlan Amran | 2022 | This research thoroughly investigates the factors that may influence SMEs implementing Industry 4.0 technology, enabling smaller businesses to embrace the technology. | SMEs | Knowledge, security | Not specified | Qualitative | Systematic literature review with TOE framework |
|  | Wong & Kee | 2022 | This research sought to determine whether firm size affected the relationship between market factors, organizational capabilities, institutional support, perceived advantage, and SMEs' enthusiasm for Industry 4.0. Organizational abilities, institutional support, and perceived benefit were all examined about SMEs' readiness for Industry 4.0. | SMEs | Organization capabilities, SME institutional support, perceived benefits, market factors, firm size | Malaysia | Quantitative | online survey |
|  | Sriram & Vinodh | 2021 | This study uses the complex proportionality assessment (COPRAS) approach to analyze the elements influencing the preparation of SMEs to embrace Industry 4.0. | SMEs | Customer-focused innovativeness, comfortability of technology use, Dealing with insecurity, Compatibility with existing technology, Existing technical skills with the organization, financial support, management support and leadership, competition, infrastructure |  | Qualitative | multi-criteria decision-making (MCDM) tool COPRAS |

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Agostini & Nosella | 2020 | This study investigates the potential benefits of investing in Advanced Manufacturing Technologies (AMTs) and social capital—the network of connections a business has internally and externally—for adopting Industry 4.0 technologies. It also looks at how strong these interactions are within the organizational setting. | SMEs | Internal social capital, External social capital, Investment in AMTs, Management support, Absorptive capacity, and Government policy | six Central European regions | Quantitative | Regression analysis of data surveyed by the European project. |
|  | Margarida Rodrigues , Mário Franco, Cidália Oliveira, and Rui Silva | 2021 | This study aims to identify and analyze the success factors of small and medium-sized enterprises (SMEs) following dynamic capabilities and resources-based views. | SMEs | Strategic Planning, Management Capability, Entrepreneurship and Innovation, Networks/Partnerships, Human Resources, and Financing | Portugal | Qualitative | Multiple case study methods through the interview |
|  | Ali Sevinç, Seyda Gür and Tamer Eren | 2018 | This study used the analytic hierarchy process (AHP) and alternative normative processing (ANP) methodologies to identify the primary and secondary criteria for determining the characteristics supporting SMEs' transition to Industry 4.0. | SMEs | Innovation, organization, environmental, and cost factors | Turkey | Quantitative | surveys  Data analyses by AHP and ANP methodology |
|  | Rojas-Berrio et al | 2022 | Considering the paucity of literature on the factors influencing the adoption of 4.0 technologies in manufacturing SMEs, this study offers a model that investigates the elements that encourage, facilitate, and hinder the uptake of developing technologies and the role of the institutional environment for a developing country. | SMEs | Financial | Colombia | Qualitative | interview method |
|  | M.P Roshan Rassool | 2019 | This study explores the potential advantages for SMEs in implementing digital transformation as a strategic initiative, examining various obstacles and real-world examples. | SMEs | Financial resources  , skilled employees, management | Sri Lanka | Qualitative | comprehensive literature review as the primary research tool |
|  | Norman, Ferly  Alamsjah, Firdaus | 2020 | This study discusses whether challenges, barriers, and critical factors are the readiness of Indonesian Textile and Clothing (TC) firms to adopt Industry 4.0 | Not specified | High investments, Lack of digital culture and absence of digital infrastructure, lack of government backing and regulation, lack of training, Inadequate Management of Change | Indonesia | Quantitative | survey |

Table2

Purpose and novelty of current research

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Author | Year | Purpose | Research object | Novelty | Country | Method | |
| ABIMANA Joseph | 2023 | This study will ground the prior bases to adopt Industry 4.0 (Internet and IoT) as a smother of the roadmap for Indonesia's SMEs to implement Industry 4.0. It investigates the relationship between SMEs’ capability and pillar enabler to the Use of the Internet to fill the research gap about the Internet's contribution to embracing Industry 4.0. | SMEs | The analysis of the organization’s capability and Pillar enabler to the use of the internet to examine its contribution to the preparatory process to adopt Industry 4.0 | Indonesia | Quantitative | Secondary data, SEM method |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Fitri Trapsilawati, Rosa Amalia, Nur Achmad Sulistyo Putroc | 2022 | This study analyzed how Indonesian small- and medium-sized firm (SME) groups decide which suppliers to trust when implementing Industry 4.0, which includes e-commerce, ergonomics, and machinery. | SMEs | Perception of technology benefits | Indonesia | Quantitative | Swarm Modeling (SM) to extract critical constraints |
|  | Margaret Tan & Thompson S.H. Teo | 2015 | By analyzing the variables influencing the Internet's adoption and non-adoption among Singaporean enterprises, this study seeks to advance knowledge of the Internet phenomenon in Asia. |  | Annual revenue, type of firm, and Number of employees | Singapore | Quantitative  &Qualitative | Survey |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Table 3. Model fit indices and Hypotheses | | | | |
| Hypothesized Relationship | Standardized Estimates. | t-value | p-value | Decision |
| Capability ->Use of Internet | 0.055 | 6.797 | p <0.001 | Accepted |
| Pillar Enabler -> Use of Internet | 0.179 | 15.286 | p<0.001 | Accepted |
| **R-Square** |  |  |  |  |
| Use of Internet | **0.06** |  |  |  |
| **Model Fit** |  |  |  |  |
| the goodness-of-fit (GFI)= 0.993, TLI=0.936, CFI=0.961, and RMSEA = 0.041. | | | | |
| Table 4. Questionnaire   |  |  |  | | --- | --- | --- | | no | Questions | | | 6. a | What is (NAME)’s highest educational attainment? | 1. Under primary school  2. Primary school or equivalent  3. Elementary school or equivalent  4. High school or equivalent  5. Vocational school 9. Bachelor’s degree  6. Madrasah School IV 10. master’s degree  7. Diploma I/II/III 11. Applied master’s degree.  8. Diploma 12. Doctorate | | 6.d | Has (NAME) ever attended any workshop/course/ training? | 1. yes 2. No | | 13. b | How many paid workers did (NAME) 's workplace/  Does business employ? | Person (s) | | 15. a | How much did (NAME) earn at their main job or business in the past month | Money Rp.  Goods Rp.  (If (NAME) was paid in the form of goods, please estimate it in rupiah) | | 15. c | Compared to August 2021, was there any change in  (NAME) s average earnings/net wage/salary? | 1. Yes, an increase  2. Yes, a decrease  3. No  4. In August 2021, (NAME) has not worked at the current job yet | | 18. a | Did (NAME) use digital technology?  In the past week at their primary job?  18. a  1. Computer (PC, notebook, laptop, tablet, or PDA)  2. Smartphone/Mobile phone  3. Other digital technologies (digital camera, voice recorder,  digital counting tools, digital medical tools, etc) | 1. Yes 2. No  3. Yes 4. No  1. Yes 2. No | | 18. c | Did (NAME) use the internet:  1. To communicate?  2. To promote?  3. To sell goods/services through e-mail/social media  (Instagram, Facebook, Twitter,)/instant mesage (LINE,  WhatsApp, Telegram, etc)?  4. To sell goods/services through website/ marketplace apps  (Tokopedia, Bukalapak, Olx, etc)?  5. Others, specify ... | 1. Yes 2. No  3. Yes 4. No  1. Yes 2. Yes  3. Yes 4. No  1. Yes 2. No |   **Figures** | | | | |

Fig.1.Industrial Revolution

**A diagram of a method

Description automatically generated with medium confidence**

Fig.2. Research design

Fig.3: Questionnaire(Badan Pusat Statistik 2022)

A diagram of a diagram

Description automatically generated

Fig.4. SEM model of this research

A screenshot of a table

Description automatically generated

Fig.5 Regression Weights

**A screenshot of a graph

Description automatically generated**Fig. 6. Standard Regression Weight

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