



## **Industrie 4.0 : Germany's Fourth Industrial Revolution ~Implications for Japan~**

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### **Industrie 4.0**

Industrie 4.0 represents a strategy of German government to improve the German competitiveness and enhance the growth power by sophisticating its manufacturing industry. It was proposed in 2011 as part of Action Plan for High Tech Strategy 2020 and currently has become a nationwide project participated by industry, government, academia as well as labor unions. It is regarded as the fourth industrial revolution following the first revolution that took place at the end of the 18th century (introduction of waterpower and steam engines), the second industrial revolution in the early 20th century (mass production by division of labor and use of electricity) and the third revolution in the early 1970s (automatic production using electronics and IT technology).

The difference of this Industrie 4.0 from the Factory Automation (FA) that was promoted during the third industrial revolution is that FA tries to centrally control the factory by using computers while the smart factories the Industrie 4.0 aims at try to integrate the virtual space (cyberspace) of computers with real (physical) world to make a shape of Cyber-Physical Systems (CPS). Not only by connecting the factories within a supply chain, by connecting the parts, semi-finished products, and machines to the internet through sensors, various simulations are to be made on a cyberspace. This enables local systems to keep the autonomy and dramatically improve the efficiency of manufacturing with a wide variety of products in small

quantities. Ultimately it enables the individually customized production at almost the same speed and cost as a standardized mass production (mass-customization).

### **Germany's Industrie 4.0 and the US's Industrial Internet**

Industrie 4.0 starts from factory. It aims not only at visualizing the whole supply chains to improve efficiency of production process by connecting factories via internet, but also at creating new services with new added values by connecting them to customers, analyzing their data and preempting their needs. On the other hand, industrial internet promoted by the leadership of the US starts from things. It is represented by a concept of Internet of Things (IoT) under which all goods and things are linked to internet and data accumulated in the process that the things are used are analyzed to create new services. It aims at a revolution of traditional business model itself. Although they differ in their approaches, both Industrie 4.0 and IoT seem to have the same final goal to seek.

In the U.S. a group named the Industrial Internet Consortium (IIC) was organized in 2014 by such companies as GE, AT&T, IBM, Cisco Systems, Intel and others to set a standard on the IoT. In Germany the industrie 4.0 is being led by manufacturing industries while the IIC is promoted mainly by IT companies in the U.S. which have a high global share for their services. If the standardization and normalization of the IoT is to be promoted by the leadership of the U.S. companies, companies in Japan and Europe could lag behind the U.S. counterparts. Therefore, they will need to take part in the work of standardization and normalization from the early stage of its development. However, the IIC is an open system and German companies (Siemens, Bosch, and SAP) joined the IIC one after another in 2015. It has been joined by more than 200 companies including large Japanese companies as well.

### **SMEs that Support the German Economy and Significance of Industrie 4.0 for them**

In Germany, SMEs<sup>1</sup> which are called Mittelstand have provided the main source of competitiveness. They have a significant presence in the German economy with their number amounting to 37.10 million (accounting for 99.6% of the total companies as of 2014) and with employment of 15.97 million workers<sup>2</sup> (59.4% of the total 26.91 million workers in 2012). Not a few of them have a great share in the global market as they have specialized in the niche markets and have been promoting internationalization from early on using their high technology as a weapon.

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<sup>1</sup> According to the definition of Institut für Mittelstandsforschung (IfM) in Germany, SMEs include those companies that employ less than 500 workers with sales of less than €50 million. They cover somewhat larger companies than those in Japan. Data on the SMEs hereafter are derived from IfM.

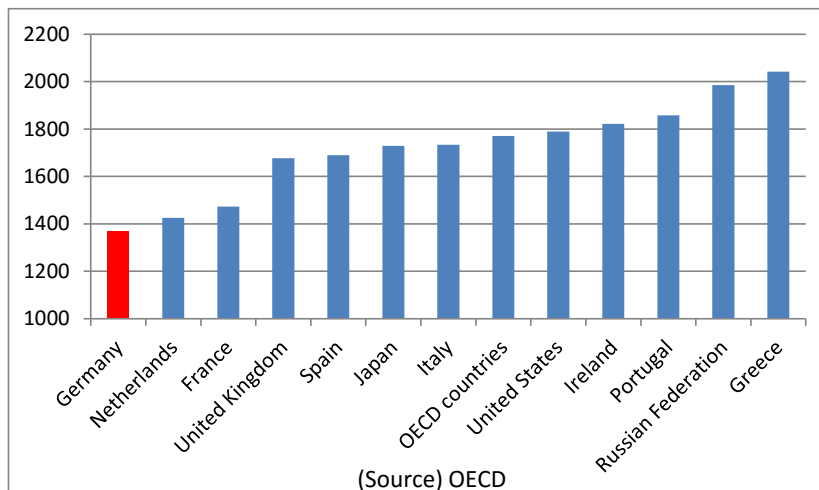
<sup>2</sup> Those people who are paying social insurance premiums.

As Industrie 4.0 requires a lot of IT investment, there is a concerned voice that these SMEs cannot afford the money adequately so that the large companies may take the initiative away from them. Also there is a strong concern among the SMEs for the possible outflow through the internet of their technologies and know-hows. For this reason, they seem to be slow to introduce Industrie 4.0 as compared to the large companies which are positively implementing Industrie 4.0. In this regard, both province (Bundesland) and regional governments have come up with the supporting measures to the SMEs in relation to Industrie 4.0. There is also a move to examine development and provision of versatile digitalization service toward those medium-sized firms and SMEs.

**Still Competitive German Workers with High Wages ~ Importance of Industrie 4.0 in Improving the Labor Productivity that Enables High Wages**

German workers work outstandingly shorter hours than those in other European countries as well as in other advanced countries. As compared to Germany, the annual per capita working hours for Japan and Italy are 1.26 times as much as in Germany, and equal to the average of OECD countries, 1.3 times for the US and 1.5 times for Greece (Chart 1).

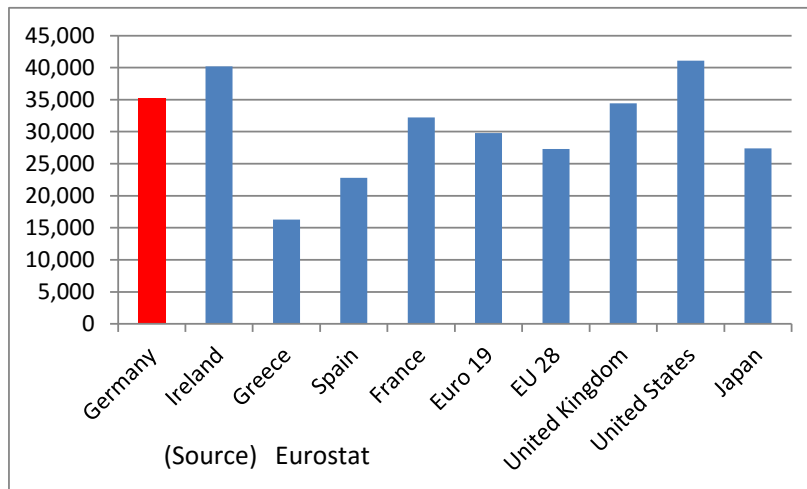
Chart 1 : Annual Working Hours in 2014(hours per worker)



Despite their shorter working hours, the per capita GDP of Germany is ranked in the higher range among the European countries and stands at 1.3 times as high as that of Japan (Chart2).

If we compare the level of average wages in manufacturing industry with Japan equaling to 1, Germany stands strikingly high at 1.56 while the US stands at 1.2, France 1.3 and the UK 1.1. The high productivity that realizes effective production with less working hours has enabled the high wages for German workers.

Chart 2 : Per Capita GDP (Based on PPP in euro, as of 2014)



### Implications for Japan

The German Government is intending to promote normalization and standardization of the domestic industries with the implementation of Industrie 4.0, then to widen it EU-wide, and finally make them as a global standard. As the German manufacturing industry has an overwhelmingly high share in the EU, there is a high possibility that the German standard become the EU standard. As noted above, when the German companies are willingly participating in the move of normalization and standardization of the IIC, it is well conceivable that the global standard is set by the US and German companies. It is desired that the Japanese companies take part in the activities from the early stage of its endeavor.

Germany is making efforts to address many agendas that include labor shortage stemming from aging population combined with fewer numbers of children, fiercer competition with the emerging industrialized countries and diversified consumer needs by introducing smart factories under Industrie 4.0 initiative. German efforts will give some food for thought to Japan which faces similar challenges as Germany does.

(References other than published in Japanese)

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