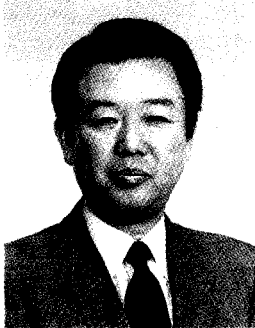


## VE APPLICATION AND MANAGEMENT IN JAPANESE CONSTRUCTION SECTOR

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### ABSTRACT

This paper first focuses on how application and management of VE in the Japanese construction has recently been accelerated not only among private construction firms but also within government and other public organizations. Then, based on the analysis of the result of a survey, the state of the art of VE application and management is described. Finally, potential issues and future prospectives in subject area are delineated.

### AN OUTLINE OF JAPANESE VE APPLICATION IN CONSTRUCTION

#### How VE was introduced in construction

In the latter part of the 1960's Japanese construction circles became interested in VE as stimulated by what the manufacturing sector had already been claiming remarkable application results, particularly in material procurement, product design, etc.

At that time, however, construction people had wondered how they can apply manufacturings' VE. The main issues were:

- \* VE application in construction cannot expect such "mass production effect" as can be realized in manufacturing: Construction orders are usually "one-time deal" in terms of varied specifications different circumstances and environmental conditions.
- \* Construction design and site construction work being performed by separate firms each other; readily allowing such design changes as would be required by VE application. In most cases, construction design is being done by A&E firms and/or by governmental design staff as owners, and site construction is done by contracted construction companies. Thus, contractors can see little VE benefits from design changes.

The fact that interest in VE application had been taken mainly by major contractors rather than the "owner circles" has put forth these issues.

Thus, some construction firms who became aware of VE as an effective management methodology started studying to find its appropriate way of VE evaluation at that time. Along with this, some construction members of SJVE organized a VE application group study activities in 1971. I was one of its starting members.

Through these VE research and study activities, VE application in construction gradually introduced many VE papers, case studies, research study reports, etc., thus, some private construction firms became interested in introducing and applying VE.

Increased VE application among private construction firms

As of July 1995, the active membership counts 70, occupying almost 20% of SJVE company membership. It is notable that the construction membership keeps growing since the 1980's.

The VE Application Research Group since its organization in 1965, consisting of interested inter-company members (either nominated or solicited), keep pursuing research on selected VE-promoting and/or "needed" subjects. So far, 24% research subjects have dealt with construction themes.

Explicit indications of active promotion of VE application are seen in the number of VE papers and case reports presented at SJVE's annual national conferences.

The cumulative total number of VE papers and case reports presented at SJVE events during the 27 years up to 1995 is 570, 151 of which (26%) is on various construction subjects.

So, it can be said that the private construction people are earnestly utilizing VE as well as achieving substantial results of application.

The specific areas of case reports on VE application can be broken down as follows:

Site Construction work	1
Building facilities,	18
Building structures	8
Administrative/management operations	8
Temporary construction structures	5
Construction equipment and components	3

Evidently, VE application has been most active in site construction work, with other areas being covered as well.

Increasing VE interests being taken by government and other public sectors.

The building construction Society began taking up VE application study to deal with public construction work projects. Also, in 1989 the industry organized a Construction Business Renewal Review Committee, with a study focus on the contract systems as being practiced in public work projects. They submitted a petition to the Ministry of Construction, including a proposal for the adoption of a "VE proposal system."

A notable trend in the first half of the 1990's is that some of public administrative bodies started reviewing and then adopting VE. For example, the Kobe Municipal government made contracts with VE-requiring clauses. Fukuoka municipal government followed suit. In 1993 the Tokyo metropolitan government tentatively implemented an in-house VE program, and based on its validity decided on a full VE promotion policy recently.

Now, the Housing Bureau of the Ministry of Construction, one of the central government agency, entrusted the Japan Construction Center Foundation to initiate a VE application research in 1993 for "stimulating owners' need for VE application for better cost management, based on their awareness of the importance of better cost management at the design phase on the part of building owners toward reducing construction costs." The review results were published in 1994 as "The review report on the cost management and owner adoption of VE at, the design phase on the part of building owners".

Further in 1995, the Ministry of Construction announced a more comprehensive action plan meant for overall reduction of public building construction costs. Its specific measure included a VE application plan to study VE and promote "design-phase VE" as related to housing construction projects, as linked in the basic theme to "reduce, construction costs through technological development.

This trend now triggers growing interest in applying VE by several other local government organizations toward their systematic VE research. Thus, VE application to public construction work will keep being emphasized.

PHASES OF VE APPLICATION AND VE ACCOMPLISHMENTS

A survey has been conducted on the Japanese construction industry from among "construction members" of SJVE on the following two focal questions:

- \* In what phase is the current VE application ?
- \* What is the tendency of such application results?

Then, based on the results of the analysis,

- 1) the VE state of the art in the construction industry are described and

2) the data are compared to those reflecting the trend of VE in manufacturing.

Phases of VE application

The actual phases of VE application in this survey are defined as follows:

Introduction being considered:

Only the basic applications policy, scope, organization, etc, are being considered.

Introduction:

VE has begun to be used.

Partial application

VE is being used in some part of the organization but not throughout the company.

Total application:

VE is being used in all units of the company.

Stabilized applications:

VE is being systematically used deriving some good results.

Table I shows the comparison of the survey analysis between construction and manufacturing.

[Phase of application]	[Response percentages]	
	Construc- tion	Manufac- turing
1. Considering introduction	18.5	2.0
2. Introduction	11.1	4.6
3. Partial appli- cation	29.6	42.4
4. Total applica- tion	14.8	20.0
5. Stabilized	22.2	31.0

The table reflects highest response in "Partial application" in the case of the construction circles, followed by "Stabilized application". Considering introduction compared with manufacturing, 18.5% for "Introduction considered" is notably high, whereas percentages of "Partial/Total/Stabilized application" are rather low and the percentages of both considering introduction and "Introduction" are higher.

Also, it is notable that all five phases in construction are rather even with two digit figures where as manufacturing percentages are apparently dense in the last three phases of "Partial/Total/Stabilized application."

Results of VE application

The results were analyzed in terms of 1) the number of VE proposals submitted and 2) the actual savings resulting from implemented proposals; the following four categories were used in obtaining responses:

- \* Both the numbers and savings amounts sharply fluctuate year by year.
- \* The numbers tend to fluctuate but the savings rather steady, or on the contrary.
- \* While both the numbers and savings amounts look steady, the figures tend to look better on projects, if any.
- \* Largely, both the numbers and savings amounts look steady or increasing.

Table 2 shows the result of analysis.

[Application status]	[Response percentages]	
	Construc- tion	Manufac- turing
1. Fluctuating year to year	11.1	22.5
2. Fluctuating in number but steady in sav- ings results	22.2	14.6
3. Steady status with better figures on projects	7.5	45.0
4. Status steady or upward	29.6	10.6

Responses from the construction circle surveyed indicate that "Both steady or increasing" was highest, followed by "Numbers fluctuating but amounts rather steady, or vise versa." Compared to the manufacturing circles' data, Both steady or increasing" was higher but steady was notably low. Also, their percentage is higher for "Numbers fluctuating but amounts rather steady," whereas it is lower for fluctuating.

Thus, VE application results in the construction industry indicate a tendency that most of them can be cut into halves with the "steady" group and the "fluctuating" group.

MANAGEMENT OF CONSTRUCTIVE VE APPLICATION

The survey results in terms of "target-setting, planning and evaluation of accomplishments" were analyzed.

Target-setting for VE application

Key questions asked were:

- 1) Whether the targets are established or not?
- 2) What kinds of targets are used?

Table 3 shows the result of analysis.

TABLE 3

[Target-setting]	Construc- tion	Manufac- turing
[Target-setting]		
1. Established periodically	63.0	75.5
2. Not periodically established	22.2	22.5
[Kinds of targets]		
1. Number of subjects to be studied	58.8	19.9
2. Potential accomplishments by VE alternatives	17.6	30.5
3. Actual accomplishments by VE alternatives	47.1	49.7

[Response percentages]

In construction, "Established periodically" was high but a little lower than manufacturing. In terms of "Kinds of targets," the percentage for "Number of subjects to be studied" was notably high, followed by "Accomplishments by VE alternatives," Compared to the manufacturing's data, the percentage for "Number of subjects to be studied" was higher and "Potential accomplishments," was as half as that for manufacturing.

In applying VE, the construction circles seem to place emphasis on 1) in bringing up actual saving results and 2) in involving as many personnel for VE application and applying VE to whatever subjects they can take up even on the work sites.

Planning, for VE application

The data in Table 4 reflects, the results of analysis as to how VE plans are being formulated in construction companies.

TABLE 4

[VE Planning]	Construc- tion	Manufac- turing
1. Not specially formulated	22.2	6.0
2. Made as deemed necessary within the division	29.6	21.9
3. Formulated but unrelated to corporate business plans	14.8	27.2
4. Formulated and related to corporate business plans	18.5	43.7

[Response percentages]

The highest percentage was for "Made as deemed necessary within the division," followed by "Not specifically formulated." A notable difference from the manufacturing is the low percentage for "Formulated /related to business plans."

The data indicates that the construction industry tends to capitalize on site construction work.

Evaluation of accomplishments

The data in Table 5 shows the results of analysis as to how their VE accomplishments are being evaluated in construction companies.

TABLE 5

[Evaluating ac- complishments]	Construc- tion	Manufac- turing
1. Not regularly scheduled	22.2	6.0
2. Up to concerned divisions as needed	19.8	35.8
3. Formal criteria & procedure followed but informal factors considered	18.5	27.8
4. Formal criteria and procedure formulated and maintained	25.9	28.5

[Response percentages]

The highest percentage was for "Formal criteria & procedure formulated & maintained," followed by "Not regularly scheduled." Compared to the manufacturing data, "Formulated & maintained" percentage was equal with the manufacturing percentage, whereas "Not regularly scheduled" was notably higher.

The data indicates that construction can be divided into "Not regularly scheduled" and "Formally implemented."

#### FUTURE ISSUES FOR VE PROMOTION IN CONSTRUCTION VE

##### VE application at the design/engineering phase

Thus far, VE has been applied mainly to the site construction work since attempts to propose VE-based design changes on the constructor side would face difficulties in making their owners and/or A&E believe in the merit of VE, while "method changes" as such in on-going construction projects can be rather liberally made at the construction site, enabling the contractors to expect some accomplishments. Yet, they can hardly expect more substantial results from VE at this level because of the limited scope of allowable changes.

A far greater merit of VE application can be enjoyed if the designers are made to fully understand and appreciate the merit of VE.

Yet, some designers insist that in principle they can see no return for changes that would save money without degrading the required building function and qualitative grade, and that they believe in perfecting their designs and drawings developed after full discussions between them and owners early in the planning stage and full consideration of optimum use.

In construction, however, VE being applied effectively to the design/engineering stages with sizable results through the effective application of such methodologies as Function Analysis and Creativity and the comprehensive use of various inter-disciplinary information.

Therefore, it is essential for more active VE application at the design phase to insure complete awareness on the part of construction designers over the basic VE and its advantage.

##### Building optimum VE application bases

So that VE can keep rendering long-term results, any organization must have a well established "in-house bases" for their satisfiable application.

As the two most important functions in the construction industry for the effective VE application, the survey indicated "implementing VE training" and "collecting/ providing information necessary for VE application."

Human resources capable of effectively applying VE are a must. Two types come under this category: 1) managers who have the right knowledge and understanding of the basic VE concepts and can effectively manage VE application, and 2) practitioners who have mastered the use of the VE techniques and their application processes. Such qualified human resources cannot be obtained in any organization without good training programs.

Another important factor for achieving higher VE application results is collection of related information. VE results can be realized only the use of proper information at each step of the VE application process. In other words, the results depend on the quality and quantity of the collected information. It is important to collect necessary information and to establish supporting systems for collecting such data.

Most of the large-scale construction projects inevitably impose certain time-limits for completion, particularly in trying to apply VE to such projects at their design stage and/or construction work. Besides, construction sites are usually unrelatedly dispersed. Thus, it is absolutely necessary to develop not only highly capable VE practitioners and managers and also to establish supporting systems as a good information source.

#### CONCLUSIVE COMMENTS

This paper covers the present state-of- the-art of construction application, particularly as being practiced in Japan.

So far, VE application in this sector has been in-house utilization within constructor organizations, and this was based on their early awareness of the effectiveness of VE in helping them accomplish their business objectives. Now, the application emphasis is being expanding upstream to the design phase.

Principally, the hardware or structures in the construction industry tend to be strongly related to the public interest. Further, the site construction process greatly affects the related environment, community and people as the third party. Accordingly, it is very important that application of VE must essentially help customers and users by satisfying not only their immediate requirements but also some requirements on the part of the general public.

Thus, VE practitioners in construction should bear in mind that they should not only use VE to help the company accomplish their business objectives but also be aware of the importance of their social contribution.