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

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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 adopt 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*

1. 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 et al., 2022). Figure 1 illustrates the Industrial Revolution succession.

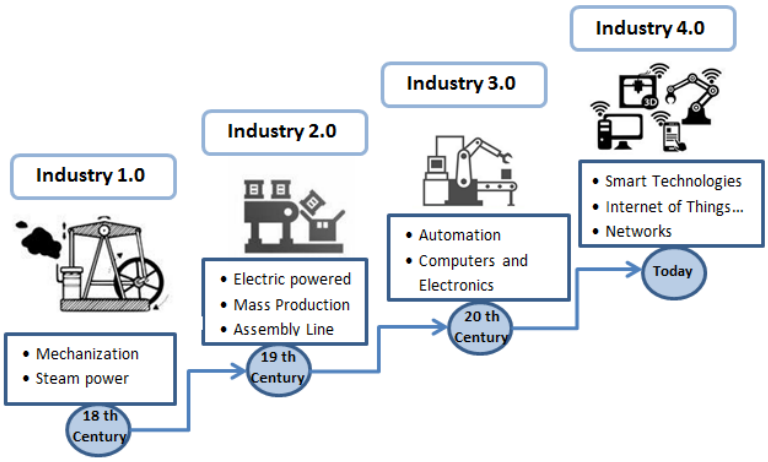

Figure 1: Industrial Revolution

Industry 4.0 technologies such as the Internet of Things (IoT), cloud computing,3D printing, big data, and artificial intelligence (AI) have given firms 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 & Nel, 2019). After Germany, The Era gained popularity, and the USA and China stepped into this revolution to stay alert on market competition(Masood & Sonntag, 2020)(Kuo et al., 2019). Industry 4.0 led manufacturing to radical improvements. It 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 & 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 & Rana, 2020). Those that have 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 & Tucker, 2019; Rana & 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 (Masood & Sonntag, 2020). Even if Industry 4.0 is significant for SMEs, there are different challenges. 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 & Sonntag, 2020). In Malaysia, the organization's capabilities, SMEs' institutional support, Firm size market factors, and perceived advantage were marked(Wong & 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 & 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 several employees influence Internet use—infrastructure(Tan & Teo, 1998). 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 roadmap to embrace those technologies separately. Industry 4.0 and Internet use are intertwined; the Internet is the foundation for connecting devices, enabling data exchange, facilitating cloud computing, supporting AI 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 et al., 2022)(Parashar et al., 2023)(Lampropoulos et al., 2019). 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 et al., 2019).

The Internet allows access to global information and establishes a global electronic presence. 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(Lampropoulos et al., 2019). Industry 4.0 and IoT are revolutionizing the manufacturing environment in SMEs with never-before-seen potential to boost their growth and competitiveness (Nagy et al., 2018).

Worldwide, SMEs are the leading economic growth of a country; for example, in Europe, they represent 90 % of registered companies (Masood & 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 driven by SMEs over the past few years. 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 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 et al., 2020)(Kurniawati et al., 2021). Investment incentives for technology adoption have been promised, €400Mn in the funding of Industry 4.0 technology research(Ministry of Industry, 2018); however, there is still a need for a detailed roadmap to embrace those technologies with low financial abilities.

While Industry 4.0 in SMEs has become an exciting topic worldwide, In Indonesia, only a few scholars generally discuss this topic. Norman has mentioned the absence of digital culture, high capital, digital framework, regulations, support, and adequate change administration in textile and clothing firms(Norman & 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. Hence, this study will analyze the Internet 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 second section is research design and methodology, the third is the Results and Discussion, and the last is a conclusion and recommendation.

2. Research Method

2.1. Research design

In this research, a quantitative approach was employed to evaluate the weight correlation between the SME's capability and Pillar enabler to the Internet use; a survey was suggested to gather the data for correlation analysis, which was later found to meet the existing Sakernas data collected in 2022(Badan et al., 2022). 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. The data has a substantial advantage due to its large number, contributing to an accurate conclusion.

This research consists of two phases, as shown in Figure 2. The first phase reviews the benefits and challenges of embracing Industry 4.0 to contribute to the factors that might be obstacles or challenges to adopting Internet use and an overview of why SMEs could embrace Internet use and IoT before they step into the Industry 4.0 paradigm. Research (Masood & Sonntag, 2020), (Sriram & Vinodh, 2021), (Rojas-Berrio et al., 2022), (Rassool & 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 & Sonntag, 2020),(Ghobakhloo et al., 2022) and (Rassool & Dissanayake, 2019) also commonly mentioned knowledge constraints, specified as Education Level and Training in current research. In contrast, analysis (Masood & Sonntag, 2020), (Wong & Kee, 2022), and (Tan & Teo, 1998) mentioned company size, which is assigned to Revenues and Number of Employees in the recent study. These factors influence the implementation of Industry 4.0 and Internet use 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, secondary data named Sakernas was rescaled to be categorized into the same group. The applications of Statistics computer-based software were utilized to test the hypothesis. The relationship between factors will be discussed in the data analysis part of this research.

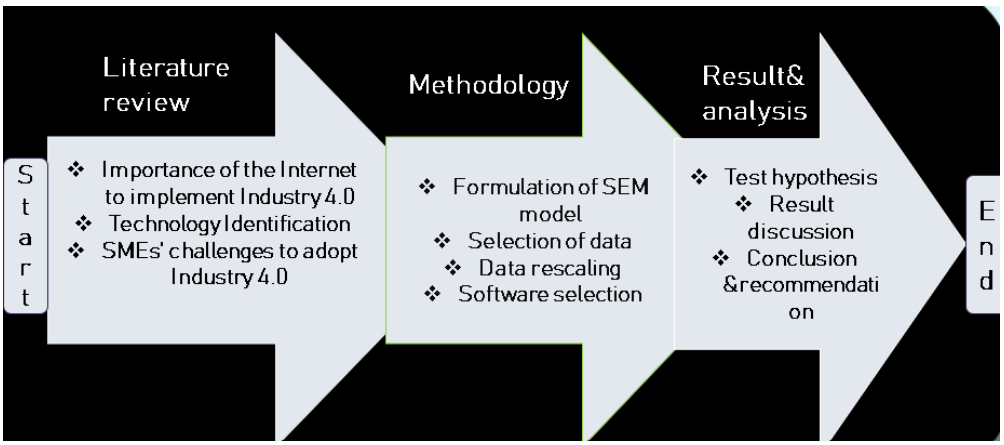

Figure 2: Research design.

2.2. SEM hypothesis model

SEM was chosen because of its capacity to gauge causal links between latent 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(Sriram & Vinodh, 2021). Figure 3 indicates the SEM model of current research.

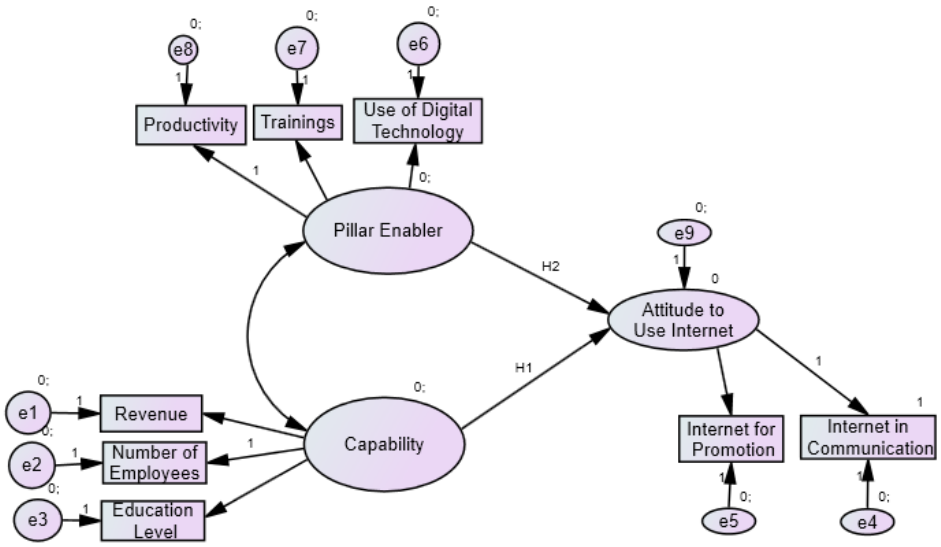

Figure 3: The SEM model of this research.

This model was developed based on the factors ascertained through the previous research, with financial aspects, skills issues, and firm characteristics as the main factors. Hence, eight 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 Table 1.

Table 1:Table of Questionnaires

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?	
	1. Computer (PC, notebook, laptop, tablet, or PDA)	☐ 1. Yes ☐ 2. No
	2. Smartphone/Mobile phone	☐ 3. Yes ☐ 4. No
	3. Other digital technologies (digital camera, voice recorder, digital counting tools, digital medical tools, etc.)	☐ 1. Yes ☐ 2. No

18. c	Did (NAME) use the internet:		
	1. To communicate?	☐ 1. Yes	☐ 2. No
	2. To promote?	☐ 3. Yes	☐ 4. No
	3. To sell goods/services through e-mail/social media (Instagram, Facebook, Twitter,)/instant message (LINE, WhatsApp, Telegram, etc)?	☐ 1. Yes	☐ 2. Yes
	4. To sell goods/services through website/ marketplace apps (Tokopedia, Bukalapak)?	☐ 3. Yes	☐ 4. No
	5. Others, specify ...	☐ 1. Yes	☐ 2. No

2.3. Hypothesis

The current research aims to study the influence between two latent variables, Pillar Enabler, and Capability, on the Attitude to Use 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.

2.4. Participants and Procedures

Small and medium-sized businesses (5–500 employees) owned by Indonesians make up the study's sample. Food, beverage, chemical, automotive, 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 in 2022.

3. Results and Discussion

3.1. 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. Capability 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. 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's capability of hiring many skilled employees and having high revenue, 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. By calculating a p-value, the weights in the model can also be evaluated for statistical significance. Figure 4 displays the test results and the accept/reject decision. The importance of path coefficients is generally evaluated based on the p-value. This study applies a significance level of 1%, which the previous author mentioned to analyze the significance of the results (Raoprasert & Islam, 2010)(Masood & Sonntag, 2020). 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 can hire many skilled employees with high education levels and have higher revenue, 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 Figure 4 for all variables is significant because it is below 0.001, taken as a reference for this research. However, we must look at Figure 5 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.

Regression Weights: (Group number 1 - Default model)

			S.E.	C.R.	P	Label
use_of_internet	<---	Pillar_Enabler	,015	6,797	***	H2
use_of_internet	<---	Capability	,008	15,286	***	H1
r18c1_2_1	<---	use_of_internet				
r18c3_4_1	<---	use_of_internet	,021	63,854	***	par_3
r15amoney	<---	Capability	2,076	21,058	***	par_4
r13bMode	<---	Capability				
r6a	<---	Capability	,214	21,443	***	par_5
r18aall	<---	Pillar_Enabler	,093	37,353	***	par_6
r6d	<---	Pillar_Enabler	,043	37,159	***	par_7
r15c	<---	Pillar_Enabler				

Figure 4: Regression Weights

Standardized Regression Weights: (Group number 1 - Default model)

			Estimate
use_of_internet	<---	Pillar_Enabler	,055
use_of_internet	<---	Capability	,179
r18c1_2_1	<---	use_of_internet	,677
r18c3_4_1	<---	use_of_internet	,743
r15amoney	<---	Capability	,247
r13bMode	<---	Capability	,055
r6a	<---	Capability	,640
r18aall	<---	Pillar_Enabler	,499
r6d	<---	Pillar_Enabler	,433
r15c	<---	Pillar_Enabler	,093

Figure 5:Standard Regression Weight

Limitations of this research

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

1. The first limitation includes missing 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.

3.2. 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 fit index (CFT) ≥0.90, values around 1 indicating an excellent fit on any index (Shek & Yu, 2014). In addition, an adequate fitting of≤ 0.05 suggests a model that fits well within the degrees of freedom. (Shek & Yu, 2014). The fit indices for the model shown in Table 2 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.

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 2.

Table 2: 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 2 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.

4. Conclusion

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.

References

Agostini, L., & Nosella, A. (2020). The adoption of Industry 4.0 technologies in SMEs: results of an international study. *Management Decision*, *58*(4), 625–643. https://doi.org/10.1108/MD-09-2018-0973

Badan Pusat Statistik. (2022). Keadaan Angkatan Kerja di Indonesia Agustus 2022. *Badan Pusat Statistik*, *August 2022*, iii–229. https://www.bps.go.id/publication/2022/12/07/a64afccf38fbf6deb81a5dc0/keadaan-angkatan-kerja-di-indonesia-agustus-2022.html

Bai, C., Li, H. A., & Xiao, Y. (2022). Industry 4.0 technologies: Empirical impacts and decision framework. *Production and Operations Management*, *July* 1–18. https://doi.org/10.1111/poms.13813

Ghobakhloo, M., Iranmanesh, M., Vilkas, M., Grybauskas, A., & Amran, A. (2022). Drivers and barriers of Industry 4.0 technology adoption among manufacturing SMEs: a systematic review and transformation roadmap. *Journal of Manufacturing Technology Management*, *33*(6), 1029–1058. https://doi.org/10.1108/JMTM-12-2021-0505

Goldfarb, A., & Tucker, C. (2019). Digital economics. *Journal of Economic Literature*, *57*(1), 3–43. https://doi.org/10.1257/jel.20171452

Hoare. (1973). *March 1973*. *1*, pp. 421–422.

Kayembe, C., & Nel, D. (2019). Challenges and opportunities for education in the Fourth Industrial Revolution. *African Journal of Public Affairs*, *11*(3), 79–94.

Kuo, C. C., Shyu, J. Z., & Ding, K. (2019). Industrial revitalization via Industry 4.0 – A comparative policy analysis among China, Germany, and the USA. *Global Transitions*, pp. *1*, 3–14. https://doi.org/10.1016/j.glt.2018.12.001

Kurniawati, E., Al Siddiq, I. H., & Idris. (2020). E-commerce opportunities in the 4.0 era innovative entrepreneurship management development. *Polish Journal of Management Studies*, *21*(1), 199–210. https://doi.org/10.17512/pjms.2020.21.1.15

Kurniawati, E., Idris, I., Handayati, P., & Osman, S. (2021). Digital transformation of MSMEs in Indonesia during the pandemic. *Entrepreneurship and Sustainability Issues*, *9*(2), 316–331. https://doi.org/10.9770/jesi.2021.9.2(21)

Lampropoulos, G., Siakas, K., & Anastasiadis, T. (2019). Internet of Things in the Context of Industry 4.0: An Overview. *International Journal of Entrepreneurial Knowledge*, *7*(1), 4–19. https://doi.org/10.2478/ijek-2019-0001

Lasi, H., Fettke, P., Kemper, H. G., Feld, T., & Hoffmann, M. (2014). Industry 4.0. *Business and Information Systems Engineering*, *6*(4), 239–242. https://doi.org/10.1007/s12599-014-0334-4

Making Indonesia. (2019). *Making Indonesia*, 1–8. https://doi.org/10.7591/9781501719370

Masood, T., & Sonntag, P. (2020). Industry 4.0: Adoption challenges and benefits for SMEs. *Computers in Industry*, *121*, 103261. https://doi.org/10.1016/j.compind.2020.103261

Ministry of Industry. (2018). Revolusi Industri 4.o di Indonesia. *Interciencia*, *30*(8), 1.

Nagy, J., Oláh, J., Erdei, E., Máté, D., & Popp, J. (2018). The role and impact of Industry 4.0 and the Internet of Things on the business strategy of Hungary's value chain case. *Sustainability (Switzerland)*, *10*(10). https://doi.org/10.3390/su10103491

Norman, F., & Alamsjah, F. (2020). *6448-Article Text-31365-6-10-20210105*. *2*(2), 73–83.

Parashar, D., Sharma, R., Rana, G., & Balaji, R. (2023). *Foundation Concepts for Industry 4.0* (pp. 51–68). https://doi.org/10.1007/978-3-031-20443-2_3

Rana, S. K., & Rana, S. K. (2020). The blockchain-based business model for digital assets management in a trustless collaborative environment. *Journal of Critical Reviews*, *7*(19), 738–750. https://doi.org/10.31838/jcr.07.19.90

Raoprasert, T., & Islam, S. M. N. (2010). Structural Equation Modeling: Results and Analysis. In *Contributions to Management Science*. https://doi.org/10.1007/978-3-7908-2372-1_6

Rassool, R., & Dissanayake, D. M. R. (2019). Digital Transformation for Small & Medium Enterprises (SMEs): With Special Focus on Sri Lankan Context As an Emerging Economy. *International Journal of Business and Management Review*, *7*(4), 59–76. www.eajournals.org

Rodrigues, M., Franco, M., Silva, R., & Oliveira, C. (2021). Success factors of SMEs: Empirical study guided by dynamic capabilities and resource-based view. *Sustainability (Switzerland)*, *13*(21), 1–18. https://doi.org/10.3390/su132112301

Rojas-Berrio, S., Rincon-Novoa, J., Sánchez-Monrroy, M., Ascúa, R., & Montoya-Restrepo, L. A. (2022). Factors Influencing 4.0 Technology Adoption in Manufacturing SMEs in an Emerging Country. *Journal of Small Business Strategy*, *32*(3), 67–83. https://doi.org/10.53703/001c.34608

Shek, D. T. L., & Yu, L. (2014). Confirmatory factor analysis using AMOS: A demonstration. *International Journal on Disability and Human Development*, *13*(2), 191–204. https://doi.org/10.1515/ijdhd-2014-0305

Sriram, R. M., & Vinodh, S. (2021). Analysis of readiness factors for Industry 4.0 implementation in SMEs using COPRAS. *International Journal of Quality and Reliability Management*, *38*(5), 1178–1192. https://doi.org/10.1108/IJQRM-04-2020-0121

Tan, M., & Teo, T. S. H. (1998). Factors Influencing the Adoption of the Internet. *International Journal of Electronic Commerce*, *2*(3), 5–18. https://doi.org/10.1080/10864415.1998.11518312

Ushada, M., Trapsilawati, F., Amalia, R., & Putro, N. A. S. (2022). Modeling Trust Decision-Making of Indonesian Food and Beverage SME Groups in Adopting Industry 4.0. *Cybernetics and Systems*, 1–17. https://doi.org/10.1080/01969722.2022.2122011

Wong, A. P. H., & Kee, D. M. H. (2022). Driving Factors of Industry 4.0 Readiness among Manufacturing SMEs in Malaysia. *Information (Switzerland)*, *13*(12). https://doi.org/10.3390/info13120552