

Review on Manufacturing for Advancement of Industrial Revolution 4.0

Anbia Adam, Yusri Yusof*, Maznah Iliyas, Yazid Saif, Noor Hatem

Faculty of Mechanical and Manufacturing Engineering, Universiti Tun Hussein Onn Malaysia (UTHM), 86400, Batu Pahat, Johor, MALAYSIA.

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Abstract: The world today stands at the threshold of a new revolution, the fourth in the history of mankind. It is imperative to study the effects of Industrial Revolution 4.0 (also known as IR 4.0) to understand the benefit that it will provides for the affected groups majority. This paper consists of review for mostly on manufacturing sector in United Kingdom, Singapore, European Union, United States and China which reveals the rapid growth and the effect of Industrial Revolution 4.0 towards these countries and consequently the world. Manufacturing has increased economy in Singapore, where incomes for employed residents in manufacturing exceed others by 0.4 percent. Meanwhile in United Kingdom and European Union, manufacturing has accounted for 8% and 24% respectively for their national jobs. However, United States shows slow increase in manufacturing employment sector and still below 18 million (before recession in 2009). Nonetheless, the employment could be affected by vast use of automated machine, unlike China which has ratio of 40 machines to 10,000 workers.

Keywords: Industrial Revolution 4.0, review, manufacturing

1. Introduction

Internet of Things (IoT) and Internet of Services (IoS) and Advanced Manufacturing- all these transformations mark the transition of current industrial production to the fourth stage IR 4.0, which is characterized by smartness and networking. IR 4.0, referred to as the “Fourth Industrial Revolution”, also known as “smart manufacturing”, “industrial internet” or “integrated industry”, is currently a much-considered issue that supposedly has the possible to affect entire industries by changing the way goods are designed, manufactured, distributed and paid.

2. Industrial Revolution 4.0

The globalization had driven the creating of the development of structures, express parkways, control ventures and modern structures with a specific end goal to satisfy human needs [1]. IR 4.0 is the latest of the industrial revolution, which will have a big influence on global manufacturing. This can proved by the number of article related IR 4.0 grows every year as shown in Fig.1. Since China’s manufacturing is currently in a phase of industrial change and upgrading, IR 4.0 provides China with further and challenges that we should be focusing on. Germany is one of the common ambitious global manufacturing industries, and is a machine manufacturing industry’s global leader in several fields, including BMW, Porsche and Volkswagen in the automotive industry, the sports brand Adidas, the electrical and electronics company Siemens. In response to the

European debt crisis, the German government presented a plan for IR 4.0, in order to further, incorporate and advance global German manufacturing clout. IR 4.0 is an important enterprise of the German government that was adopted as part of the “High-Tech Strategy 2020 Action Plan” in 2011 [2].

In Germany, a significant discussion on IR 4.0 has begun, which in the meanwhile has developed also to other countries, like the US or Korea or China. The concept is that the first three industrial revolutions occurred about as a result of industrialization, electricity and Information Technology (IT). Now, the introduction of the IoT and IoS into the manufacturing environment is leading to a IR 4.0 [3].

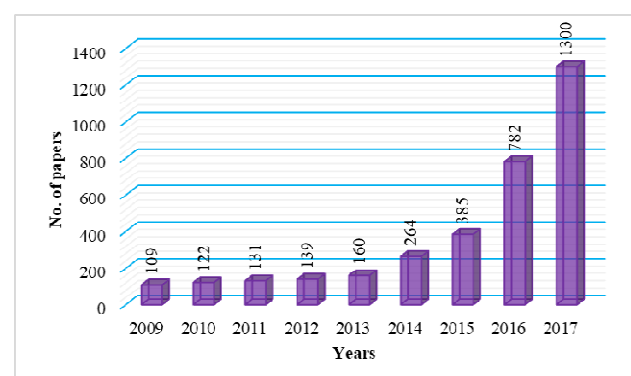


Fig. 1 The number of IR 4.0 articles by year [4]

The goal of the IR 4.0 is to develop the product model is greatly flexible of and digital products and

services, with real-time communications between people, products, and devices during the production process. For example, a company that accepts customer orders and immediately provided the required product ships will distribute of separate selling and exchanging ways, which will have a big influence on the traditional e-commerce sales model.

IR 4.0 will affect not only the German industry or even international industrial development but will become leadership government which will change the conventional industrial techniques generation, and future manufacturing introduction [5]. It is not an easy matter to realize IR 4.0, and it is likely to take ten or more years to achieve. Currently, IR 4.0 is the vision for the future, because it includes several features and appearances for many types of complexities and challenges, including scientific challenges, technological difficulties, economic challenges, human problems, and political issues [4].

2.1 Manufacturing in Singapore

Manufacturing sector in Singapore's continues to face phenomenal difficulties amid global economic headwinds. Hence, the time is ready for an all-encompassing redo of its manufacturing sector to receive the full rewards of Industry 4.0, while proactively dealing with the challenges and disengagements made by this noteworthy progress.

Growth story of Singapore since independence, and continuously by the help of the Ministry of Manpower, turns to develop a workforce able to compete globally for Singapore, to build a progressive workplace and to ensure financial security and staffing over the life of all Singaporeans [6]. In view of the manufacturing sector's strong backward linkages to the services sector, efforts to grow highly-productive modern services under the Government's Industry Transformation Maps will be supported by the concomitant development of a globally-competitive manufacturing sector [7].

The manufacturing sector has workers around 510,000 specialists in December 2015, while employment in the sector has seen a decline in recent quarters due to global economic conditions slow more compact than foreign labour and the provision of, and out of the average income of the local population in the region to grow [4]. In 2015, the average monthly nominal income of the population increased full-time workers in the sector raised by 5.4 per cent, from 4104 dollars in 2014 to US \$ 437 4 US dollars. Over a period of 6 years longer than in 2009 to 2015, the average monthly nominal income of the population employed rose full-time in the sector by 5.5 per cent on the basis of an annual compound, which is higher than the annual growth rate of 5.1 per cent for staff full-time residents of the macroeconomic shown in Fig. 2 [8].

The results in the manufacturing sector is also the indirect effects that benefitted the rest of the economy, given that various intermediate inputs such as distribution services, transportation, finance and what is required in the production process [4]. By utilizing the input-output tables in Singapore, it is estimated to be S\$ 1,000000

increase in the final demand for manufacturing which generates S\$ 81,000 from real Value Added (VA) and non-manufacturer from non-industrial opportunities, which especially benefit the wholesale trade sector. Relatively, a staggering S\$ 1,000000 increase in the final demand for services generates \$ 22,000 of non-VA services and non-services jobs [8].

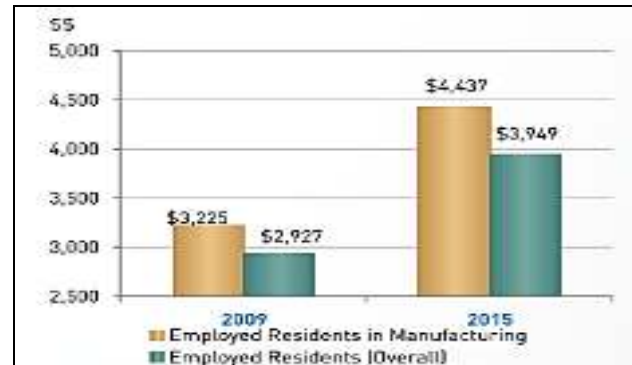


Fig. 2 Median gross monthly income for full-time employed resident [8]

The electronics industry in Singapore since 2012 is the backbone of the manufacturing sector, contributing to the countries by 5.2% (GDP) where it supports Singapore's economic growth, by contributing 25% of total value added production. On the other hand, total fixed assets investments reached 16 billion dollars in 2012, with the percentage of electronics industry about 38.8% of total investments. The number of factory workers is about 80,000, which is 19% of total manufacturing jobs which accounts for almost 20% of the mass electronics and semiconductors representing the largest and fastest-growing sector and competing with countries such as Japan, South Korea, Taiwan, the United States and China in terms of chip production capacity [4].

Singapore has become one of its three largest economies of the world in the region, which is one of the major players in the Free Trade Agreement (FTA) activity. Nonetheless, ASEAN as a group is developing as the centrepiece of the Asia Free Trade Agreement (FTA) package. In contrast, it has maintained Asian free trade agreements through strong regional, trade coverage increased free trade agreements, and other issues of trade liberalization such as investment, intellectual property rights, labour standards or mobility has been included [9].

2.2 Manufacturing in United Kingdom

Manufacturing sector in the UK with statistics in 2016 has been accounted for 8% of jobs, while 2.7 million in total UK of 10% and the output economic of £177 billion. Hence, 57% of imports, which worth £243 billion and 70% (£15 billion) of UK research and the development of spending [10] are shown in Fig. 3.

The manufacturing sector has not recovered to the pre-crisis level. The initial recovery in manufacturing output stalled in early 2011 and declined for the following two years. In early 2013 a more sustained recovery began and between Q1 2013 and Q3 2017 manufacturing output

grew by 7%. However, manufacturing output is still 2% below its recent peak in Q1 2008 [10].

In the Fig. 4 demonstrates the various industries that make up the manufacturing sector. However, these industries share of total manufacturing output, food manufacturing accounted for 16% of the manufacturing industry in 2016, while the manufacture of transport equipment which incorporates the automotive industry accounted for 15%, and the manufacture of metals and metal products accounted for 12% [10].

The manufacturing companies have turned themselves into majority-owned companies in providing the service. To date there are more than 2000 CNC models far and wide, and turning centres require a solitary standard especially in the territory of machining to enhance profitability by expanding the lavishness of connections and exchanges [11]. One of the most notable examples of service company is IBM, which now considers itself primarily in the service business, although they still makes computers. Production of material goods has now

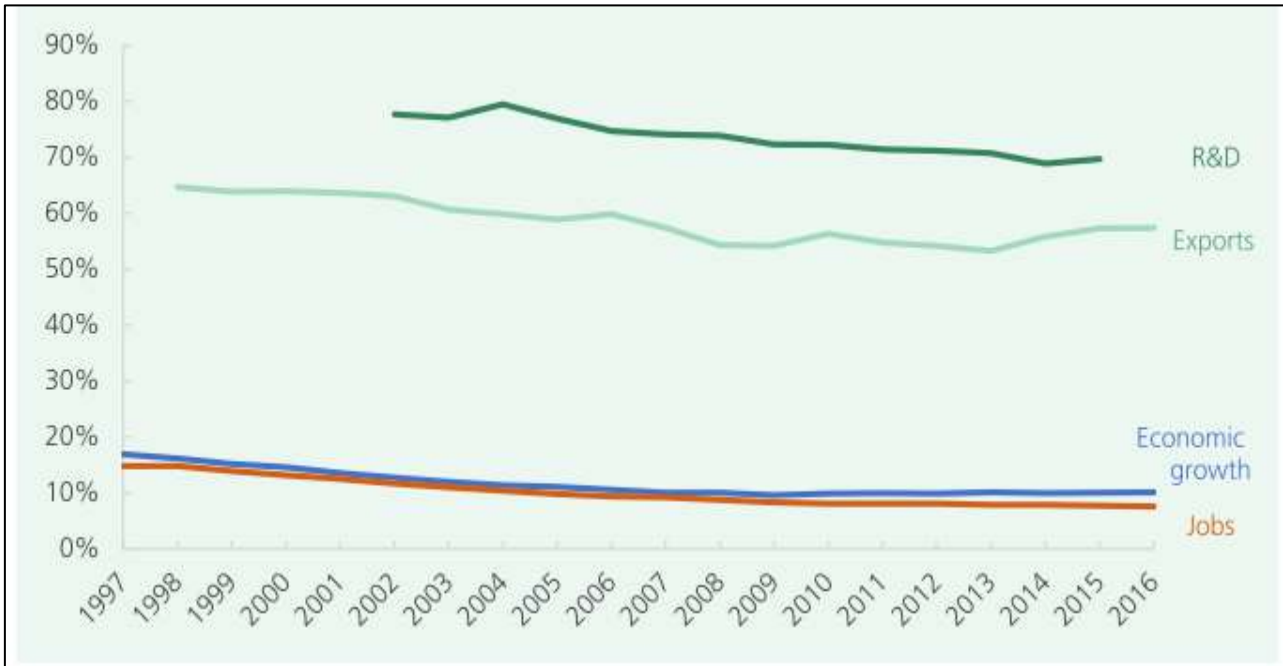


Fig. 3 Manufacturing as a Percentage of UK total: Output, jobs, R&D and exports [10]

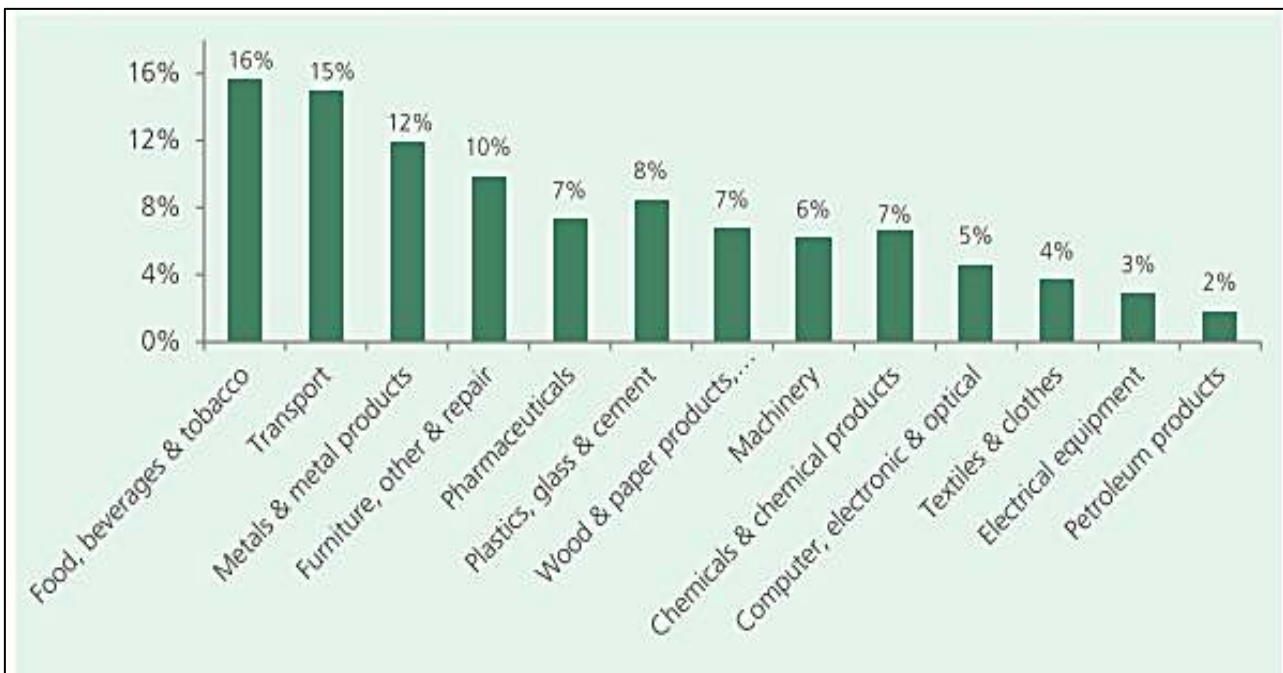


Fig. 4 Output of Manufacturing Industries as a percentage of total manufacturing in 2016 [10]

become secondary to companies that focus instead on providing "business solutions". So the shift from manufacturing companies to service providers is part of a shift in the comparative advantage of the advanced economies [12].

In particular, it is the most recent survey of purchasing managers working in the employment growth industry in the UK manufacturing sector, has reached its highest level in more than three years. The survey also indicated that manufacturing companies were experiencing sharp increases in costs, which rose at their fastest rate in seven months [13].

2.3 Manufacturing in European Union

The European Union between the Future of Manufacturing Scenarios (2015-2020), providing creative images that are based on potential social and economic developments and future technologies that are likely to shape the European industrial sector in the coming years. Especially, scenarios that highlight important trends, challenges and potential critical trend breaks, opportunities and present four visions conceived industrialization in Europe in 2015-2020.

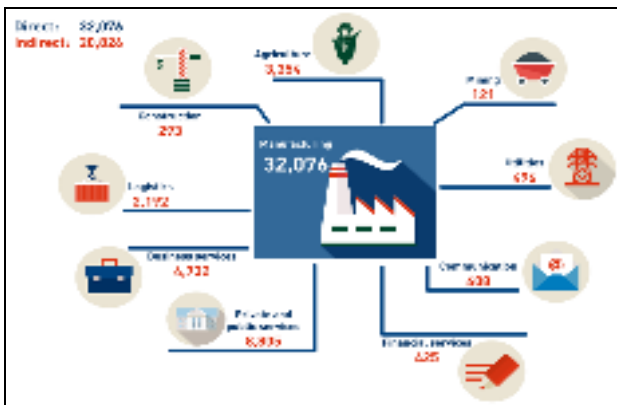


Fig. 5 Direct and indirect employment in the manufacturing sector, 2016 [14]

The European Union has been informed of the relevant data and trends in the food and beverage industry in the 2016 edition, providing a comprehensive and general picture of the structure and economics of the food and drinks industry sector in Europe, which is one of the largest manufacturing industries in the European Union in terms of turnover of value added and employment [15]. Europe is a worldwide pioneer in numerous industries which supply high-value employments, for instance the automotive, aeronautics, engineering, chemicals, energy solutions and pharmaceutical industries. Manufacturing industry represents for over half of Europe's exports, around 65% of research and development investments, it provides more than 52 million occupations (through direct and indirect jobs, meaning 24% of jobs in Europe), generally high-skilled jobs and above average pay, and in high economic value added activities. Manufacturing industry generates strong positive spill-overs on the

economy. In certain countries, industrial front-runners generate 25% of all added-value through direct and indirect effects as show in Fig.5 [14].

The European manufacturing sector is likely to undergo drastic changes over the next two decades. On the other hand, this section paints the results of an in-depth discussion on the major drivers of industrialization in Europe that emerged from the scenario-building process for drivers and the difficulties that will likely reflect the future of industrialization in Europe. However, the technological, environmental, economic, political and social factors shaping the future of the industry may have an impact to accelerate the pace of development in the EU [16]. Analysis and documentation at the corporate level suggest that multinational German companies still produce a significant share of global output in their home country, although the fact is that they are active in several other countries. However, the appreciation of the changing efficiency of foreign production and increase returns on the factory level of losses suggests that multinational companies described as inaccurate. Both differences in variable production costs across countries and fixed costs for the establishment of foreign stations have become important barriers to foreign production of multinational German companies.

2.4 Manufacturing in United States

Presented to states and political systems, manufacturing is seen as a fundamentally significant and intense force of strong economic power. In the advanced economies, the strong manufacturing sector has to make the labour generously well-paid, and keep up with the specialized capacity; the shrinking manufacturing sector is evidence of the decline. Moreover, manufacturing is recognized as an engine of development, which raises the level of the agricultural population from poverty and transforms poor countries into actors in the world economy. Today, the global manufacturing sector is facing a series of changes and challenges stretching from the shift in demand to developing economies to new constraints on key inputs such as resources, energy, transportation [17].

The United States has long prospered its ability to manufacture and sell goods in local and global markets. Where, it has supported the industrial activity of economic growth, leading to a rise in exports of the country, and the employment of millions of Americans. Yet throughout the 20th century, the US manufacturing sector led to an increase in the production of knowledge and innovation through the shift from R & D to products used worldwide [18].

In the United States, occupations are classified as an industrial function if they occur in a facility whose primary activity is production. Therefore, there is a clear situation for the employees who work in the factory that produces steel for use in cars. However, designers of manufactured products in a design company or warehouse workers assemble products manufactured prior to shipment not to be considered as manufacturing workers. Thus, the total number of full-time and part-time

staff is now on the payroll of manufacturing enterprises. For the manufacturing sector in the United States, it claims to add jobs, but not at a very fast rate. In addition, the current level of employment of about 12.5 million workers is still well below the level of 18 million that existed before the recession period 2007-2009 [19].

2.5 Manufacturing in China

At the global level, there is still industrial output (as measured by gross value added) to boost its growth by 2.7 percent a year in advanced economies and 7.4 percent in large developing economies (between 2000 and 2007). However, the growth of the economies of China, India and Indonesia are in the early stages of global industrialization and in the world's 15 largest manufacturing economies, contributing to the sectors from 10% to 33% of the value added [17].

China has various organizations that have advanced capabilities and dominated competitive market conditions. When it contrasts with the giants of the West's leading industries, as well as Japan and South Korea, China's manufacturing base is currently enjoying an average level of development. For example, on average, Chinese companies are much less automated use where only 49 robots per 10,000 workers [20].

China Manufacturing 2025 (CM2025) faces these continuing challenges in the overall global advancement of manufacturing and technology relentlessly. These first, second and third industrial revolutions have resulted in the development of mechanical production driven by water and steam power, the adoption of assembly lines to produce large quantities driven by electricity and the move towards automation through the utilization of electronics and information technology (IT), respectively. By increase the digitization of productive manufacturing with "cyber-physical systems". Thus, Mass data and cloud computing enable data exchange to be shared and analysed across entire industrial value chains, human-related networks and robots interact and work together [21].

3. Conclusion

The advancement of manufacturing all over the world has been affecting the IR 4.0. Countries such as China and German are rapidly growing and forging their countries into manufacturing leaders which should be an example towards other developing countries. The growth in IR 4.0 will hopefully benefit the world into making it a better and efficient place to live for mankind for many years to come.

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