ANALYSIS AND IMPROVEMENT OF FINISHING WORK PROCESS FOR COST MANAGEMENT (FOCUSED ON INDOOR FINISHING WORK OF APARTMENT)

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Abstract

Apartment housing in the Korean domestic construction industry has had various and high-quality finishing work since the enforcement of price deregulation in 1998. Before the enforcement of price deregulation, feasibility studies of housing projects have not had particular difficulties as uniform description of finishing work items were reflected and finishing work cost also was equalized. However, the recent distinction of finishing work based on the same floor plan brings about project cost variation, along with many effects on construction management due to project cost increment.

Accordingly, this paper suggests the improved plan of cost management to control the feasibility study result consistently during the life cycle of a project through an analysis based on cost management phase due to cost blackout, appearing at the commencement of a project, cost gradation caused by high-quality finishing work item, and cost reduction due to the degradation of finishing work after analysis of current apartment construction process focused on finishing work using the IDEF process analysis technique.

Keywords : Cost Management, Finishing Work Process, I.D.E.F(ICAM DEFinition)

1. Introduction

1.1 Research Background and Purposes

In recent apartment housing in Korea, the options in finishing work items are being diversified and becoming highly-qualified. Because such options were selected uniformly regardless of the location of the apartments for sale and the scope or properties of apartments, there was little trouble in feasibility studies, construction, and material requirements in the past. However, due to the diversification and high standards of finishing work items for each work section, the overall cost is on the increase. The

tendency is to consider unpredictable problems in the analysis of feasibility in earlier phases. Also, there was a period of cost blackout in the analysis of earlier business profile, schematic design, detailed design, and construction in the overall construction process, and cost management as one of the measures influencing the success of the overall project can be a problem in performing projects.

Therefore, this study is to analyze the problems shown in existing business processes by using IDEFØ for each process, and to present an improved method of cost management for measuring the deduced problems by each process.

1.2   Research Methodology and Scope

The scope of this study is limited to the unit space interior finishing work item for items having great flexibility and diversification of design decision making in surface work (See Figure 1. In order to present an improved business method for cost management in unit space surface work items in apartment housing, the research was performed as follows:
(1) Project cost management and modeling tools were theoretically considered through investigating relevant literature.
(2) By using the IDEFØ modeling tool, the processes of apartment housing operations were modeled and analyzed primarily on finishing work to deduce problems by process.
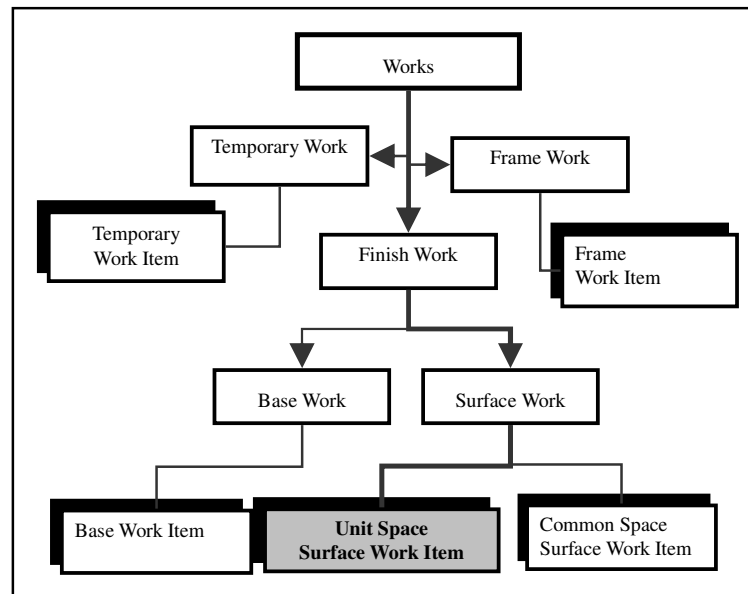(3) Further improvements were provided for the deduced problems by process.

Figure 1. Research Scope

2.   Review of theory and modeling tool

2.1   Project Cost Management Process

According to PMBOK, project cost management can be divided into four processes: resource planning, cost estimating, cost budgeting, and cost control.

(1) Resource Planning is a process in which physical resource requirements including manpower, equipment and materials are determined, and the type, the quantity, and the points of need of resources necessary to perform the project should be defined.

(2) Cost Estimating is performed for each resource or for the overall project, and the cost estimating for each resource is carried out by multiplying input quantity of each resource by unit cost. As for the estimating methods, top-down estimating depends on experience, bottom-up estimating is based on activity, and the latter is regarded as the most precise method. There is also parametric modeling, which is an estimating method based on the results of mathematical analysis of abundant past data.

(3) Cost budgeting is a tool for measuring the result of the project and estimating the overall cost of a project, and the estimated overall cost can be established as the baseline of the overall process.

(4) Cost control is a process in which the deviation between the estimated cost and established budgeting is analyzed and necessary corrective measures are taken.

2.2 Concept of IDEF Modeling Tool

IDEF, a process model tool, is the Structured Analysis and Design Technique (SADT) which was developed for modeling the functional relations of weaponry processes by the U.S. Air Force in early 1980s. Due to its hierarchical, modularized, and standardized structures, the SADT is considered appropriate in expressing complex processes of construction. In addition, its graphical expressions make it simple for the teams performing each function to communicate with each other.

The basis of the IDEFØ model diagram consists of an activity expressed in the form of a box and ICOM (Inputs, Controls, Outputs, Mechanism) expressed in the form of an arrow (See Table 1).

Table 1. Functions of ICOM

Classification	Functions
Activity Box	Expressing activities, movements, processes, or performing functions in operations.
Inputs	Expressing what is consumed or transformed as functions are performed as an individual or data
Control	Restrictions controlling functions, or necessary in determining guide or output
Outputs	Products as a result of functions or activities
Mechanism	Persons or individual performing functions
Call Arrow	Citing related diagrams for detailed description

3. Analysis of Problems in Each Process Phase by Using of IDEF

On the basis of responsibility relations for activity performers, the processes for finishing work were understood in the relations among the phases and the correlations among ICOM data related to operations of participation bodies, and then problems shown in each phase were analyzed.

3.1 Feasibility study at inception phase

The initial feasibility is analyzed by examining schematic design, and the result of the feasibility analysis, or estimations (construction cost, approval and permission cost, site purchase cost, contingency cost, design cost, apartment price, and home office overhead), which are used for calculating operating profit. After that, in a meeting on sales strategy, the CEO performs decision-making on business commencement and business schedule planning in beginning the business. There may be problems in this phase:

1) Error between rough estimated construction cost and actual construction cost
   Because there is no information on finishing work items in the calculating rough estimated construction cost in the analysis of earlier feasibility, it is not possible to draw cost based on it. This is analyzed not to be produced in activity for finishing work items.

2) Problem of establishing cost baseline in the initial feasibility analysis
   Failing to present cost baseline for finishing work item grades serves as a cost management problem in further phases such as planning, design, model house, actual budgeting, construction and sales.

3.2 Model House (Design, Change Order and Construction)

Figure 2 shows the process of designing, change order and constructing a model house (the mock-up of interior finishing work). The design of the model house is performed through investigating basic data and design documents according to project schedule, and the construction of the model house is achieved by using the results of the design of model house including finishing work items for each space and element and interior drawings.
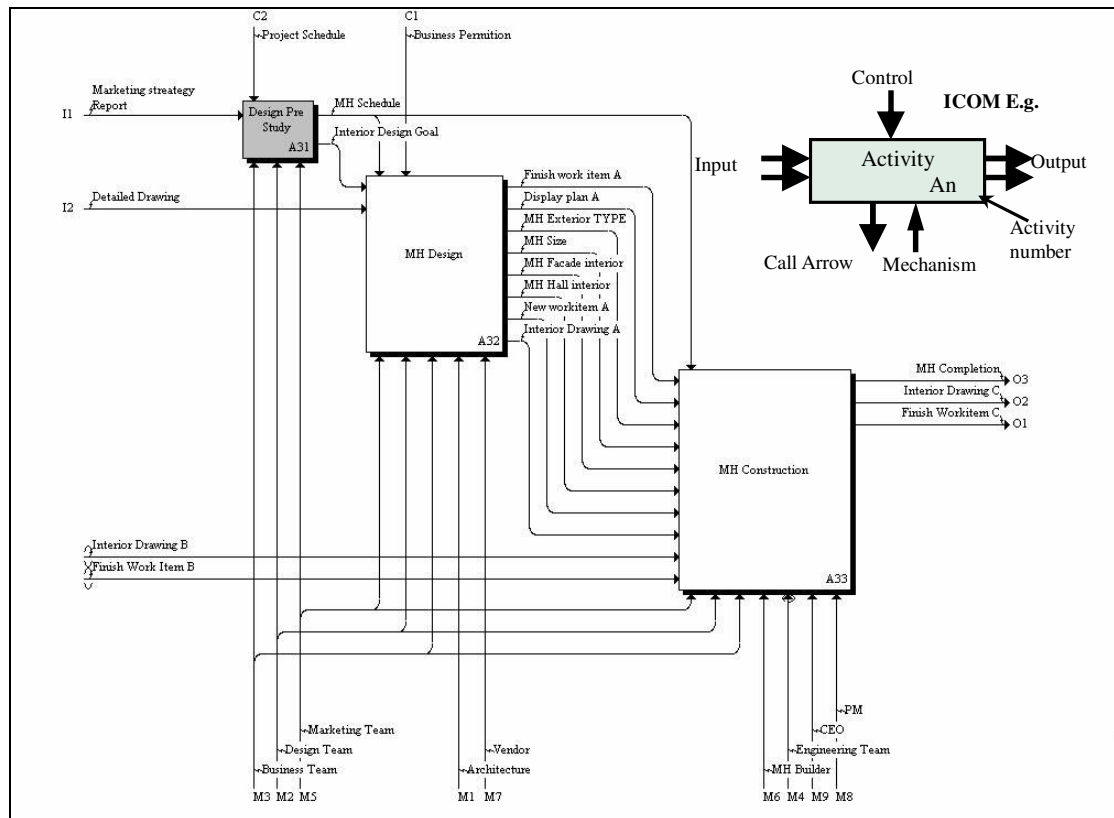

Figure 2. Model House (Design, Change Order and Construction) [A3]

In the construction of a model house, unit finishing work items are constructed and changed to be completed. Then the model house is completed after setting up a display, establishing a model house hall, and performing exterior work.

The results of completing the model house, such as interior drawings, the data of finishing work items for each space and element(specifications, detail drawings, photos and samples), are used as input data in calculating actual budget and in finishing work item construction in the future. There may be problems in this phase:

1) Cost control in model house phase

Because it is not possible to examine cost based on activity for finishing work item options that are required and changed in designing and constructing a model house, problems in cost control occur in decision-making regarding increasing and decreasing the cost for finishing work items.

2) Data management of finishing work items due to time transit

Because it takes at least one year to one year and a half to start actual construction of finishing work items after finishing a model house, there occur problems in the management of finishing work item options of design teams (such as detail drawings, photos, and samples) during the period. In other words, from underground construction through frame work to finishing work, management problems occur because of the absence of a system in which the properties of designing such as samples, specifications, and detail drawings can be contained.

3.3   Budgeting phase

The phase of actual budgeting consists of the examination of input data for finishing work items, quantity survey, construction cost survey, and feasibility study and CEO confirmation (See Figure 3).

Interior finishing work quantity is calculated from the input data of examining the design documents and the list of finishing work items for each work section which were adjusted in the phase of the examination of input data for finishing work items. The results are limited to the unit finishing work quantity for each work section in which the major subjects are almost excluded from the properties for finishing work items. The unit finishing work quantity for each work section is used as input data in calculating direct cost. The direct cost is estimated from the input data of unit quantity for each work section and unit cost, and then unit finishing work construction cost for each work section is estimated. By estimating indirect cost for direct cost, total construction cost is estimated.

In feasibility study and CEO confirmation, operating profit is estimated for the established total cost, price, and project cost. After CEO confirmation, the actual budget is distributed. Problems may occur in this phase:

1) Impossibility of examining the properties and cost of finishing work items for each space and element

Because actual budgeting applies to the construction cost for each work section, such as the estimation of direct cost, it is not possible to examine the properties and cost of finishing work items for each space and element.

2) Duality of information on finishing work item properties

The interior drawings and finishing work items for each space and element(such as specifications, detail drawings, photos, and samples) that were produced for the actual budget in the completion phase of the model house are re-arranged to be examined   from the list of finishing work items for each work section, and are used as basic data for estimating interior finishing work quantity. The results as unit quantity for each work section lead to the final results as the cost of unit finishing work quantity for each work section in estimating direct cost. The cost of unit finishing work quantity for each work section only has cost properties, and its properties on the basic information of finishing work item options (specifications, detail drawings, photos, and samples) are hoarded.
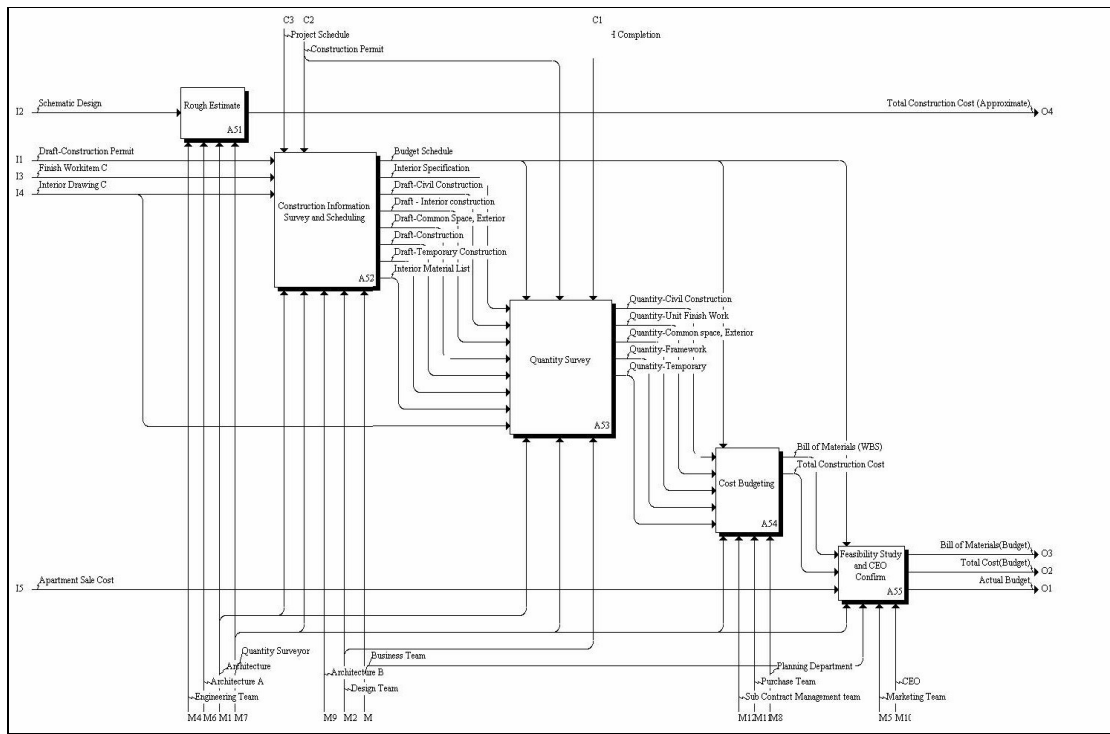

Figure 3. Budgeting phase[A5]

3.4   Construction phase

In this phase of constructing finishing work items, the design documents are examined, the budget is applied, the commencement of construction is approved, and finishing work is performed when the frame work is completed. Figure 4 shows the analysis of process for each detailed phase. When finishing work after underground construction, temporary work, and frame work are performed, the finishing work item information (samples, photos, and specifications) and interior drawings produced in the phase of completing model house are examined, and finishing work items request and subcontractor management are performed on the basis of the statement of items for each work section produced in the phase of actual budgeting to execute the unit interior finishing work. There may be problems in this phase:

1) Tracing and finding of finishing work item information

Because of the duality in planning, designing, MH, construction and finishing work item information for each construction phase and the diversification of finishing work item information for each phase, problems occur in recognition of the ultimately approved finishing work item data for each space and element in construction sites.

2) Operation Inefficiency due to the re-journalizing actual budget
Operational inefficiency occurs in re-journalizing as finishing work items requests and subcontractor management are performed on the basis of the statement of items for each work section produced in the phase of actual budgeting.
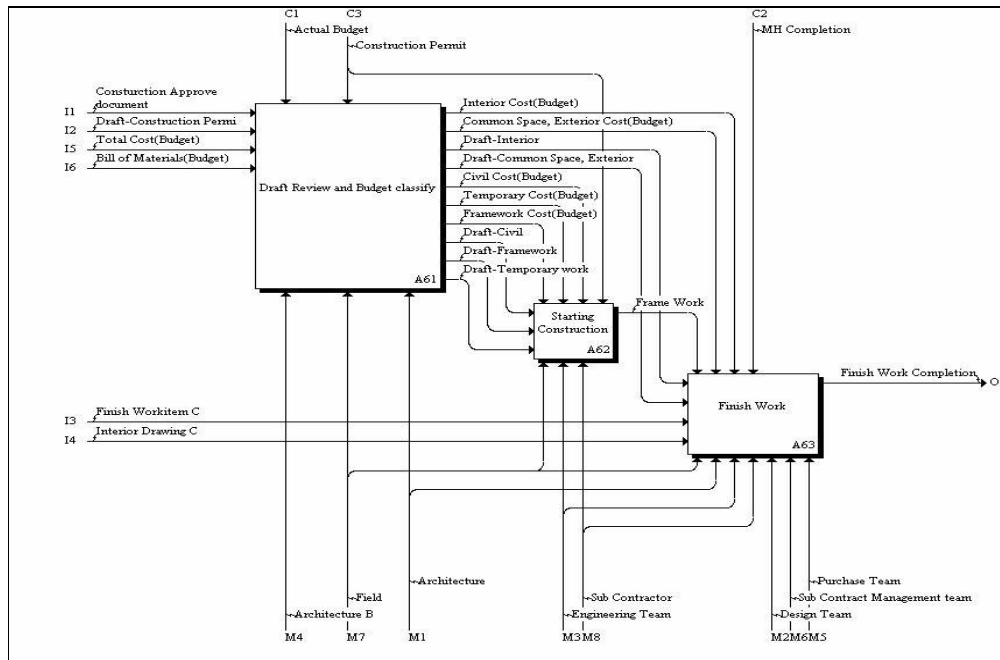

Figure 4. Construction phase [A6]

3.5   Problems of cost management

The problems of cost management are derived through the analysis of the processes for each phase. Although the properties of finishing work item activity are changed by the flows of each process including design phase, model house designing, change order and confirmation, the estimate of cost and the process for activity management are not presented. However, in actual budgeting, the properties of design and cost are re-integrated to cause inefficiency due to dual operations in re-arranging the finishing information for each work section and the construction of finishing work items. In other words, as seen in Table 2, it has been proven that project cost management for each phase is not presented.

Table 2. Analysis of Changes in Activity and Cost for Each Project Phase

Cost Classification	Design			MH		Budget (W.B.S)	Actual (W.B.S)
	None	None	None	None	None	Budgeting	Finishing Work Construction
	Schematic Design	Detailed Design	Interior Design	Change Order	Construction		
Activity	None	None	A	B	C	C	C

4. Improvement of Each Phase for Cost Management

As shown in Table 3, in order to improve the problems due to the absence of activity and cost change produced in each phase, cost management process for supporting all the phases of project processes should be improved.

As for solving cost blackout, in the analysis of feasibility in earlier phases, cost should be specified by an activity-based cost plan to solve the problem in the setup of baseline in the analysis of initial feasibility. After completing the model house without additional actual budgeting work, the established cost information is set up as the baseline of constructing finishing work items to remove the inefficiency of dual operations. The methods for improving each phase are as follows:

Table 3. Current and Improved Conditions in Activity and Cost for Each Project Phase

Classification		Current		Improvement		Remark
		Activity	Cost	Activity	Cost	
Design	Schematic Design	None	None	A-TYPE	A	
	Detailed Design	None	None	B-TYPE	B	
M/H	Interior Design	A-TYPE	None	C-TYPE	C	
	Change Order	B-TYPE	None	D-TYPE	D	
	Construction	C-TYPE	None	E-TYPE	E(Budget)	
Budgeting		C-TYPE	Budget	E-TYPE	E(Budget)	Budgeting process Reduction at finishing work
Finishing Work Construction		C-TYPE	Actual	E-TYPE	Actual	

1) Cost A is estimated for Activity A produced in the schematic design phase and is set up as the baseline of further phases (such as planning, designing, Model House, and construction), and Cost B is estimated for Activity B produced in the detailed design phase. Then, as seen in Figure 5, cost control is performed to identify if Cost B is estimated within the baseline (Cost A). [Control factor :   Cost B < Cost A]
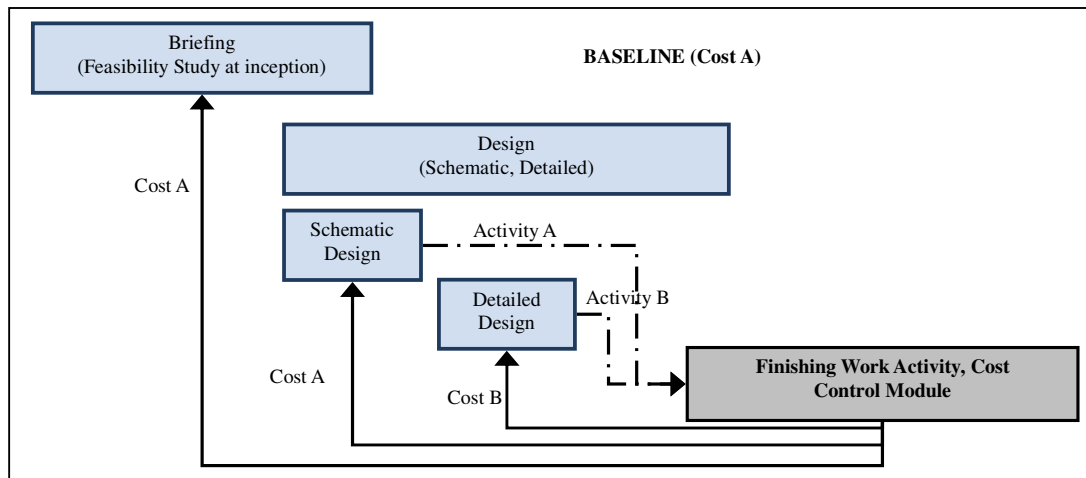

Figure 5. Cost Management in Earlier Phases

2) In the model house phase, as shown in Figure 6, activity-based cost management such as model house interior design, change order and completion is performed under the control of the baseline (Cost A), and Cost E produced after the completion of model house

is set up as the baseline of further phases including actual budgeting and construction of finishing work items.
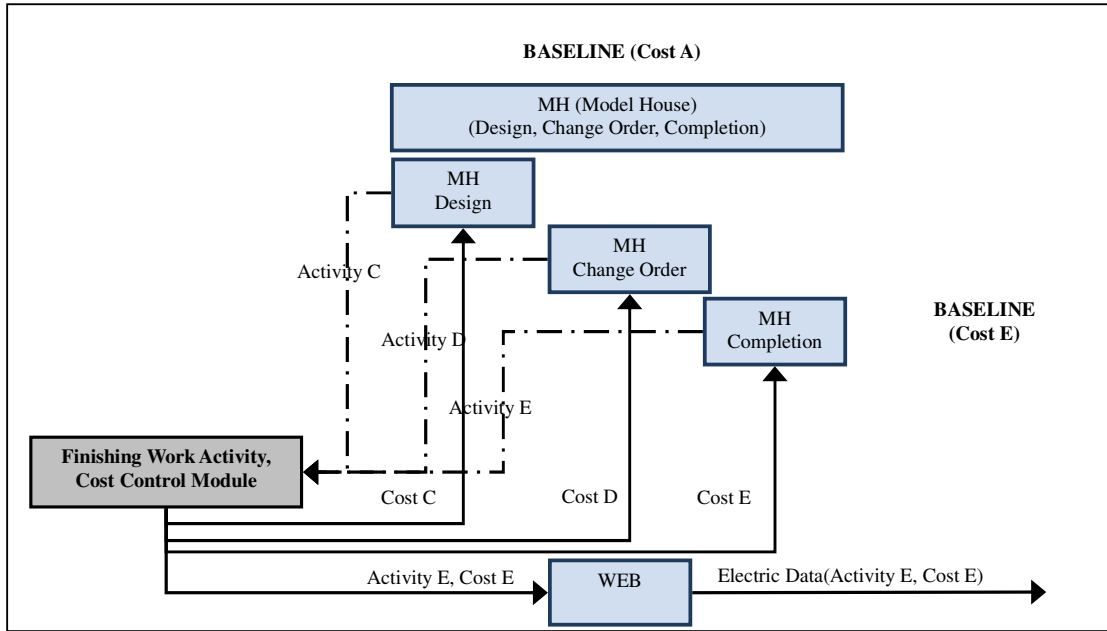

Figure 6. Cost management in Model House Phase

3) In the actual budgeting phase, Cost E produced in the completion of the model house is used in the total construction cost without additional budgeting work. In the construction of finishing work items, what is needed is a system which can be immediately used without requiring additional re-assortment and re-journalizing.
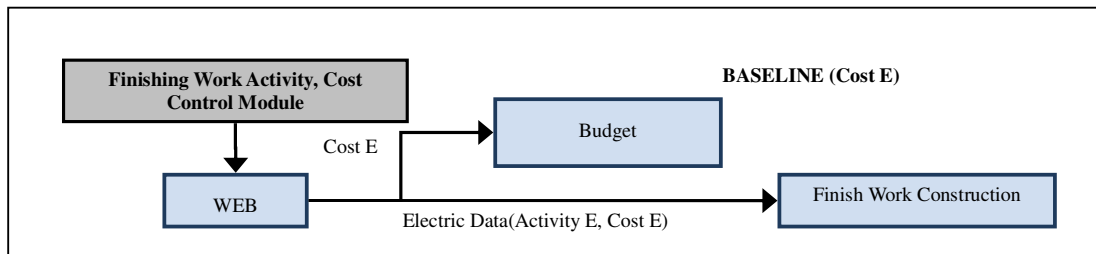

Figure 7. Cost Management in Actual Budgeting and Construction Phases

5. Conclusion

The earlier phases in construction management have relatively considerable influence on all the operation phases, but the accuracy of cost information is quite low. In particular, the diversification and flexibility of the finishing work options in housing make cost management difficult.

In this study, analyzed the current apartment housing processes focusing on finishing work by using IDEF, and suggested improvement methods after deriving problems in cost management in each phase.

For cost management on apartment housing interior finishing work, cost baseline should be set up in the earlier phases, and in the model house phase, cost management should be

performed for the interior design, change order, and completion of the model house under the control of the baseline. In the actual budgeting phase, the cost produced in the completion of the model house is used without additional budgeting work, and in the construction phase, the problem of the re-assortment of finishing work items should be removed and the search and tracing of finishing work items should be executed without difficulty. For the methods of improvement suggested in this study, further studies are required to establish a system of information management on finishing work items.

6.   Acknowledgment

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