



A Critical Review of Value Engineering Development in Indonesian Construction Industry

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Abstract

Instead of Value Management (VM,) term of Value Engineering (VE) in Indonesia has been known over three decades. So far, there seems to be scanty attention, if any, from academia to summarize and review practical application of VE, particularly in construction industry. This paper, therefore, attempts to encapsulate and critically review the extant of VE application in Indonesian construction industry. The review presents the development of VE, identifies the opportunities and challenges and proposes new direction for future development. Both document searching technique and literature review were undertaken to find and view the existence of the methodology. It can be said that the practical application of VE in Indonesian construction projects is running in place. Four shortfall issues contributing to this patency were identified comprising lack of regulation, promotion, knowledge and expertise. Nevertheless, there are still big opportunities to echo and develop this methodology.

Keywords: Value engineering application, Construction Industry, Indonesia, Critical review

1. Introduction

In the current globalization era, substantial improvement in both technical and management aspects constitute an inevitability in all kind of industry, including construction. In the last two decades, this industry has changed dramatically in term of practical implementation, managerial and technology aspects in order to meet the latest required standard. Construction practitioners are challenged to propose innovative and efficient approaches for addressing customers' demands. Unfortunately, this sector often fails to encounter contemporary issues because of lack of idea. In contrast, manufacturing industry has made successful leapfrog in generating innovative technology and management solution to deal with current problem. Many inventions of manufacturing industry especially management system, then has been adopted by construction industry. One of the techniques is Value

Management (VM) or Value Engineering (VE) methodology.

Since firstly introduced at General Electric Company by Lawrence D. Miles in 1947, development of Value Management (VM) technique becomes increasing on modern-day discussion of construction projects. As a unique management tool, VM can play important roles to reduce unnecessary costs and is convinced as a basis for enhancement of investment return in construction through increasing competitiveness, providing better satisfaction and mitigate the globalization impact on industry [1].

Studies on VM present an increasing recognition and application in a number of business sectors, including construction area. This development has also been followed by establishment of VM professional institution in several countries such as Society of Value Engineering (SAVE) in the United State,

Institute of Value Management in the United Kingdom, Australia, Hong Kong, Malaysia and other several countries [2]. In Indonesia, similar organization had also been established in 2006 and legalized in 2007, known as *Himpunan Ahli Value Engineering Indonesia - HAVEI* (Indonesian Association of Value Engineering Professional).

Indonesia currently has been under investigated regarding the application of VM/VE in the construction projects. Relatively speaking, Indonesian construction industry is still left behind in adopting this methodology compared to neighboring countries, Malaysia. Thus far, there has been no report issued officially about the implementation of VM/VE in local projects. Similarly, very scanty research outputs have been disseminated globally in the context of Indonesian industry. This paper, therefore, aims to present the latest development of VM/VE application and critically review its development in Indonesian construction industry. The contribution of present study on one side assists the industry to more conceive the benefit of VM/VE and on the other side enrich further to vibrant body of VM/VE knowledge.

This study was conducted based on literature review of document obtained from text books and information retrieval in internet. References search used combination of specific keywords including “value management”, “value engineering” and Indonesia”. Among the type of references successfully gained include journal article published in international and local journals, thesis stored in online library repositories, governmental document such as acts and regulations as well as official website of institution. These documents were then used to support facts and argumentation of VM/VE development in Indonesia.

2. Concept, Application and Development of VE/VM

A. Definition

As a strategic management approach, VM has been proven in assisting various types of project's stakeholders to attain objective, value for money, to the client. Shen and Yu [3] highlighted the discussion and clarification, understanding of the project, simplification of communication, built trust, ownership and commitment among different stakeholders as the critical value of this approach. Following definitions are provided to explicate the nature of this term.

“An organized function-oriented systematic team approach directed at analyzing the functions and costs of a product system, supply, equipment, service or facility, for the purpose of enhancing its value through achieving the required functions specified by client at the lowest possible overall cost, consistent with requirement for performance” [4]

“A proactive, creative, problem-solving or problem seeking services which maximizes the function value for a project, product, services, system or facilities by managing its development from concept to use. The process uses structured, team-oriented exercise that make explicit and appraise existing or generated solutions to a problem by reference to the value requirements of the client” [5]

“A rigorous, systematic and innovative methodology with multidisciplinary approach to achieve better value for project, products, facilities and system without sacrificing the required performance level. Is a creative way of working together in achieving client and stakeholder's requirements” [6]

“The application of systematic process used by a multidisciplinary team to improve the value of project through the analysis of function to achieve strategic value improvement” [7]

“A value-focused management style within an integrated framework based on the relationship between satisfying needs, expectation and the resources required to 31 achieve them to create sustainable value through unique combination of management principles and proven tool by focusing on objectives and function to enhance innovation” [8]

Various lexical semantic definition of VM/VE has been proclaimed by different scholars and professional institutions as mentioned above. As long as this field is concerned, researchers gave their opinion on VM by imitating and modifying the definitions as defined by past studies. The definitions, like others, merely repeat almost important points but leak of insight into the concept. As admitted by Green and Liu [9] that VM theories to support its applications are drawback. All

acceded and emphasized that VM/VE is a systematic team-approach (multidisciplinary team), function-oriented, focused on value enhancement of a product, system, supply, service or facility at the lowest possible cost by proposing applicable solution which consistent with customer requirements.

B. Value Management Methodology

There will be always worthless items or elements in any product or project contributing to poor value in which they have to be dealt with. These items are results of time limitation, habitual thinking, lack of communication and coordination process, poor standards or specification, outdated technology, reluctance to seek advice and poor human relations [10]. This philosophy can be found in construction industry that some unnecessary costs are inevitable in the course of project stages due to the nature of the industry. VE in this industry therefore focuses on the assessment of alternative material, construction method, assembly technique, and life cycle cost analysis strengthen [11]. VE was then designed to eliminate and improve these elements and to reach efficiency and effectivity by three following approaches EUR 16096 EN 1995 in Shen et al [2]:

- *Cost reduction.* This method is carried out by maintaining the required function and quality of product, while reducing the cost.
- *Function increase.* This way is undertaken by enhancing the required function and quality of product, while maintaining the cost.
- *Hybrid.* This technique adopts both cost reduction and function increase methods in which increasing the function and quality of product and reducing the cost at the same time.

VM methodology provides a platform for the project participants to identify the project objectives and derive optimal solutions to fulfill the client's needs. VM is conducted through several hierarchy phases called as *job plan*. Well-organized VM job plan is the key success in a VM workshop [12]. There are four models of VM job plan designed by different institutions including US Environmental Protection Agency (EPA), General Service Administration (GSA), SAVE and the original model from General Electric Co. (GE) (see Table 1). The most common version of VM job plan follows the SAVE involving six phases, from information to presentation comprising information phase, function analysis, creativity,

evaluation, development, and presentation [7]. Other scholars divided the job plan into five stages consisting: information, speculation, evaluation, development, and recommendation [13] [14]. Due to word limit, the process in each phase is not revealed in detail.

Table 1. VM Job Plan Variations

<p>GE</p> <ol style="list-style-type: none"> 1. Information phase 2. Creative phase 3. Judgement phase 4. Development phase 5. Recommendation phase 	<p>EPA</p> <ol style="list-style-type: none"> 1. Information phase 2. Creative phase 3. Analytical phase 4. Investigation phase 5. Recommendation phase 6. Implementation phase
<p>GSA</p> <ol style="list-style-type: none"> 1. Information phase 2. Functional analysis phase 3. Creative phase 4. Judgement phase 5. Development phase 6. Presentation phase 7. Implementation phase 8. Follow-up 	<p>SAVE</p> <ol style="list-style-type: none"> 1. Information phase 2. Function analysis phase 3. Creativity phase 4. Evaluation phase 5. Development phase 6. Presentation phase

Sources: Adopted from Johan [12]

According to Yu [15], information phase is aimed to provide a platform of workshop in which all participants understand the background, scope, and limitations of the project being studied and assist to make any judgement and clarification on assumptions during the workshop. Function analysis phase constitutes a vital stage in VM workshop aiming to recognize, categorize and develop the most advantageous functions for further study [2]. This phase is undertaken through a systematic hierarchical procedure called Functional Analysis System Technique (FAST), a technique to develop function relationships based on intuitive logic of HOW-WHY relations [7]. In creativity phase, VM participants are urged to explore their ideas as many as possible in connection with accomplishing functions identified in function analysis phase. Any irritation by such as habitual thinking, tradition, negative attitudes, etc. which may disturb participant in expressing their opinion have to be avoided [16]. Therefore, judgement, argument or discussion is prohibited during this phase [17]. Ideas generated during creativity phase are examined to find the most feasible alternative in evaluation phase. Evaluation matrix is used to rate or score the alternatives based on determined criteria [7].

Development phase in VE workshop aims to seek the real value from the best alternative obtained earlier, written recommendations have to be prepared [2]. Based on SAVE [7], the chosen alternative then is distributed especially to client and his design team together with necessary data to allow them to make initial consideration. Finally, consensus and commitment of all stakeholders have to be reached. A final proposal containing all recommendation is prepared and sent to client to seek approval. All proposed alternatives together with supporting data is then compiled by VM team in a final report.

C. Value Management Application in Construction Industry

Many modern industries have acknowledged VM methodology as an evolutionary approach which may increase competitiveness. According to Dell'Isola [18] VM may contribute to the total project cost saving in the range of 10 to 30 percent, while in investment, it may save one to three percent of initial cost. Historically, VM or Value Analysis, as the first name, was developed in General Electric Company to find substitution of material due to shortcoming of raw materials [19]. Further historical development of VM can be seen in Shen et al. [2].

In construction industry, the role of VM/VE was explored by many scholars, optimizing the result, this technique should be performed at the early stage of project [18]. Dennis [20] strengthened the point for the greater potential cost reduction if VM is undertaken at the early stage. In planning or design stage, VM has a role in examining design, construction method, schedule, and quality assurance method. The role benefits to project's stakeholders as impeding unnecessary cost and waste time caused by design changes while construction works as stated by Sasaki 1994 in Cheong [21]. Whereas, in construction stage, VM could be conducted to review constructability, material and facilities selection and even to evaluate contracting package especially for general condition section. La Ruffa [22] convinced the contribution of VM in reducing cost when assessing the general condition of contract.

D. Value Management in Specific Country

A number of countries have witnessed the successful applications of VM in the construction industry. In the US where this methodology was created, governmental bureaus and agencies as well as federal and local government such as Department of

Defence, General Service Administration, Department of Transportation and even National Aeronautics and space Administration (NASA) realized the importance of VM and boosted to implement it in many strategic projects [18]. In Canada, study by Male and Kelly [23] found that VM has been recognized in the early 1980s. Whereas, according to Canadian Society of Value Analysis [24], in 1973, McGill University introduced VM course in Mechanical Engineering department to narrow the gap between student and industry. Federal government such as Quebec, Ontario, British Columbia and Manitoba has actively introduced VM study through conducting workshops and training and used VM methodology in various infrastructure projects such as waste water treatment, hydro power and transportation.

There are different opinions when VM was exactly introduced in Europe for the first time. Commission of the European Community (1991) in Shen et al. [2] noted the recognition around 1955 to 1960. The Commission recorded a potential demand in which 38,000 VM activities were undertaken in consecutive five years until 1996 all around European nations. In addition, an interview survey on VM cases showed that 83 percent participant having experiences in VM considered as a great success and 97 percent recommended it in the future. Parallel with the noticeable advantages of the approach, several European countries established VM association aimed to promote awareness the importance and standardize the VM methodology. Institutes of Value Management (IVM) has been set up in 1966 in UK, *Verein Deutscher Ingenieure* (VDI) – Zentrum Wetr Analyse (ZWA) in Germany in 1974, *Associate Francaise pour L'analyse de la Valeur* (AFAV) in France in 1978 and *Associazione Italiana per L'analisi del Valore* (AIAV) in Italy in 1985 [2] [4].

The development of VM application in the region of Asia Oceania is represented by Australia and New Zealand, Hong Kong, and China as among early countries recognizing this techniques. Awareness of importance of VM in Australia began in 70s and followed up by establishment of Institutes of Value Management Australia (IVMA) in 1977. Yet, its application in construction projects in Australia began in the late 80s. Together with New Zealand, a practical standard of VM methodology, AS/NZS4183:1994, was proposed (IVMA, nd). In Hong Kong, Architectural Service Department (ArchSD) is

among leading bodies initiating VM studies in construction sector. Since the first introduced in 1988, Hong Kong construction projects have actively utilized the methodology at various types of project [2]. In line with the development of VM studies in Hong Kong industries, in 1995 The Hong Kong Institute of Value Management (HKIVM) was set up. Three years after establishing HKIVM, the Chinese Society of Value Engineering was founded. Historically, VE was introduced in mainland China in 1987, coincide with economic reform in this country. A number of industry sectors such as manufacturing, mining, agriculture, commerce and services applied VA methodology in their activities. Though, the intensification of VE study increased and booked a fantastic cost saving (RMB 500 billion) in the late 1980s, gradually, this technique is becoming obsolete in the new environment. Government policy to cut-off all kind of administrative irritation in normal working procedure to introduce new market economy strategy is convinced as a major factor [2] [25].

3. VE Application in Indonesian Construction Industry

A. Development of VE in Indonesia

In Indonesia, the term VE is used synonymously with VM and VA and more familiar than the two later terms. For the sake of simplicity, the term VE will be used in discussion of Indonesian context. This section begins with a short history and research development related VE in this country followed by common perception on VE in community.

Development of VE in Indonesia, so far has not been traced chronologically by Indonesian scholars. A number of academia e.g. Latief and Untoro [26]; Kaming and Prastowo [27]; Zheta and Sesmiwati [28] agreed that VE was introduced in Indonesia in 1986 through seminars and workshops. In the initial years, not stated clearly, VE was implemented in a few of infrastructure project such as *Cawang fly-over*, *Tomang fly-over*, *Jakarta interchange*, *Toll road Padalarang-Cileunyi* [28]. The later scholars stated that an evaluation of *Value Engineering Change Proposal* proposed by contractor was carried out for Toll road *Padalarang-Cileunyi* project by Directorate General of *Bina Marga* of Ministry of Public Work. Another source, Susanto [29] asserted

that this technique was introduced by Dr. Ir. Suriana Chandra in 1986. He further explained that starting in 1987, *Badan Perencanaan Pembangunan Nasional* (National Development Planning Bureau) together with Department of Finance and Directorate General of *Cipta Karya* (Building and Housing Affair) encouraged the use VE study in development of government staff housing and office building. Unfortunately there has no published document recording the VE process on such projects.

In terms of regulation, in Construction Service Act No. 18 year of 1999, application of VE in construction sector is not stated explicitly, however, implicitly there is two indications that this methodology may be implemented in government projects. The indication is shown in the explication sheets of the act as follow:

Clause 2 – Principle of Honesty and Fairness, “... all construction service activities should be conducted under the principle of capability and professional responsibility, efficiency and effectively ...”.

Clause 16, verse 3 – “The integration of the three functions in a model of engineering, procurement and construction, while ensuring the realization of efficiency”.

The word “efficiency” in above verses implies that every activities in construction industry have to be carried out in any possible way to achieve the optimal standard quality of works in the range of a budgeted cost.

In 2007, Ministry of Public Works issued a regulation of Technical Guide for Public Building Construction (Reg. No. 45/PRT/M/2007) [30]. This regulation clearly states that Project Consultant for development of public building with gross floor area above 12,000 square meter or higher than 8 floor is mandated to conduct a VE workshop at design/planning stage (p. 67). VE workshop is one of activities in Technical Planning works aiming to improve conceptual design/planning (p. 68). In order to suggest an alternative bidding, if it is required, contractor candidates may propose VE Change Proposal at tendering stage (p. 74). This regulation also allocates the proportion of cost saving resulted of the VE Change Proposal to be distributed to involved parties (p.74). For example, if VE study results USD 100 of cost saving, USD 60 is allocated for increasing quality or adding scope of work or refunded to state treasury. Other USD 40 is shared among Contractor (USD 25), Design Consultant (USD 10) and Construction Management Consultant (USD 5, if any) or sent

back to state treasury. Finally, the term of VE is explicitly stated in Ministry of Public Work Regulation No. 06/PRT/M/2008 [31]. The regulation urges the use of VE to review and analyze if any inefficiency indication on design/planning, working methods, construction methods and construction material and equipment selection [30] [31]. In higher educational institution, subject VE has been introduced in Master degree classes especially in Building, Construction and Industrial Engineering related departments. Again, it has been unknown exactly when the subject was firstly introduced. Table 2 shows the major historical of VE development in Indonesia.

Table 2. Development of VE in Indonesia

Year	Major historical development
1986	VE was introduced through seminars and workshops.
1990s	Informed that several government projects have implemented VE methodology and VE Contractor Change Proposal during this period but there has been no authentic evidences published or official document stated the activities.
2006	Association of Indonesian Value Engineering Expert (<i>Himpunan Ahli Value Engineering Indonesia – HAVEI</i>) was established.
2007	Ministry of Public Work issue a regulation No. 45/PRT/M/2007 stating a mandatory for VE study for specific public building projects at design stage and a VE Change Proposal can be proposed by contractor at tendering process.
2008	Ministry of Public Work issue a regulation No. 06/PRT/M/2008 stating that VE methodology can be applied for any indication of inefficiency in construction and working method.
2015	Ministry of Employment issue a decree for National Standard of Competency for Value Engineering expertise (<i>Keputusan Menteri Ketenagakerjaan No. 159 Tahun 2015</i>).

B. Opportunity and Challenges of VE Implementation

The construction sector in Indonesia markedly has contributed in national development. In the last decade, this sector grew over 7.5 percent and contributed to economic growth above 10 percent in the last consecutive three years. While, GDP of construction sector based on basic current price

hit IDR 907.3 trillion in 2013, up to 7.5 percent from 2012. In order to accelerate the economic growth, the government has set up a program for acceleration and expansion of Indonesian economic development well known as MP3EI. The total investment for the projects was estimated IDR 4000 trillion, from 2014 to 2025. Previously, government through the Ministry of National Development Planning has already set up 100 infrastructure projects under the Public Private Partnership scheme, with total investment USD 47.3 billion for the year of 2010 to 2014 [32].

This above reality provides opportunities and challenges at the same time for construction stakeholders in Indonesia. Government as key player in setting the projects and budget has two main objectives. All programs can be performed as efficient as possible in every aspects and they give benefit to society welfare. Both objectives allow government to encourage other construction stakeholders to propose the best methods, management and technology to deal with the large size and mega projects. Encouragement of VE application particularly in the early stage of such projects is appropriate and recommended. Large size and mega projects commonly encounter change of design in every stages due to several aspects such as insufficient time, lack of information, idea and habitual thinking of designer. Government's notion to apply VE in strategic projects may be embodied by VE workshop or VE Contractor Change Proposal. The side effects of above scenario create opportunities for VE development in the future as follows:

1. Law enforcement on regulation of VE implementation in construction projects,
2. Promotion and sufficient facilities for conducting VE workshops and trainings,
3. Increasing research and development of VE application by academia,
4. Establishment of HAVEI as training center and accreditation for VE experts, and
5. Development of subject VE in higher education institutions.

As mentioned early that information of VE application in Indonesian is very limited. This may be caused the number of VE study applied in project are little as well. Based on observation and referring to previous research, there are four main issues toward application of VE in Indonesia. The four issues constitute a challenge to be addressed wisely by Indonesian construction industry stakeholders. They are as follow:

1) *Lack of regulation.*

Government as a major client in construction industry has not been actively role in promoting and implementing VE in their projects. Latief and Untoro [26] highlighted the absence of regulation underlying VE implementation for government project in particular. Since firstly introduced in 1986, almost two decades, a regulation accommodating VE methodology was issued. However, law enforcement on both regulations (Reg. No. 45/PRT/M/2007 and Reg. No. 06/PRT/M/2008) have not been executed exhaustively. Zheta and Sesmiwati [28] strengthens that the lack of regulation backing up the approach affects to its implementation. While, such regulation is directed only to building projects and not to accommodate other infrastructure project [26]. The obligation of VM by government has provided definite contributions [18]. For instance, the mandatory of VE in government projects in the Australia is regulated by Australian Capital Territory Associations Incorporation Act (1991), while in Malaysia is set up by Economic Planning Unit Circular No.3 (2009) of Prime Minister's Department [33]. In the case of Indonesia, instead of issuing a VE regulation, a higher regulation level (e.g. *Government regulation*) is more effective way for obligating government to implement it.

2) *Lack of promotion.*

Information about advantages and benefit of VE methodology, so far, spread over through discussions, training and workshops. There has not attempted to disseminate the results of VE studies undertaken in the past. Reflecting on China, this country enjoyed hundred millions cost saving in the late of 1980s resulted of a massive promotion of VE in various sectors. In Hon Kong, other than institution and industry as main actors in promoting VE, academia has contributed significantly in the context of research and development [2]. In contrast, socialization and promotion conducted by HAVEI as VE expert organization is not optimal since the activity was carried out centralized in several cities only. While, research and development conducted by academia have not influenced significantly to VE existence. Berawi et al. [34] observed that lack of promotion and publication as one factors causing VE less popular in Indonesia.

3) *Lack of knowledge.*

Equalizing VE and other cost reduction technique is main problem in implementing VE in Indonesia. Prastowo [35] found that cost

reduction as result of VE is the most considered by construction practitioners rather than value for money or added value improvement. Such understanding leads to misconception in implementing VE study. Furthermore, many thesis and final project of university students explored and simulated the VE methodology into current or past projects, for instance VE application to floor slab of official building [29], VE application to housing project [36], VE application to floor slab and beam of student dormitory project [37] and other similar works. The concept of VE methodology is definitely misleading in such works by simply change of construction method and material which contribute to cost reduction, even VE job plan procedure were reported. VE methodology is not merely a cost cutting or cost reduction technique. Four key components contrasting VE to other cost efficiency method are systematic process, multidisciplinary team approach, function oriented and value [2]. It is a noticeable mistake if considering above studies as VE application. There are two factors contributing to the misperception. First, student did not obtain comprehensive information about VE and second, students have never involved in a VE workshop simulation.

4) *Lack of expertise.*

There are two components in a VE workshop, VE/VM facilitator and participants. Theoretically, VE facilitator a person who assist to facilitate and arrange a VE workshop starting from pre-workshop to post-workshop stage. VM facilitator significantly determines the success of the VE workshop [38]. He/She is acknowledged as expert by accredited professional institution. Several countries such as the US, Hong Kong and Malaysia have certification body to certify VE facilitators. Shen [25] and Leung [39] opined that the certification system is crucial for certifying the competence of the VM facilitators. Regarding VE facilitator in Indonesia, so far there is no accredited board certifying VE facilitator. HAVEI as an institution has not had a manual for assessing VE facilitators. HAVEI activities and program tend to focus on socialization and promoting VE through short courses and trainings. The question is, to what extent Ministry of Employment issues National Standard of Competency for Value Engineering expertise for Indonesia? This question should be addressed by HAVEI and a review on the standard have to be carried out as well.

4. Conclusion

Value Management (VM) or Value Engineering (VE) is a powerful management tool being able to bridge the lack of conservative reducing cost techniques. Although this method has entered in Indonesia almost three decades, in reality, VE has not been actively implemented. This paper aimed to present the development VE in Indonesia and critically review the opportunity and challenge of its existence.

Four key issues becoming major challenges of VE implementation in Indonesia are lack of regulation, lack of promotion, lack of knowledge, and lack of expertise. To cater these shortcomings, government rule is extremely crucial. Government as main client in construction projects can regulate a strategic policy to encourage the use of VE. In parallel, other efforts have to be carried out to echo the existence, increase the number of expertise and provide regular trainings and courses around country. Considering Indonesia is among the largest construction market in Asia, this condition obviously gives opportunity for VE implementation to be more develop.

It is realized that this is not an exhaustive study. Literature review conducted to a few number of document and manuscripts is not enough to come out with a comprehensive conclusion. At least, this paper can provide a reflection of Value Management existence in Indonesia for providing direction to future research.

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