

# Demand Analysis of Modeling & Simulation for Innovation of National Manufacturing Productivity

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**Abstract.** A next-generation manufacturing innovation strategy has been required to improve national manufacturing productivity through the convergence of manufacturing industry and supercomputing-based simulation technology and dramatic increase of high-quality jobs. To figure out current status and problems of Information and Communications Technology (ICT) in domestic manufacturing environment and derive a solution, therefore, a demand survey was conducted against domestic manufacturers. An increase in sales was found in M&S-based manufacturing firms, and M&S was very useful in the development of new products. However, people's awareness on M&S is still low on the market. To expand M&S-related industry and market, therefore, it is important to change people's perception.

**Keywords:** Manufacturing Innovation, Manufacturing Service, Modeling & Simulation, Supercomputing

## 1 Introduction

Manufacturing industry has been the driving force of Korea's economic growth since the 1960s. However, it has reached its limit in terms of growth, profitability and job creation. In fact, Korea ranks 2nd in the world (30.5% of GDP) in terms of the percentage of manufacturing industry and 7th in terms of the capacity of manufacturing industry. However, the growth of manufacturing industry has continuously weakened.

The world's advanced manufacturing powers are now competitively promoting a policy to boost manufacturing industry using ICT. For example, the U.S. has established the 2014 National Strategic Plan for Advanced Manufacturing to build leadership in a high-tech manufacturing field. For this, it has invested a total of US 2.9 billion dollars in a high-tech manufacturing sector. Germany also announced to invest 500 million Euros in 'Industry 4.0' for the ICT-based manufacturing industry innovation throughout three (3) years as a part of 'High-tech Strategy 2020'. With a goal of boosting manufacturing industry, in addition, Japan has established 'Japanese Industry Restoration Plan' and decided to increase investments in high-tech facilities up to JPY 70 trillion (increase by 10% for three years) for the advancement of manufacturing technology.

In these policies led by advanced countries, the government's strong leadership based on 'manufacturing innovation plan' for the convergence of advanced ICT (ex:

supercomputing-3D printing, etc.) and manufacturing industry is commonly found. Therefore, Korean government also needs to develop government-led support policies and come up with a specific execution plan for the innovation of manufacturing industry and development of related technologies through the establishment of national infrastructure based on science technology and ICT.

This study has analyzed the current use, general perception and future demand for M&S against domestic manufacturers in order to establish a supercomputing-based manufacturing productivity innovation policy and provide related services. Even though people's awareness on M&S is still low on the market, direct effects such as increase in sales have been observed in M&S-promoted firms.

## 2 Survey Design

To examine the current use of ICT and related problems in domestic manufacturing environment and derive a solution, a demand survey was conducted against domestic manufacturers.

Among the manufacturing firms, a questionnaire survey was carried out against those with a high possibility of using supercomputing-based simulation. Specifically, primary industry group (ex: automobile, aerospace, machine, etc.) and secondary industry group (ex: rubber, metal, electronic parts, etc.) were analyzed. A telephone survey was conducted against a total of 500 manufacturers.

**Table 1.** Measurements

Category		Description
Manufacturing industry	Respondents	- 2013 sales, number of employees, existence of R&D team, etc.
	Use of M&S	- Experience of M&S, M&S utilization tool, SW maintenance cost, difficulties, easiness of securing manpower, etc. - Reasons for not fulfilling M&S, willingness to use it in the future, etc.
	M&S effects	- Increase in annual sales, sales duration, etc.
	Use of 3D printing	- Experience of 3D printing, future use, etc.

## 3 Demand Analysis

### 3.1 Current Use of M&S

Among a total of 500 manufacturing firms participated in the survey, 42.0% had the experience of M&S while 58.0% didn't. As sales volume and number of employees

were higher, the experience of M&S increased. In terms of the M&S tool, CAD/CAM software programs (ex: Auto CAD, CATIA, etc.) accounted for 53.3% while 'product design' software programs which include Maya and 3D Studio were 23.1%.

In terms of changes in annual sales because of M&S, 45.2% witnessed increase (average annual growth of KRW 4,004,758,000). In addition, more than half (54.7%) of the firms responded that the increased sales would last for at least five (5) years. When asked why they don't adopt M&S, 'no necessity (42.2%)' was most responded, followed by 'I don't know much about M&S (22.9%)'. Among the firms which experienced M&S through an external organization such as professional agent or college even though they didn't carry out M&S in person, 85.4% responded that they were willing to use consulting services for M&S.

### **3.2 Effects of M&S**

In terms of the effects of M&S, 'development of new products (31.6%)' was the highest, followed by 'reduction of manufacturing time'. Among the firms which experienced M&S, 91.9% responded that they were willing to maintain or expand M&S.

### **3.3 Difficulties for M&S**

The biggest barrier for M&S turned out 'software cost'. The annual average maintenance cost for the required software was KRW 94,355,000. However, 'software cost' was mostly responded by the firms with less than KRW 10 billion in sales. Among the firms with more than KRW 50 billion in sales, 'lack of professional manpower' was the largest problem.

### **3.4 Current Use of 3D Printing**

Among a total of 500 manufacturing firms, 24.4% used 3D printing in product design and manufacturing process while 75.6% didn't. However, 62.0% responded that they were willing to use the 3D printing if we would get an aid from a public organization. In terms of the purpose of 3D printing, 'prototype development and testing (39.1%)' was most responded, follow by 'mockup fabrication (28.1%)'.

## **4 Suggestions**

Among the firms which have used M&S, there was a high demand for professional manpower. To back up the development of M&S-related industries and provide energy for their continued growth, it is essential to develop a professional manpower supply policy.

The biggest reason for the low use of M&S among manufacturing firms was their lack of awareness on M&S. According to the analysis, those which adopted M&S

primarily used it for 'development of new products'. In fact, 'development of new products' is essential for firms to grow and develop further. Even so, those which had no experience of M&S responded 'no necessity' when asked why they don't use M&S. In other words, they don't know the fact that M&S could be used for the development of new products.

Among the manufacturers which experienced M&S in person or through a consulting firm before, 80.0% responded that they were willing to use M&S in the future. The average annual growth from M&S was as high as KRW 4,004,758,000, and the effects were particular high in 'development of new products'. Because M&S has a positive effect on technology development and sales growth, if it is spread across the manufacturing industry, there will be more effects.

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