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Implementation status of Value Management Practice in Egyptian construction projects

Amr Mohammed Zakaria Ghareeb
Lecturer of Architecture Department
at Higher Institute of Engineering and Technology, Menoufia

amr.m.zakaria1990@gmail.com

ABSTRACT:
Value management has attracted a lot of attention in developing countries such as Egypt due to the massive gains seen with this entirely accepted theory in advanced countries. This paper aims to explore the current status of implementing value management methods, tools, and techniques in the Egyptian construction industry. It also explores the barriers of implementing value management in Egyptian construction projects. A questionnaire survey as a quantitative approach was conducted after gathering data from the literature. In many companies in Egypt, data were collected from a sample of 152 project managers and project management teams. By using "frequency analysis" as descriptive statistics, it was concluded that the current status of implementing value management is at a low level due to some barriers in the Egyptian construction sector. This study will help project managers and project management teams to enhance the implementation of value management in construction projects in Egypt.

KEYWORDS:
Value Management – Construction – Implementation -Project Management.

1- INTRODUCTION

One of the primary challenges in value management is defining the scope of the project, including the financial implications [1]. Value management operates at a strategic level by helping to develop a correct project brief that is used effectively [2]. Value management can reduce design and build time by giving the project team a clearer focus on client priority requirements [3]. The terms value management and value engineering may tend to be synonymous, but the distinction between value management is strategic, and value engineering is tactical [4]. Value management encourages the project team to reduce the cost project through eliminating unnecessary costs from the project, or eliminating some of its component without reducing specifications below the level of performance required by the client [5]. Value engineering (VE) and value management (VM) both aim to maximize the value of a project given the constraints of time, cost, and quality [6]. Although sometimes, we should be aware that improving the value of a project for life sometimes requires additional initial capital expenditures. Previous studies inspected the critical value management activities, the effective application of value management, the attempt to link value management and sustainability, and The role of stakeholder management in reducing the risks associated with value management in construction projects in Egypt; but this study was concerned with determining the current status of the extent of awareness and a real implementation of value management in the Egyptian construction industry, which no studies have done so far.

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2- REVIEW OF RELATED LITERATURE

2-1- The Concept of Value Management

Value is expressed as a comparative measure that reflects the desire of obtaining or keeping an item [7], so the value is represented as the satisfaction of need/use of resources [8]. In construction projects, the resources are mainly used, it is expressed in terms of the whole life cost of the project, so the value becomes what is represented as meeting the needs/cost of the life cycle of the project [9], so reducing the cost of implementing those needs can improve the value. Value is usually referred to as value for money [10]. Value depends on three basic elements: quality, functionality, and cost [11]. Researchers, experts, and practitioners in the construction industry have been interested in value management. As the institute of value management (IVM) [12], value management (VM) is a well-established methodology for maximizing value for money and maximizing project efficiency, that can be applied to any type of construction project regardless of size or time frame and at all stages throughout the project lifecycle. It depends on the relationship between satisfying different needs and resources. Abidin, N., et al. [13] say that the needs may include various aspects such as high quality, good internal environment, durability, low maintenance, and ease of use. Othman I, Kineber A, et al. [14] decade that value management is a method using tools and techniques. Jaapar et al. [15], Male. et al. [16], and Alan Short et al. [17], define value management (VM) as an organized, analytical, systemic method of analysis and proactive problem-solving management system that increases the functional value of the project by a multidisciplinary value team led by an experienced leader.

2-2- Value Management Methods and Technique

There is a different method for implementing the value management process. The 40-hour workshop is the most comprehensive implementation of the VM process. According to Phillips [19], the 40-hour workshop method may be dependent on the type of project and the objectives of the client. The 40-hour workshop. Kelly and Male [20] decade that although this traditional approach can provide the best results, it takes five full working days to complete and consider as highly time-consuming and expensive. Design charette is a shortened version of the value management process that may be adopted. It takes between one and three days to complete, so it is shorter and costs consider a preferred approach [4]. As Kelly and Male [20], a value management audit is interested in analyzing the expenditure proposals of associated branches of large companies or government departments. As Kelly and Male [20], it is a continuous and parallel process of implementing value management throughout the design development phases. It would require a specialist value manager employed for its implementation. The contractor's change proposal is essentially a post-tender method.

Bolton et al. [21] define the function analysis technique as one of the formal basic methods used to analyze the function of each project element and thus reach the goal of value management. This method is based on the development of a matrix (cost/function) where the costs of performing each of the specified functions can be determined. Mishra [22] describe (FAST) as a technique based on logical linking functions that allow people from different lex systems to create a quick technical backgrounds to describe and relate functions of comp schema. Hayles [23] said that to produce a FAST schema,the team will have to interact and communicate with each other effectively to come up with a logical schema that they can d agreeunderstand an-on. Cost / Worth technique is a comparison of the two schemes indicates the "cost/value" of the function. The function whose cost greatly exceeds their value may require further study to explore whether they can be done differently at a lower cost. [24].

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Fitriani [25] describe (SMART) as a two-stage methodology ,the first is that this methodology uses the concept of a value tree to link functions by creating an important hierarchy of functions. A value tree begins on the left-hand side with a statement of the project's objectives and then expresses the answer to the question with" how" in simple attributes to add the value needed to achieve the project objective. Wendee [26] described the development of generic value drivers provides progression in creating stochastic value drivers for each project, and creates the advantage of comparability, as projects with similar goals can be compared to each other. Value measurement tool will help in measuring the target, through the clear contrast between the current performance values and the target values. [27]. Perera [28] describes Function Performance Specification that it describes exactly what is required in detail and the scope of the innovation or alternative options. Performance specification describes the required output from a component or subsystem.

Value management techniques can be used not only to determine what functionality the customer wants, but also to determine how much the customer is willing to pay for it. Construction, being a highly competitive market, operates in an environment which the price generally set by the customer [29]. Historically, the industry operated on the following business basis, *Price = Cost + Profit* **[**30**].** Designers would produce a design based on the client's requirements; Surveyors price the design based on market testing and experience. Often, the customer is not willing to pay, inferior alternative specifications are adopted, and function reduced to reach the price the customer is willing to pay. The functional cost model will identify areas of discrepancy. The client will work with designers and suppliers to align the cost without creating hostile or confrontational conditions.

2-3- The Barriers of Implementing Value Management

A developing nation such as Egypt is interested in value management because of the enormous benefits of implementing this approach [31]. Although it, most of these countries did not adopt value management methods, tools, and techniques in the construction industry [32]. Asian countries such as Malaysia, Vietnam, Jaapar et al. [33], Kim et al. [32] pointed out that value management hasn't been adopted because of selecting an inappropriate method; most stakeholders involved in value management may not adapt to the 40-h workshop approach because of the inherent workshop difficulties and because they are away from their daily activities for an entire week. Cheah, Ting [34] pointed out that value management hasn't been adopted in most countries in the south-east of Asia due to selecting the wrong people who have no experience or the absence of qualified value management staff. In Nepal, value management hasn't been adopted as Malla's [35] due to selecting the wrong people who have no experience, lack of time for the introduction of value management, and technical concerns and impediments. In Indonesia, Latief et al. [36] indicated that value management hasn't been adopted due to the absence of qualified value management staff, haven't the complete necessary information on a project's component value costs, absence of knowledge of value management, and lack of policies and systems to support value management. In Hong Kong, value management hasn't been adopted due to a lack of time for introduction of value management [37]. Perera [38], in the case of Sri Lanka, said that the reasons for not adopting value management are not having the complete necessary information on a project's component value costs, and technical concerns and impediments. In the western countries of Asia such as Iran, the technical concerns and impediments were the reason for not implementing value management in the construction sector [39]. The construction sector of Saudi Arabia, as al-Yami said[40], face many problems to adopt value management due to not having the complete necessary information on a project's component value costs, lack of time for the introduction of the value management, and the customer's willingness to try something and his commitment to conducting a value management process.

In African countries such as Nigeria, Hayatu [41], and Aduze [42] said that the absence of qualified value management staff, the cost of conducting value management, and the

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customer's willingness to commit to conducting a value management process are the reasons of not implementing value management in the construction industry. In the case of South Africa, the problem of haven't adopted value management is the cost of conducting value management, and predicting the quality of the final product [43], while technical concerns and impediments are the problems of not adopting value management in Ghana and the most of African countries [44]. From previous, it may be said that there is a problem with implementing value management in the most developed countries, so, it is important to examine value management methods, tools, and techniques in Egypt due to the similarities in implementing the project in these countries.

3- METHODOLOGY

The research follows a methodology through a logical hierarchy of the aspects of the research problem. This research aims to explore the present situation of value management implementation in Egypt. The study adopted an exploratory strategy and an inductive approach by browsing and analyzing the particles to achieve a comprehensive holistic judgment to improve the findings of the study for appropriate discussion [45]. Fig. 1 shows the research process for the study. After reviewing the previous studies about value management and its concept, methods, and technique; a questionnaire forms are delivered to project managers and project management teams to determine the extent of understanding of the concept of value management and the status of implementing value management in Egyptian construction, then, projects Findings, conclusions, and recommendations were discussed.

Achieved the objective of the research was the aim of the analytical research, which is the validity of the hypothesis that value management has attracted a lot of attention in emerging countries, because of the massive gains in developed countries with this entirely accepted theory.

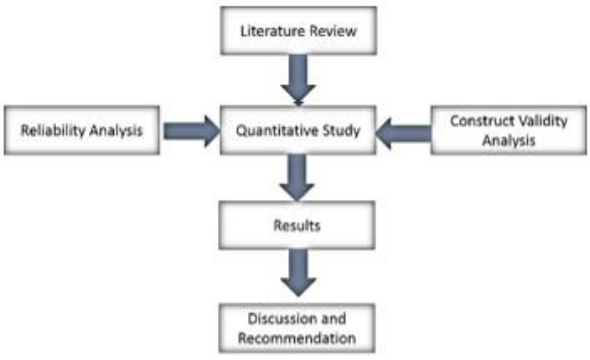

Fig. 1: Research flowchart
Source: Researcher

4- RESEARCH PROCESS

4-1- QUANTITATIVE STUDY (QUESTIONNAIRE SURVEY)

The questionnaire was subjected to a pilot test to inspect its clearness, intelligibility, coherence, and ease of response, as well as to decide the desired time for the survey. Exploratory Factor Analysis (EFA) as one of the functions built into the Statistical Package for the Social Sciences (SPSS) [46] was used to evaluate the response to the use of value management methods, tools, and techniques in construction projects in Egypt. It is also used to define constructs' validity by gathering data about the relationship among factors, decreasing the factors into many main structures, and evaluating the reliability of questionnaire models.

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A research method's validity and quality are essential and must be taken into consideration to ensure the results' accuracy. Validity is used for both face and content to evaluate the degree to which the research instrument components are written and are reflective of a focus on the inquiry about structure.

5- DATA COLLECTION

The research was performed in Egypt's construction sector. The research was scoped to value management implementation in Egyptian construction projects, and the barriers of implementing value management in the Egyptian construction. The questionnaire survey was structured into three main sections. First, was to collect data about respondents' information; Secondly, using a 3-point Likert scale, collecting data about participants' value management practices using value management tools, techniques, and methods in the Egyptian construction industry, were 1= weak, 2= medium, 3= strong. Third, using a 3-point Likert scale, collecting data about barriers of implementing value management in the Egyptian construction sector, were 1= weak, 2= medium, 3= strong. A total of 165 questionnaires were distributed, 152 of them were completed and appropriate for analysis, and 13 responses were omitted as they were incomplete responses. The rate 92.1% of return is considered normal according to Kothari, and Wahyuni [47,48], and no issues related to the questionnaire needed attention. In addition, the researcher conducted a questionnaire and analyzed.

6- RESULTS

6-1- Respondents' Profiles and Characteristics

A total of one hundred and sixty-five target respondents from Egyptian companies operating in the construction sector were identified, and survey questionnaires were sent to them. A high response rate attributed to an 92.1% response rate has been effectively achieved. 25.4% of the respondents were from contracting companies, 63.5% of the respondents were from consulting firms and 11.1% of the respondents followed owners.

6-2- The Current Implementation of Value Management Methods, Tools, And Techniques in Egypt

The literature review has identified many methods, tools, and techniques that have led to construction success. The literature review also identified some barriers effect on the value management implementation. The collected data, via questionnaire, were entered into the last version of SPSS software (2022)

Table 1, shows that the usage of the value management method differs among the Egyptian construction companies, 50.9% of respondents said that they always use the 40-hour workshop method, but 33% of respondents said that implementing value management is moderate, and 16.1% of respondents said that they never use this method. It also shows that 90.8% of respondents said that they never both the design charette method and the value management audit methods, and only 9.2% may use these methods.

According to Table 1, the application of value management in construction projects in Egypt is weak. it shows that 12.5% always use both function analysis technique, and function analysis system technology; while 16.1%, may use these techniques, and 71.4% of participants don't use these techniques. Both simple multi-attribute rating techniques, and value driver were the least with 0% of usage in value management practice. It also shows that 18.7% of respondents use always use the (Cost / Worth) technique, while 17.9% may use this technique, and 63.4% of respondents haven't used this technique. It also shows that 20.5% of respondents always use the value measurement technique, while, 34.8% of them have a moderate usage of this method, and 44.7% of respondents haven't used this technique. Table 1, illustrate that 12.5% of respondents always use Functional performance specification (FPS), while 16.1% have a moderate usage of this technique, and 71.4% of respondent have not used

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this technique. It also shows that 18.8% of respondents use the target cost technique, while 28.6% of them may use this technique, and 52.6% have not used this technique.

Table 1: The current implementation of value management methods, tools, and techniques in the Egyptian construction industry
Source: Researcher

Variable	Code	Ref.	1	2	3
The 40-hour workshop Method	VM. M 1	[19]	24	50	77
The Design Charette Method	VM. M 2	[4]	137	15	0
The Value Management Audit Method	VM. M 3	[20]	137	15	0
Function Analysis Technique	VM. T 1	[21]	109	24	19
Function Analysis System Technology (FAST)	VM. T 2	[22], [23]	109	24	19
(Cost / Worth) Technique	VM. T 3	[24]	96	27	28
Simple Multi-Attribute Rating Technique (SMART)	VM. T 4	[25]	152	0	0
Value Driver	VM. T 5	[26]	152	0	0
value measurement	VM. T 6	[27]	68	53	31
Functional performance specification (FPS)	VM. T 7	[28]	109	24	19
Target cost technique	VM. T 8	[29]	80	43	28

6-3- The Barriers of Implementation of Value Management in The Egyptian Construction Sector

The literature review also identified some barriers effect on the value management implementation. Barriers are assessed by evaluating the level of the impact of those barriers caused by stakeholders on the project and the probability ratio of those barriers occurring.

Respondents indicated as Table 2, that the barriers that effect on value management implementation in the Egyptian construction projects ranged from medium to powerful impact. Through respondents' answers, it finds that the barriers of medium impact on value management implementation, are represented in the weakness of knowledge of the value management team, which was at a ratio of 50.7%, the poor selection of members of the value management team, which was the rate of 50%, the impact of the high cost of the value study at ratio 50%, the level of the customer's commitment to value management procedures, and the level of support of stakeholders who were involved in the project were with the percentage of each of them reaching 50% and 49.3%, in a row; while the barriers of high impact on value management implementation, are the use of the inappropriate methodology was 74.7%, the timing the practice of value management barrier was 80.7%, in addition to the tender type was 83.3%. The incompleteness of cost information has a high impact with percentage 83.8%. The impact of each lack of awareness of value management and the risk of lack of policies, laws and guidelines on carrying out value management was high, where the percentages were, in a row, 83.8% and 75%. Finally, having enough time to study was at ratio 90.4%.

Table 2: The impact of the barrier on value management implementation in the Egyptian construction projects
Source: Researcher

Code	References	Barrier	Impact factor	1	2	3
VM.B1	[37], [40]	Having enough time to study	90.4	11	22	119

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VM.B2	[35], [36], [41], [42]	Weakness of the knowledge of value management team	50.7	22	87	43
VM.B3	[34]	Poor selection of team members Value Management	50	43	43	65
VM.B4	[33],[32]	Using inappropriate methodology	84.4	22	76	54
VM.B5	[37], [40]	The timing of value management practice	80.7	33	33	87
VM.R6	[38], [40], [41], [42]	High cost of conducting Value Management	50	54	76	22
VM.B7	[36], [38], [40]	Incomplete cost information	80.7	11	54	87
VM.B8	[35] ,[38], [44]	Tender method	83.8	53	0	97
VM.B9	[38]	Final product quality	83.8	43	11	98
VM.B10	[40]	The level of the customer's commitment to conducting Value Management	50	43	76	33
VM.B11	[40]	The support level from stakeholders	49.3	33	65	54
VM.B12	[36]	The Lake of awareness of Value Management	83.8	11	43	98
VM.B13		Lack of policies, regulations, laws, and guidelines on how to do Value Management	75	22	54	76

6-4- Reliability of Status of The Implementation of Value Management In The Egyptian Construction Industry

Accuracy and reliability were used as an evaluation criterion because the data was gathered using surveys as original research, and the author must disclose the validity or reliability of the data in this case. [51]

To conduct statistical analysis of data, the Statistical Package for Social Science (SPSS) version 22 was used. Using Cronbach's Alpha, the internal consistency reliability and how well the set of 11 variables associated with the status of the real implementation of value management in the Egyptian construction industry, and 13 variables associated with barriers of value management implementation in the Egyptian construction sector which correlated to one another were checked. Cronbach's alpha is a measure of internal consistency, that is, how closely related a set of items are as a group. It is considered to be a measure of scale reliability. Theoretically, Cronbach's alpha results should give a number from 0 to 1. A negative number indicates that something is wrong with data. The general rule of thumb is that a Cronbach's alpha of 0.70 and above is good, 0.80 and above is better, and 0.90 and above is best. A Cronbach's Alpha of all variables was 0.94. Through exploratory factor analysis (EFA) the reliability statistics were determined by the extracted factors. Table 3 indicates the results. The value of the Cronbach alpha becomes more acceptable as it tends towards 1.0 [52]. Consequently, as shown in Table 3, all variables have appropriate reliability since alpha Cronbach levels are greater than 0.9.A Cronbach's Alpha of all variables was 0.94. Through exploratory factor analysis (EFA) the reliability statistics were determined by the extracted factors. Table 3 indicates the results. The value of the Cronbach alpha becomes

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more acceptable as it tends towards 1.0 [52]. Consequently, as shown in Table 3, all variables have appropriate reliability since alpha Cronbach levels are greater than 0.9.

Table 3: Reliability statistics for extracted factors (Cronbach's alpha)
Source: Researcher

Factor	No. of Variables	Cronbach's Alpha
The value management method uses in the Egyptian construction industry	3	0.74
The implementation of value management tools and techniques in the Egyptian construction industry	8	0.92
The impact of the barrier on value management implementation in the Egyptian construction projects	13	0.97
All factors associated with the status of the extent of the real implementation of value management in the Egyptian construction industry	**24**	**0.94**

This study's aim is to explore the status of the extent of real implementation of value management and its barriers in the Egyptian construction industry, and this was achieved through EFA analysis. Before launching the EFA study, it is vital to test the data normality. In the current study, the normality of data was measured as elementary assumption results of the normality test for barriers associated with value management practice. If the kurtosis result is between −7 to +7 and skewness results are between −2 to +2 [53], the data are regarded as normal. As shown in Table 4, the skewness ranged from -1.08 to 1.97, and the kurtosis ranged from -1.53 to 6.56, which indicates that most variables are normally distributed.

[Table 4] normality data of extracted factors
Source: Researcher

Variables	kurtosis result	skewness results
VM. M 1	-0.65	0.77
VM. M 2	6.56	1.97
VM. M 3	6.56	1.97
VM. T 1	0.65	1.46
VM. T 2	0.65	1.46
VM. T 3	-0.67	0.99
VM. T 4	0	0
VM. T 5	0	0
VM. T 6	-1.08	0.58
VM. T 7	-0.65	1.46
VM. T 8	1	0.71
VM.B1	1.027	-1.076
VM.B2	-0.143	0.222
VM.B3	-0.885	0.080
VM.B4	-1.476	-0.106
VM.B5	-1.150	-0.467
VM.R6	0.027	0.768
VM.B7	-0.391	-0.355
VM.B8	-1.527	-0.413

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VM.B9	-1.209	-0.587
VM.B10	-0.455	0.413
VM.B11	-1.022	0.069
VM.B12	-0.490	-0.763
VM.B13	-1.017	-0.236

7- DISCUSSION

Value management techniques in the construction industry are not a new subject in the world. Literature review shows that there is a lot of publishing about value management applying value management in the construction industry is important [54]. There is a great impact construction projects have on the economy of countries [55], especially developing countries such as Egypt. There are many studies about value management in the world. Previous studies concerned with value management and the construction industry in developing countries focused on critical value management activities [56], the effective application of value management [57], and the attempt to link value management and sustainability [58], but this study was concerned with determining the current status of the extent of a real implementation of value management in the Egyptian construction industry, which no studies have done so far. From the result section, it can say that the current status of the implementation of value management in Egypt is weak due to many reasons. There are many reasons led to the current status of implementing value management in the construction sector in Egypt, these reasons include having enough time to study, weakness of the knowledge of value management team, poor selection of team members Value Management, using inappropriate methodology, the timing of value management practice, high cost of conducting Value Management, incomplete cost information, tender method, final product quality, the level of the customer's commitment to conducting Value Management, the support level from stakeholders, the Lake of awareness of value management, and lack of policies, regulations, laws, and guidelines on how to do Value Management.

When the barrier exceeds the acceptable level allowed, the first strategy is avoiding. Avoiding involves preventing the occurrence the removing the impact of barrier [60]. Reduction, or mitigation action is used to reduce the impact of barrier [59]. Preparing contingency plans is to set extra money aside, to draw on in the event of unforeseen cost overruns [59].

According previous, the proper handling of not having enough time to study is to reducing the number of days in the value study and facilitating the workshop, and have an experienced independent project manager who understands both value management and barrier management to facilitate studies. The mitigation method is the proper handling of inflation and other economic indicators that affect the cost and price of materials and resources is using some investment evaluation methods with a focus on the economic aspects. The mitigation method is best suited to the high cost of conducting value management by keeping the study cost as low as possible without compromising the skills and activities needed to achieve an optimal output.

The avoidance method can be used by setting up guidelines on how to do value management to avoid any unfamiliar result that may result from that barrier. The proper handling of the timing of value management studies is to do a value management study first and then study risk management. The suitable handling for timing of value management is allocating sufficient time to the study based on the size and nature of the project. The study may range from 2 to 5 days for the same study workshops. It is also important to give breaks between workshop sessions. Moreover, giving a few days between the main sessions helps the participants to think of and develop new ideas.

The avoidance method is best suited to the low level of the customer's commitment to conducting Value Management, and the low support level from stakeholders by assigning communication responsibilities to experts who provides stakeholders with information. The

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value management team should preferably include members of the original design team for the project to generate new ideas and easily achieve value management results. It is also essential to ensure that the 'influential' members of the design team are selected as well as those who have the time and ability to contribute positively to the success of the value management. Avoidance method can be used to the barrier of lake of awareness of value management by making sure that the team members are trained, and have more knowledge before starting the study to ensure effective study. The avoidance method also is optimal for the barrier of the tender method by considering previous experience of value management as one of the qualification requirements for the contractor. It is important to developing a successfully applied model as a guiding model for value management in construction projects in Egypt, and Create Egyptian local policies, regulations, laws, and guidelines on how to do value management.

8- CONCLUSION AND RECOMMENDATIONS

This study provides a snapshot of the status of value management implementation in the Egyptian construction industry. Value management has not yet reached the level of implementation and popularity in Egypt. There is a low level of use of VM tools and techniques within today's construction industry in Egypt, with low levels of success. There are a number of barriers associated with value management. Previously, studies focused on the effective application of value management in developing countries such as Egypt, and the attempt to link value management and sustainability. This study focused on the practice of value management in the Egyptian construction industry, and its barriers to suggest a strategy for dealing with these barriers. These findings are further confirmed through a quantitative methods research was conducted through a questionnaire survey. it was concluded that 13 barriers associated with the practice of value management in construction projects in Egypt such as lack of enough time to study, incomplete cost information, quality of the final product, the absence of guiding policies and laws, weakness of knowledge of the value management team, high cost of conducting value management, lack of selection of the value management team, type of tender, the level of support of the stakeholders to conduct value management procedure, the level of the customer's commitment to the value management procedure, the use of an inappropriate methodology, and the timing of the value study.

9– STATEMENTS AND DECLARATIONS

9-1- Competing Interests and Funding

This research did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors. The authors declare that they have no competing interests.

9-2- Acknowledgments

I hereby acknowledge the help of all project managers and senior project management teams who assisted and accompanied me in collecting data for the study.

9-3- Availability of data and materials

All data generated or analyzed during this study are included in this published article by the author. Data was gathered from the literature, taken after a qualitative approach through a semi-structured interview, and a quantitative approach through a questionnaire survey

9-4- Ethics approval and consent to participate

The submitted work is original and has not been published elsewhere in any form or language.

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9-5- Consent for publication

All participants gave their consent for their data to be published in the journal article.

9-6- Abbreviations

VM	Value Management	EFA	Exploratory Factor Analysis
IVM	The Institute of Value Management	SPSS	Statistical Package for the
FAST	Function Analysis System Technique		
SMART	Simple Multi-Attribute Rating Technique		
FPS	Functional Performance Specification		

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