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A Study on the Introduction of the Work Breakdown Structure for Infrastructure Asset Management

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Abstract: Several scholars in South Korea have predicted that maintenance costs of social infrastructure will sharply increase from the mid-2020s, and cause budgetary deficits among facilities management agencies. Interest in infrastructure asset management (IAM) is rising as a solution to such problem. In this study, an information system for asset valuation that reflects the salvage value and deferred cost of social infrastructure based on WBS (work breakdown structure) was developed in consideration of IAM. To reuse the construction cost information such as the acquisition cost, the interconnection between CBS (cost breakdown structure) and WBS was considered. Furthermore, asset valuation information was developed with XML schema to facilitate the exchange and reuse of the information among project participants.

Keywords: Social Infrastructure, Asset Management, Work Breakdown Structure, Asset Valuation

I. Introduction

As the operation period of social infrastructure becomes longer, their deterioration accelerates and their maintenance costs increase. Several scholars have predicted that the rising maintenance costs will be a major cause of budgetary deficits of social infrastructure management agencies. To solve such problem, interest in infrastructure asset management (IAM) began to rise in the late 2000s in South Korea.

IAM is a decision support system that determines an investment plan and the optimum alternative by considering conventional engineering aspects and estimating the value and depreciation cost of assets, in the process regarding social infrastructure as assets. However, IAM is still in its infancy in South Korea. In this study, a work breakdown structure (WBS) was introduced to connect the salvage value of assets with the construction cost and to facilitate information exchange among the project participants.

II. Case Studies

A. Infrastructure Asset Management

The Korea Institute of Civil Engineering and Building Technology (KICT) had researched on the introduction of IAM in South Korea from 2008 to 2012. KICT defined asset management as "a management strategy that aims to optimize infrastructure management, to evaluate the object as an asset, beyond the analysis of the infrastructure condition only in terms of engineering, and to ensure its value and improved service for the maximum satisfaction of the user". KICT presented an IAM framework appropriate for the development of an environment wherein engineering, economic, and business aspects are interconnected or integrated.

Infrastructures are not assets traded in the market, and their cost generation timing differs from that of other assets. Therefore, their asset value must be evaluated at specific time points. The Ministry of Strategy and Finance published the Infrastructure Accounting Guide in 2011 for the economic valuation of national assets based on accrual basis and double-entry bookkeeping (MOSF, 2011). This guide applies the acquisition cost, which is equal to the construction cost or the purchase price of an asset, plus incidental expenses. For the revaluation, the written-down replacement cost was applied to the asset valuation, as shown in Equation (1).

$$\text{Written-down replacement cost} = \text{Re-procurement cost}^* \times \text{Remaining useful life/Useful life} \quad (1)$$

*Re-procurement cost = (Re-procurement cost per unit × Quantity in the standard unit) or (Acquisition cost × Price multiple)

If a maintenance budget cannot be obtained even though the social infrastructures have an asset value, their repair and reinforcement must be postponed inevitably. The postponement cost is referred to as the deferred cost. The calculation of the salvage value and the deferred cost of social infrastructure is critical from the economic aspects of IAM.

B. Work Breakdown Structure

Most project methodologies and EVMS (earned-value management system) use WBS to plan and control the quantities, costs, and work progress, and to identify the performance results of the project. To improve the individual preparations and double management systems of the construction progress and cost, KICT began to develop the Standard for Digital Quantity Calculation (QDB) since 2005.

QDB is a system that specifies the digital

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information system structure and file formats, to facilitate the exchange and reuse of the quantity calculation information among project participants. It presents the information systems for WBS and CBS. The WBS information system defines and expresses the project scope as a logical structure by grouping project elements from the perspective of products into six hierarchical levels: the facility, work type, structure, directional space, expanded space, and account control. The quantity calculation information refers to a system of work items with WBS as the classification criterion, and the associated quantities and details.

III. Development of the Asset Valuation Information Structure based on WBS

A. Definition of the Logical Structure for Asset Valuation Information

IAM evaluates the asset value based on the salvage value and deferred cost of social infrastructure, to select the optimum maintenance option with the minimum budget. In this study, the asset valuation information of social infrastructure based on WBS for IAM was considered. Figure 1 shows the WBS information system and the asset valuation information structure for social infrastructure presented in QDB as logical structures.

In Figure 1, the 'tgValuation_IAM_Info' group element defines a group of asset valuation information of social infrastructure, which is connected to the CBS that corresponds to the account control or work package of WBS.

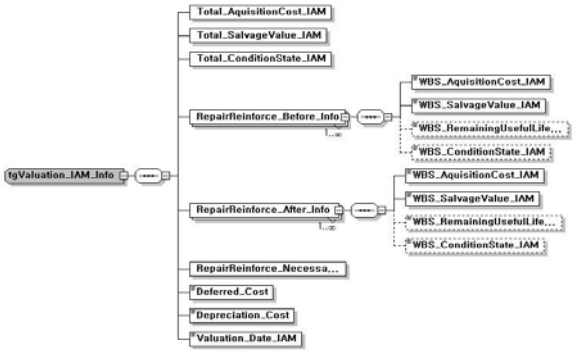

FIGURE 1. A logical structure for asset valuation

The asset valuation information includes elements that indicate the acquisition cost, salvage value, condition state, and remaining useful life separately before and after the repair and reinforcement for all facilities. Furthermore, to facilitate the exchange and reuse of construction process-cost information among the project participants, the logical structure of the asset valuation has been developed into an XML schema by applying the XML syntax rules. In this study, the applicability of the asset valuation information structure for social infrastructure based on the developed WBS was verified. Table 1 shows an example of asset valuation information for a social infrastructure that corresponds to the work package of WBS.

TABLE 1. Example of the Interconnection of WBS and the Asset Valuation Information Structure

(a) Interconnection between WBS and the Asset Valuation Information Structure

Work Breakdown Structure												Asset Valuation Information Structure
L1: Facility		L2: Work Type		L3: Structure		L4: Directional Space		L5: Expanded Space		L6: Account Control		Items
Code	Name	Code	Name	Code	Name	Code	Name	Code	Name	Code	Name	
F15000	Bridge	01	Structure construction	F15101NN	Bridge name	S31101	Upward	S13200	Superstructure work	S16140NN	Span N	Values by item based on the WBS

(b) Example of an Asset Valuation Information Structure

Infrastructure Asset Valuation Information Structure														
Total Acquisition Cost	Total Salvage Value	Total Condition State	Before Repair & Reinforcement				After Repair & Reinforcement				Repair & Reinforcement Necessary Cost	Deferred Cost	Depreciation Cost	Valuation Date
			Acquisition Cost by WBS	Salvage Value by WBS	Remaining Useful Life by WBS	Condition State by WBS	Acquisition Cost by WBS	Salvage Value by WBS	Remaining Useful Life by WBS	Condition State by WBS				
$15,000,000	$7,500,000	C	$75,000	$38,000	15	D	$90,000	$60,000	25	B	$40,000	$25,000	$7,500,000	20140608

IV. Conclusion

In this study, a method of introducing WBS to the selection of the optimum maintenance option through the asset valuation of social infrastructure from the economic aspect was proposed. For this purpose, a logical structure for the infrastructure asset valuation information was defined based on WBS, and it was developed as an XML schema. This study is significant because of its attempt to interconnect WBS and the infrastructure asset valuation information from the economic aspects. To implement the proposed method of introducing WBS for the use of asset valuation information in IAM, concrete objective evaluation standards for the salvage value, remaining useful life, depreciation cost, and deferred cost must be established.

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