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Measures to Improve the Promotion System in the Smart Factory Promotion Process

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Abstract

Recently, the world is facing many difficulties in all areas as a result of price instability and the Russian-Ukraine war. Personally, as many jobs disappear, household income is declining sharply. In particular, the possibility of such bankruptcies is relatively increasing in small and medium-sized enterprises (SMEs), and it is highly likely that this will continue for the time being. In this situation, countries around the world are continuously making efforts to improve corporate productivity. In Korea, the smart factory support project implemented by the Smart Manufacturing Innovation Promotion Team has been continuously promoted for the past several years, providing opportunities for SMEs in need to improve productivity and change the corporate structure. In this study, the current status of smart factory promotion at home and abroad was examined, and problems and improvement measures were studied for the insufficient efficiency in the smart factory promotion system implemented in Korea.

Keywords: *Smart Factory, Promotion System, Robot, 3D printer.*

1. Introduction

Due to the recent deterioration of the global economic environment, the economic environment of Korea is also experiencing difficulties. These economic difficulties appear to have a relatively large impact, especially on small and medium-sized enterprises (SMEs). To overcome this poor environment, many companies are trying to make their manufacturing sites smart. Smart manufacturing can be said to be a broad manufacturing category using computer-assisted integrated manufacturing, high degree of adaptability and rapid design change, and digital information technology [1]. Goals for smart manufacturing sometimes include rapid change in production levels according to demand, supply chain optimization, and efficient production [2]. Based on this concept, smart factories are equipped with interoperable systems, intelligent automation, strong cyber security and network sensors, etc.

The meaning of the smart factory is very diverse and broad, and the technologies required are also diverse. Core technologies include big data processing capabilities, industrial connected devices and services including

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various sensors, and advanced robots [3],[4].

The government is also promoting smart factory support projects, led by the Ministry of SMEs and Startups. The main purpose of the smart factory support project is to improve the management environment system including production using ICT technology. The meaning of the smart factory can be expressed in various contents, but in the smart factory promotion group, which is supporting the smart factory business nationally, the smart factory integrates all production processes from product planning to sales with ICT (information and communication) technology to reduce costs and reduce costs. It is described as a people-oriented advanced intelligent factory that produces customized products with time [5].

The smart factory promotion project in Korea is supervised and implemented by the Smart Manufacturing Innovation Promotion Team, and regionally, regional manufacturing innovation centers perform functions such as on-site evaluation, intermediate inspection, and final inspection of companies belonging to the region.

In this study, through the promotion process for the smart factory project, which is currently being promoted for many small and medium-sized enterprises (SMEs), improvement points that can be improved by adding more efficiency were studied. In Chapter 2, the current status of smart factory promotion was investigated. In Chapter 3, problems that may occur in the implementation process and improvement measures to solve problems were described. Finally, the conclusion is described.

2. Smart Factory Promotion System

2.1 Smart Factory Status

Germany is one of the countries that is attracting worldwide attention in relation to the promotion of smart factory [6],[7],[8],[9],[10]. Adidas is a representative company related to Germany's smart factory business. Adidas, a company represented by sneakers, has been mass-producing in China and Vietnam in 1993 due to deterioration in profitability. However, it is known as a manufacturing company that returned to Germany with the completion of a smart factory in the Ansbach region of Germany in December 2015. The Ansbach Smart Factory is recognized as a speed factory. This is because the entire process is mostly operated by automatic robots, which can be interpreted as meaning that shoes can be made quickly. In addition, using 3D printing technology, it is equipped with an environment to produce more precise shoes. The main characteristics of Ansbach's Speed Factory are shown in Table 1 below. The initial goal of the Ansbach factory was to mass-produce fast and precise shoes by configuring an automated process with robots and 3D printers. However, 'Speed Factory', which reflects these characteristics, produced shoes for 4 years from 2015, but decided to stop operating the factory in 2019. It seems that the positive effect expected at the beginning did not appear as a background of closure. In fact, the production performance in 2018 showed that the 'Speed Factory' produced only about 1 million units out of the total Adidas production of 400 million units. This is the result of low production in technology-intensive factories, and the result is that the recovery cost is lower than the investment cost.

Table 1. Main characteristics of speed factory

Goal	• Fast, precise, personalized sneaker creation
Characteristics	• Automation, flexible production • Low inventory management costs
Major contents	• Ansbach factory construction in Germany in December 2015 • Atlanta plant construction in the US in April 2018

	• Decision to close German and US factories in 2019 • Automation of the production process by robot and 3D printer

Despite Adidas' decision to close the speed factory, the future value of the valuable assets that Adidas acquired in the course of the speed factory business is expected to be high. The main advantages and disadvantages are shown in Table 2 below.

Table 2. Main advantages and disadvantages of speed factory

Advantage	• Reduced production time by 3 times using cutting-edge technology • Accumulated vast amounts of data • Retry possible when 3D technology is improved
Disadvantage	• Limitations of 3D printer technology unsuitable for mass production

A successful example of a smart factory promotion project in Korea is the refrigeration and refrigeration warehouse management system applied by fresh food companies. This system maintains the warehouse in the best condition by controlling the temperature of refrigeration facilities such as refrigeration and refrigeration warehouses through the temperature sensor attached to the warehouse. With this function, it can be said that it is a very useful function for a company dealing with fresh food [5].

2.2 Domestic Smart Factory Promotion System

In relation to the progress of the smart factory project currently in progress, it is being implemented in two major stages. The overall project is managed by the Smart Manufacturing Innovation Promotion Team under the Small and Medium Business Technology Information Promotion Agency. In addition, each local government's manufacturing innovation center performs project selection evaluation, interim inspection, and final evaluation for companies that have applied for the smart factory project in each local government, and thus performs management and supervision functions for the entire evaluation-related process. .

The promotion process for the smart factory support project is as follows. First, starting with the business promotion announcement of the Smart Manufacturing Innovation Promotion Team, applications for business are received from each company. After that, the selection of evaluators is carried out for the selection and evaluation of the company. All of the above processes are being carried out by the Smart Manufacturing Innovation Promotion Team. Next, for each company that applied for the project, an on-site evaluation based on the business plan will be performed. In this on-site evaluation work, the selected evaluators visit each company's site and check and check the contents described in the business plan for the sites related to project promotion. Based on this, evaluation work is being carried out. The evaluation work consists of items for the supplier and the adopting company, and is carried out in consideration of the supplier's technological prowess and the performance of related businesses, whereas the content of the adopting company includes the company's will and system for business promotion. It contains the contents of whether the conditions have been created to accept it.

Companies that conduct business through the on-site evaluation process for each company will proceed with the business through an agreement. Next, an interim inspection process is performed during the project execution period. Literally, it means an intermediate inspection of the entire business period, and it can be said to be a process of checking whether the business is progressing smoothly between the introduction and supplier companies. These interim inspections are basically performed on hardware or software (including packages)

to be introduced through the final business plan determined through the agreement.

The final inspection, which is the last stage, is carried out at the end of the project. It can be said to be a check on whether the project has been carried out and completed as planned. The object of inspection includes H/W and S/W. Checks are made as to whether planned hardware is introduced, whether meaningful data is aggregated and reflected in the system through the introduced hardware, and whether customized application software functions are operated accurately. In addition, checking whether the target levels for the performance indicators presented in the business plan are properly achieved is also an important subject in the final inspection. Table 3 below summarizes the main contents of the evaluation process.

Table 3. Evaluation process system

Evaluation Stage	Main Contents
On-site evaluation	• Evaluation for selection of a smart factory support business company • Introduction of smart factory system, inspection of target sites • Presentation, inquiries, and responses to introducing and supplying companies to determine the appropriateness of the business plan based on on-site inspection
Intermediate Check	• The main purpose is to check whether the project is being carried out in accordance with the business plan. • Inspection target includes H/W and S/W (including package)
Final Check	• In accordance with the business plan, check whether the hardware has been introduced, the appropriateness of operation, and the appropriateness of the operation of software functions. • Checking the achievement of the target level after building the system suggested in the business plan

The last step in smart factory promotion is supervision. It is to supervise whether the overall contents related to the project promotion are carried out according to the contents presented in the project plan. Through this process, the success or failure of the project is ultimately decided. The entire process in smart factory promotion process is shown in Table 4 below.

Table 4. Smart factory promotion process

Promotion system sequence	Related organizations
1.Business Announcement	Smart Manufacturing Innovation Promotion Team
2.Business Application	Cooperation between the adopting company and the supplier
3.On-site Evaluation and Cost Review	Regional Manufacturing Innovation Center, Cost Agency
4.interim Inspection	Regional Manufacturing Innovation Center
5.Final Inspection	Regional Manufacturing Innovation Center
6.Supervision	Regional Manufacturing Innovation Center, Supervision Agency

3. Improvement Plan for Smart Factory Promotion System

The results of the smart factory promotion project are generally positive when looking at reports from various related organizations [11]. If there are any improvements in the overall business described above, it will enable more efficient business execution. In this regard, we would like to examine some of the issues that may hinder the completion of the project.

For new companies whose project support has been decided through on-site evaluation and cost calculation review process, the project period in the business plan submitted at the time of project implementation should be less than 6 months. The original project period can be said to be the period necessary to carry out the contents included in the business plan. Recently, this project period is not just a period for carrying out the project. The point is that the final inspection and supervision of the project will be carried out within this period. As a result, there may be a possibility that essential business performance may not be performed or delayed for the corresponding period. This may lead to unnecessary disputes between the company and the implementing agency. Therefore, it seems undesirable for the final inspection and supervision activities to take place during this project period.

Second, the process of judging the achievement of goals for the key indicators, which are quantitative goals specified in the business plan, must be done within the project period. As an example, let's look at the quantitative indicators of the two companies described in Tables 5, 6.

Table 5. Quantitative goals of company A

Field	Key indicator	Now	Goal
Production	Hourly Production (Unit: EA)	12.5	15
Quality	Process Defect Rate (reduction) (Unit: EA)	80	60
Cost	Inventory in stock (reduced) (Unit: EA)	300	200
Delivery	Reduced Delivery Time (Unit: day)	3.5	2.5

Table 6. Quantitative goals of company B

Field	Key indicator	Now	Goal
Production	Facility Utilization Rate (Unit: %)	75	80
Quality	Process Defect Rate (Unit: PPM)	2013	1900
Cost	Inventory Cost (Unit: one million won)	1000.9	950.9
Delivery	Improvement of Delivery-based Yield (Unit: %)	99.6	99.9

The target level evaluation for the key indicators shown in the table described above is possible after the development of the software functions related to the key indicators is completed. This is because the target level can be calculated by the system after the related data is accumulated in the system. In addition, the data subject to the target level calculation may be data corresponding to 1 month or 3 months, or 6 months or 1 year at the longest. Therefore, it is not appropriate to judge whether the quantitative goal is achieved within the project period. Therefore, it can be said that it is reasonable to perform the final inspection after the minimum period of time when the project is completed and the established system is stably operated. Based on this, it will be possible to more accurately grasp the results of whether the quantitative target level has been achieved. It seems necessary for the overall smart factory support project that the project supervision procedure be followed. Therefore, it seems reasonable to proceed with the contents of Table 7 below for the overall process of business promotion in each company.

Table 7. Comparison of progress before and after improvement

Current(before)	▪ Mid-term inspection, final inspection, and supervision are in progress during the project period(about 6 months) ▪ It is not appropriate to judge whether the quantitative goal is achieved within the project period.

Plan(after)	▪ The final inspection and supervision phase is implemented separately after the project period ▪ Final inspection and supervision will be implemented after the construction system has gone through the stabilization stage ▪ Since the final inspection is carried out after the stabilization period of the construction system, it is possible to confirm whether the exact quantitative goal has been achieved

4. Conclusion

Due to the impact of COVID-19 that has occurred in the past year, human society is facing a situation that has never been experienced before. These environmental changes are having a great impact on our lives, and in particular, small businesses such as SMEs and the self-employed have greater difficulties. In this situation, many companies are carrying out smart factory support projects for smart manufacturing processes in order to improve the company's productivity and constitution. The government has been promoting the smart factory support project for many companies for the past several years, and the evaluation is also positive, and related organizations such as the 4th Industrial Revolution Committee are reporting it. Through this smart factory support project, companies will continue to pursue smartized companies that include artificial intelligence and Internet of Things technology beyond the existing factory automation process.

In this study, we looked at the current status of smart factory projects at home and abroad, and also suggested ways to improve the inefficiencies in the promotion system for projects currently being promoted in Korea. It is expected that this improvement plan will further enhance the degree of completion of the project.

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