

World-Wide Manufacturing Overview: A Discussion On The Future

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Abstract - This paper is describing about the manufacturing situation in the world. Today's era is of industry, machine and continuously developing technology. The present world has been developed unexpectedly than the past. Now a days, without manufacturing technology, survival is in-imaginable. The author wants to highlight an overview of present condition and a corresponding analysis of the future.

Keywords- Manufacturing, World-wide manufacturing, overview, Discussion on the Future, Significance of manufacturing, opinion.

I. INTRODUCTION

At present we are the witness of "twenty-second century" bestowed with modern science and technology. Machines are the greatest inventions of gradually developed and continuously developing modern science. In fact, it can be said that we are the children of technologies. However, if we look back to the past, in the beginning of the earth, there was neither heavy machines nor technologies. Manufacturing has improved human being's living standards [1].

Let's go to the flash-back for a while, it is clearly visible that in the past while there was no manufacturing method invented, life was in the lowest point of the standard scale. Raw meat, in-developed weapons, in-civilized dresses made of tree leaves lack of medicines and so on. Life was not comfortable. But time flies, with the passage of time, industries and the manufacturers made the revolution in human civilization. From the era of industrialization, good quality weapons, clothing, medicines, quality foods, furniture, and other necessities were being manufactured. All these things just added a new level in human's life style. Mills and factories turned human life into a new angle to develop. And finally at present, civilization stands on the base of manufacturing.

II. MANUFACTURING

Manufacturing can be defined as - "The process of converting raw materials, components, or parts into finished goods that meet a customer's expectations or specifications. Manufacturing commonly employs a man-machine set up with division of labor in a large scale production"[2].

"Manufacturing is the production of products for use or sale using labour and machines, tools, chemical and biological processing, or formulation, and is the essence of secondary industry. The term may refer to a range of human activity, from handicraft to high tech, but is most commonly applied to industrial design, in which raw materials from primary industry are transformed into finished goods on a large scale. Such finished goods may be sold to other manufacturers for the production of other more complex products (such as aircraft, household appliances, furniture, sports equipment or automobiles), or distributed via the tertiary industry to end users and consumers (usually through wholesalers, who in turn sell to retailers, who then sell them to individual customers)"[3].

In its earliest form, manufacturing was usually carried out by a single skilled artisan with assistants. Training was by apprenticeship. In much of the pre-industrial world, the guild system protected the privileges and trade secrets of urban artisans. In the pre-industrial world, most manufacturing occurred in rural areas, where household-based manufacturing served as a supplemental subsistence strategy to agriculture (and continues to do so in places). Entrepreneurs organized a number of manufacturing households into a single enterprise through the putting-out system.

The factory system was first adopted in Britain at the beginning of the Industrial Revolution in the late 18th century and later spread around the world.[4] The main characteristic of the factory system is the use of machinery, originally powered by water or steam and later by electricity. Increased use of economies of scale, the centralization of factories, and standardization of interchangeable parts were adopted in the American system of manufacturing in the nineteenth century.

Manufacturing in the Soviet Union was based on collectivism[5].

1. World-wide Manufacturing- The digitalization of manufacturing is changing how products are designed, fabricated, used, and serviced, just as it's transforming the operations, processes, and energy footprint of factories and supply chains. Smart manufacturing is being driven by the advent and maturation of many technologies, including: high-performance computing (HPC)-powered computer aided design (CAD) and engineering (CAE) software; cloud computing; the Internet of Things; advanced sensor technologies; 3D printing; industrial robotics; data analytics; machine learning; and wireless connectivity that better enables machine-to-machine (M2M) communications.

Amongst the most important of these are the marriage of sensors and software into the Internet of Things (IoT). In the factory environment, IoT refers to the use of sensors in production equipment (such as robots, stampers, actuators, 3D printers, computer numerical control (CNC) machines, etc.), and the products they make (such as jet engines, gas turbines, radio-logical equipment, vehicles, etc.) to enable a real-time flow of information about the operational status and condition of the equipment or product [6]. For better understanding, a brief description is given below. All the information provided are quoted from the source.

1.1 United States - Manufacturing contributes 12.3 percent of U.S. GDP [7]. America's more than 230,000 SME manufacturers form the backbone of U.S. manufacturing supply chains and employ a considerable share of America's overall manufacturing workforce [8]. In fact, as of 2014, 98.5 percent of U.S. manufacturing establishments were SMEs (defined by having fewer than 500 employees) [9]. America's SME manufacturers intensively export; in fact, as of 2013, 96.5 percent of manufacturing exporters were from SMEs and they contributed 19.1 percent of total U.S. manufacturing exports [10].

Launched in 2012 by the Obama administration, and renamed in September 2016, Manufacturing USA, consists of 14 manufacturing innovation institutes that represent public-private partnerships focused on developing advanced manufacturing product and process technologies, facilitating their commercialization, and developing workforce skills around advanced manufacturing technologies [11]. Manufacturing USA plays a pivotal role in revitalizing America's industrial commons, enhancing America's industrial competitiveness, and helping ensure U.S. leadership across a range of advanced manufacturing process and product technologies [12].

1.2 Germany- Germany essentially wants to create a center of gravity in Industry 4.0 standards Development [13]. It has worked hard to internationalize its standards, including recently forging a trilateral cooperation that seeks to bring together the key digitalizing manufacturing initiatives of France, Germany, and Italy—France's Alliance Industrie du Futur, Germany's Plattform Industrie 4.0, and the Italian initiative Piano Industria 4.0— and collaborate on three core subjects of shared interest: standardization, engagement of SMEs, and testbed development [14]. Finally, Germany wants to “use China as a multiplier for German standards”, implementing German beta standards into Sino-German cooperation initiatives in order to improve their chances of being adopted on the global market [15].

1.3 China- In 2014, manufacturing in China accounted for 19 percent of global manufacturing value added and for 35.9 percent of China's gross domestic product [16]. China surpassed the United States in manufacturing value-added in 2011 and today China ranks first worldwide in terms of output in more than 220 categories among 500 major types of industrial products [17]. China hosts the world's largest market for industrial robotics, with 428,000 units deployed in 2017 (although its robot density per 10,000 workers is about half the global average).

Research firm IDC predicts China will become one of the world's leading IoT markets, with nearly one out of every five of its industrial units (e.g. machines, tools and components) connected by 2020 [18]. With regard to smart manufacturing, China's Made in China 2025 initiative clearly calls for the country to develop its own smart manufacturing standards, which have the potential to be trade-distorting. Under Made in China 2025 smart manufacturing products may be required to meet vague and undefined standards [19]. For instance, in 2015 and 2016, China's Ministry of Industry and Information Technology (MIIT) issued separate notices for “Smart Manufacturing Pilot Demonstrations” that call for “indigenous and secure and controllable equipment and software.”[20] In 2016, MIIT and China's National Development and Reform Commission (NDRC) issued a three-year plan on the smart hardware industry calling for a “secure and reliable” framework and platform from cloud to end user.

1.4 Japan - Japan operates several initiatives designed to prepare the nation for an advanced manufacturing future. The country's prefecture-led Public Industrial Technology Research Institutes, or Kohsetsushi Centers, represent the principal entities that work with SME manufacturers in hands-on technology development and innovation activities. However, driving digitalized manufacturing more broadly is Japan's Industrial Value Chains Initiative (IVI) as well as a Cross-Ministerial

Strategic Innovation Promotion (SIP) Program focused on Innovative Design/Manufacturing Technologies. Finally, Japan's Small and Medium Enterprise Agency (SMEA) operates several programs designed to bolster the professionalization and business operations of all SMEs, including SME manufacturers. As of 2014, Japan had 413,339 SME manufacturers, which accounted for 11 percent of SMEs in the country [21]. However, Japanese policymakers are concerned that the productivity of Japan's SMEs manufacturers has been stagnating, with the productivity gap between SMEs and large enterprises already significant and continuing to expand [22].

1.5 South Korea - South Korea's standardization agency, KATS (the Korean Agency for Technology and Standards), has tended to pursue a bottoms-up standards-development approach, working closely with industry to ensure that its standardization activities mainly benefit national suppliers [23]. South Korea's government and industry have called for rapid standardization solutions to enable interoperability. Korean government agencies, including the South Korean Ministry of Trade, Industry, and Energy (MOTIE); the South Korean Ministry of Science, ICT, and Future Planning (MISP); the Korean National IT Promotion Agency (KIPT); and the Korea Institute for Industrial Economics and Trade (KIET) have been keen to engage in international cooperation and dialogue and to involve the private sector in Industry 4.0 standards setting [24]. Ensuring interoperability, both nationally and internationally, and especially for SMEs, has been a touchstone of the South Korean smart manufacturing standards development approach [25].

1.6 United Kingdom - The UK's manufacturing sector, the world's 11th largest, contributed £177 billion in gross value-added (GVA) to the UK economy in 2016, representing 11 percent of UK GVA, and accounting for over 50 percent of UK exports and 70 percent of UK R&D. The sector employs 2.6 million workers; 133,000 manufacturers operate in the United Kingdom, 99 percent of which are SMEs [26]. But the United Kingdom has struggled with productivity and innovation in recent years. Britain's productivity has long lagged behind that of major competitors, and output per hour worked in the British economy has remained virtually unchanged since the Great Recession [27]. Moreover, a recent UK Innovation Survey found that just over half of UK businesses can be classified as innovative and that fewer UK SMEs introduce new products and services than their European competitors [28].

1.7 Austria - Austria's manufacturing sector, comprised of 29,000 companies employing 640,000 workers, generates \$74 billion in value-added annually, accounting for approximately 19 percent of the country's GDP [29]. Over two-thirds of all employees in Austria, and every fifth euro (i.e., 20 percent of Austrian GDP), is tied

directly or indirectly to the country's manufacturing sector [30]. In 2014, the Austrian Federal Ministry for Transport, Innovation, and Technology (BMVIT) announced it would dedicate €250 million (\$300 million) for R&D projects associated with Industry 4.0 [31]. The country also launched the Association Industry 4.0 Austria: The Platform for Smart Production ("Industrie 4.0 Österreich"), a membership based not-for-profit organization that brings together companies (16), academic institutions (6), research organizations (6), and non-government organizations (18) to advance the implementation of digital transformation in Austria and to unify Austria's Industry 4.0 community [32].

2. Significance of Manufacturing - Manufacturing production is now at the highest point in its history and is keeping pace with that of the overall economy in terms of physical output. Manufacturing pays higher wages and has a higher multiplier effect than other economic sectors. It competes effectively in advanced sectors of the global economy by focusing on technology-based industries and effectively managing its costs. Manufacturing continues to generate more economic activity per Dollar of production than any other business sector in the country. Manufacturing helps improve living standards by keeping product prices low.

Manufacturing has a large meaning. When it comes about significance, it is certain to say, there is not a single necessary of human lives where manufacturing can be skipped. International trade, service industries, job markets, economic growth, national power over all to create a peaceful world manufacturing is compulsorily needed. Explanations are given below:

2.1 International trade- According to the World Trade Organization, 80% of inter-regional trade is in goods, and only 20% is in services.[33] It means manufactured goods are needed to trade for foreign markets or to build up a business relation with foreign country. Only currency based trading is expensive and inconvenient. But goods exchange are much more convenient and saves credit, though it depends. In a word, to make a balanced trade manufacturing is compulsory.

2.2 Service industries- Manufactured goods are crucial for the service industries. Even though about two-thirds of most economies are composed of service industries, these service industries are dependent on manufactured goods for their operation and for their own technological progress. For instance, the retail and warehousing industries, which comprise about 11 percent of American GNP (value-added), are in the business of selling manufactured goods. The airline industry, the telecommunications industry, and the software industry depend on airplanes, phones and broadcast equipment,

and computers for both their existence and for their technological progress.[34]

2.3 Job Market- Manufacturing can create middle class job market for the people. Jobless youth can find jobs in manufacturing companies, mills and factories as labor, worker, officer, manager and so on. Thus manufacturing can reduce unemployment and bring solvency.

2.4 Economic growth- The economic stability of a country is decided by the manufacturing industry. If the industries are strong, the economical condition is well of.

2.5 National Power- National power depends to a great extent on manufacturing power. Over the last 100 years, the "Great Powers", or most powerful four or five countries, have controlled about 75 percent of global industrial machinery production. This is because industrial machinery is used both to generate national wealth and to produce military equipment. If all regions of the world had an independent capacity to produce manufactured goods, there would be little opportunity to intimidate and dominate countries. In fact, there would probably be fewer wars because global power would be balanced.[35]

A world where all regions had a strong manufacturing base would go far to remove poverty and war. Manufacturing creates middle class jobs that anchor a middle class economy. Unions thrive in manufacturing industries because it is easier for the employees to bargain. If all global regions have the power to create the wealth that comes with manufacturing, there will be less opportunity for wars to break out as a result of imbalances of power.

3. Discussion on the Future - On the basis of above descriptions and information, it can be said that the competition of smart manufacturing has been started around the world is running in a super fast speed. Even in today's era, civilization has stepped into the world of intelligent manufacturing. Though this is just a beginning, but it's certain to increase the percentage in the near future. And in the future, it can be predicted that artificial intelligence will rule in the field of manufacturing.

Because in manufacturing field, the competition is growing over making the best technology or product. But making a best quality product has no limit. That's the reason why manufacturing is upgrading so fast. For example, the time has been passed away when telephone used to be rarely used because of ability to afford. But now a day there is variety of smart phones like Huawei, Xiaomi, i-phone and so on. And all these branded smart phones are even upgrading in a competitive percentage with each other. Once upon a time only a few transportation used to be enough, but today's smart vehicles not only have made human lives easier and

comfortable but also created a huge demand for smoother transport system and flexible travel. And for sure this situation will keep upgrading with a continuous process.

3.1 Opinion- The fight in manufacturing field is to manufacture the best quality. As no one can assure which one is the best quality, the products will continue to be manufactured in a upgrading process. Though the best quality has no limit, but the upgrading process for a certain product has limit. When it will face the limitation, a new model of the same product will replace the previous one and the cycle will be continued.

III. CONCLUSION

Manufacturing has been a compulsory system in human's regular life. To keep pace with the speedy world both in technology and economy, manufacturing is the only way.

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