The Study of Copper Resource Management System and Process for Effectively Operation*

Sungmo Jung, Yangsok Kim, Seoksoo Kim
Department of multimedia, Hannam University, Korea
School of Computing, University of Tasmania Sandy Bay, Australia
SungmoJ@gmail.com, yangsokk@utas.edu.au, sskim@hnu.kr

Abstract

In construction project management, ideologies and tasks related to resource supply are more significant than the integrated resources management. Such ideologies and tasks are considered crucial for achieving terms, pricing, quality and the goal of the project. It makes metal work resources even more important and as the target for special management. With these pressing issues in construction project management, the researchers proposed a web based system to improve such management task.

Keyword*: Copper Resource Management System;*

1. Introduction

Following the recent trend in the construction field favoring construction of high rise buildings and multi-complex facilities and as type and specification of construction supplies are becoming more complex, On time delivery and management of construction materials are becoming a critical issue in the construction field. In construction project management, ideologies and tasks related to resource supply are more significant than the integrated resources management in the working level, which combines the construction resources purchasing management and stock management. Furthermore, such ideologies and tasks are considered crucial for achieving terms, pricing, quality, and the goal of the project.

In effort to acquire competitive edge in the construction industry while turning the industry in to core technology centered industry, various construction companies tried to actively respond to such changes while promoting effective construction management and material supply. Presently, domestic construction companies are in the progress of building web based information system and the government is promoting the development of CBIS. Various concepts such as TPS, implemented on other industries have been applied in the construction industry, creating evolution in the construction processes. However, automated systems built for material management have concentrated on existing material management only. In most cases, material planning does not adequately consider methods for improving delivery and transportation of copper resources from and to the site.

Currently, there is no uniform process for managing copper resources. Also, there is no system that can automatically conduct unit conversion required during processing raw materials. Therefore, most of processes rely on documentation and computer oriented systems for managing copper resources which has not been efficient enough.

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Basing on the recognition of the importance of metal resource management in construction project management, the study wants to examine methods that can be implemented to efficiently manage resource. Furthermore, the method to effectively improve copper resource management, which takes the largest weighting of material expenditures of a construction project while influencing the project most directly, shall be proposed from the perspective of the ordering company. The researcher shall integrate processes involved in the management in to one in Dataflow based process and develop a system for copper resource management.

2. Related Work

2.1 Consideration

1) Features of Metal Resource management

The resource management in construction project can be defined as the act of managing in terms of ordering, controlling and adjusting materials during the entire course of the project, which starts from material usage planning, requesting, purchasing, delivery, storing, usage, stocking, etc., to its completion in the delivery. Following characteristics of internal and external site conditions and difficulties in making an accurate calculation for material usage, construction material management, unlike general material management adopted by the manufacturing industry, show following differences. Such differences can be noted more clearly in metal resource management.

(1) Disadvantageous in integrated purchasing and delivery as sites are scattered all over the region.

(2) Dedicated material purchasing and redemption is difficult.

(3) Long-term planning is difficult following an uncertainty of winning the bid.

(4) Difficult to perform standard management following variable factors.

(5) Difficult to set standard and specification.

2) Methodology of Process Improvement

Generally, in order to improve a process, clear understanding and accurate problem recognition innate in the existing process must be conducted first. Also, during the procedure of process redesign, technical and organizational solutions have to be suggested so that such solutions can be implemented on the process. However, in the case of copper resource management, there is no clear documentation requirement that has been set and such management is done per task basis.

From the perspective of management information, task process can be said to be a set of activities that accepts more than one input to deliver valuable results to customers. In lieu with this, the construction industry is a type of industry where all tasks are based on processes. Therefore, competitiveness of the construction industry in the future shall be derived from adequate management and improvement of such processes. Thus, existing processes must be understood clearly and researches dedicated on processes used by the construction industry must be conducted as well.

Therefore the study wants to develop a more efficient process by analyzing dataflow.

3) Researches and Instances of Resource management Work Processes

In the service industry and general manufacturing, tasks related to distribution and purchasing are considered as a process that is directly related to customer satisfaction, being treated as an important task which requires professional consultation and regular improvement innovation.

In the construction industry, unlike other managements, the material management tends to favor tracking of actual goods. Therefore, most of researches had been dedicated on the overall procedure from purchasing to site delivery by basing on the existing theories on reengineering. For a case study, the D industry has promoted BPR for improving inventory management system. The inventory management system had been segmented in to 4: Order, Delivery, Inventory Management and Information sharing. The D industry's goals in promoting BPR were management reflecting actual site, integration of inventories, etc., by strengthening strategies for purchasing and improving site delivery. Also, by basing on analysis of overall material management tasks performed by various identities involved in a project, the material management methods used at the working-level had been redesigned so that it can be used by higher managements. That is a model for the project owner, builder and CM had been designed so that it can be directly implemented in the construction project cycle. In the case of 'Back', process requiring large work load and a large volume of resources had been the target for implementing improvement. For a task that costs less but requires a bigger work load, process innovation had been implemented to improve efficiency of purchasing from the material management.

In the existing cases and studies, rather than analyzing information generated from the work processes, generalized processes common to all tasks and common information had been determined for suggesting improvement methods. Therefore, the researcher has classified information generated from copper resource management processes in to input data and output data. By basing on the result of such classification, the researcher has simplified and unified processes to propose methods that will improve work efficiently.

2.2 Research Extent and Method

Depending on the status of the site, copper millwork can be in the form of purchase materials, provided materials and subcontracted materials. Such characteristics of copper resources have been considered for analyzing management tasks then the researcher has designed web based process and system. Detailed research methodologies are as follows.

(1) Classified information generated in the process of conducting tasks and determined process flows for determining core tasks required for processing copper resource management.

(2) Determined existing task processes involved in the copper resource management. Collected and analyzed documents generated during the course of conducting such tasks and integrated the tasks. And finally, integration together.

(3) The researcher has reviewed various IT technologies that can be applied to core tasks and proposed the development of information system for initial inventory management and transportation process for improving efficiency of copper resource management.

(4) Researched theoretical backgrounds for building processes and studied improvement cases dedicated on construction task process improvement.

Research Methodologies are shown in the Figure 1.

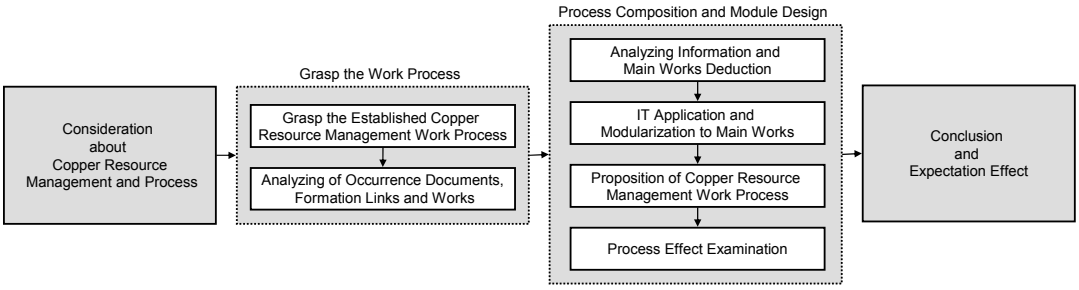

Figure 1. Research Methodologies

2.3 Preexistence Copper Resource Management Work Process

Material management process at site can be divided largely in to 6: Planning-implementation-review cycle, material planning, purchasing management, inventory management, production management, delivery management and site management. When these processes are applied in the copper resource management, process shown in the Figure 2 can be achieved.

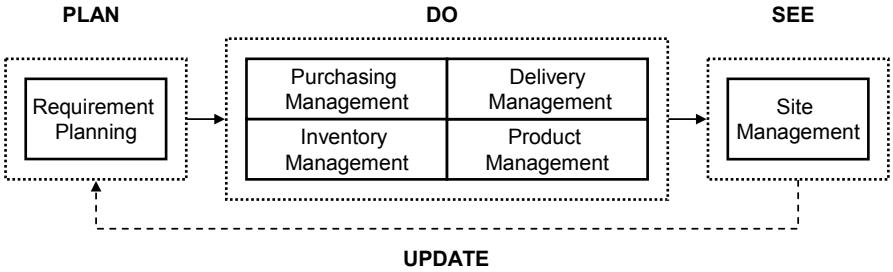

Figure 2. Roughly Methodologies

Tasks and communications at site get exchanged through unofficial means of communication. Therefore, the study has analyzed and designed framework by basing on document preparation and safe keeping procedures that requires documentation procedures.

3. Design of Copper Resource Management System and Process Composition

3.1 Process Composition

In the copper resource management, documents are crucial communication means for processing requests. Since such documents contain certain information required by staff in charge of the management, these documents are very useful in analyzing task and process flows.

Data Processing Method is shown in the Figure 3.

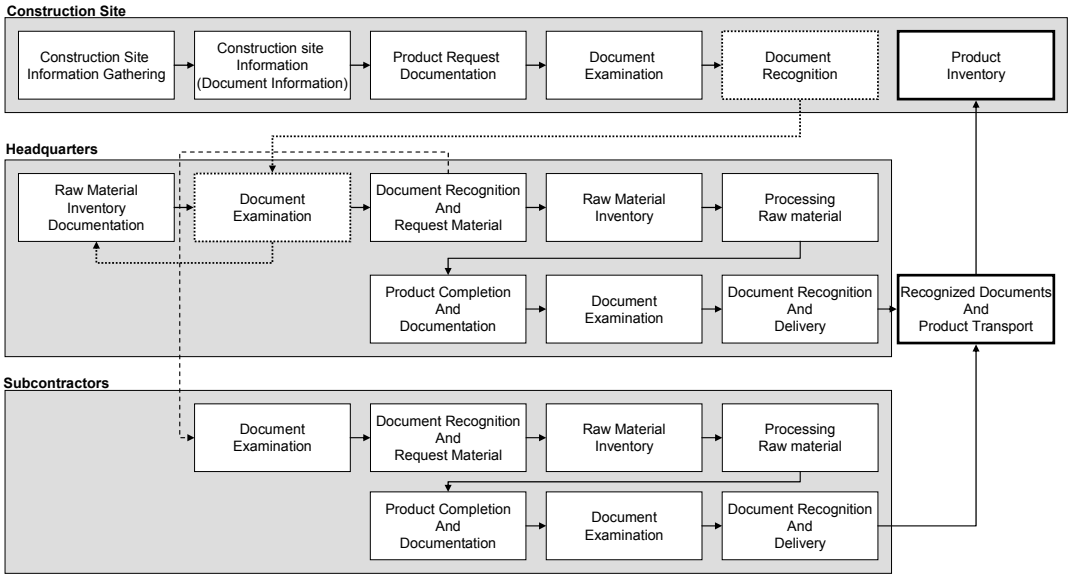

Figure 3. Data Processing Method

Figure 3 summarizes types and procedures involved in the web based processing of documents among headquarters, site, subcontractor and delivery. Input and Output comprising each process had been sourced from various categories shown on the document.

The above process flow shows data processing involved in the copper resource request process submitted from the construction site. In reality, documents used at site, headquarters, subcontractors, etc., are not unified. Therefore when the request gets submitted by the site in a document format favored by the site, such format has to be reformatted into a format favored by headquarters. Furthermore, document sent by headquarters gets sent to various subcontractors and such subcontractors have to reformat or analyze the document format to proceed with copper millwork.

Therefore in the process flow, all processes are developed by using web based technology so that all data within a document can have the same value for variables. Therefore, these processes are designed in much simpler manner than existing processes while minimizing time wasted in performing tasks.

3.2 System Design

System is developed in web based technology so that compatibility, convenience and promptitude can be experienced. Therefore, the study has summarized various steps comprising the copper resource management managed by headquarters and developed a web based system for managing copper resources.

In this study, the copper resource management is divided in to 4 separate processes and detailed descriptions of these processes are as follows.

1) Purchase Order

The purchase order authorized by the site manager gets delivered to headquarters, related department reviews such order, accepts quotations from vendors, selects a vendor then places purchase order. Basing on the progress of the construction, the material inventory manager decides adequate time for placing purchasing order and stocking materials and most of construction companies purchase materials through the purchasing department of headquarters.

The Purchase Order is composed by three stages: Planning, Purchasing and Stocking. Following characteristics of copper millwork, stocking and production gets conducted simultaneously. Inventory management is not needed. Therefore, the researcher has integrated planning and purchasing management in to one, 'the purchase order' and simplified steps required for placing purchase order and removed unnecessary factors.

2) Delivery Request

Raw materials purchased through purchase order process get delivered to the site for production. The delivery request is used to deliver raw material for production. Therefore, the production can be performed at headquarters and subcontracting company. However, problem arises from differences in the specification and the units used during material storing and production.

As shown in the Figure 3, there is a procedure for material delivery and production and another procedure for millwork completion and documentation. During these procedures, measurement units used for measuring a material changes. For example, delivered material gets measured by using measurement units for mass, product under production gets measured by using measurement unit for length and finished product gets measured by using mass. Therefore, complex measurement procedures presently exist.

Universally, material storing gets processed by using the unit mass per material. Here, the Thickness and Weight are used for composing the unit mass. In addition, the length gets added during production task. For instance, when the copper has to be cut, Thickness, Weight and Length for unit length gets used. Normally, such data are converted manually to be recorded on various documents. However in this study, [i] quantity of finished goods against the weight of raw material and [ii] equation for calculating the weight of finished goods, are used so that such equation can be implemented in the web based system while much faster data conversion can be achieved.

Following characteristics of copper resources, copper resources are stored by using units such as Millimeter (mm) and Gram (g) and final goods use units such as Meter (m) and Kilometer (kg).

$$[i] \quad M(m) = EA \times \frac{Length(mm)}{100}$$

$$[ii] \quad KW(kg) = \frac{Weight(g)}{100} \times Thickness \times 0.9 \times M$$

3) Delivery

Material can be delivered to the site either through direct delivery to subcontractor for site usage or surplus materials from a site gets delivered to other sites. In the delivery task, delivery authorization, delivery order, delivery request and delivery form must be prepared. In the existing work procedure, all documentation had to be prepared manually. However, the system developed by the study automatically fills in the blanks by using value generated from purchasing order stage and delivery stage, reducing work load while increasing accuracy. Furthermore, in the delivery order form, unit price submitted by subcontractors gets automatically erased so that confidentiality of pricing can be uplifted as well.

4) Account Settlement and Documentation

In this stage, payments for all tasks and resources consumed during stock management, delivery, maintenance of delivered goods, etc., are processed. Here, the study will assume that the authentication of material delivery shall be confirmed by the inventory manager. Therefore, the system will automatically return the value for positive delivery to the next procedure for preparing documentation.

Figure 4 shows tasks, documents and contents used in the copper resource management. For detailed tasks, they have been segmented furthermore for conducting analysis. However in the study, such segmentation has been done in subcategory level.

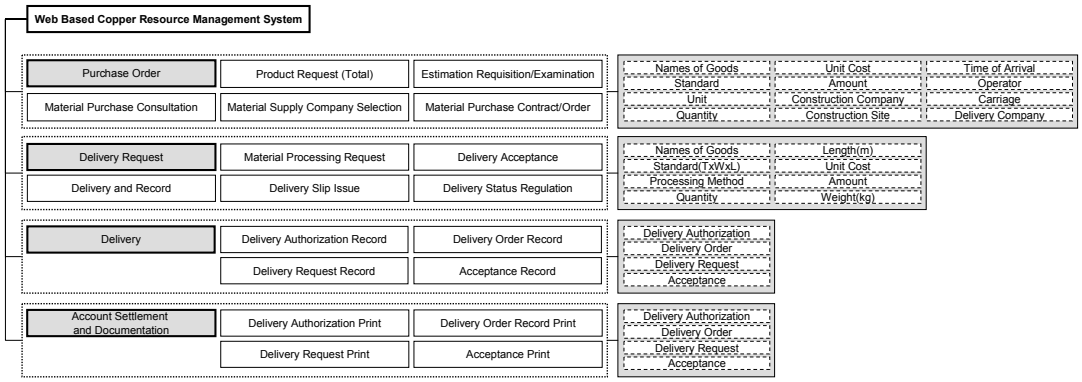

Figure 4. System Method

The Figure 5 shows development of copper resource management process by using IDEF0, the functional modeling method. Dataflow of the proposed system is as follows.

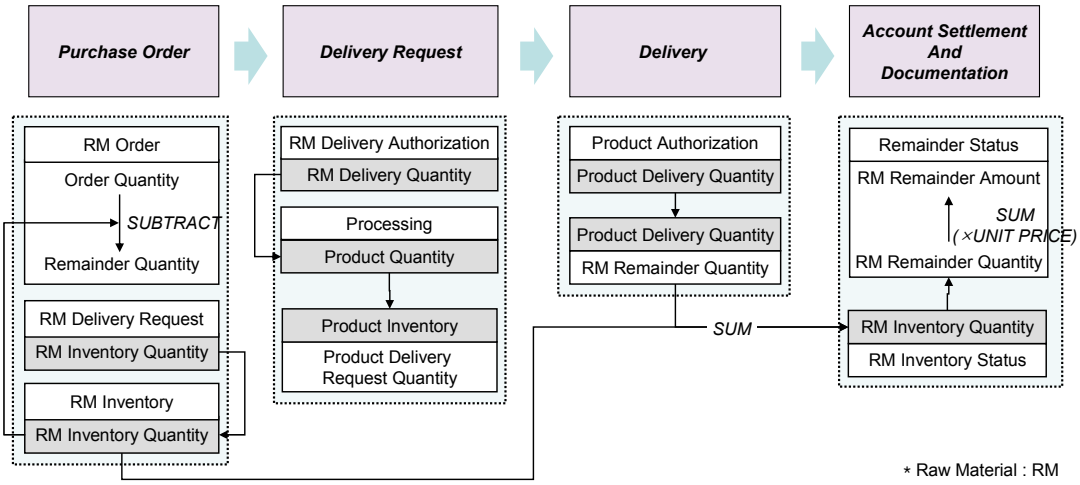

Figure 5. Dataflow in System

The copper resource management process links core processes such as resource planning, material request, vendor selection, material testing, material delivery authorization, inventory status, etc., to tasks handled by manager at the headquarters. By doing so, the overall copper resource management process can be developed in to system. Detailed procedures of such development are shown below.

(1) In the purchasing order stage, material planning gets reviewed and necessity of such material in the present construction stage gets determined. Also, by basing on the regularly updated progress schedule, purchasing order gets reviewed. Then, material requests gets authorized by using existing procedures and such order gets linked to the online resource purchasing system for selecting the vendor.

(2) In the delivery order and delivery stage, when the material inventory and millwork delivery used for calculating the present status get recognized by the system, the system automatically organizes such data and shows summary of present status.

(3) The main procedures of the resource management have been determined as planning and status management.

3.3 Effects by System Design of a Proposal

The study has analyzed information generated from conducting tasks, determined work flow and determined critical tasks among them. Then, the researcher has designed a system for copper work resource management. Benefits expected by implementing the designed system are as follows.

(1) By designing processes by centering on critical tasks, unnecessary tasks during evaluation, multiple document preparation, etc., had been greatly reduced, and simplify the overall work process.

(2) While maintaining rights given to site managers for copper resource management, increase the role of the Headquarters. Through this, the Headquarters where the status of production and delivery of copper millwork takes place had conveniently and efficiently manage the copper resources.

(3) The researcher has eliminated factors reducing efficiency of work process and developed web based management system for improving work efficiency.

(4) To improve the existing document centered and supply centered resource management system, the researcher has integrated resource planning and manufacturing process in to one in web based system and added inventory management function as well.

4. Conclusions

The importance of resource management from the aspect of construction projects management is emphasized in the trend of constructing high rise and multi-complex buildings. Copper work resources which are considered critical in most construction projects, became a target for special management. However, systems that exist currently concentrate solely on the document automation which rarely benefits copper millworks management. With this advent issues, the study has determined work process of copper work resources management, since copper millwork is one of the most important construction materials in most of construction projects and proposed a web based system for improving such management task.

The study was done by analyzing documents and information generated during copper work resource management task, suggested a new task process based on the major tasked involved in the construction works and design. The study had successfully classified systematically the information generated during the course of task handling and distinguished critical task among them by analyzing the work flow. The researcher then removed unnecessary task, integrated overlapping tasks and designed a web based system. Based on such work process system the researcher was able to propose a more efficient construction work procedure. Integration and simplification of tasks are directly related to expenditures and improving the quality of construction tasks. Highlighting the significance of the study, it is equated to the fact that such task can lead to reduction in miscellaneous costs depending on the area.

The researcher shall conduct a research dedicated on the implementation of the system in the future. Giving much consideration on the crucial area of shared information since many management tasks in the construction industry interlinked and shared information and further improve efficiency of construction tasks and work flow of a resource management.

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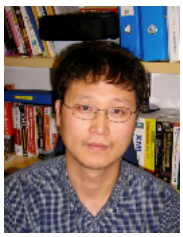
Authors

Sungmo Jung

In 2008, he received the B.S. degree in Department of Multimedia from Hannam University, Daejeon, Korea. Now, he is working on the Master's degree in Multimedia Engineering from Hannam University. His research interests include Software Engineering, Embedded database systems and Sensor network.



Yang Sok Kim

He received a B.S. degree in University of Seoul, Korea, 1995, and M.S. degree in computing from University of Tasmania, Australia, 2004. Now, he is working on the PhD's degree in University of Tasmania, Australia. He was working on Hyundai Information Technology Co., Ltd and E-2 Corporation Co., Ltd.

Seoksoo Kim

Received a B.S. degree in computer engineering from Kyungnam University , Korea, 1989, and M.S. degree in Information engineering from Sungkyun-kwan University, Korea, 1991 and Ph D. degree in Information engineering from Sungkyun-kwan University, Korea, 2002. In 2003 he joined the faculty of Hannam University, Korea where he is currently a professor in Department of Multimedia Engineering. His research interests include Multimedia Communication systems, Distance learning, Multimedia Authoring, Telemedicine, Multimedia Programming, Computer Networking. Information Security. He is a Member of KCA, KICS, KIMICS, KIPS, KMS, and DCS.