INFORMATION EXCHANGE OF CURTAIN WALL WORK FOR THE APPLICATION OF SUPPLY CHAIN MANAGEMENT SYSTEM

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Abstract : The SCM system must apply to the curtain wall work because many stakeholders are participated in this work. By the way, each participant has its own system. Although the system is helpful for them to control its enterprise, it isn't available between one another system. The SCM system is necessary to use between the participants, but doesn't support the inner working of each participant and making new system is the low utility and unsmooth supply chain management in the SCM system. To solve this problem, this paper proposes the information exchanging system between from subcontract's system to other systems in the whole curtain wall work by using for the curtain wall work by analyzing functions, contents and types in the system.

Keywords : Supply Chain Management(SCM), Information Management, Information Exchange, Unit type Curtain Wall

1. INTRODUCTION

The construction industry is changing to pre-fabricate, standardize and automate. The curtain wall work which is the one of most important work in the construction is also changing for its efficiency. The curtain wall process is divided by 4 phases which are architectural design, shop drawing, manufacturing, packing & delivery, installation and maintenance, and almost 30 subcontractors participated in this whole work. Many firms and institutes which are touched with the construction industry apply the concept of SCM(Supply Chain Management), JIT(Just In Time) for the curtain wall work to manage efficiently and also make an effort to create the support system for the curtain wall process.

Each contractor has its own systems which called PMIS(Project Management Integrated System) or ERP(Enterprise Resource Planning), but these systems are different from one another because they have different purpose and composition for themselves. So they need new system to harmonize these systems to make efficiency for the curtain wall process.

Because there are some troubles in the new system such as inputting data repeatedly and unnecessary waiting, the system needs new information management method to reduce the information waste with using the existing system. This paper will show the information exchanging method using the existing system in the phase of manufacturing, installation in curtain wall work for their productivity.

2. SUPPLY CHAIN MANAGEMENT OF CURTAIN WALL WORK

2.1 Supply Chain Management

Handfield and Nicols(1999) define that "the supply chain encompasses all activities associated with the flow and transformation of goods from the raw materials stage, through to the end user, as well as the associated information flow. Material and information flow both up and down the supply chain." They also define that "supply chain management is the integration of these activities through improved supply chain relationship, to achieve a sustainable competitive advantage." Although the concept of SCM was initiated from the manufacturing industry, studies on the application of SCM in curtain wall work have shown great potential for other applicable areas of SCM.

2.2 Curtain Wall Work

The curtain wall process is composed by many phases which are architectural design, shop drawing, manufacturing, delivery, installation, and maintenance and has many participants. Especially, manufacturing phase is

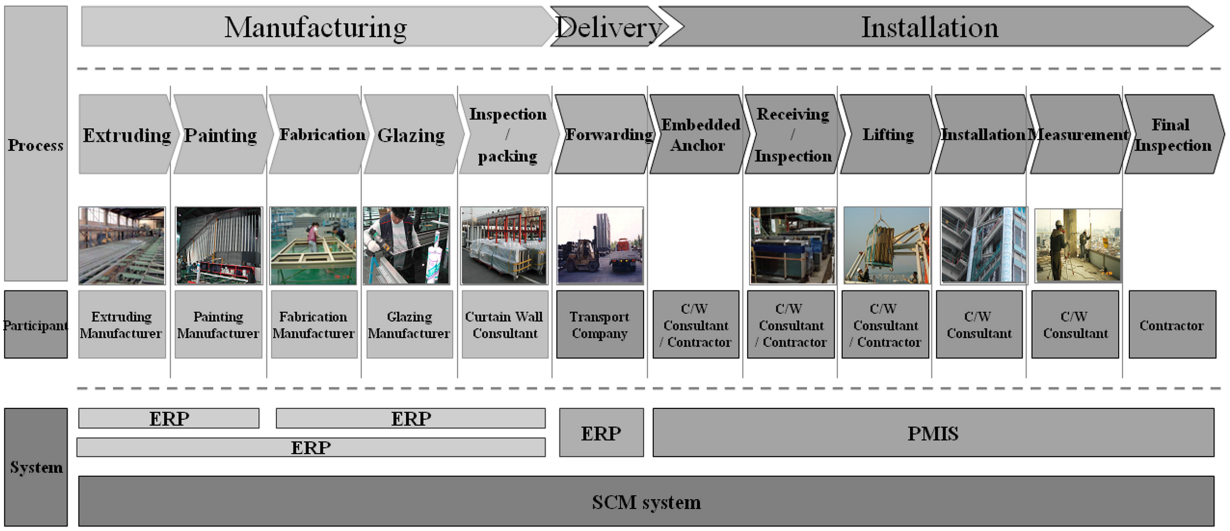

Figure 1. Curtain Wall Work Process

divided by 5 steps which are extruding, painting, fabrication, glazing and inspection/packing and installation phase. It is also broken down by embedded anchor, delivery, inspection, lifting, installation, measurement and final inspection. The supply chain in curtain wall work needs about 30 subcontractors in the whole work. The work scope in the curtain wall manufacturing firm for this paper's discussion is presented by Table 1.

Table 1. The Current Status of Curtain Wall Manufacture firm in Korea

Division	Firm	Extruding	Painting	Inspection /Packing	Glazing
Bundle Manufacturing System	H	○	○	○	○
Distributed Manufacturing System (outsourcing)	I	○	○	×	×
	D	○	○	×	×
	N	○	○	×	×
	Y	×	×	○	×
	S	×	×	○	○
	C	×	×	○	×
	SW	×	×	○	×
	HB	×	×	×	×

2.3 Supply Chain Management of Curtain Wall Work

In the current status of curtain wall manufacturing firm in Korea, some firms have bundled manufacturing organization, but most firms have done only specific work in curtain wall manufacturing step using the outsourcing. This trend of the outsourcing is able to be understood by grasping the trend of other industries. This complicated production system needs the application of SCM.

3. SYSTEMS FOR CURTAIN WALL WORK

3.1 Common Systems for Curtain Wall Work and its Problem

The system, used the most among the systems that curtain wall firms are constructing by themselves, is ERP. It is the one built centering on its inner working by the company expert at curtain wall. The functions such as Financial Management and Human Resource Management are for operating its own company, and Engineering Management and Customer Service is for its own technology development and customer satisfaction. Meanwhile, Manufacturing Management is the function used through cooperation with the main companies participating in a curtain wall life-cycle. The detailed function applies for these items: Manufacturing Planning for based on the main document from a contractor, Manufacturing Results for after completed manufacturing, Delivery Management for output and Defect Management in case that defect unit happens. When participants exchange the information generated at the moment with others, the document is used as the exchange method. It causes unsmooth information flow and long lead time.

On a point of view of SCM, although the function requiring the cooperation with each related subject needs information exchange, all the information flow in this system is in the state of being operated only in the inside of a system.

Since the information including Financial Management, Human Resource Management, Engineering Management and Customer Service has a confidential feature as the information for own inner working, they should be protected and are not important information from a SCM view as well. Therefore, it is effective to search for the information exchange method laying stress on Manufacturing Management.

3.2 SCM System for Curtain Wall Work and its Problem

On the other hand, in order to manage the whole of a curtain wall life-cycle, it is necessarily to construct the SCM system that each participant including a contractor, a curtain

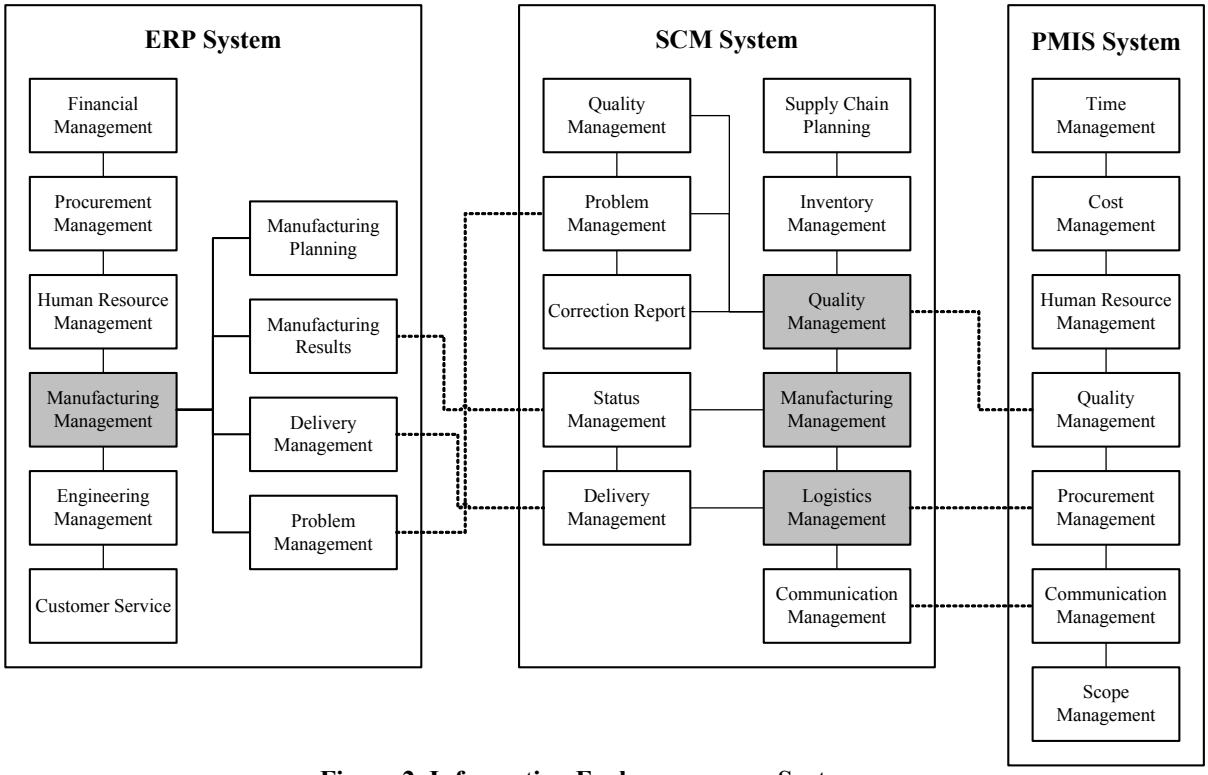

Figure 2. Information Exchange among Systems

wall consultant, manufacturer, a transport company, a supervision agency and a client use. For the information needed in common for many participants to support the operation watched through a process, there are Quality Management, Manufacturing Management and Logistics Management, and through this, it can share the information and cooperate. Status Management is the function to express the status of curtain wall unit after colligating the result of Manufacturing Management and Logistics Management, and this makes it easier for all participating subjects to see through the status of manufacturing, delivery, installation and final-inspection of each material.

However, as the system was constructed centering on the important function and information on the point of an SCM view, the function that each participant operates its company isn't supplied. This leads to encountering the problem that falls short of utility as each participant applies it, and in spite of using the system at the same time, the repeated input of information into each system by the related person, the omission or the error of information and unnecessary latency occurred.

In order to embody SCM of curtain wall work by utilizing an SCM system more efficiently, addressing the problem, we would like to suggest the method to exchange the needful information with each other laying stress on the function such as the Manufacturing Results and the Delivery Management of ERP and the Manufacturing Management and the Delivery Management of a SCM System.

4. INFORMATION EXCHANGE OF CURTAIN WALL WORK FOR THE APPLICATION OF SCM SYSTEM

This paper, centering on the production and the operation bringing about an improvement in an effect through information exchange, presents an SCM System and the main information exchange system of ERP from the companies which is established already. Figure 3 shows the concept connecting the system of SCM and of participants to manage the whole of a curtain wall work life-cycle.

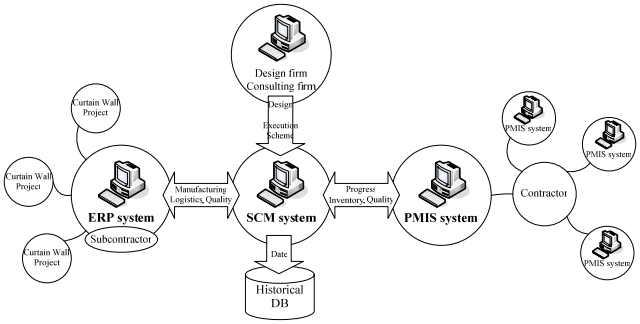

Figure 3. Conceptual Presentation of Information Exchange

The main information to share on the point of a view of SCM among the information generated in the process of manufacturing are the Glazing Date which indicates when the curtain wall unit that had passed a quality standard was produced, and the result of a quality inspection. This is the information that a manufacturer manages among

subcontractors, and as the specific items of the Manufacturing Management Function of ERP, it consists of a manufacturing plan, delivery results and defect management as well as manufacturing results. Information contents and types in order to connect this function with an SCM system, are as follows in Table 2.

Table 2. Information Contents and Types of ERP

Function		Contents	Type
Manufacturing management	Manufacturing Planning	Order Title	Title
		Order Number	Number
		Product Code	Number
		Scheduled Date	Date
		Appointed Date	Date
	Manufacturing Results	Order Title	Title
		Order Number	Number
		Inspector	Name
		Product Name	Text
		Unit ID	Number
		Install Position	Text
		Size	Size
		Glazing Date	Date
	Delivery Results	Order Number	Number
		Customer	Text
		Destination	Text
		Receiver	Name
		Product Type	Text
		Product Code	Number
		Unit ID	Number
		Install Position	Text
		Size	Size
		Sending date	Date
	Defect Management	Order Title	Title
		Order Number	Number
		Occurrence Date	Date
		Unit ID	Number
		Problem Type	Text
		Manager	Name
		Install Position	Text
		Size	Size
		Completion Date	Date

The Manufacturing Results information that a manufacturer inputs after Glazing and the Delivery Results information when delivered are the main information that needs to connect with an SCM System. Since the data needed for other participants is about what the unit was produced, when it was produced and when it was delivered, it must send off the Unit ID of Manufacturing Results, the information of Glazing Date, the Delivery Results and the information of Delivery Date. On the other hand, as Defect Management is done based on the information that a contractor sends, it should be sent from an SCM System on which unit made failure, when the failure was made and what kind of failure occurred. After working on a defect unit again, it will send the completion date to SCM System back.

Information contents and the types of an SCM System which need to exchange are as follows in Table 3. As manufacturing, logistics, quality and others are managed central to the information related to a unit, each information is connected through Unit ID. In case of the information on which curtain wall unit information and when the curtain wall unit information is produced, among the information that a manufacturer input into his company's ERP, because the Information of Unit ID and Glazing Date has the same content and type that must be input into the Status Management of an SCM system, the information exchange is available. Also, for the information on when the curtain wall unit was taken out of a factory, since this information has the same content and type with the information that must be input into the Delivery Results and the Invoice Management function of an SCM System, it can exchange the information. Exchangeable parts are indicated in the shapes of shadow.

Table 3. Information Contents and Types of SCM system

Function		Contents	Type
Manufacturing management	Status management	Unit ID	Number
		Order Date	Date
		Glazing Date	Date
Logistics Management	Status management	Unit ID	Number
		Receive Date	Date
		Installation Date	Date
		Final Inspection	Text
	Invoice Management	Unit ID	Number
		Receiver	Name
		Sending Date	Date
		Receive Date	Date
Quality Management	Inspection	Unit ID	Number
		Manufacturing Inspection	Text
		Receive Inspection	Text
		Final Inspection	Text
	Defect Management	Unit ID	Number
		Occurrence Date	Date
		Defect Type	Text
		Deadline	Date
		Appointed Date	Date
	Correction Report	Report Number	Number
		Receiver	Text
		Title	Title
		Issue Date	Date
		Deadline	Date
		Appointed Date	Date

The SCM system in order to manage the whole of curtain wall life-cycle, the ERP of a subcontractor and the information exchange model through the PMIS of a contractor are as follows in figure 2.

By such an information exchange, the repeated input of information, an error and an unnecessary latency reduces, and the whole efficiency improves on the point of a view of SCM since real time management is available. In addition, not only by using the system support to the inner working process of his own but also by using an SCM System that controls the whole of curtain wall life-cycle, each participant can cooperate smoothly with others through.

5. CONCLUSION

Curtail wall work is a kind in common that needs the application of SCM due to many participants. The problem

occurred while applying the SCM system. Each participant is in the state of having constructed the system needed for operating his company, and it isn't compatible with cooperation although the system is helpful for the inner working of his own. Meanwhile, as an SCM System is constructed centering on a supply chain, it doesn't support the inner working function of each participant. This causes the low utility in a SCM system and unsmooth supply chain management.

In this paper, for the purpose of addressing the problem, the method to exchange the information with each other was proposed by analyzing the composure of a system function and the content or the type of information. By means of this, each participant might improve the efficiency through cooperation as well as the inner working of his own in its manufacturing and installation phase, and might provide the whole of a curtain wall life-cycle with efficient supply chain management.

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REFERENCES

[1] Handfield, R. and Nichols, E. Jr.(1999). “Introduction to Supply Chain Management,” Prentice-Hall, Inc., New Jersey, the United States.

[2] O'Brien, W.J.(1998) "Capacity Costing Approaches for Construction Supply Chain Management," Stanford University, Stanford, CA.

[3] Park, s., Kim, Y and Chin, S. (2003). “Implementation of Supply Chain Management in the Construction Industry,” Korean Journal of Construction Engineering and Management, Vol. 4(3), 85-94

[4] Chin, S., Yoon, S.W., Kim, C.D., Choi, Y.K., and Chun, J.Y. (2004). “An analysis of the Life-Cycle Curtain Wall Process through Supply Chain Management,” Proceeding of International Group of Lean Construction, Copenhagen, Denmark, September

[5] Janak Singh. (1996) “The importance of information flow within the supply chain,” Logistics Information Management, Vol. 9, 28-30, MCB University Press

[6] J. Michael Tern, David C. Yen, Marcus Beaumont. (2002) “ Exploring the rationales for ERP and SCM integration,” Industrial Management & Data systems, Vol. 102, 26-34, MCB University Press