Opportunities for Using Technology Industry 4.0 to Overcome the Negative Effect of he Covid-19 Pandemic

Peluang Pemanfaatan Teknologi Industri 4.0 untuk Atasi Dampak Negatif Pandemi Covid-19

Sigit Setiawan[1)], Ishelina Rosaira Poerbosisworo[2)]

[1,2] Research Center for STI Policy and Management – Indonesian Institute of Sciences
[1,2] Jl. P. Kemerdekaan Km. 9 Makassar Telp/Fax: 0411-587194/0411-587266
[5]Jl. Ampera Raya No. 7 Jakarta 12560

sigitsetiawan@gmail.com[1)], ishelina.rosaira@gmail.com[2)]

Diterima : 17 Februari 2021 || Revisi : 02 Agustus 2021 || Disetujui: 19 Oktober 2021

Abstract – Currently the Covid-19 pandemic has affected us a lot, both in personal behavior, or especially in the economic sector which continues to deteriorate due to the closure of regions and / or restrictions on human movement. Many companies have closed, and many have become bankrupt because they had to close their companies. Various stimulus programs and efforts have been made by both the companies themselves and each countries to overcome this problem. On the other hand, in Indonesia the concept of Industry 4.0, which is currently developing rapidly, was proclaimed by President Joko Widodo at the beginning of his second term government. The concept of Industry 4.0 has been developed since 2015 and is now still under developing to be applied in the world. This concept is based on digitalization and ICT networks to carry out production. In addition, the goal of the industrial 4.0 concept is to produce a production system capable of producing revolutionary system that can produce customized product taht being produce in mass production way and therefore able to open up a new market niche. Since then, there are much progress been done by the government in its efforts to apply the industry 4.0 concept to all lines. But the problem is, is it true that what is being implemented is industry 4.0? Also, will the technologies and management concepts promoted by Industry 4.0 be able to overcome the current Covid-19 pandemic conditions if they have been implemented? This paper seeks to explore this theoretically, by looking at key technologies from Industry 4.0 that might solve the problem of the Covid-19 pandemic. There are several technologies from Industry 4.0 that can overcome the conditions of the Covid-19 pandemic, for example AI and Additive manufacturing. It is hoped that from the results of this research experience can be drawn for the application of industry 4.0, especially during the current Covid-19 pandemic.

Keywords: Industry 4.0, Covid-19 Pandemic, industry challenges, technology of Industry 4.0

Abstrak *– Saat ini pandemi Covid-19 telah banyak mempengaruhi kita, baik dalam perilaku pribadi, atau terutama di bidang ekonomi yang terus memburuk akibat penutupan wilayah dan/atau pembatasan pergerakan manusia. Banyak perusahaan yang tutup, dan banyak yang bangkrut karena harus menutup perusahaannya. Berbagai program dan upaya stimulus telah dilakukan baik oleh perusahaan itu sendiri maupun masing-masing negara untuk mengatasi masalah ini. Di sisi lain, di Indonesia konsep Industri 4.0 yang saat ini berkembang pesat dicanangkan oleh Presiden Joko Widodo pada awal masa pemerintahan keduanya. Konsep Industri 4.0 telah dikembangkan sejak tahun 2015 dan saat ini masih dalam pengembangan untuk diterapkan di dunia. Konsep ini didasarkan pada digitalisasi dan jaringan ICT untuk melakukan produksi. Selain itu, tujuan dari konsep industri 4.0 adalah untuk menghasilkan sistem produksi yang mampu menghasilkan sistem revolusioner yang dapat menghasilkan produk yang disesuaikan yang diproduksi secara massal sehingga mampu membuka ceruk pasar baru. Sejak itu, banyak kemajuan yang telah dilakukan pemerintah dalam upaya menerapkan konsep industri 4.0 ke semua lini. Namun masalahnya, benarkah yang diterapkan adalah industri 4.0? Juga, apakah teknologi dan konsep manajemen yang diusung Industri 4.0 mampu mengatasi kondisi pandemi Covid-19 saat ini jika sudah diterapkan? Makalah ini berupaya mengeksplorasi hal tersebut secara teoritis, dengan melihat teknologi kunci dari Industri 4.0 yang mungkin dapat menyelesaikan masalah pandemi Covid-19. Ada beberapa teknologi dari Industri 4.0 yang bisa mengatasi kondisi pandemi Covid-19, misalnya AI dan Additive manufacturing. Dari hasil penelitian ini diharapkan dapat diambil pengalaman untuk penerapan industri 4.0 khususnya di masa pandemi Covid-19 saat ini.*

Kata kunci*: Industri 4.0, Pandemi Covid-19, tantangan industri, teknologi Industri 4.0*

doi: 10.30818/jpkm.2021.2060306

INTRODUCTION

At this time, at the end of 2020, the Covid-19 Pandemic which is currently rampant in the world and has caused many disasters, losses and difficulties, both in the form of loss of life, suffering due to Covid 19, as well as indirect effects in the form of disruption of company production processes, terminations employment relationship due to non-operation of the company, loss of market share and so on. On the other hand, this is also the time when the concept of industry 4.0 starts to develop and is widely applied, including in Indonesia, where in Indonesia the initiative to implement industry 4.0 was initiated by President Joko Widodo, which was translated by the Ministry of Industry in a document regarding the direction for implementing industry 4.0 in Indonesia (Kementrian Perindustrian, 2019). Therefore, many companies have started to apply the principles and technologies in accordance with the concept of Industry 4.0.

Industry 4.0 is an industrial concept that developed from Germany which was first attempted to be applied in the German automotive industry. By definition, Andreja Rojko (2017) defines it as "an approach based on integration of the business and manufacturing processes, as well as integration of all actors in the company's value chain (suppliers and customers)". Meanwhile, the European Commission (2017) said that industry 4.0 aims to encourage the use of advanced digital manufacturing and also increase digitization and interconnection of products, value chains and business models. Basically Industry 4.0 focuses on changes to both horizontal and vertical integration and the use of data to achieve a customized product. But in the end, the concept of industry 4.0 can be simplified by being defined as an industry that is able to produce customize mass products. The products are highly customized, following the wishes of the customer, but the manufacturing process still follows the computer-based mass products as in the industrial 3.0 concept. Of course, special technologies are use to make that happen, on which are the enebler technology of Industry 4.0. The other most important change is a change in mindset, where the digital mindset and networking are the main midset to change.

There are still frequent mistakes or misconceptions between the concept of industry 4.0 and industry 3.0. There are still many who think that computer-based automation means implementing industry 4.0, even though it is a concept from industry 3.0. Not all industry 4.0 is industrial automation, sometimes capital-intensive industries can also use the industry 4.0 concept if the main concept is fulfilled. From the results of interviews conducted in the context of research conducted by P2KMI-LIPI (Kardoyo, et al., 2019), there is an impression that these mistakes or mistakes occur at all levels, from the entrepreneur level, to the regulator (government) level.

With the use of industrial 4.0 concept, even though it is a partial use, there are opportunity to use industry 4.0 technology and concepts to deal with the impact of the Covid-19 pandemic. The impact of the pandemic can be reduced either through the use of Industry 4.0 technology or the concept of an industrial 4.0 management system.

So it will be interesting to see how the technologies and concepts offered by Industry 4.0 can be used to mitigate the consequences of the Covid-19 pandemic. In this paper, two things will be discussed, regarding how technology and industrial managerial concepts 4.0 can overcome the problems caused by the Covid-19 pandemic.

METHODOLOGY OF THE DISCUSSION

The discussion method uses qualitative data and discussed by means of using descriptive method. Meanwhile, the data used are secondary data and data from the PAPPIPTEK - LIPI research (Kardoyo, et al., 2019) and (Hermawati, et al., 2019) which were conducted in 2019. In this study, there were 6 companies per sector, So the method used is the multiple case study method (Yin, 2003).

Research done by Kardoyo et.al (2019) is about the readiness of the automotive industry, especially the supplier industry from the largest automotive factory in Indonesia, to implement the industrial 4.0 model and its challenges. Meanwhile, research conducted by Hermawati et. Al (2019) is about the value chain in the garment industry in Indonesia and its readiness to apply the industrial 4.0 model. These two studies are part of the research on Industry 4.0 conducted at P2KMI - LIPI.

Data were taken from interviews and observations from both studies. In discussing the role of the Industry 4.0 model to alliviate challenges of Covid-19 Pandemi, first we will discuss what the challenges of the industry in dealing with this Covid-19 pandemic and after that how the industry 4.0 model can alliviate these challenges. The discussion will be carried out in a

descriptive manner by discussing the data taken from the results of the two studies.

Each study examines 6 industries from each sector and research on the automotive industry also interviews the industry providing equipment and technology for the Industry 4.0 model implementation which is one of the largest in the world.

The explanation will focus on two main aspects of the industry, namely the production process, and the technology of the production process that can be used to deal with the constraints posed by the Covid-19 pandemic. The technology and production processes are, of course, the technology and production processes that are part of the industrial model 4.0.

Industry 4.0

Industry 4.0 as stated above is an industrial revolution that started in Germany, known as Industrie 4.0. This term originated from the writing of Klaus Schwab, an executive at the World Economic Forum in 2015 (Schwab, 2015). After that this concept was rolled out and was used by the German government for high technology strategy projects in 2011 (BMBF-Internetredaktion, 2016). After that, this concept spread throughout the world and is often labeled with other terms by each institution or country that will adopt this industry 4.0 concept.

In Industry 4.0, there are 9 key technologies that are part of industry 4.0, namely virtual reality, additive manufacturing, IOT, big data, cloud computing, simulation, autonomous robots, universal integration, and cyber security (Haseeb, Hussain, Slusarczyk, & Jermsittiparsert, 2019). Many of this technology has already existed in the previous industrial revolution or model, namely industry 3.0, but some technologies are specific to industry 4.0, especially those concerning integration and data. There are several technologies that are considered to be very specific technologies from industry 4.0, namely IOT, basically this system is the same as computer-based automation, but currently the computers are connected in an ICT network.

Apart from changes in technology or the use of new technology in Industry 4.0, no less important is a change in mindset that underlies the concept of industry 4.0. The expected mindset change is a change in accordance with the Industry 4.0 concept, namely digital and networking concepts. The mindset to do work is not through face-to-face or tangible intentions, but through digitalization and is done through networks facilitated by ICT devices.

Differences between Industry 4.0 and Industry 3.0

As explained in the introduction above, there are often mistakes in the concept of Industry 3.0 and Industry 4.0. Another thing that is interesting to see is that the impetus for the application of Industry 4.0 comes from the very top level, namely the president, but the question is whether under him are understand enough about the concept of Industry 4.0? This is important to realize Industry 4.0 which is actually in accordance with the goals of the country.

The fallacy regarding the concept of industry 4.0 and industry 3.0 was clearly seen in interviews, where many respondents linked one of them: automation with the concept of industry 4.0, computerization with the concept of industry 4.0, or automation using computers with the concept of industry 4.0. Even though the 3 meanings do not indicate the concept of industry 4.0 but rather refers to the concept of industry 3.0. In fact, many official government documents suggest this, especially news from the mass media which have less knowledge of the subject of Industry 4.0.

Table 1 Differences in the Concept of Industry 3.0 and Industry 4.0

Features	Industry 3.0	Industry 4.0
Core Concept	Highly automated system	Smart factory with CPS and IoT
Production Strategy	Mass Production	Mass Customization
Quality Control	Statistical Process Control	Self-aware; Self-predict
Resources Management	Materials Management; Human Resource Management; etc.	Self-configure; Self-optimize
Development Priorities	Investment of hardware	Construction of CPS and IoT

Source : Chen-Fu Chien, Tzu-yen Hong and Hong-Zhi Guo (2017) modified by author

All of this shows confusion or misunderstanding between the concept of industry 4.0 and industry 3.0, this is actually happening both at the industry level and at the regulatory level. The end result is an incorrect assumption of the concept of industry 4.0 which results in a misdirection of all parties to refer to the true concept of industry 4.0. What happens is an effort to automate production using a computer-based system within the company is considered an application of

industry 4.0, even though it is more about the application of industry 3.0.

To explain this phenomenon, it is necessary to look at the differences between the concept of industry 3.0 and industry 4.0 in sufficient detail. Chen-Fu Chien, Tzu-yen Hong and Hong-Zhi Guo (2017) state in sufficient detail the difference as in Table 1. It can be seen in the table above that 3 things that are often interpreted as the concept of industry 4.0 are actually the concept of Industry 3.0 as described above. In interviews there is always mention of investment in equipment, even though the concept of industry 4.0 is not always making a large investment in equipment. Likewise the main concept, mostly still talking about the concept of automation or the use of computers in the production process which is actually an industrial 3.0 concept.

Therefore, basically, apart from unpreparedness in the supporting / inhibiting factors of the application of the industrial model 4.0, what is more important is that there is a misunderstanding of the concept of industry 4.0. The possibility of this happened because of the short time available from the President declaring the industrial movement 4.0 to and time to make the implement it in the field/industries. This causes decision makers not able to learn enough or carefully study the concept of Industry 4.0, even though they have summoned many experts in the field of Industry 4.0. The result is to reducing the meaning of the concept of industry 4.0 to the concept of computer-based automation, which is actually part of the industry 3.0 concept.

Unfortunately, the government through the ministry of industry issued guidelines and assessments for industry to determine the level of application of industry 4.0, when viewed from the table above, it will be more likely to implement industry 3.0 compared to industry 4.0. This of course will give rise to the illusion that Industry 4.0 has been implemented even though this is not the case.

The Covid-19 Pandemic Challenge

The Covid-19 pandemic has caused problems in the production or manufacturing goods or services in the form of limited human mobility due to the need to carry out social distancing or even lockdown. This of course will cause disruption of industry process and decrease its production capability, and it could even stop altogether. As a result, the availability of goods decreases and the survival of the company will be threatened, which in turn will eliminate many job vacancies. This is exacerbated by the fact that many people lose their jobs or experience a decrease in income which results in many people, especially the middle class, holding back from doing shopping (CNN Indonesia, 2020), (Yovanda, 2020). This results in a decrease in the amount of market demand for many products, thus worsening the situation. Infact there are huge shift in people spending or buying pattern coused by this pandemi.

However, the spread of the pandemic in Indonesia and in the world is uneven. There are some areas that are very affected, have experienced severe transmission so that practically a lockdown is carried out. However, there are other parts of the region that are less affected or not at all, so that economic and industrial activities continue to run. The uneven distribution of the Covid-19 pandemic has actually caused production activities in Indonesia or in the world to continue and be able to provide goods or production products needed by the community.

On the other hand, changes in people's lifestyles caused by the Covid-19 Pandemic, which is based on changes in human interaction patterns and patterns of money flow, have caused changes in the shopping patterns of the community. This change in spending patterns has also caused many retailers to decrease their income, but on the other hand, many have also increased. The biggest change is the shift in shopping patterns from face-to-face shopping to on-line shopping. Of course this causes many SME retailers to become unable to operate because they do not have access to the online retail world. This change in buyer behavior requires agility from a manufacturer to make adjustments, both in the product and in the distribution chain.

Industry 4.0 Solutions to the Challenges of Covid 19

The main challenge of the industry during the Covid-19 pandemic is to continue or maintain production capabilities. This is necessary to maintain the income of the company which is bound to experience a great decline due to stopping or reduction in production and having to pay employees and various other costs. If this was not done, the company could not be sustained for too long before bankruptcy, especially in a protracted pandemic like this. Of course this condition has more effect on small companies, the smaller the company, the faster the influence will be.

However, if large companies go bankrupt, it will have a big effect on the community (as workers) and the regional / regional economy, and eventually cause a recession for the country (ASEAN, 2020).

The fact that there is an unequal status of the pandemic in all regions opens up opportunities for industry to continue to carry out production in places that are still not heavily affected by Covid-19. This is also detrimental for companies that still use conventional systems, where production becomes erratic with the threat of factory closures due to Covid-19. However, the effect can be reduced by carrying out distributed production. For example, during the world war, where many countries experienced strategic bombing. Because of strategic bombing, production of important war equipment stopped, so the warring countries, especially the axis countries, need to distributed their production of war equipment, such as tanks, aircraft, were produced in various hidden parts of that country and then assambled in some hidden central places as well (Okazaki, 2010). By using this system, even Germany continued to experience an increase in the production of its war equipment until the invasion of Germany in late 1944 even though the country was in ruins due to allied strategic bombing (Budraß, Scherner, & Streb, 2005). Even then, it decreased of production is coused by the shortage of raw materials and their territory slowly was controlled by the allies, not because productivity itself decreased.

Production distribution has been done a lot nowadays and is often referred to as the Distributed Manufacturing System (DMS). DMS has its roots in the rural production system, where a company, its production is distributed to residents' homes. Currently DMS is used to maximize regional potential in producing part of a product, as part of the effects of globalization (Raucha, Dallingera, Dallasegaab, & Mattab, 2015). But in Industry 4.0, DMS can be said to be used even more strongly by carrying out strong vertical and horizontal integration (Hedberg, Helu, & Sprock, 2018) (Kim, 2019), where vertical integration means integration of its supply chain (Kumpe & Bolwijn, 1988), while horizontal integration means the integration of the production system (K. Chukalov, 2017). This horizontal integration is then carried out by distribution to various factories in different geographic locations. However, using the Industry 4.0 concept is carried out very efficiently using ICT devices in the form of connectivity from various location of the company using both the internal network and the internet.

The distribution of production as carried out in the DMS is likely to overcome the problem of the Covid-19 pandemic. If a factory in a geographic area is affected by the Covid-19 pandemic and must be closed, then production can be diverted to another factory in other location that can still produce. Because vertical integration is also very strong, changes in the supply chain can easily be done by substituting one supplier with another supplier in a different region. This can be done quickly if the supply chain system is linked to an ICT network so that changes to the supply chain can be identified and executed quickly by actors in the supply chain.

The use of the DMS system has actually been widely used in Indonesia, especially in MNC companies. The author has seen this fact in the automotive industry, where production involves many supply chains and factory locations which, although not yet fully using the industry 4.0 concept, may be able to change the supply chain and production lines (Kardoyo, et al., 2019). Even so, there are still many changes that are needed in accordance with the concept of Industry 4.0 so that the capabilities of this DMS can be fully implemented, as desired by the Industry 4.0 concept. Unfortunately, this capability is likely not owned by many companies engaged in other sectors. From field observations in the textile industry (Hermawati, et al., 2019), they do not have the ability to do this DMS. This is because the industry is still very dependent on imported raw materials, and because domestic production is not sufficient both in quantity and quality. The materials referred to include threads, fabrics and accessories. In addition, absorptive capacity of many industry 4.0 technology has not yet been developed (the ecosystem has not been well developed including: human resource capacity is still low, institutions and regulations are not fully supported). Also the use of new technology like automation at the production unit level has not been fully integrated at the company scale. But the use of technology 4.0 at the management level has begun to be practiced even though it is not yet fully integrated. There is lack of commitment to update technology, given that the current order of apparel has not demanded significant technological changes, although latest technology is

actually available in the market. Companies also have financial constraints, and government incentives are not available, human resource skills are not yet supportive, and so on further inhibit implementation of industry 4.0.

The use of technology developed for Industry 4.0 such as additive manufacturing that uses 3D printers also opens up an opportunity to create a factory that is universal. This is because 3D printers can make almost any shape of the product on the condition that it uses the same raw materials, and within certain dimensions. Only the assembly and finishing processes, such as coloring or painting, must be carried out separately, but this does not change the nature of the universality of production. However, the weakness of the 3D printer system is that each 3D printer currently can only handle 1 type of raw material, or a group of similar raw materials. This causes a product to be made from several raw materials, it takes several types of 3D printers. The most extreme case is Elon Musk's Falcon 9 rocket engine that being produce by using 3D printers.

Other Industry 4.0 technologies that can support DMS are cloud coumputing and control systems with IOT technology. By moving controllability to the cloud by means of IoT, geolocation is not important, because cloud does not have a fixed geolocation. As a result, even though a factory location is completely closed, the control system can still run, and production in other places can still be done. Controllers in the form of humans / staff who supervise also do not need permanent geolocation, so they avoid the danger of total paralysis of the production system due to the closure of a factory / office location due to the Covid-19 pandemic.

Apart from doing distributed manufacturing, Industry 4.0 also allows a company to quickly change its production. This is because using additive manufacturing technology is not required to re-tool from a production line. All production lines and ways to produce a new product will be simulated and modeled in software and implemented by changing the software from the 3D printer. This capability takes advantage of augmented reality and AI technology from Industry 4.0. The ability to change this product is important due to changes in shopping behavior from the community. Traditional products produced by a company may not be able to be sold because of this change, so it requires new product development and must reach the market as soon as possible to avoid losses due to loss of momentum and idle production capacity of companies that must stop production of old goods.

Changes in people's shopping behavior also cause changes in the distribution channel of a product. It is important to immediately make adjustments to ensure the market and the survival of a company. Strong horizontal integration can solve this problem. Whenever there is a marketing channel that is part of horizontal integration disrupted, data indicating it can be quickly predicted using big data processing in the form of marketing data, market data, and buyer behavior data with AI technology so that the decision to make changes to distribution channels can be quickly done, maybe even that decision making is carried out automatically by AI.

Big data itself also plays an important role in Industry 4.0. Big data is a collection of all data that can be obtained by a company in its day-to-day operations. From production systems, supply chain systems, marketing systems, to sales data from products that represent market trends. Previously, this data would be processed partially so that correlation between data groups could not be done. This is due to the large amount of data collected, and ancient computer devices were unable to store and process that much data (Bonner, Kureshi, Brennan, & Theodoropoulos, 2017). Moreover, currently AI technology has developed to extract trends from such large data from big data, which is likely so hidden that it cannot be discovered by humans if processed manually.

A.I also does many things related to knowledge gathering, both from big data on market behavior and production data as described above, as well as from the experiences of company employees. This effectively allows A.I to perform knowledge management effectively. In addition to AI to carry out knowledge management, cloud computing can also be used in order to perform knowledge management to store and process AI without looking at geolocation so there is no need for the company to implement extensive risk management system and implement costly computer and information systems to handle that. Knowledge management is one of the important factors in handling information and knowledge that is part of the industry 4.0 concept, where all information in the organization will eventually be used by the organization to increase

the competitiveness of the organization in market competition.

Another influence of knowledge management is codifying the knowledge possessed by employees so that it becomes organizational / company knowledge. This is important so that if a key employee is affected by Covid-19 and is unable to do their job, the knowledge they have at least can still be learned from the codification of knowledge that has been done. This can be obtained by doing good knowledge management. If not, the lack of knowledge can result in failure to produce for the company, and loss of many opportunaty. Through good knowledge management, existing knowledge can be codified and disseminated to other employees. It is also possible to transfer knowledge from tacit to tacit, as in the SECI model (Nonaka & Takeuchi, 1995). Also the reuse of knowledge that has been 'captured' will also reduce re-learning or in other words re-use of existing knowledge (Setiawan, 2007) thereby reducing costs and time for formal education / training, or finding replacement employees who unable to work due to Covid-19. In addition, network analysis can also be carried out to determine any obstacles or encouragement to the flow of knowledge in an organization or company (Setiawan, 2010), (Setiawan, 2012). Not only that, knowledge management also allows a company or organization to have a good plan to deal with general emergencies caused by the current Covid-19 pandemic (Deliu, 2020). Therefore the concept of the Chief Knowledge Officer or knowledge Officer which in the era of 2000 to 2015 is very popular (Lee, 2015) deserves to be reviewed as part of an effort to manage all the knowledge that is in the organization or company that will implement the industry 4.0 .

The most important thing about AI technology is its ability to extract trend data from the big data collected. This is done to predict market trends and production trends. Predicting market trends is needed to predict how the market will change due to something, for example due to the effects of the Covid-19 pandemic as described above. When combined with market surveys that are routinely conducted, a company can see where the market will move and predict what products will be trending in the future, and of course can model how the production system is to produce these products with the help of augmented reality technology. Thus, the supply chain can also be predicted and adapted to current needs, which have changed due to the Covid-19 pandemic, for example. Of course, as explained above, online shopping behavior can be overcome by modeling these changes in behavior and making changes to the marketing system of the company in order to overcome them.

It can be seen from the many existing industrial 4.0 technologies, there are several technologies that are very helpful in overcoming disruptions or challenges caused by the Covid-19 pandemic conditions in a company or industry. The best technology to counter Covid-19 Pandemi is additive manufacturing and ICT devices in the form of big data, cloud computing and AI. Basically usefull technologies are those related to universal production systems and data processing. All of this is used to predict trends and products that sell well in the market due to changes in consumer spending patterns, and also to carry out a distributed manufacturing system, bypassing areas affected by the Covid-19 pandemic. All of that is actually capable of being done by the traditional production not only with Industry 4.0 system, but it is will be very, as was done by Germany during World War II. Only through a complicated and difficult management system can production be maintained, whereas when using industrial technology 4.0, the system becomes much simpler, even the computer device has no form because it is placed in the cloud, and maybe without human intervension except in final decision.

Indonesia Industry Condition in Implementing Industry 4.0 Solutions to the Challenges of Covid 19

From research conducted in 2019 in two industrial sectors, namely the automotive and textile sectors regarding the application of industry 4.0 we found many things regarding the application of industry 4.0 in Indonesia.

In the automotive industry, a survey was conducted to 6 industries which are component suppliers to a large multinational automotive company in Indonesia. 3 industries are component supplier industries from the vehicle assembly industry which are integral and under the control of the company, while the remaining 3 industries are suppliers but not integral to the company.

In the 6 industries, all of them stated that they were implementing industry 4.0. From observations in the field, it was found that all companies are trying to

implement industry 4.0, although there is 1 company that is still only doing automation (which is actually industry 3.0). 1 company also produces simple vehicles for the countryside in addition to supplying components to the large automotive industry. The industry has implemented a fairly good industrial 4.0 model, where every stage of the process is inputted to the sistem even though it is done manually, so that the basic concepts of industry 4.0 can be fulfilled. Not only the application of industry 4.0 is fairly applied, but the company also apply good knowledge management too. All of these industries are able to produce almost every item needed by the automotive industry they supply.

When viewed from the main automotive industry, namely the multinational automotive industry, in general, the concept of distributed manufacturing can be applied to these 6 supply industries. This has also been done if there is a greater need for a component, other supplier companies will be contacted to be able to meet these demands. Therefore, the supply will not be cut off easily even though there is 1 supplier company that is not functioning, for example due to the closure due to this covid.

All surveyed companies have also implemented big data processing in their supply chains including marketing, this causes predictions of product absorption and changes in market trends from sales data to be quickly accommodated without the need to accumulate raw materials or finished products. This system is in accordance with the Just in Time principle which is generally used in the automotive industry, where the supply chain can supply materials on time and in the right quantity, thereby reducing the need for stockpiling of raw materials or products.

However, there are still misconceptions between the industrial 4.0 model and the 3.0 industry in the automotive industry, so many of the companies surveyed stated that they had implemented the industry 4.0 model even though they were still at the stage of fully implementing industry 4.0.

In the textile industry, there were 6 industries surveyed, all of which stated that they were trying to implement the industry 4.0 model. Technically, the textile industry that implements fairly modern machines is actually capable of centralized automation using networks such as IOT in industry 4.0, but many companies do not use this capability, only using machine automation capabilities locally in every machine.

Due to the nature of the textile industry, which is mostly ordered, the prediction of sales data is less important. When the industry produces production that is sold directly to the market, the predictive ability is not fast enough so that there is a surge in stored stock. This may be due to supply chain data processing, especially in sales, which has not been processed properly.

Similarly, in the case of the automotive industry, all the textile companies surveyed made a misunderstanding between the industry 4.0 model and industry 3.0, so that in their interviews they stated that they had used industry 4.0 when in fact when viewed in factory visits and explanations of the process, these industries had only reached the level of the Industry 3.0 model by implementing automatic production equipment based on computers, but still being or not yet unifying them in a network that is in accordance with the Industry 4.0 model.

When viewed from the level of use as discussed above, under current conditions it is impossible that the textile sector industry at least in the companies served, it is impossible to carry out distributed manufacturing except using manual methods as was done by Germany in World War 2.

The two industries did not change their production process much because they were limited by existing capital and market capabilities. Full automation compliant with industry 3.0 costs a lot of money, and the shift from industry 3.0 to industry 4.0 also costs money. All industries surveyed stated that the biggest obstacle was this problem. They do not view that total changes will not generate sufficient financial returns to justify these changes, they think that they cannot meet the Return on Investment (ROI) for their investment if major changes are made to reach industry 3.0 let alone industry 4.0.

DISCUSSION

After the discussion above, we can summarize how the Industry 4.0 model can overcome the problems that occur due to pandemic 4.0 especially in two industry sectors, which can be seen in the Table 2. From the explanation above, it can be seen that the textile industry is behind the automotive sector in terms of the application of industry 4.0 so that the ability to deal with disruptions from production caused by the COVID-19 pandemic is limited. This has been explained above because the automotive industry is the

industry that is most ready to implement the 4.0 industry model, while the textile industry is an industry that is sunset industry in Indonesia. This is due to the specific nature of the automotive industry that is able to automatically achieve the industry 4.0 model.

Tabel 3. Problem and Solution

Sector	Problem	Solution	Remarks
Automotive	People movement restrictions	Distributed manufacturing	
	Changing consumer buying behavior patterns	Prediction of sales data using big data/data mining to change product and manufacturing	
Textile	People movement restrictions	Unable to do distributed manufacturing	Actually, it can be done when doing cooperatives with other companies
	Changing consumer buying behavior patterns	Do not have the ability to predict sales data well	Production speed sometimes exceeds sales predictability so there is stock left. Excluding preordered products

In addition, the automotive industry has already implemented or even invented modern industrial concepts involving supply chains, such as the Just in time concept or kanban that ease implementation of industry 4.0 model. While the textile sector industry only applies it, or acts as an industry follower in the concept. Even only just to do distributed manufacturing, the textile sector industry is also experiencing difficulties because their management process is still very manual, only using computers and network as labor replecement.

In both industrial fields, they feel that they are using the 4.0 industry model only because of the trend set by the government. However, in practice, not much has changed from before the industrial 4.0 movement was announced by the government. There are only minor adjustments. The difficulty again is that the assessment instrument set by the ministry of industry currently reflects more towards industry 3.0 model compared to industry 4.0 model, so that entrepreneurs or industries who take part in the assessment get a false view or belief or only illusion that they have or are already or towards implementing industry 4.0. This causes the digital and network mindsets that crucial to the implementation of industry 4.0 model is not properly embedded in the owners and leaders of the company, only making process automation the goal of the company, thus causing them to be unable to apply the true industry 4.0 model. Infact this failures to implement digital and networking mindset is already a problem notice by technology supllier of industry 4.0 equipment.

CONCLUSION

The challenges of the Covid-19 pandemic mainly come from changes in public spending behavior and restrictions on human movement when there is a very high increase in cases in an area. However, the Covid-19 cases were not evenly distributed in all locations, creating opportunities to overcome this pandemic.

Meanwhile, to overcome the challenges of the Covid-19 pandemic, we can use Industry 4.0 concept that is the use of additive manufacturing technology to carry out DMS for its production capabilities to overcome the closure of a factory in an area heavily affacted due to the Covid-19 pandemic. Also changes in market behavior can be detected by extracting trend using big data analysis by AI and can be overcome by using augmented reality capabilities to simulate and model new products and production lines without significant re-tooling, because 3D printing technology from additive manufacturing can produce almost all types of objects with the same material and in certain dimensions.

Changing shopping behavior in terms of changing the purchasing path from offline to online also requires a change in the distribution channel of a product or a company. With the strong horizontal integration caused by the implementation of Industry 4.0, this can be done. Predictions of changes in shopping behavior patterns can be detected and predicted by processing big data using AI. Both are also technologies that are unique to Industry 4.0

On the other hand, there are often mistakes in understanding between Industry 3.0, which is the concept of mass production using computer-based automation and Industry 4.0, which prioritizes digitalization and networks.

In addition, the discovery of misconceptions between industry 3.0 and 4.0 is an important finding to follow up so that the right policies can be taken by decision maker to make sure the development of Industry 4.0 in Indonesia can be applied in all sectors.

ACKNOLEDGMENT

This paper uses data obtained from research conducted by the Research Center for the Development of Science and Technology (PAPPIPTEK) - Indonesian Institute of Sciences (LIPI) (currently the Research Center for Science and Technology Policy and Management (P2KMI) - Indonesian Institute of Sciences (LIPI)) which was conducted in 2019. Data was taken from 2 studies. in the same year. We would like to thank PAPPIPTEK-LIPI / P2KMI-LIPI for their support so that this research and this paper can be published. Both authors contributed equally to this paper

REFERENCE

ASEAN. (2020). *Economic Impact of COVID-19.* Jakarta: The ASEAN Secretariat.

BMBF-Internetredaktion. (2016, January 2016). *Bundesministerium für Bildung und Forschung.* Dipetik October 30, 2020, dari Zukunftsprojekt Industrie 4.0 - BMBF: https://www.bmbf.de/de/zukunftsprojekt-industrie-4-0-848.html

Bonner, S., Kureshi, I., Brennan, J., & Theodoropoulos, G. (2017). Exploring the Evolution of Big Data Technologies. Dalam I. Mistrik, R. Bahsoon, N. Ali, M. Heisel, & B. Maxim, *Software Architecture for Big Data and the Cloud* (hal. 253-283). Morgan Kaufmann.

Budraß, L., Scherner, J., & Streb, J. (2005). *Demystifying The German "Armament Miracle" During World War II. New Insights From The Annual Audits Of German Aircraft Producers.* Yale University.

Chien, C.-F., Hong, T.-y., & Guo, H.-Z. (2017). A Conceptual Framework for "Industry 3.5" to Empower Intelligent Manufacturing and Case Studies . *27th International Conference on Flexible Automation and Intelligent Manufacturing* (hal. 2009-2017). Modena: Elsevier.

CNN Indonesia. (2020, August 12). *Perlu Dorong Belanja Orang Menengah dan Kaya Agar Tak Resesi*. Dipetik October 30, 2020, dari CNN Indonesia: https://www.cnnindonesia.com/ekonomi/20200812062508-532-534706/perlu-dorong-belanja-orang-menengah-dan-kaya-agar-tak-resesi

Deliu, D. (2020). The Intertwining between Corporate Governance and Knowledge. *Journal of Emerging Trends in Marketing and Management, 1*(1), 93-110.

European Commission. (2017). *Digital Transformation Monitor : Germany Industrie 4.0.* European Commission.

Haseeb, M., Hussain, H. I., Slusarczyk, B., & Jermsittiparsert, K. (2019). Industry 4.0: A Solution towards Technology Challenges of Sustainable Business Performance. *Social Sciences*.

Hedberg, T., Helu, M., & Sprock, T. (2018). A Standards and Technology Roadmap for Scalable Distributed Manufacturing Systems. *13th Manufacturing Science and Engineering Conference.*

Hermawati, W., Fizzanty, T., Rosaira, I., Manalu, R., Budiansyah, A., Pitaloka, A., & Ariyani, L. (2019). *Peran Global Value Chains Industri Garmen Indonesia Dalam Mendukung Penerapan Teknologi 4.0.* Jakarta: P2KMI-LIPI.

K.Chukalov. (2017). Horizontal and Vertical Integration, as A Requirement For Cyber-Physical Systems in The Context of Industry 4.0. *Iinternational Scientific Jornal "INDUSTRY 4.0", 2*(4), 155-157.

Kardoyo, H., Isnanti, Y., Hendrix, T., Febrianda, R., Setiawan, S., Romadona, M. R., & Indriasari, D. T. (2019). *Tantangan dan Kesiapan Industri Manufaktur Komponen Otomotif di Indonesia dalam Menghadapi Tren Industri 4.0.* Jakarta: P2KMI-LIPI.

Kementrian Perindustrian. (2019). *Making Indonesia 4.0.* Jakarta: Kementrian Perindustrian.

Kim, J. (2019). Vertical Integration and the Theory of the Firm. *Oxford Research Encyclopedia of Business and Management*.

Kumpe, T., & Bolwijn, P. T. (1988). Manufacturing: The New Case for Vertical Integration. *Havard Business Review, March-April*, 75-81.

Lee, J. (2015, September 16). *The death of the chief knowledge officer*. Dipetik 10 30, 2020, dari KMWorld: https://www.kmworld.com/Articles/Editorial/ViewPoints/The-death-of-the-chief-knowledge-officer-106344.aspx

Nonaka, I., & Takeuchi, H. (1995). *The knowledge creating company: how Japanese companies create the dynamics of innovation.* New York: Oxford University Press.

Okazaki, T. (2010). *Supplier Networks and Aircraft Production in Wartime Japan.* University of Tokyo.

Raucha, E., Dallingera, M., Dallasegaab, P., & Mattab, D. T. (2015). Sustainability in Manufacturing through Distributed Manufacturing. *The 22nd CIRP conference on Life Cycle Engineering* (hal. 544 – 549). Procedia.

Rojko, A. (2017). Industry 4.0 Concept: Background and Overview. *International Journal of Interactive Mobile Technologies*, 77-90.

Schwab, K. (2015, December 12). *The Fourth Industrial Revolution : What It Means and How to Respond.* Dipetik October 30, 2020, dari Foreign Affair: https://www.foreignaffairs.com/articles/2015-12-12/fourth-industrial-revolution

Setiawan, S. (2007). Penggunaan Kembali Knowledge (Re-Use Knowledge) : Suatu Pandangan Teoritis Terhadap Manajemen Knowledge. *Warta Kebijaka IPTEK dan Manajemen Litbang, 5*(2), 86-105.

Setiawan, S. (2010). Faktor Penghambat Knowledge Sharing di Lembaga Litbang : Kasus Lembaga Ilmu Pengetahuan Indonesia. *STI Policy and Management Journal, 5*(2), 159-173.

Setiawan, S. (2012, June). *Peningkatan Knowledge Sharing di Lembaga Litbang Pemerintah Melalui Modifikasi Tata Kelola Honor Penelitian*. Depok, Indonesia: Universitas Indonesia.

Yin, R. L. (2003). *Case Study Research: Design and Methods (Second edition).* California: Sage Publications.

Yovanda, Y. R. (2020, September 28). *Pandemi Covid-19 Disebut Bikin Kelas Menengah ke Atas Takut Belanja ke Mal*. Dipetik October 30, 2020, dari Tribunnews.com: https://www.tribunnews.com/bisnis/2020/09/28/pandemi-covid-19-disebut-bikin-kelas-menengah-ke-atas-takut-belanja-ke-mal

Halaman ini sengaja dikosongkan