IJIBC 24-3-32

A Plan for Writing a Desirable Smart Factory Business Plan by Diagnosing the Main Contents of the Smart Factory Business Plan

Seong-Hoon Lee*

*Professor, Division of Computer Engineering, Baekseok University
shlee@bu.ac.kr

Abstract

The smart factory promotion project is a project that uses ICT technology to improve the production process and the entire management environment system. In Korea, the smart factory promotion project has been continuously implemented since 2014, and the Smart Factory Promotion Team is supporting it nationally. The smart factory promotion project has shown positive results in some companies even in difficult environments such as the COVID-19 situation. In order for each company to promote the smart factory project, it must receive business approval through an evaluation based on the business plan. In order to receive business approval, it is important that the main contents described in the business plan (introduction (business) goals, qualitative goals, quantitative goals, functional composition diagram, etc.) are described consistently. In this study, we studied the cases of several companies to determine whether the main contents of the companies' business plans were consistent. The main contents to be maintained in consistency were the purpose and necessity of introduction, quantitative goals, qualitative goals, functional composition diagram, and expected effects.

Keywords: Smart factory, Business plan, Smart factory promotion project, qualitative goal.

1. Introduction

The smart factory promotion project is a project that uses ICT technology to improve the production process and the entire management environment system. Companies receive some of the necessary funds from the government through this project. In Korea, the smart factory promotion project has been continuously implemented since 2014. The smart factory promotion project is supported by the Smart Factory Promotion Team at the national level. The meaning of a smart factory in the Smart Factory Promotion Team is an intelligent factory that integrates all production processes from product planning to sales with ICT (information and communication technology) technology [1]. By promoting the smart factory project, each company is producing customized products for customers at the lowest cost and time. The issue report published by the Overseas Economic Research Institute of the Export-Import Bank of Korea defines smart factories as next-

generation advanced factories [2]. They aim to realize productivity improvement, energy saving, and customized production through the operation of these advanced factories [3, 4]. In Korea, some companies have achieved positive results in the smart factory promotion project even in difficult environments such as the COVID-19 situation [5, 6].

In order for each company to promote the smart factory project, they must receive business approval through an evaluation based on a business plan. In order to receive business approval, the main contents described in the business plan, such as business objectives, qualitative objectives, quantitative objectives, and functional composition diagram, must be described consistently. In this study, we studied the cases of several companies to determine whether the main contents of the business plans of companies were consistent. The business plans presented by each company included contents such as the purpose of introduction, qualitative goals, quantitative goals, and overall functional composition diagram for introducing smart factories. These contents include interrelationships when promoting the business. For example, contents corresponding to the purpose of introduction must be included in qualitative goals, functional composition diagram, etc.

In Chapter 2, the composition of this study diagnosed whether the main contents of the business plans were consistent based on cases. Finally, the conclusion was described.

2. Diagnosis of consistency between key contents of business plan

In this chapter, we looked into whether the main contents of the business plan written by each company when promoting a smart factory were consistently described. The consistency of the main contents is an important factor in achieving the business goal. Therefore, it can be used as a key indicator to determine the possibility of a company's business promotion. For this purpose, the main contents used were the introduction goals, quantitative and qualitative goals of the business, and the functional composition diagram shown in the business plan. The companies applied to this study were three companies, and the description was based on the contents of each company's business plan.

2.1 Case 1 (Company A)

First, as the first corporate case, the system to be introduced through the smart factory promotion project is an MES system, and its main content is production management. The main qualitative goals that the company is trying to achieve are as shown in Table 1 below. The main core elements in Table 1 are productivity improvement and quality improvement.

Table 1. Company A's key qualitative goals

Building system	• Establishing a production system	
System building goals	• Speed-up production and improve quality	
3 Major detailed system building goals & major contents for achieving goals	Early stabilization	• Establishing optimal work processes • Establishing a simple on-site system • Establishing a system considering expansion • Smooth system adjustment and change
	Increased productivity	• Fast and accurate field operation and information collection by performing process work through the system • Establishment of a monitoring system based on collected information • Optimal production plan and material supply

		• Early detection and rapid response to work delay factors • Reduction of lead time by eliminating disconnection between processes
	Improved quality	• Prevent work errors by performing process work based on the system • Integrated management of production/quality data • Reduce quality costs by controlling processes • Support for tracking production history when quality issues occur • Quality individualization through analysis of quality information

Next, the quantitative goals presented by the company are as shown in Table 2. The core indicators shown in Table 2 are composed of indicators that reflect the company's qualitative goals of productivity improvement and quality improvement. For productivity improvement, indicators of shortening manufacturing lead time (P) and increasing production volume (P) are presented, and for quality improvement, indicators of reducing finished product defect rate (Q) and reducing inspection defect rate (Q) are presented.

Table 2. Company A's key quantitative goals

No	Field	Key Indicator	Unit	Current	Target	Weight
1	P	Shorten manufacturing lead time	Hr	52	42	0.1
2	P	Increase production volume/day	EA	180	250	0.2
3	Q	Reduce finished product defect rate	%	3	1	0.1
4	Q	Reduce inspection defect rate	%	5	1	0.1
5	C	Reduce product cost	WON	11,700/no	10,200/no	0.25
6	C	Reduce inventory quantity and cost	%	50	20	0.15
7	D	Reduce manufacturing lead time	%	3	1	0.1

In addition, the MES system that the company wants to promote is largely divided into four main functions. The overall functional configuration diagram including detailed functions is as shown in Table 3 below.

Table 3. MES system functional structure

Main function	Detailed function
Material management	• Material management: Material receipt/disbursement management, Inventory status inquiry, Inventory change history inquiry, First-in first-out management, Material barcode management
Real-time data collection	• Production management: Production plan inquiry/input, Inventory status inquiry • Process data management: Process condition management, Process data collection
Performance management	• Production tracking management: History search by product ID • Production performance management: Production performance input & search • Material input management
Baseline Information	• System criteria information: Workplace code, Process code, Equipment code, other Criteria information, Defect code • User information: User registration/deletion, User authority management • Work standard management: Work standard registration/inquiry

The quantitative and qualitative goals of the company, and the characteristics (problems) shown in the functional structure diagram can be summarized as follows:

First, if we look at the qualitative goal content, the company wanted to establish a production system by introducing an MES system. The detailed goals to be achieved through the establishment of the production system are productivity improvement and quality improvement, as shown in Table 1. However, the functional structure diagram does not present functions for quality management for quality improvement. Also, the detailed functional description does not include contents for quality improvement. Second, if we look at the quantitative goal items of the company presented in Table 2, the item that is pointed out as the most problematic is the product cost reduction item. This item is shown to have the highest weight. Therefore, it can be said that the most important factor for the company is the reduction of product cost. In order to manage costs, BOM management should be a priority. However, the system function structure diagram and detailed description contents presented in the table above do not mention any BOM-related content at all. Lastly, among the quantitative goals of the company, the two indicators corresponding to production (P) (shortening manufacturing lead time, increasing production volume) are related indicators related to productivity improvement among qualitative goals. In addition, the two indicators corresponding to quality (Q) (reducing finished product defect rate, reducing inspection defect rate) seem appropriate as indicators related to quality improvement among qualitative goals. However, there is no clear description of the qualitative goal content corresponding to product cost reduction, which is a quantitative goal indicator related to cost (C). In addition, the related content is not described in the MES functional configuration diagram.

2.2 Case 2 (Company B)

The company is a company that applied for the project with the goal of introducing the MES system and raising the level of the smart factory from the current non-application of ICT to the basic level. The purpose of the company's smart factory system construction is to increase productivity and improve corporate profits. The means to achieve the purpose are to shorten the manufacturing lead time, improve the delivery compliance rate, and perform systematic production/process management. The expected effects to be obtained through these construction purposes and construction methods are productivity improvement, quality improvement, and manufacturing cost reduction. The related contents are briefly described in Table 4 below.

Table 4. Company's system construction purpose, method, and expected effects

System construction purpose	Construction method	Expected effect
• Increased production efficiency • Improved corporate profits	• Shortened manufacturing lead time • Improved delivery compliance rate • Systematic production process management	• Increased productivity • Improved quality • Reduced manufacturing costs

The quantitative goals presented by the company are as shown in Table 5. The core indicator settings shown in Table 5 consist of contents that correctly reflect the system construction plan and expected effects. For example, it is desirable to set indicators such as hourly production volume (P) that indicates improved productivity among the expected effects. Also it is desirable to set indicators such as finished product defect rate (Q) that indicates improved quality. However, among the items that indicate the shortened manufacturing lead time of the construction plan and the increased production efficiency of the construction purpose, shortened 'manufacturing lead time' may be more desirable as the core indicator than 'hourly production volume'.

Table 5. Company B's key quantitative goals

No	Field	Key indicator	Unit	Current	Target	Weight
1	P	Hourly production	EA/day	300	310	0.3
2	Q	Finished product defect rate (reduction rate)	%	3	2	0.2
3	C	Inventory cost (reduction rate)	million won	200	180	0.3
4	D	Delivery time reduction (reduction rate)	hour	48	46	0.2

The MES system that the company wants to promote is largely divided into 11 main functions. The overall functional configuration diagram including detailed functions is as shown in Table 6 below.

Table 6. MES system functional structure

Main function	Detailed function
Standard information management	• Product/model information, material information, process/line information, organization personnel information, customer information, defect information, operation/loss information, facility information, recipe information
System management	• Business management, user management, login management, document management
Sales management	• Order management, shipment management, A/S management, sales management
Order quotation management	• Work specification information, order request, quotation request, price calculation information, mass production price information, payment information
Purchase management	• Material purchase/order management, receipt management, material inventory management, warehouse issuance/process input, material transfer, etc.
Production management	• Production plan & work order management, input performance management, production performance management, finished product inventory/warehouse management, etc.
Process management	• Work & input management, LOT & field management, line management/obstruction management, efficiency analysis, recipe & production resource management, etc.
Facility management	• Maintenance plan & work management, tool management, consumables management, facility operation & monitoring, facility history management, specification information
Quality management	• Incoming inspection, process inspection, shipment inspection, abnormality management
Performance management	• Production overall status, target performance, production/quality analysis, facility analysis
Monitoring	• Order status, material order status, production status, quality status, shipment status

The quantitative and qualitative goals of the company, and the characteristics (problems) shown in the functional structure diagram can be summarized as follows:

First, one of the expected effects of building a smart factory system for a company is a reduction in manufacturing costs. In order to achieve accurate cost reduction, BOM management must first be implemented. However, if you look at the system function configuration diagram for the company, there is no BOM management function. Second, the key indicators set in the quantitative goals presented by the company are

composed of contents that correctly reflect the system construction plan and expected effects. However, as an item that represents the 'shortening of manufacturing lead time' in the construction plan and the 'increased production efficiency' of the construction purpose, the key indicator 'shortening of manufacturing lead time' may be more desirable than 'production volume per hour'.

So far, we have analyzed whether the main contents of the business plans written by each company (business objectives, quantitative and qualitative objectives, functional composition, expect effects) are consistent, and the main contents are as follows.

Table 7. Main characteristics (problems) and desirable solutions

	Problems and characteristics	Desirable business plan writing method
Case A	• The detailed goal of establishing a production system is to improve productivity and quality. However, the function configuration diagram does not present quality management functions for quality improvement.	• Quality management function is needed in the function configuration diagram
	• The most problematic item in the quantitative goal items was the product cost reduction item, which had the highest weight. In order to manage product costs, BOM management should be given priority.	• BOM management function is needed in the system function configuration diagram
Case B	• One of the expected effects for the company is a reduction in manufacturing costs. In order to achieve accurate cost reduction, BOM management must first be implemented. There is no BOM management function at the company's system function configuration diagram.	• BOM management function is needed in the system function configuration diagram

3. Conclusion

The smart factory promotion project has been promoted for the purpose of improving productivity and management of domestic companies. Each selected company is receiving support in various forms from the government. The government is promoting smart factories in various forms. If we comprehensively examine the contents of various press releases regarding the promotion of these smart factory projects, it is reported that they are showing positive effects in various fields such as improving productivity. In order to promote smart factory projects, each company must receive approval at an evaluation meeting based on a business plan. In this study, we diagnosed whether the main contents of the business plans written by each company to promote the project were consistent. The business plans of several companies were used as the subjects of the study. The main contents of the business plans were introduction goals (business goals), qualitative goals, quantitative goals, and functional composition diagrams. Based on the contents of two companies, we diagnosed whether the main contents were consistent. Through this, more desirable and consistent business plans can be written when promoting future projects.

Acknowledgement

References

[1] https://www.smart-factory.kr/smartFactoryIntro#.

[2] H. J. Lee, "Analysis of the main contents and effects of the smart factory support project," Korea Export-Import Banking Association Issue Report, 2022.

[3] M. Liffler and A. Tschiesner, "The Internet of Things and the future of manufacturing". Mckinsey.com. Retrieved 30 November 2016.

[4] S. H. Lee and D. W. Lee, "Smart Factory Promotion and Operation Analysis in the 4th Industrial Revolution Environment", IJASC, Vol.11, No.3, pp. 42-48, 2022.
DOI: http://dx.doi.org/10.7236/IJASC.2022.11.3.42

[5] Ministry of SMEs and Startups, "Ministry of SMEs and Startups Achieves 20,000 Smart Factories," Press Release, 2021.

[6] Press release by the Ministry of SMEs and Startups, "Productivity increased by 30% and employment increased by 3 (4.2%) after the introduction of smart factories for small and medium-sized enterprises" 2019. https://www.mss.go.kr/site/smba/ex/bbs /View.do?cbIdx=86&bcIdx=1011893&parentSeq=1011893

[7] https://kosis.kr/search/search.do;jsessionid=qxpB1l2NZuPiz6VE1zJ6a7ucKFXuxXtzJZ8gqCB4bB41e9FnbXtJM1 zXG35Pe0Uz.STAT_SIGA1_servlet_engine1.