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# Development of Innovative Strategies for the Korean Manufacturing Industry by Use of the Connected Smart Factory (CSF)

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### Abstract

A smart factory refers to a hyper-connected network-based integrated manufacturing system. It acquires all information on manufacturing facilities in real time through the Internet, autonomously changes a manufacturing method, replaces raw materials and ultimately implements an optimized dynamic production system. The realization of top three integrations (integration of production system, integration of product life cycle, integration of inter-company value chain) is a key factor for the success of a hyper-connected smart factory. First, the capability of vertical integration represents the ability to realize the vertical integration of a production system (sensor-control-MES-ERP) and customized production and respond to traditional static production processes. Second, the capability of integrating product life cycle means the optimization of tailored production through complete information exchange after the enterprise integration of product life cycle. Lastly, horizontal integration refers to the capability of providing products and services on time through close inter-company collaboration after integrating inter-company value chain and information network. From this standpoint, this study proposes the success factors which are critical for the successful introduction of hyper-connected smart factory.

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### 1. Introduction: The crisis of manufacturing industry and changes in production environment

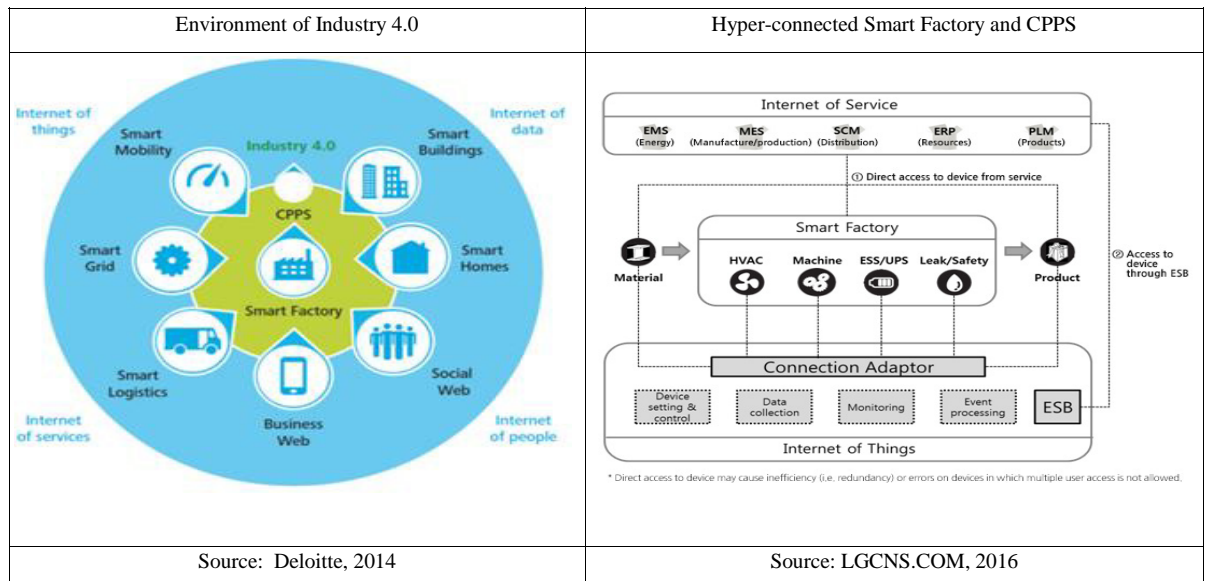
At present, the reality of South Korea's manufacturing industry can be divided into four situations: First, price competition among domestic businesses has become fiercer while global demand for manufacturing industry is still stagnant since the financial crisis. In addition, aging working population and lack of innovation motives have weakened export competitiveness and decreased domestic consumption. Second, under these unfavorable

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circumstances, Korean firms are pulling their manufacturing facilities from China and shifting them to Southeast Asia where labor costs are lower as labor costs in China rise. Third, even though the Republic of Korea is the world’s second highest with 28% in terms of the contribution of manufacturing industry to GDP, the country imports 97% of the energy needed for product production. Therefore, it appears that domestic firms wouldn’t be able to restore their competitiveness without taking care of energy problems such as reduction of energy costs through the improvement of manufacturing productivity. Lastly, making hyper-connected technology-based manufacturing facilities smart and intelligent and adding values and convergence of products and services would very critical right now. The low-cost, high-variety and flexible production through the spread of convergence between manufacturing industry and IT&SW/services/other industries and introduction of 3D printing and smart factory emerges as a new manufacturing paradigm. Under these circumstances, manufacturing advanced countries such as the U.S. and Germany has promoted the innovation of manufacturing industry through the hyper-connected technology-based Industry 4.0 to take care of current problems such as decrease in the percentage of manufacturing industry, decline in production population and drop in labor productivity. The 1st Industrial Revolution (Industry 1.0) (late 18th century) refers to the operation of machine-based production facilities through hydraulic/steam engine. The 2nd Industrial Revolution represents a mass production system (early 20th century) through the adoption of the production facilities powered by electricity. The 3rd Industrial Revolution states an expansion of automated production process fields (early 1970s) through the supply of electronic equipment and IT. Lastly, the 4th Industrial Revolution refers to a strategy designed to construct a communication system between production equipment and products based on hyper-connected technology and integrate the entire production processes. ACATECH, Apr. 2013) In conclusion, the final results are implemented in a form of connected smart factory (CSF) which applied ICT to industrial facilities such as factory.

**2. Concept of the CSF and Its Expected Effects**

The CSF is the result of the application of new paradigm titled ‘ICT-based smart (smart building, smart grid, etc.)’ to the factory where automatic production is enabled by machine through simulation (see Figure 1. Industry 4.0 and CSF). In addition, the CSF builds a complete automatic production system through the Cyber Physical Production System (CPPS) and implements pre-qualification, real-time management and post analysis.



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