

# Evaluating Effectiveness of BIM-based Idea Bank during VE Workshop

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**Abstract:** Value Engineering has been recognized as one of the construction management techniques for improving the value and benefits of whole project. However, due to the lack of the past data and inefficient free-thinking techniques, the idea generation during VE workshop is still inefficient and ineffective. Even though various studies related to theoretical methodology and technical systems relevant to database were conducted, VE team still mainly rely on their experience for idea generation. With this regard, this study suggests an approach of BIM-based idea bank and assesses its effectiveness by interviewing 20 VE experts in the industry. This approach covers the three steps of idea generation, consisting of 1) Developing BIM based VE database, 2) Generating VE ideas, 3) Updating VE ideas. The result showed that the proposed approach has great potentials to support VE team and improve the quality of VE ideas during creativity phase.

**Keywords:** Value Engineering, VE workshop, Creativity, Building Information Modeling

## I. INTRODUCTION

Value Engineering (VE) is one of the proven management techniques in the construction industry, which is applied to improve the function and to eliminate unnecessary costs of projects. However, due to the lack of structured VE data and ill-managed 2D based documents from past projects, the idea generation during VE workshop is often costly and time consuming. Even though various studies have been performed relevant to database and knowledge management system development for retrieving and reusing VE data, VE teams still mainly rely on their experience for idea creation [1]. With this regard, this study proposes an approach of BIM-based idea bank and assesses its effectiveness by interviewing VE experts in the industry. Using the BIM, the VE team can conveniently reuse and retrieve VE ideas from past similar projects through BIM models and also generate high quality VE ideas in short-time efficiently. In addition, the proposed approach can allow the VE team to modify BIM-based parametric objects in order to collaboratively work with various engineering disciplines.

## II. METHODOLOGY

Literature reviews on the theory and practices related to idea creativity in the construction industry was investigated for current issues. Afterwards, an approach of BIM-based idea bank is proposed by linking existing past VE database with parametric objects of BIM models. Finally, interviews and questionnaires with 20 VE experts in the industry were performed in order to evaluate the effectiveness of the proposed approach.

## III. CREATIVITY PHASE

The objective of creativity phase is to generate various ideas in terms of alternative ways. It includes workshop, brainstorming, and idea lists. In order to achieve the goals, VE team would collect related data including 2D drawings, the past ideas from similar projects, and functions analysis.

TABLE I. Current Status of Creativity Phase

Objectives	Procedures	Current Issues	Required Solution
Creative Idea Generation	Workshop	Lack of structured data	Systematically structured database
	Brainstorming	Inefficient technique (brainstorming)	Tool for supporting brainstorming
		Misunderstanding VE study area	Tool for visually understanding VE study area
Idea lists	Depending on VE team's experiences	Collecting the past data	

However, many studies show that the current issues of idea creativity have been recognized as follows: 1) *Lack of structured data*: Due to the lack of the structured data, VE teams performed idea generation relying on their experience [2]. 2) *Inefficient brainstorming technique*: The traditional way of idea generation mainly relies on brainstorming technique, which focuses on quantity without considering quality. Therefore, it is hard to achieve expected goals of VE [3]. 3) *Misunderstanding VE study area*: Inexperienced VE members cannot create good ideas during VE workshop, due to misunderstanding VE study area [1]. In order to overcome the above problem statements, state-of-the-art technology such as BIM can be utilized in the VE area. BIM has potentials to improve design quality and assist users to easily understand projects through 3D visualization [4]. Furthermore, it is can be systematically integrated with VE database based on logical relationships. From this point of view, it can visually support VE idea retrieval and generation and thus enhance the effectiveness of VE study.

## IV. APPROACH OF BIM-BASED IDEA BANK

The approach of BIM-based idea bank during the creativity phase covers three steps, consisting of 1) Developing BIM-based VE database, 2) Generating VE ideas, 3) Updating VE ideas, as shown in Fig. 1.

Firstly, developing the BIM-based VE database phase focuses on linking parametric objects of BIM with database of VE ideas. The VE database would be integrated with completed BIM models via breakdown structure coded by

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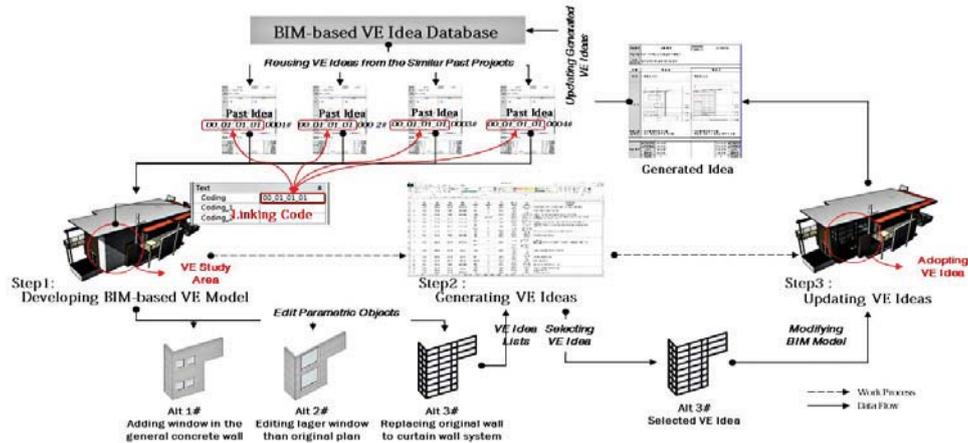


Fig. 1 Approach of BIM-based Idea Bank

the VE team. Through this step, the VE ideas from previous similar projects can be extracted from the parametric objects of BIM for supporting idea generation easily and conveniently at the second phase. For example, a VE team which wants to improve the value of a general concrete wall can input the code (00\_01\_01\_01) to the parametric objects. And then the past ideas, which was inputted same code (00\_01\_01\_01) can be extracted from the BIM model. Secondly, VE team can use BIM-based idea bank to visually refer and evaluate VE ideas from past similar projects and quickly generate their own ideas. As showed in Fig. 1, the VE team generates three kinds of alternatives for general concrete wall by using brainstorming. Afterward, they can virtually edit each alternative by adding windows or replacing curtain walls in the BIM model. Through this step, the VE team can effectively suggest VE ideas by comparing to the past VE ideas, and virtually editing parametric objects. Furthermore, inexperienced VE members would not only be trained but also generate good ideas during creativity. Finally, this step focuses on updating new BIM-based VE ideas from current projects to BIM models. Thus, VE team can select the “replacing curtain wall” optimal alternative and link VE ideas to BIM model by the code defined at the first step. Through this step, the past ideas can be reused and retrieved for future projects more effectively.

#### V. EVALUATING EFFECTIVENESS OF BIM-BASED IDEA BANK

In order to evaluate the effectiveness of BIM-based idea bank compared to the traditional approach, interviews and questionnaires with 20 VE experts were performed.

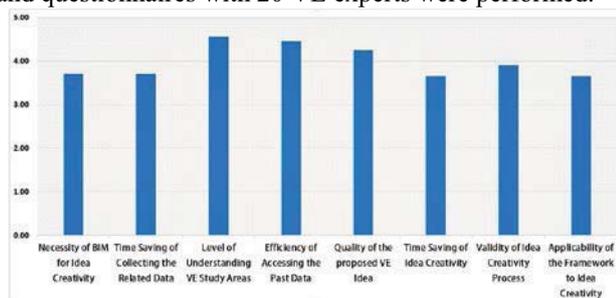


Fig. 2 Evaluation of Effectiveness of BIM-based Idea Bank

They are filled out a 5-points Likert scale from strongly disagree (1) to strongly agree (5). As illustrated in Fig. 2, the result showed that mean of each criteria ranged from 3.57 to 4.57. Most of the participants seem to be in favor of the proposed approach. In particular, it has great potentials to support understanding VE study area (4.57), efficiency of accessing the past data (4.42), and quality of proposed VE ideas (4.26).

#### VI. CONCLUSIONS

This study suggested an approach of BIM-based idea bank for improving the current issues of the traditional creativity phase. It comprises of three steps: 1) Developing BIM-based VE database by linking parametric objects of BIM with VE ideas, 2) Generating VE ideas by editing parametric objects of virtual 3D model, 3) Updating VE ideas in order to reuse and retrieve the data for future projects. The feasibility and applicability of the proposed approach was assessed through interviews and questionnaires with 20 VE experts. The results showed that it can support visual VE data retrieval and improve quality of VE idea generation.

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