

Issues and Challenges in Implementing Industry 4.0 for the Manufacturing Sector in Indonesia

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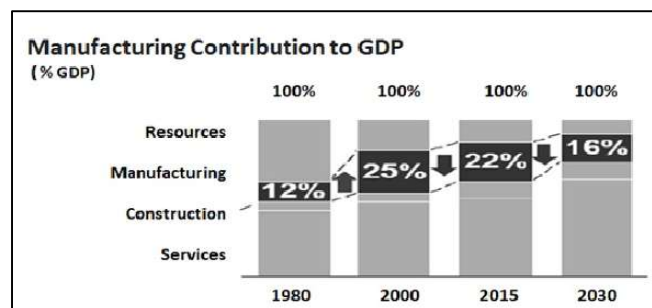


Abstract – Industry 4.0 is a popular topic today because of its significant influence in the manufacturing sector. Issues and Challenges in implementing Industry 4.0 for the Manufacturing Sector in Indonesia examined in this study. The problem will be considered the 4.0 industrial revolution is related to the issues and challenges facing the manufacturing industry in Indonesia. The main purpose of this research is to conduct an empirical analysis of the effect of issues to challenges the implementation of Industry 4.0 for manufacturing sectors in Indonesia. The research method in this study uses a quantitative approach. The data were collected and analyzed statistically using smartPLS software. The main results of this study state that the issues in implementing Industry 4.0 have a positive and significant impact on the challenges of the manufacturing sector in Indonesia. This study results also revealed that the most dominant issues in implementing Industry 4.0 are high investment costs. On the other hand, financial constraints are the biggest challenges in implementing industry 4.0. Finally, the benefit of this research will be to encourage the manufacturing sectors in its consideration to implement industry 4.0.

Keywords – *Issues, Challenges, Industry 4.0, Manufacturing Sectors.*

I. INTRODUCTION

The Industry 4.0 concept is the new reality of the modern economy, as innovation and technological development play a significant role in every organization. Currently, the industrial value creation in the early industrialized countries is shaped by the development towards the fourth stage of industrialization, the so-called Industry 4.0[1]. Industry 4.0 significantly changes products and production systems related to design, processes, operations, and services[2]. Countries are embracing Industry 4.0 to advance their manufacturing industries and to position themselves to compete in the future[3]. Studying the concept of Industry 4.0 for its application in Indonesia is a must because if not, then industry and manufacturing in Indonesia will not be able to compete with industry and manufacturing in other countries in the world[4]. According to Partama & Farizal[5], this Industry 4.0 phenomenon is the right time to revitalize the manufacturing industry sectors and contribute significantly to Indonesia's GDP.



Source : Kemenperin RI, 2018

Figure. 1. Contribution of Manufacturing to Indonesia's GDP

According to the United Nations Statistics Division (UNSD), Indonesia is ranked fourth in the world out of fifteen countries that have contributed its manufacturing industry to GDP was more than ten percent in 2016[5]. However, this contribution may decline when Indonesia does not improve in terms of revitalization. The historical contribution of GDP is shown in Figure 1.

In 2017, Indonesia experienced the largest global economic growth that occurred since 2011. This was due to each manufacturing industry accelerating its productivity and growth. Acceleration and productivity growth in the manufacturing sector is a form of the influence of technological advances that have been applied to the manufacturing industry sector. The effect of technological advances is integrated role empowerment between industry and technology, which is currently known as industry 4.0. Indonesia is committed to implementing Industry 4.0 which can be one way to accelerate the achievement of Indonesia's vision to be in the top ten countries that have the strongest economies in 2030 in the world.

The Ministry of Industry of the Republic of Indonesia in 2018, launched the “Making Indonesia 4.0” initiative as a roadmap for Indonesia's strategy in entering the digital era as a clear guide for industrial development, especially in the manufacturing sector. . Industry 4.0 can revitalize the Indonesian manufacturing sector through the “making Indonesia 4.0” initiative[6]. By encouraging the application of industry 4.0 in the manufacturing industry sector, the government is targeting Indonesia to be included in the world's 10 largest economies by 2030, doubling the ratio of productivity to costs, encouraging net exports to 10% of GDP, budgeting 2% of GDP for research and development. This is shown in Figure 2.

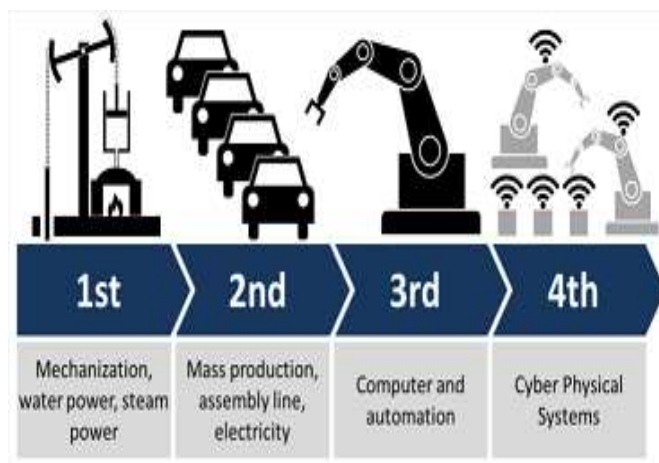


Source : Kemenperin RI, 2018

Figure. 2. Making Indonesia 4.0

To achieve this, the Indonesian state is trying to advance the industrial sector, especially the manufacturing industry based on Industry 4.0. The main problem, of course, is how to face obstacles and conquer challenges when the manufacturing sector applies industry 4.0 to advance the Indonesian state.

The term Industrial Revolution (IR) 4.0 (illustrated in Fig 3) was first published in 2011 under the term “Industrie 4.0” by an association of businessmen, politicians and academics who proposed the idea of strengthening the competition for the manufacturing industry in Germany. In April 2013 at Hannover Messe, a consortium of universities, research institutes and industrial plants in Germany, announced a report on investment, development awareness, ideas and further research on the implementation of Industry 4.0[7].



Source : <https://www.allaboutlean.com/industry-4-0/>

Figure. 3. Industry Revolution 4.0

The German state has a great interest in this matter because IR 4.0 is part of its development plan policy called the High-Tech Strategy 2020[2]. This policy aims to maintain Germany to always be at the forefront of the manufacturing world.

In Industry 4.0 infrastructure and technology overlays make it possible to better and faster use information, which results in a shift of the foundations of information transfer in production activities[7].

Issues and Challenges to Implementing Industry 4.0

The Indonesian government has selected 5 priority sectors in implementing Industry 4.0 in Indonesia. The five (5) priority sectors are the food and beverage sector, the chemical sector, the textile sector, the automotive sector and the electronics sector. This is shown in Figure 4. concerning the Impact and Feasibility of the manufacturing industry in Indonesia.

However, in implementing industry 4.0, there are many issues and challenges for the manufacturing industry sector. These issues and challenges generally come from the costs of implementing Industry 4.0 which are still high, lack of knowledge of Industry 4.0, and the lack of supporting infrastructure in Indonesia. While the challenges that arise as a result of the implementation of industry 4.0 in the industrial sector, especially the manufacturing industry, include: financial constraints, low productivity, high labor costs, high logistics costs and limited research and experts in implementing this 4.0 industry.

Previous Research

Research related to the Industrial Revolution 4.0 has been carried out by several researchers.

A previous research paper reviewed by Ing et al[8] examines the challenges in implementing Industry 4.0. The results of their research suggest that there are many challenges implementation of Industry 4.0 for the industrial sector, especially in manufacturing.

Partama and Farizal's research[5], aims to bridge this deficiency by comprehensively examining the obstacles in the application of industry 4.0 to the manufacturing industry in Indonesia by identifying, validating and weighting using the Best Worst Multi Criteria Decision Making Method. The results of the research show that high investment costs, complexity issues in its integration and lack of management support are priority obstacles that must be resolved first in order to create an effective and efficient application of Industry 4.0.

Another research conducted by Suharman and Murti[4] in this study aims to study the concept of IR 4.0 for its implementation in Indonesia. The results of the study conclude that industry 4.0 is an era that empowers the role of digitizing manufacturing and supply networks that involves the integration of digital information from various sources and locations to drive manufacturing and distribution physically[4].

This study aims to analyze empirically the effect of barriers to the challenges of implementing industry 4.0 in the manufacturing sector in Indonesia, and then to find out the dominant obstacles and challenges in implementing industry 4.0 in the manufacturing sector in Indonesia.

Conceptual Framework

Based on the previous understanding of industry 4.0, a conceptual framework for research can develop, as shown in Figure 4.

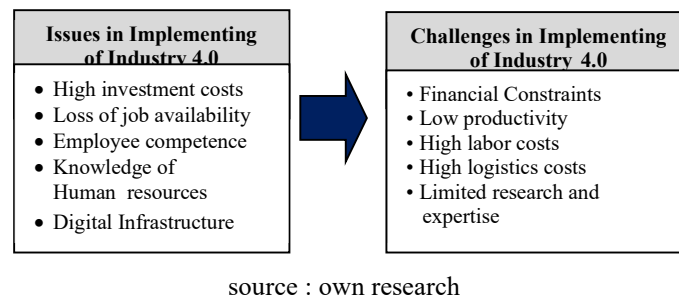


Figure. 4. Conceptual Framework

This study has two main variables, namely Issues in Implementing of Industry 4.0 and Variables Challenges in Implementing of Industry 4.0.

According to Suharman and Murti[4], Issues in Implementing of Industry 4.0 indicates High investment costs, Loss of job availability, Employee competence, Knowledge of human resources, Digital Infrastructure. Meanwhile, the variable Challenges in Implementing of Industry 4.0 indicates: Financial Constraint, Low productivity, High labor costs, High logistics costs, Limited research and expertise.

Formulation of the problem

The formulation of the problem raised in this study is how to analyze the effect of barriers to challenges in implementing industry 4.0. Furthermore, based on the formulation of the problem, this study also seeks to answer the research question (RQ = Research Question) as follows:

(RQ) Do the issues to implementing industry 4.0 affect the challenges of implementing the manufacturing sector?

Research purposes

Based on the formulation of the problems mentioned, the main objective of this study is to critically analyze the effects of barriers to challenges in implementing industry 4.0. The targets also to be achieved in this study are:

- (1) To determine the most dominant issues in implementing Industry 4.0
- (2) To determine the biggest challenges in implementing Industry 4.0.

As a result, the contribution of this research can provide insight and understanding for companies in the manufacturing sector in implementing Industry 4.0, especially in Indonesia.

This empirical analysis of the effect of issues to challenges the implementation of Industry 4.0 for manufacturing sectors in Indonesia, is the novelty of this study.

II. METHODS

The research method used in this study is an empirical method with a quantitative approach[9].

Sampling and Data Collection

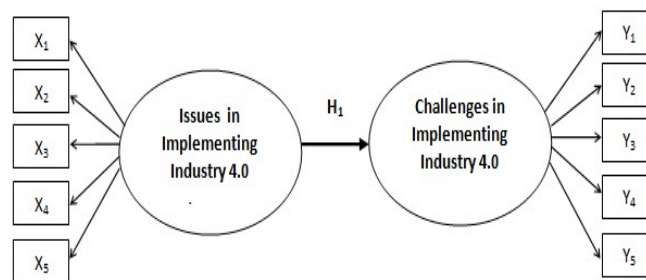
For qualitative methods, research data were collected by means of literature studies, in-depth interviews with related parties. For the application of quantitative methods, data collection through customer survey techniques is collected using online surveys. Thus, the unit of analysis for this study is employees or students who belong to the manufacturing sectors in Indonesia. The sampling using convenience sampling technique. The number of valid samples in this study was 50 samples.

Data analysis

Likert scale to measure the variable of this study (scale 5), with criteria ranging from strongly disagree (scale 1) to strongly agree (scale 5). SmartPLS 3.2.7 is a software used for data analysis in this study. For this study, the Outer Model evaluation was conducted by evaluating the validity and reliability of the variables and indicators, where the

Cronbach's Alpha and Composite Reliability values were used (value > 0.7). According to Hussain et al.,[10] stated that the Inner Model evaluation is evaluated, among others, through the value of the R-square (R²). The hypothesis was tested using a P-Value < 5% and T-Statistic > 1,960[11].

Research Model and Hypothesis Development



source : own research

Figure. 5. Research Model

Based on the research model as shown in Figure 5, a hypothesis can be developed.

Suharman & Murti[4], in their study, analyzed the effect of barriers to the challenges of implementing industry 4.0 in the manufacturing sector in Indonesia. So based on this, a hypothesis developed:

H1: Issues in Implementing Industry 4.0 have a positive effect on the Challenges of Implementing Industry 4.0

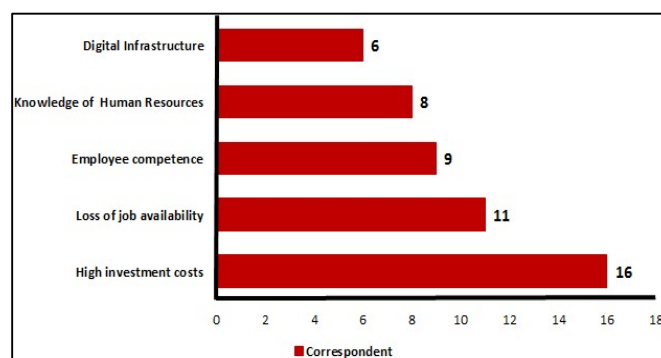
III. RESULT AND DISCUSSION

This section will reveal all the results of this study, the discussion, implications, and limitations of this research study.

Results of This Study

(1) The Result of Descriptive Analysis

The survey results had conducted to determine the choice of respondents from 50 manufacturing sectors, related to the most dominant issues in the implementation of industry 4.0, shown in Figure 6.

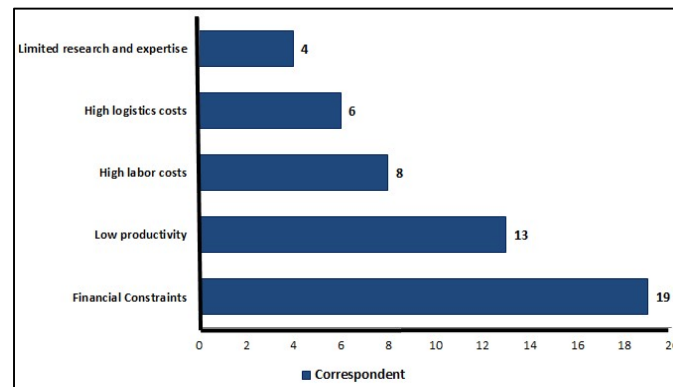


source : own research

Figure. 6. The Most Dominant Issues In Implementing Industry 4.0

The survey results had revealed that the most dominant issues in implementing Industry 4.0 are high investment costs. Furthermore, followed by the issues of Loss of job availability, Employee competence, Knowledge of Human resources, and Digital Infrastructure.

The survey results had conducted to determine the choice of respondents from 50 manufacturing sectors, related to the biggest challenges in implementing industry 4.0, shown in Figure 7.



source : own research

Figure. 7. The Biggest Challenges In Implementing Industry 4.0

The survey results of this study reveal that financial constraint is the biggest challenge in implementing industry 4.0. Furthermore, it was followed by the challenges of low productivity, high labor costs, high logistics costs, and limited research and expertise.

(2) The Result of Model Testing

First, perform the analysis phase of the outer model test results. The analysis of the results of measuring the validity and reliability of the research variables was seen by the magnitude of the Cronbach's Alpha value and the Composite Reliability value.

Table 1 . Validity and Reliability Test Result

Variables	Cronbach's Alpha	Rho_A	Composite Reliability	Average Variance Extracted
Issues in Implementing Industry 4.0	0.889	0.921	0.920	0.704
Challenges in Implementing Industry 4.0	0.879	0.901	0.910	0.608

source : own research

The results of data processing and execution with Smart-PLS version 3.2.7, which is also used in the study conducted by Hussain et al [17], Table 1, shows the value of Cronbach's Alpha > 0.700 and Composite Reliability > 0.700, this shows all the variables used in research is valid and reliable.

In the results of the study using Linear Regression analysis[12], the following Linear Regression equation is obtained:

$$Y = \gamma_{11} X + \xi_1 \quad (1)$$

where,

Y = Challenges for implementing Industry 4.0

γ_{11} = Coefficient Value Beta

X = Issues in implementing industry 4.0

ξ_1 = Measurement Error

Challenges for implementing Industry 4.0

$$= 0.876 * \text{issues in implementing industry 4.0} + 0.767 \quad (2)$$

$R^2 \rightarrow 0.767$ so correlation (r) = $\sqrt{0.767} = 0.875$. This means that issues in implementing industry 4.0 have a strong correlation with challenges in implementing industry 4.0.

$R^2 \rightarrow 0.767$, it can be stated that 76.7 percent of the challenges in implementing industry 4.0 are influenced by issues in implementing this industry 4.0, then 23.3 percent are influenced by other factors not discussed in this study.

GoF = 0,820 $\rightarrow$ From the results of testing the model by looking at the magnitude of the GoF value, it shows that the model has a very high overall suitability index (GoF value > 0.36).

Q - Square value is 0.981 $\rightarrow$ Furthermore, the model has a very high degree of predictive relevance (Q-square value > 0.35).

3.2 The Result of Hypothesis Testing

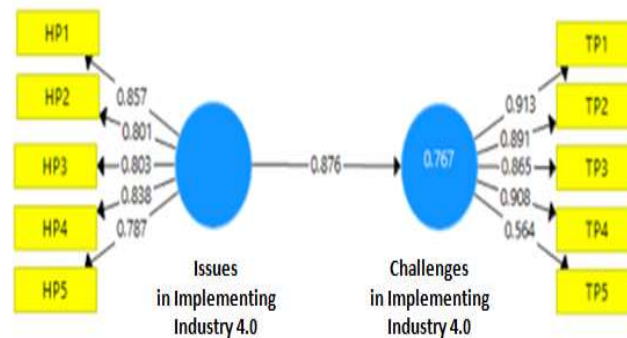
The results of the hypothesis test analysis are shown in Table 2.

Table 2 . Hypothesis Test Result

Hypothesis	Original Sample	Sample Mean	Standard Deviation	T-Statistic	P-Value
Issues $\rightarrow$ Challenges	0.876	0.879	0.007	50.915	0.000

source : own research

While the T-Statistical Value in the Path Analysis Model with Bootstrapping Algorithm[12], can be seen as in Figure 8.



source : own research

Figure. 8. T-Stat Value in the Path Analysis Model

Analysis of the results of testing the hypothesis, then explained as follows:

H1: identifies the relationship between issues to implementing industry 4.0 and the challenges of implementing industry 4.0. As shown in Table 3., the measurement of the Beta coefficient value is 0.876, and the T-statistic value = 50,915 (> 1.96), and the P-value is 0.000 (<0.05). So this result means that issues to implementing industry 4.0 have a positive and significant impact on the challenges of implementing industry 4.0.

Discussion

This research is related to the implementation of Industry 4.0 in the manufacturing sector in Indonesia. This study supports the Government of the Republic of Indonesia program. In particular, the Ministry of Industry in its program launched the “Making Indonesia 4.0” initiative. This program serves as a roadmap for Indonesia's strategy in entering the digital era as a clear guide for industrial development, especially in the manufacturing sector. This study is in line with research from Partama and Farizal[5]. Their study made bridges this deficiency by comprehensively examining the issues in implementing Industry 4.0 to the manufacturing industry in Indonesia. Besides that, this research is also in line with the study conducted by Suharman and Murti[4].

Based on model testing, all the variables and indicators used in research is valid and reliable, and this regression model is suitable for use. Besides, this study revealed that issues in implementing industry 4.0 have a strong correlation with challenges in implementing industry 4.0. Furthermore, it can be stated that 76.7 percent of the challenges in implementing industry 4.0 are influenced by issues in implementing this industry 4.0, then 23.3 percent are influenced by other factors not discussed in this study

The hypothesis result of this study state that the challenges of implementing Industry 4.0 positively and significantly influenced by the issues of implementing Industry 4.0 in manufacturing sectors in Indonesia. This results are in line with research results from Suharman and Murti in 2019. This study results also revealed that the most dominant issues in implementing Industry 4.0 are high investment costs. On the other hand, financial constraints are the biggest challenges in implementing industry 4.0.

Implications

There are several implications of this study that may be relevant for managers in manufacturing sectors and scientific research for implementing industry 4.0

First, the study implications from the managerial side, manage the application of Industry 4.0 well and then take into account these issues and challenges in their industrial sector. Second, theoretically, the findings of this study have broad implications regarding the revolution of industry 4.0, in IT adopting precisely.

Limitations

This study still has several limitations. Firstly, the subjects in this study only examined companies in the manufacturing sectors in Indonesia. Secondly, the manufacturing sectors data reports had collected in 2018. Thirdly, the limitations of the sample and data make it possible that the study results are not representative.

IV. CONCLUSION

The main purpose of this research is to conduct an empirical analysis of the effect of issues to challenges the implementation of Industry 4.0 for manufacturing sectors in Indonesia.

The main results of this study state that the challenges of implementing Industry 4.0 positively and significantly influenced by the issues of implementing Industry 4.0 in manufacturing sectors in Indonesia. This study results also revealed that the most dominant issues in implementing Industry 4.0 are high investment costs. On the other hand, financial constraints are the biggest challenges in implementing industry 4.0.

For future studies, it is necessary to carry out other studies on the plan and implementation of other industrial sectors in Indonesia.

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