Industry 4.0 and Its Effect on Reorientation of International Trade Patterns

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Abstrak

Dunia Industri sejak awal hingga saat ini setidaknya telah mengalami 3 kali revolusi. Revolusi pertama terjadi pada tahun 1784 di Inggris yang ditandai dengan mekanisasi produksi. Revolusi kedua terjadi di akhir abad 19 hingga tahun 1970an dengan dipergunakannya mesin-mesin bertenaga listrik untuk kegiatan produksi massal, sedangkan revolusi ketiga terjadi pascatahun 1970-an hingga saat ini yang ditandai dengan penggunaan teknologi komputer/ digital untuk otomasi kegiatan produksi. Pertama kali diperkenalkan di The Hanover Fair di Jerman, istilah Industri 4.0 dimaksudkan untuk mewakili konsep Revolusi Industri keempat. Layaknya Revolusi Industri di era-era sebelumnya, Revolusi Industri keempat yang ditandai dengan digitalisasi alat produksi dan integrasinya dengan internet diprediksi akan memberikan banyak peluang manfaat sekaligus potensi resiko bagi siapa saja yang terlibat didalamnya. Beberapa hasil studi sebelumnya telah banyak mengupas definisi, karakteristik Revolusi Industri keempat dibandingkan dengan Revolusi Industri sebelumnya beserta adanya perubahan orientasi Negara dalam kebijakan aktivitas dagangnya dengan Negara lain dalam kerangka Industri 4.0. Oleh karena itu, artikel ini bertujuan untuk menelaah bagaimana Industri 4.0 beserta dengan berbagai macam karakteristiknya dapat mempengaruhi pola aktivitas dagang antar Negara. Artikel ini akan menggunakan pendekatan ekonomi liberal-kapitalis dan konsep pasar bebas untuk memberikan gambaran tentang bagaimana Revolusi Industri keempat dapat mempengaruhi pola aktivitas dagang antar Negara. Melalui pendekatan tersebut, artikel ini berpendapat bahwa perkembangan teknologi pada era industri 4.0 memberi pengaruh kepada perubahan interaksi antara produsen dan konsumen yang kemudian memicu perubahan interpretasi pola

perdagangan yang seharusnya terjadi antara produsen dan konsumen.

Kata kunci : *Industri 4.0; pengaruh; perdagangan antar Negara*

Abstract

From the beginning until today, the industrial world has experienced at least three revolutions. The first revolution occurred in 1784 in England, marked by the mechanization of production. The second revolution occurred in the late 19th century until the 1970s with the use of electric-powered machines for mass production activities, while the third revolution is after the 1970s until now, which is characterized by the use of computer / digital technology for automation of production activities. First introduced at The Hanover Fair in Germany, Industry 4.0 was intended to represent the Fourth Industrial Revolution concept. Like the Industrial Revolution in previous eras, the Fourth Industrial Revolution marked by digitizing production equipment and its integration with the internet is predicted to provide many opportunities for benefits and potential risks for anyone involved. Some of the results of previous studies explored the definitions, characteristics of the Fourth Industrial Revolution compared to the previous Industrial Revolution and changes in the state's orientation in its trade activity policies with other countries within the framework of Industry 4.0. Therefore, this article examines how Industry 4.0 and its various characteristics can influence trade activities between countries. This article used the liberal-capitalist economic approach and the concept of free markets to provide an overview of how the Fourth Industrial Revolution could influence the pattern of trade activities between countries. By implementing the approach mentioned above, this article argues that the development of technology in the era of industry 4.0 influences the interaction between suppliers and consumers, leading to changes in the interpretation of what should happen in the pattern of trades afterward.
Keywords: *Industry 4.0; influence; trade between countries*

INTRODUCTION

Industry 4.0 or the Fourth Industrial Revolution (4IR) is one of the hottest issues currently being discussed by many groups, including scientists, economic practitioners, and policy-making politicians (Schwab, 2016). Industry 4.0 was first mentioned in Germany on occasion called the Hanover Fair in

2011 to describe the 4th Industrial Revolution (Rainer Drath, 2014).

Based on references from the European Parliamentary Research Service, the industrial sector in this world has evolved three times and is currently completing its fourth revolution. The first revolution occurred in 1784 in England, marked by the mechanization of production where steam-powered machines began to replace human hands to make a product. The second revolution occurred at the end of the 19th century until the 1970s with electric-powered machines for mass production activities. In comparison, the third revolution is after the 1970s to the present, marked by using computers / digital technology to automate production activities.

Today, the rapid development of digital technology, sensors, and the internet has led to integrating it into production factors to achieve more efficient and profitable results. This latest idea marks the start of the Fourth Industrial Revolution. Angela Merkel reveals that Industry 4.0 is a comprehensive transformation of the industrial world's entire production sector by integrating digital and internet technology with conventional industrial technology. All aspects of production in the industrialized world are expected to be related to one another in a digital connection to increase effectiveness and integration (Davies, 2015).

Based on this definition, the public has taken an illustration or description of the new concept. Some terms that have been widely circulated are smart factories, smart industry, or industrial internet. Although different, the highlight of these concepts remains the same. They describe a situation in which a computer-based production system will monitor physical processes and make decentralized decisions independently. This situation is made possible by integrating a production system with a digital information network via the internet. It then increases the adaptability and effectiveness of the production system, reduces costs, encourages income and investment growth to make the countries' competitiveness to improve the face of dynamic global market competition (J. Smit, 2016).

As the central aspect of Industry 4.0, digitalization plays an essential role in influencing the global economy. For example, the internet can increase capital owners' ability to observe markets, find patterns of demand in them, and

enable capital owners to take part and compete in global markets. Of course, this technology makes the global market broader and more accessible (Papachashvili, 2018).

With his research, Riker added a positive relationship between the openness of a country to international trade and the increasing use of the internet. The results of Riker's research revealed that at least there would be an increase in trade openness of 6.88% in developed countries and 1.67% in developing countries if calculated and reviewed through predictions of increasing internet users in the next five years (Riker, 2014).

Seeing this pattern, the concept of industry 4.0 has influenced trade patterns between countries recently. Another fact shows that many countries have started to adjust their international trade policies to take advantage of the current transition.

In his research, Mishra (2017) underlined that the trend of Preferential Trade Agreements (PTAs) such as the Japan-Mongolia Economic Partnership Agreement and the Trans-Pacific Partnership Agreement raised policies about cybersecurity, data protection, network neutrality, and online intellectual property. They are intended to expedite and facilitate electronic/online transactions. This fact is interesting because it shows the tendency to reorient and review the trends in trade policies between countries that have been made so far (Mishra, 2017).

Based on the arguments above, this article will attempt to discuss how the aspects and changes have occurred because the industry 4.0 concept can affect trade patterns between countries. This article will use the liberal-capitalist economic system approach to view and compare the phenomena in the history of the Industrial Revolution in the world from its first appearance to the present (Industrial Revolution 4.0). It is expected to provide an overview of patterns or trends in trade activity between countries before Industry 4.0 and how these patterns or trends can undergo adjustments or changes when implementing Industry 4.0.

HISTORY OF THE INDUSTRIAL REVOLUTION 1.0 TO 4.0 AND ITS IMPACT ON TRADE PATTERNS BETWEEN COUNTRIES

According to Schwab (2016), the word "revolution" describes a fundamental and fast/sudden change from various forms of the revolution taking place nowadays. These revolutions arise when new

and different technologies and world views appear. New technologies and perspectives trigger changes in the existing social and economic structures **(Schwab, 2016)**.

The term "Industrial Revolution" is always related to technology, as Friedrich Engels explained that the Industrial Revolution emerged as the climax of the technological development of production, especially at that time - the textile industry. This development then gave rise to fundamental and prolonged changes (Griffin). In its historical development, this world has experienced at least three times the Industrial Revolution, so the last Industrial Revolution is marked as 4.0.

According to Davies (2015), the first Industrial Revolution occurred in 1784 in England, marked by the mechanization of production where steam-powered machines began to replace human hands to make a product. (Davies, 2015). According to Landes (1969), the first means of production to undergo mechanization was textile production tools. The textile industry, especially wool and cotton, was the industry with the largest number of workers in England. With the mechanization of production tools in spinning machines, the production percentage increased rapidly, making the textile industry develop, which could absorb more labor. This situation gradually increased the income per capita so that the economy and the community's welfare would also increase.

This trend continued to spread not only in the UK but also to other countries, causing textile products and raw materials to increase rapidly and became a trade trend between countries. The rapid increase in one production sector would usually increase or the emergence of innovations in other sectors. In this case, the rapid growth of the textile industry and innovation in the mechanization of production tools at that time triggered developments in the distribution sector (steam vehicles, railroads), mining, and other raw goods (coal, iron, etc.) (Landes, 1988). In this era, trade activities between countries still focus on fulfilling the need for raw materials, exploring potential areas of resources, and distributing free market values.

The second revolution occurred at the end of the 19th century until the 1970s with electric-powered machines for mass production activities (Davies, 2015). At that time, electric power triggered a large-scale evolution of production

machines. With electricity, some large machines - driven by steam power - could be more efficient with no larger size and increased precision. Some examples of the evolution and development of machines in this second Industrial Revolution were the means of communication (telegraph), cars, weapons of war, and other means of production.

Besides the significant development of production machines, the application of concepts such as assembly line, mass production, and intensive labor division in each production process in factories had also helped to realize the Second Industrial Revolution. Ford (1922) introduced the assembly line as a design of an item's manufacturing process by separating parts of the item into specific manufacturing posts to be more efficient. This concept, combined with mass production and division of labor or division of workers based on their specializations, would increase production efficiency. (Ford & Crowther, 1922).

Here is an illustration that explains how this concept combination works—first, the assembly line. If a factory wanted to build a car with an assembly line, a production series of cars would be sorted according to its parts. For example, the car assembly line would consist of 5 posts, each of which would be in charge of making one of the car parts such as body, engine, chassis, wiring, interior, and final finishing post. In the assembly line, workers did not need to move because each part must be put together from the car delivered via conveyor or other means of transportation such as a forklift until it was finished at the last post. Second, mass production, if one assembly line could complete its task in 5 hours multiplied by the total number of assembly lines in 1 factory - for example, 10 - then every 5 hours, a factory would produce 50 cars. This concept could not be compared to the car production done small team. Mainly if the concept of division of labor or labor division, according to specialization, was applied, the entire production process could run even faster.

Based on these phenomena, the second Industrial Revolution triggered higher economic and technological growth. With an efficient production factor, consumer desires would be easily fulfilled, and transactions became increasingly popular with large profits. The attractiveness of these production machines was so high that the demand for these

machines also increased. With increasingly sophisticated and fast communication and distribution machines, consumers' barriers to transfer their wants and interests to the market decreased. Demands for private vehicles, goods, or resources exclusive to other remote areas could be brought in. Even telegram services were gradually becoming popular (Landes, 1988; Davies, 2015).

However, it turned out that the positive trend was slowly finding its saturation point. With sophisticated production tools that were increasingly cheap and accessible, the percentage of production factors increased dramatically. They created two consequences: an increase in the unemployment rate because workers were replaced by machines and the percentage of supply beyond its equilibrium point to the percentage of demand. The price of goods decreased and resulted in economic depression (Wells, 1889).

Based on the explanation described above, the trade pattern between countries at that time had undergone significant changes in the scale of production and distribution speed. However, on a more fundamental basis, the trade patterns during the first and second industrial revolutions had not changed. The trade pattern during the second industrial revolution still focused on meeting the need for raw materials, exploration of areas rich in potential resources (natural and human), and the distribution of free-market values, although with a few exceptions regarding the limitation or prohibition of the use of atomic/nuclear energy sources referring to the conditions after the World War. At that time, sustainability had not yet developed into an issue closely related to trade and production activities.

Next, the Third Industrial Revolution is after the 1970s to the present, marked by computer / digital technology to automate production activities. In this era, the production factors increase performance again with increasingly sophisticated technology and globalization. Through globalization, the interaction between individuals becomes easy. Long distances in this era can be closed due to the influence of increasingly fast transportation technology and the more efficient interconnection of communication devices. If individuals' interaction gets more comfortable, their access to the free market will also become more accessible. However, behind these beneficial potentials, there

will still be consequences that must be faced.

Over time, the sophisticated products that have already numbered will always need a supply of energy to operate. The energy used to utilize production is still in fossil energy, which many predict will not last long because they are not renewable. On the other hand, the result of the continuous and massive use of fossil energy begins to cause problems for this planet's inhabitants, as proved by global warming, sea-level rise, and forest fires (Rifkin, 2012).

In this era, the trade pattern between countries still refers to fulfilling the needs for goods and services with a change in orientation, especially those concerned with preserving nature. Trade activities between countries in this era begin to review sustainability or their influence on environmental sustainability openly. Some evidence of concern for this problem is the Kyoto Protocol's initiation, which urges each country owner to monitor the level of carbon emissions produced by their means of production and the growing movements of used goods and environmentally friendly materials.

Today, the rapid development of digital technology, sensors, and the internet has led to the idea of integrating them into production factors to achieve more efficient and profitable results. This latest idea marks the start of the Fourth Industrial Revolution. Angela Merkel reveals that industry 4.0 is a comprehensive and comprehensive transformation of the industrial world's entire production sector by integrating digital and internet technology with conventional industrial technology. All aspects of production in the industrialized world are expected to be related to one another in a digital connection to increase effectiveness and integration (Davies, 2015).

In this era, production means have experienced significant growth due to their integration into an internet connection and an artificial intelligence (AI) program. This program allows them to monitor physical production processes and even react to the dynamics of demand in the market to run automatically, massive and fast. As an illustration, the speed of production of a manufacturing process that combines the concepts of the assembly line, mass production, and division of labor (which have been applied in the previous Industrial Revolution era) becomes two times more

efficient because of these means of production. They can also identify demand trends in the market while monitoring the smooth running of the production process and the obstacles they might face—all of that without human intervention.

However, there is no perfect system. The industry's state, integrated with the internet and other digital software, also creates new consequences. Some of these consequences are cybersecurity, data protection, piracy, and legal-formal problems (J. Smit, 2016; Papachashvili, 2018; Mishra, 2017). Seeing this pattern, the concept of industry 4.0 has - in a way - provided a stimulus for countries globally to review their patterns of trading activity in this era. Trade interests, which are basically to meet the need for goods and services, are typical. However, adjustments to the risks that may arise due to the consequences mentioned earlier also need attention.

Recently, public awareness of the need to adjust the trading activity patterns in the industrial era 4.0 has increased, as Mishra mentioned (2017). In his research, that Preferential Trade Agreements (PTAs) such as the Japan-Mongolia Economic Partnership Agreement and the Trans-Pacific Partnership Agreement have generated policies relating to cybersecurity, data protection, network neutrality, online intellectual property, intended to facilitate market transactions taking advantage of the implementation of Industry 4.0 (Mishra, 2017).

1. Industry 4.0 in the Capitalist Economy's Eyes

After discussing the history of the Industrial Revolution and the trends in trade activity patterns between countries, there should be a discussion about the primary system for countries in doing their trading activities to explain how each variable in Industry 4.0 can affect trade activity patterns between countries. The system is a liberal-capitalist economic system.

According to Adam Smith, the market - a gathering place for supply and demand factors - should be separated from the government's influence, and the government should let the market run itself without intervention. If individuals are given the freedom to pursue their interests, the free market's invisible hand mechanism will automatically force each individual to behave responsibly (Gregory & Stuart, 2014; Smith, 1776).

The products that consumers want (demand) will be absorbed by the producers (suppliers), who will then be produced according to the type and quantity through the most efficient production means. Such a cycle will continue and automatically run without government intervention or other structured social action. Individuals acting in their interests will almost certainly act to serve their interests properly. Government action may interfere with this natural process. The government should be limited in providing essential public services, which private capital owners cannot produce or realize (Gregory & Stuart, 2014).

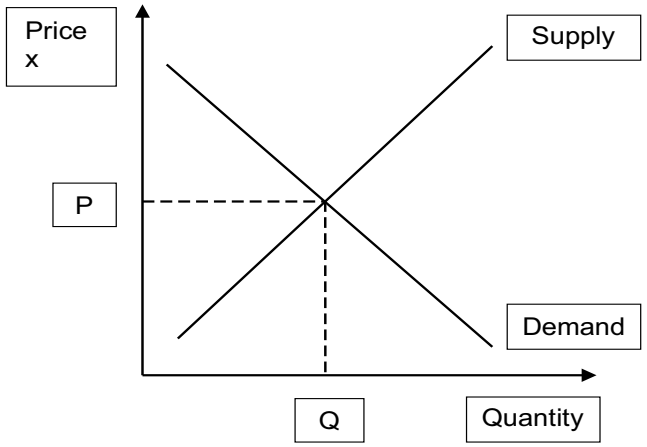
After knowing the capitalist economic system's outline, especially those directly related to markets and trade interactions, the next issue that needs to be parsed is the market's definition and aspects. Parsing the market definition and its aspects is essential because the industry 4.0 concept is implemented directly into the market and its aspects.

Returning to the theory of capitalism formulated by Smith, according to him, the market is an organized structure, which functions to bring together sellers and buyers (Seller and Buyer). If sorted out, at least three crucial variables must exist for a market to be formed: buyers, sellers, which automatically coincide with the next variable, namely the means of production. According to Smith's market concept, the buyer represents the demand variable, and the seller represents the supply. Simultaneously, production means the variables that affect the equilibrium or balance between demand and supply in the market (Gregory & Stuart, 2014).

In practice, consumers will always want to maximize their interests following the desire to get a product at the lowest possible price. Therefore consumers/buyers are a source of demand. Sellers/producers, on the other hand, will always be willing to maximize their profits by offering as many products as they can produce with a price forecast that is higher than demand, of course, while paying attention to production costs. The market will then bring together them and their conflicting interests (Gregory & Stuart, 2014).

According to Smith, this phase is where the invisible hand's natural process comes into play. If the number of products requested exceeds the quantity supplied (demand exceeds supply), the price will automatically increase. These

results in reduced demand because consumers with lower purchasing power will retreat and, on the other hand, attract producers to produce more. This tug of war continues so that a balance is reached where the buyer agrees to buy the producer's product at the current price (Gregory & Stuart, 2014). Below is a scheme showing a state in which an equilibrium or supply and demand balance has been reached.



Scheme 1 Illustration of supply and demand relations in the market (Gregory & Stuart, 2014)

Through the above discussion, every variable in the market - producers affect consumers, consumers influence producers, and even conditions or technological developments - will influence each other and make adjustments independently and naturally, leading to achieving equilibrium (Gregory & Stuart, 2014).

After describing the factors of production and how they work in influencing the market, the next step is to ascertain the scope of industry 4.0 in the capitalist economic system, especially the free market. In its history, the term industry 4.0 was first used in Germany in 2011. Therefore it is only natural that the definition expressed by Angela Merkel that industry 4.0 is a comprehensive and comprehensive transformation of the entire production sector in the industrial world through the integration of digital technology and the internet with conventional industrial technology (Davies, 2015). Through this definition, the central aspect of implementing Industry

4.0 is technology integration. The technological aspect in the market concept can be categorized as a means of production, where technology is a tool for producers/ owners of capital to make products.

Looking at the market concept formulated by Adam Smith, the digital technology intended by Industry 4.0 will not be found. However, looking at its function as a means of production, digital technology functions as labor. According to Smith, workers' availability (labor) is essential to producing other goods by consumers. The higher the productivity level and the number of workers under a producer is, the higher the supply level will be. If producers can accommodate consumer demand in the market, the number of transactions will increase. It is undoubtedly useful and can increase the economy and prosperity where the market is located. However, increasing the number of workers does not always have a good impact because workers have costs that capital owners will later be borne. Workers are human beings who also need food and clothing and have different skills. The capital owners' expertise owners to manage workers will ultimately be needed to maintain production costs, affecting the market's trade equilibrium. Therefore, in his book, Wealth of Nations, Smithave rise to the term division of labor (Smith, 1776).

In line with history, technology has evolved, and the industry has undergone a revolution. The Industrial Revolution has always been associated with technological developments that have made industrial production tools more efficient. In Industry 4.0, conventional production technology integrated with digital technology can also be categorized as workers. This technology will apply a digital manufacturing process where a production tool is integrated with a digital device, software, and the leading internet. It will also monitor physical production processes and react automatically to demand dynamic massively and quickly (J. Smit, 2016). Technology development can then minimize time, reduce errors, and accommodate flexibility in the production process, resulting in reduced production equipment owners' reduced costs. Cutting costs means increased profits earned by producers. From the consumer side, the speed and flexibility of the new technology's production process can accommodate consumer

interests. Even more than only accommodating consumers' interests in the scope of getting the goods and services requested, today's technological sophistication also allows consumers to choose or monitor how the goods and services requested get to them.

Through the implementation of Industry 4.0, trade dynamics have become much faster. Individual producers and consumers can access the market more easily and quickly. The digitalization of technology allows consumers to make more demands, and producers can produce faster and better quality. From the point of view of a Capitalist Economy, it will help bring a broader and more inclusive free market. On the other hand, the increased speed of access to information and markets and interconnectivity between producers means of production and consumers globally also provide new consequences and challenges. Some of the consequences and challenges are legal-formal issues, cybersecurity, data protection, and even a lack of skilled human resources in these technologies (Davies, 2015) (Papachashvili, 2018). The emergence of these consequences and challenges, in the end, made the public realize that there needs to be a reorientation or review of trafficking practices in recent times.

2. Conclusion

Based on the previous chapters' explanation, the concept of Industry 4.0 can influence changes in patterns/policies of trade activities between countries through the aspect of digitizing production. The digitization of production technology allows consumers to make more demands, and producers can carry out the production process faster and with higher quality. From the side of a Capitalist Economy, it can help realize a broader and more inclusive free market.

However, carelessly encouraging the digitization of production growth without having a plan and measurable standardization cannot always bear positive results. On the other hand, the increased speed of access to information and markets and interconnectivity between producers means of production and consumers globally also provide new consequences and challenges such as cybersecurity issues, data protection, and formal legal problems that will not be so quickly resolved without them—sufficient skill and understanding in their field.

This phase is where the gap in which trade patterns between

countries are reoriented. Producers need to increase their capabilities in dealing with consumers. The high level of interaction between producers and consumers in the industrial era 4.0, which is not found at other industrial levels, is a new commodity that the producer needs to process correctly. The density of information regarding consumer interactions with producers based on the internet and similar technologies can add value for individual producers if the information can be maintained, managed, and implemented correctly. However, it can also be an inhibiting factor and a source of significant loss if the opposite happened.

Recently, several countries have tried to implement the Industry 4.0 concept in their domestic industrial policies or international trade activities, including Indonesia (ADB & Bappenas, 2019; BPPI, 2018). Even though market dynamics will dash supported by increasingly sophisticated information and production technology, each country needs to review its trade or industrial policy orientation before implementing the concept of Industry 4.0 to take every opportunity and benefit optimally.

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