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Addressing the Value Management Approach in Public Construction Works: Barriers, Critical Success Factors, and Potential Risks

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Abstract: Value management (VM) is a management approach aimed at inspiring individuals, nurturing their talents, and fostering synergy and innovation, all with the objective of enhancing an organization's overall performance. This methodology seeks to reduce costs while actively engaging a diverse array of stakeholders throughout the project lifecycle. Despite its significance in construction projects, there exists a notable gap in the literature regarding the implementation of value management in public works. This study aims to identify the barriers that hinder the effective implementation of value management, as well as the critical success factors and potential risks associated with its adoption in public projects. Additionally, it assesses Turkey's readiness for implementation within the construction sector by examining awareness levels, legislative issues, and other pertinent topics. To conduct the study, a quantitative survey was administered to 337 participants from various roles within the Turkish construction sector. The findings revealed that the inherent complexity of construction projects, time constraints, and difficulties in alternative selection are the primary barriers to implementing the value management approach in public works. Regarding the critical success factors for effective VM implementation, the involvement of end users, a collaborative workshop environment, and the multidisciplinary composition of the VM team were identified as the most significant contributors to success. Additionally, the study highlighted potential risks associated with the adoption of VM in public works, including low operating efficiency, a low participation rate in tenders, and cost overruns. The discussion also addressed legislative and process-oriented strategies for the potential adoption of value management.

Keywords: value management; construction; risk

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1. Introduction

Value management (VM) is a management approach designed to inspire individuals, cultivate their talents, and foster synergy and innovation, all with the goal of enhancing an organization's overall performance. Developed by L. D. Miles in the United States of America (USA) as value engineering (VE) during the 1940s and 1950s, VM arose from material shortages after World War II, and it was discovered that prioritizing core needs and employing technical solutions led to similar outcomes with alternative materials, achieving better performance at lower costs [1]. Following the successful implementation of the VM model in the USA public sector in 1963, the UK adopted and refined this concept into value management to provide strategic value for effective project development [2].

A multidisciplinary approach is essential for addressing strategic and highly complex challenges in value management. This methodology aims to reduce costs while engaging a diverse range of stakeholders throughout the project lifecycle. Value engineering, a technical or project-oriented analysis, serves as the foundational method for applying value management. The goal is to foster a shared understanding of the design problem and establish a high-value design that is clearly accepted by all project stakeholders.

A value management study is executed through several steps, including preliminary preparation, project definition, planning, data collection, functional analysis, idea generation, alternative valuation, proposal development, and proposal presentation, the implementation phase, and involves project decision-makers, a certified team leader who facilitates collaboration, and certified team members along with operational department managers. [3]. This methodology can also be implemented at every stage of construction projects, from the design phase to the implementation phase, and aims to reduce costs while increasing value for a diverse array of stakeholders throughout the project life cycle. Value management (VM) is widely utilized in the construction sector across many developed countries, such as the USA and the UK [4–9]. However, in other regions, the adoption of this technique faces resistance. Despite this resistance, which often stems from concerns about a lack of information on application procedures and the time required for implementation, recently, interest in value management from several countries has led to an increase in global demand for its application [10–13].

Practices related to value management vary from country to country in construction projects. For instance, VA (value analysis) was first introduced in Hong Kong in 1988, and the Architectural Services Department (ArchSD) of Hong Kong has organized a series of VA studies as the primary representatives of the construction of new government buildings, which continues to play a leading role in promoting the integration of sustainability within value management IT processes [9]. A study in Egypt examined the adoption of value analysis (VA) in building projects and aimed to identify factors hindering VA adoption through previous studies, interviews, and pilot data [10]. The key finding was that VA application in Egypt's construction sector remained very low. A survey among Nigerian construction professionals evaluated key activities driving value engineering (VE) implementation to enhance efficiency and productivity [11]. It identified the requirements for decision-makers and stakeholders to successfully implement VE, aiming to reduce project costs, shorten completion times, optimize functions, and improve overall construction management skills. Standards play a crucial role in enhancing the implementation of value management (VM). In Turkey, the Turkish Standards Institution (TSE), Turkey's official standard-setting and publishing body, has adopted the European Union's standards on value management and recognized them as the Turkish Standards (TS, 2024)

The standards include:

- TS EN 12973 "Value Management", which has been in effect since its acceptance on 9 November 2020, replacing the previously canceled standard from 11 November 2002 [14].
- TS EN 1325 "Value Management—Dictionary—Terms and Definitions", currently effective since 29 April 2014, superseding the standards canceled on 11 December 2002 and 2 December 2004 [15].
- TS EN 16271 "Value Management—Functionality of the Required Expression and Functionality of the Performance Attribute—Requirements for Validation and Expression of the Need for the Provision of a Product and Fulfillment of the Purchase Process", which is valid with a confirmation date of 12 June 2013 [16].

The objective of these standards includes translating the purpose sections of the corresponding European Union member state legislation into Turkish. Additionally, the

scope section of the TS EN 12973 Standard Detail outlines that a system maintained by National Value Societies in Europe documents individual professional competencies related to value management. The "Professional in Value Management" (PVM) qualification is recognized as a competence indicator by these societies throughout Europe and is also acknowledged in several countries beyond Europe.

The literature review was specifically examined, addressing three categories: (1) barriers to implementation of VM in public works; (2) critical success factors; and (3) potential risks in case of VM implementation.

Numerous studies have examined the barriers to implementing value management in construction projects. Nejatyan et al. [17] identified factors that influence the improvement of construction project management performance through the earned value-based value engineering strategy. Alhumaid et al. [18] conducted research to explore the obstacles to adopting value engineering in the Saudi Arabian construction sector and proposed various solutions to overcome these challenges. Additionally, a study in Hong Kong discussed the future expectations and obstacles that impede the implementation of value management in the local construction industry [19]. A study conducted in Malaysia revealed that the global evolution of value management has impacted the Malaysian construction industry; as a result, the methodology of value management has been incorporated into the curriculum of most public universities, equipping future construction professionals with essential knowledge of value management techniques [20]. This foundation aims to enhance the functionality and cost-benefit ratio of construction projects. Another study in China has identified a general lack of understanding of value engineering concepts among industry practitioners [21]. Several studies also addressed the critical success factors in VM implementation. A study in South Africa aimed to develop a model for state-owned enterprises, identifying key elements for successful value engineering implementation and the obstacles to it, while offering recommendations [22]. The study concluded that the government should take an active role in promoting the application of value engineering in local projects. In Egypt, research analyzed the current use of value engineering in construction and identified integration barriers [23]. Khan et al. [24] highlighted incomplete databases, life cycle integration challenges, and resistance to change as major obstacles in construction projects. A study conducted in Rwanda clearly demonstrated that professionals in the construction sector are aware of the significant benefits of adopting value management techniques [25]. In a study by Kineber et al., the barriers to implementing value management were categorized into four main areas: environment and culture, workplace dynamics, knowledge and stakeholder engagement, and standardization [26]. Another study conducted in South Africa identified several significant obstacles to the adoption of value management, including insufficiently qualified personnel, a lack of education and training on value management techniques, political influence, inadequate awareness of value management methods, bureaucratic challenges within government, and the absence of a practical guide for applying value management techniques [27]. Similarly, research conducted in Egypt highlighted that the primary factor hindering the use of value engineering for road maintenance projects was a lack of education on the subject [28]. A study conducted in Nigeria identified several barriers to the implementation of cost reduction techniques in the construction of educational buildings [29]. Similarly, in Malaysia, the most significant barriers to the implementation of value management in small construction projects were recognized [30]. A study conducted in Singapore identified "communication and interaction among participants" as the most critical factor for the successful implementation of value management in the construction industry [31]. Meanwhile, research in China categorized the primary obstacles to implementing value management in the construction sector into four main groups: environmental factors, stakeholder and

management factors, technological factors, and knowledge factors. Moreover, the findings indicated that the adoption of value management within the Chinese construction industry remains inadequate [32,33]. However, the overall level of awareness remains disappointingly low. According to the study, the key barriers to the effective adoption of value management include a lack of awareness, high costs, inappropriate procurement choices, insufficient education and training, rigid standards, absence of contract provisions, poor communication, ignorance of essential issues, and conflicts of interest.

Kineber et al. explored the relationship between critical success factors and overall project success by modeling this relationship to assess how critical success factors correlate with project outcomes [34]. Another study conducted by Bioku and Ataguba aimed to evaluate the level of awareness and competence among stakeholders in the construction sector in Kogi State, Nigeria, with respect to value engineering principles [35]. Another research focusing on analysis of construction projects in Saudi Arabia showed that it was unequivocally established that the foremost critical success factor is "achieving the time targets set in the project schedule", while "staying within the financial budgets of the project" ranks as the second most crucial factor [36]. Furthermore, Rostiyanti et al. [37] outlined that critical success factors were distinctly determined during three pivotal stages of the value management workshop for infrastructure projects utilizing the design-build method in Indonesia.

Some studies in the literature focused on potential risks in case of VM implementation. Potential risk factors were assessed at various stages of the value management process, revealing that "insufficient experience in value management" emerged as the most significant risk, with a consensus on risk prioritization across different stages. In a study conducted in Saudi Arabia examining the risk factors influencing the value generated by green buildings, the following were identified as the most significant risks: "failure to identify low-value, long-delivery items", "inaccurate time estimation", and "poor design that may result in higher operating costs". A study in Vietnam identified the four primary problems to implementing value management: a shortage of value management experts, insufficient knowledge of value management, the absence of local guidelines, technical norms and standards, and inadequate investment, support policies, and human resources within construction companies to effectively carry out value management [12]. In Rwanda, a study revealed that the issues of adopting value management included a lack of awareness, high costs, inappropriate procurement system choices, insufficient education and training, rigid adherence to standards, absence of contract provisions, poor communication, ignorance among key stakeholders, and conflicts of interest [25].

On the other hand, the adaptation of value management to the construction project processes can yield significant benefits. Atabay and Galipoğullari [38] found that by implementing value management on a highway project in Croatia, approximately $43,000,000 in costs and 12 months of time were saved. In another study focusing on projects where earned value management and value engineering were utilized to enhance productivity, improvements in productivity costs varied from 66% to 90%, with total man-hour savings ranging from 33% to 88.7% across different disciplines [39]. Likewise, Yassin et al. highlighted that value management is among the most effective tools for supporting the sustainability success of the Malaysian construction industry, as it simultaneously controls time, cost, and quality while meeting customer needs [40].

The examples clearly demonstrate that integrating value management into project processes can lead to substantial financial benefits for both the country and contractor companies while also facilitating the construction of high-value structures. Turkey, as a developing nation, is actively engaged in construction projects with impressive capacity and budgetary scope. The extensive construction activities taking place both domestically

and internationally highlight the significant gains that can be achieved through the incorporation of this method. Although Turkey published several standards, it is imperative to assess Turkey's readiness for implementing value management in construction projects. While numerous studies examine value management and engineering, there remains a notable gap in the literature regarding their application in public works. This study aims to identify the barriers that impede the implementation of value management, as well as the critical success factors and potential risks associated with its adoption in public projects. Additionally, it seeks to assess Turkey's readiness for implementation in the construction sector by highlighting awareness levels, legislative concerns, and other pertinent topics.

2. Materials and Methods

The flow of this study is illustrated in Figure 1 and encompasses the following three steps:

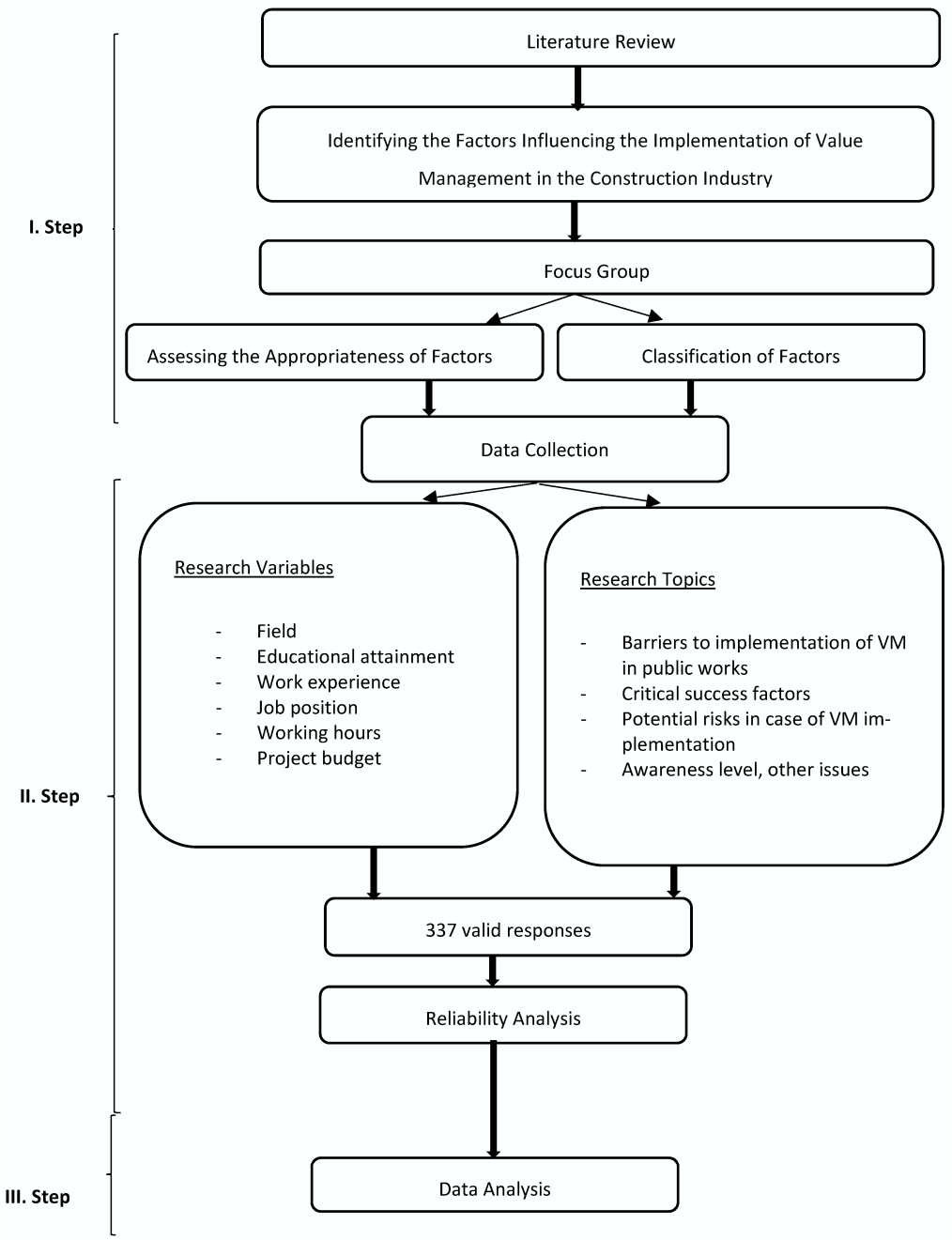


Figure 1. Flowchart of the study.

1-Literature Review and Focus Group Study: In the initial phase, a comprehensive examination of previously published studies concerning the factors influencing the implementation of value management and value engineering within the construction sector was conducted. This literature review laid the groundwork for identifying and analyzing the relevant factors.

Following this, a focus group workshop was held to evaluate the relevance of the identified factors and to explore new potential factors for the study, categorizing them as necessary. A total of 14 professionals contributed to the focus group (FG) study. As indicated in Table 1, the group comprised professors of civil engineering and architecture, administrative staff in different public works, including infrastructure and strategy departments, experienced contractors, consultants, and designer professionals from the construction industry. The 'Results' section (Table 2) indicates which factors were derived from the literature review and which were obtained from the focus group study. The questions of the survey were prepared based on these factors (namely, barriers to implementation of VM in public works, critical success factors, potential risks in case of VM implementation, awareness level, and other issues) as indicated in Table 3. The focus group method was employed to evaluate, classify, and organize the factors. This phase resulted in the categorization of research variables and factors into three distinct groups: barriers to implementation of VM in public works, critical success factors, and potential risks in case of VM implementation in public works.

Table 1. Background information of focus group participants and survey participants.

No	Profession	Field
1	Academic	Civil Enginering
2	Academic	Civil Enginering
3	Academic	Civil Enginering
4	Academic	Civil Enginering
5	Academic	Actitecture
6	Expert	Infrastructure Investmenets
7	Expert	Strategy development
8	Civil Engineer	Municipality
9	Project Manager	Consultant
10	Project Manager	Design
11	Vice manager	Contractor
12	Project Manager	Contractor (Infrastructure)
13	Project Manager	Contractor(Infrastructure)
14	Project Manager	Contractor (High-rise Buildings)

2-Data Collection: In the second step, data collection was conducted. Questionnaires were distributed to employees at various levels within the construction sector in Turkey. The survey employed a convenience sampling method and was completed by 337 participants. The background information of survey participants is indicated in Table 1. It included a multiple-choice table along with a 1–7 Likert scale (1—I definitely think, 2—I think, 3—I partially think, 4—I am undecided, 5—I partially think, 6—I do not think, 7—I definitely do not think), as well as multiple-choice options and checkboxes.

3-Data Analysis: In the third step, both descriptive and inferential statistical analysis techniques were used to systematically evaluate the data obtained through the survey.

The analyses were carried out using the IBM SPSS Statistics 23.0 program. During this phase, statistical methods such as descriptive analyses, reliability testing, normality testing, Welch's *t*-test, independent one-way analysis of variance (one-way ANOVA test), and cross tabulation were applied. These analyses were utilized to identify the characteristics, relationships, and differences within the data.

Table 2. Background information of survey participants.

Variables	Categories	n	(%)
Field	Academic	11	3.26
	Public Sector	31	9.20
	Consultant	79	23.44
	Contractor	187	55.49
	Design	29	8.61
Educational Attainment	Associate Degree	16	4.75
	Bachelor	194	57.57
	M.Sc.	52	15.43
	PhD	75	22.25
Work Experience	Lower than 10 years	179	53.12
	Between 11–20 years	45	13.35
	More than 20 years	113	33.53
Job Position	Researcher	12	3.56
	Employer (contactor)	11	3.26
	Administrative staff	62	18.40
	Technical staff	205	60.83
	Manager	47	13.95
Project Budget (VAT excluded)	Lower than 250 Million TL	18	5.34
	Between 250 Milllion TL and 500 Milllion TL	24	7.12
	Between 500 Milllion TL and 1.5 Billion TL	21	6.23
	More than 1.5 Billion TL	254	75.37
	None	20	5.9

In the initial stage, descriptive statistical analyses were conducted to define the demographic characteristics of the participants and to outline the distribution of responses to the scale items. This involved calculating the mean, standard deviation, frequency, and percentage values, as well as examining the data for extreme values. This analysis was a crucial step in gaining a deeper understanding of the study's dataset and assessing the appropriateness of advanced statistical methods. Subsequently, the Jarque-Bera test was employed as a normality test to determine whether the dataset met the assumptions required for parametric tests. This test evaluates the data's conformity to a normal distribution based on skewness and kurtosis values, thus informing the selection of variables for parametric testing. The results indicated that the data exhibited a significant normal distribution, allowing for the planning of subsequent analyses in alignment with these findings.

Table 3. ANOVA test results (mean, standard deviation, ranking, and *p* values).

No	Barriers to Implementation of VM in Public Works	Reference	Mean	Std. Dev.	Rank	*p*-Values				
						Field	Educational Attainment	Work Experience	Job Position	Project Budget
1	Lack of best practices	FG	2.576	1.341	4	0.001	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
2	Multifunctionality of projects in VM implementation	FG	3.015	1.555	1	0.042	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
3	Insufficient information about VM	[21,33]	2.202	1.296	18	0.000	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
4	Lack of support and active participation from the employers and stakeholders in VM studies	[21]	2.332	1.189	12	0.015	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
5	Absence of contract provisions for the obligations and incentives related to VM implementation	[25]	2.312	1.235	13	0.008	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
6	Inexperience and inadequacy of contractors designated to implement VM	FG	2.264	1.251	16	0.004	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
7	Conservative attitudes of the project/design teams	[24]	2.510	1.282	5	0.001	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
8	Contractors' lack of investment, supportive policies, and human resources for VM	[12]	2.288	1.233	15	0.000	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
9	Shortage of VM experts	[12]	2.217	1.231	17	0.000	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
10	Lack of cooperation and interaction between the project design group and the VM team	[25]	2.386	1.270	10	0.000	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
11	Inexperience of the VM team in accurately estimating costs	FG	2.430	1.278	8	0.003	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
12	Inadequate experience of VM team members	FG	2.306	1.197	14	0.007	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
13	Unqualified VM team manager	FG	2.421	1.367	9	0.019	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
14	Ideas and alternatives that may arise with incomplete information in the early stages of the work plan	FG	2.466	1.229	6	0.023	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
15	Difficulties that may be encountered in generating and evaluating alternatives for problem solving in VM implementation	FG	2.659	1.311	3	0.018	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
16	Time required to conduct VM studies	[12,36]	2.677	1.388	2	0.003	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
17	Lack of VM technical norms, standards, and guidelines	[12,26]	2.454	1.329	7	0.001	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
18	Lack of legislation on VM implementation	FG	2.368	1.319	11	0.000	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$

Table 3. *Cont.*

No	Barriers to Implementation of VM in Public Works	Reference	Mean	Std. Dev.	Rank	*p*-Values				
						Field	Educational Attainment	Work Experience	Job Position	Project Budget
	Critical Success Factors	FG								
1	Risk management	FG	1.926	0.950	18	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
2	Commitment and support of senior management	FG	1.941	0.894	17	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
3	Value management training	FG	1.807	0.914	20	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
4	Practice desire of state institutions	FG	1.941	0.998	17	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
5	Properly implemented work plan	FG	1.884	0.904	19	0.007	$p > 0.05$	0.046	$p > 0.05$	$p > 0.05$
6	Resource allocation for VM	FG	2.074	0.984	4	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
7	Awareness of VM	[25,27,35]	2.056	0.997	6	0.040	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
8	Collaboration, trust, communication, and interaction among participants	[31]	2.015	0.977	11	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
9	Sufficient participation of project stakeholders	FG	2.071	1.000	5	$p > 0.05$	$p > 0.05$	0.027	$p > 0.05$	$p > 0.05$
10	Innovation and critical thinking	FG	1.988	0.939	15	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
11	Multidisciplinarity of VM team	FG	2.116	1.036	3	$p > 0.05$	$p > 0.05$	0.036	$p > 0.05$	$p > 0.05$
12	Personality, skills, competence, and qualifications of the VM manager	FG	2.012	1.023	12	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
13	Active support and participation of the employer	FG	1.955	1.024	16	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
14	Detailed activity analysis of the VM study	FG	2.018	0.994	10	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
15	Participation of the design team (initial designer) in the process	FG	1.991	0.934	14	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
16	Participation of the end user	FG	2.264	1.063	1	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
17	Cost savings	[29,36]	2.053	0.977	7	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
18	Experience of VM team members in their fields	FG	2.018	0.913	10	0.039	$p > 0.05$	0.042	$p > 0.05$	$p > 0.05$
19	Implementation of VM in the early stages of the project	FG	2.042	0.981	8	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
20	Proposals for changes to improve project functions with VM	FG	2.036	0.975	9	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
21	Workshop environment of VM studies	FG	2.220	1.035	2	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$

Table 3. *Cont.*

No	Barriers to Implementation of VM in Public Works	Reference	Mean	Std. Dev.	Rank	*p*-Values				
						Field	Educational Attainment	Work Experience	Job Position	Project Budget
22	Follow-up of the process of adaptation of the changed project to the current project with VM by the contractor company and support from the public institution	FG	2.012	0.994	12	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
23	Sufficient time for VM study	FG	2.006	0.985	13	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
	Potential Risks in case of VM implementation in public works									
1	Inadequacy in determining the project functions to be worked on in VM	FG	2.442	1.413	16	0.039	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
2	Low rate of participation in the tender	FG	3.095	1.627	2	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
3	Inability to adapt to the process changes that will occur with VM	FG	2.760	1.457	10	0.003	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
4	Delay of construction	FG	2.973	1.548	7	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
5	Cost overrun	[25]	3.083	1.613	3	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
6	Availability of financing	[12]	3.009	1.567	5	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
7	High financing cost	FG	3.015	1.636	4	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
8	Delays in approval and permits	FG	2.700	1.553	12	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
9	Change orders	FG	2.840	1.457	9	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
10	Proposal of unapplied engineering techniques	FG	2.846	1.568	8	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
11	Operating cost overruns	FG	2.982	1.585	6	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
12	Low operating efficiency	FG	3.101	1.608	1	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
13	Insufficient experience in VM	[12,27,31]	2.665	1.513	14	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
14	Incompetence of VM team	[12]	2.671	1.468	13	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
15	Lack of commitment from project parties	[26]	2.730	1.570	11	0.004	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
16	Lack of communication	[25]	2.632	1.545	15	0.001	$p > 0.05$	$p > 0.05$	$p > 0.05$	$p > 0.05$
	Significant Relationships where $p < 0.05$									

To ensure the reliability of the data measurements and assess the internal consistency of the scales utilized, a reliability analysis was conducted, and Cronbach's alpha coefficient was calculated. The reliability coefficient for the overall scale was found to be high ($\alpha > 0.90$), and similarly high values were obtained for the sub-dimensions. This indicates that the questionnaire yielded consistent results regarding the constructs it measured, providing a solid foundation for the analyses. In the inferential analysis section of the study, one-way variance analysis (one-way ANOVA) was employed to test the research hypotheses. This method was chosen to compare the effects of groups on the dependent variable when the independent variable had three or more categorical levels. If the ANOVA test produced significant results, it indicated that the mean of at least one group differed from the others. However, there were instances where the assumptions of classical ANOVA could not be satisfied due to the non-homogeneity of group variances or significant differences in group sizes. In these cases, Welch's t-test was utilized as an alternative, allowing for the evaluation of mean differences between the two groups while accounting for variance inequality. This approach has proven to be a crucial tool for enhancing the statistical validity of the research findings.

The chi-square test was employed to assess the relationships between two categorical variables. This analysis, for instance, was utilized to examine the correlation between participants' education levels and their perspectives on value engineering practices. Significance levels were interpreted by constructing cross-tabulations. These analyses provided the statistical foundation for the research, addressing the study's primary questions, identifying significant differences between participant groups, and validating the scales used. Consequently, the data obtained were analyzed in accordance with scientific methods, reinforcing the validity of the research results that were supported.

3. Results

After analyzing the collected data, we identified key factors by comparing average values. We also examined whether there were significant relationships between participants' responses based on different variables. The results of these analyses are presented in Table 3, Figures 2–4.

When considering the challenges that hinder the use of value management (VM) in public projects, it becomes evident that the multifunctional nature of projects and the time required for VM studies pose significant obstacles. Additionally, difficulties in generating and evaluating alternatives during the implementation of VM play a crucial role. Conversely, factors such as insufficient knowledge about VM, a limited number of experts in the field, and the inexperience or inadequacy of contractors assigned to implement VM are not perceived as major obstacles.

Regarding critical success factors for effective VM implementation, the participation of end users, a collaborative workshop environment, and the multidisciplinarity of the VM team are recognized as the most important contributors to success. In contrast, factors like value management training, a well-executed work plan, and risk management are viewed as less significant.

Examining the potential risks associated with VM implementation in public works, we find that low operating efficiency, a low rate of participation in tenders, and cost overruns are considered important risks. However, inadequacies in determining the project functions to focus on in VM, lack of communication, and insufficient experience in VM are not regarded as significant concerns.

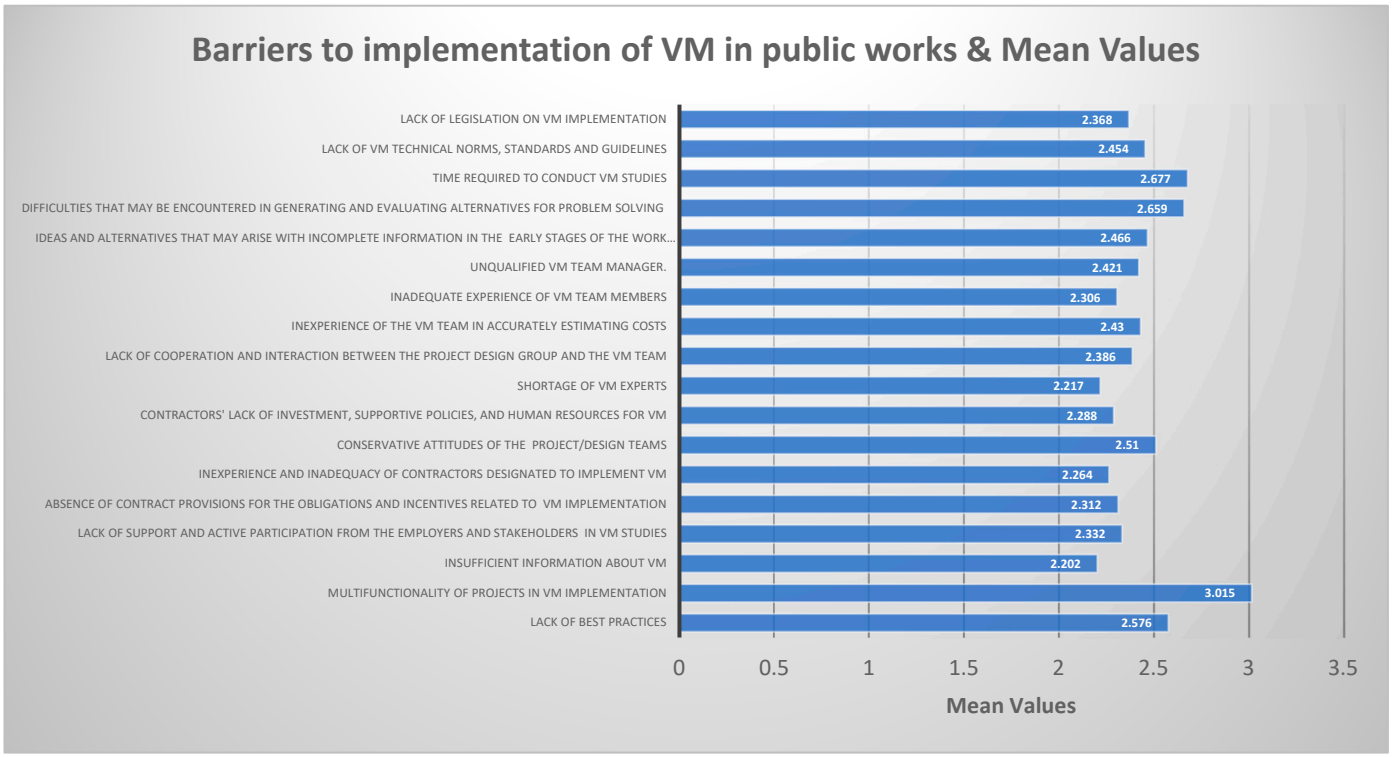


Figure 2. Barriers to implementation of VM in public works and mean values.

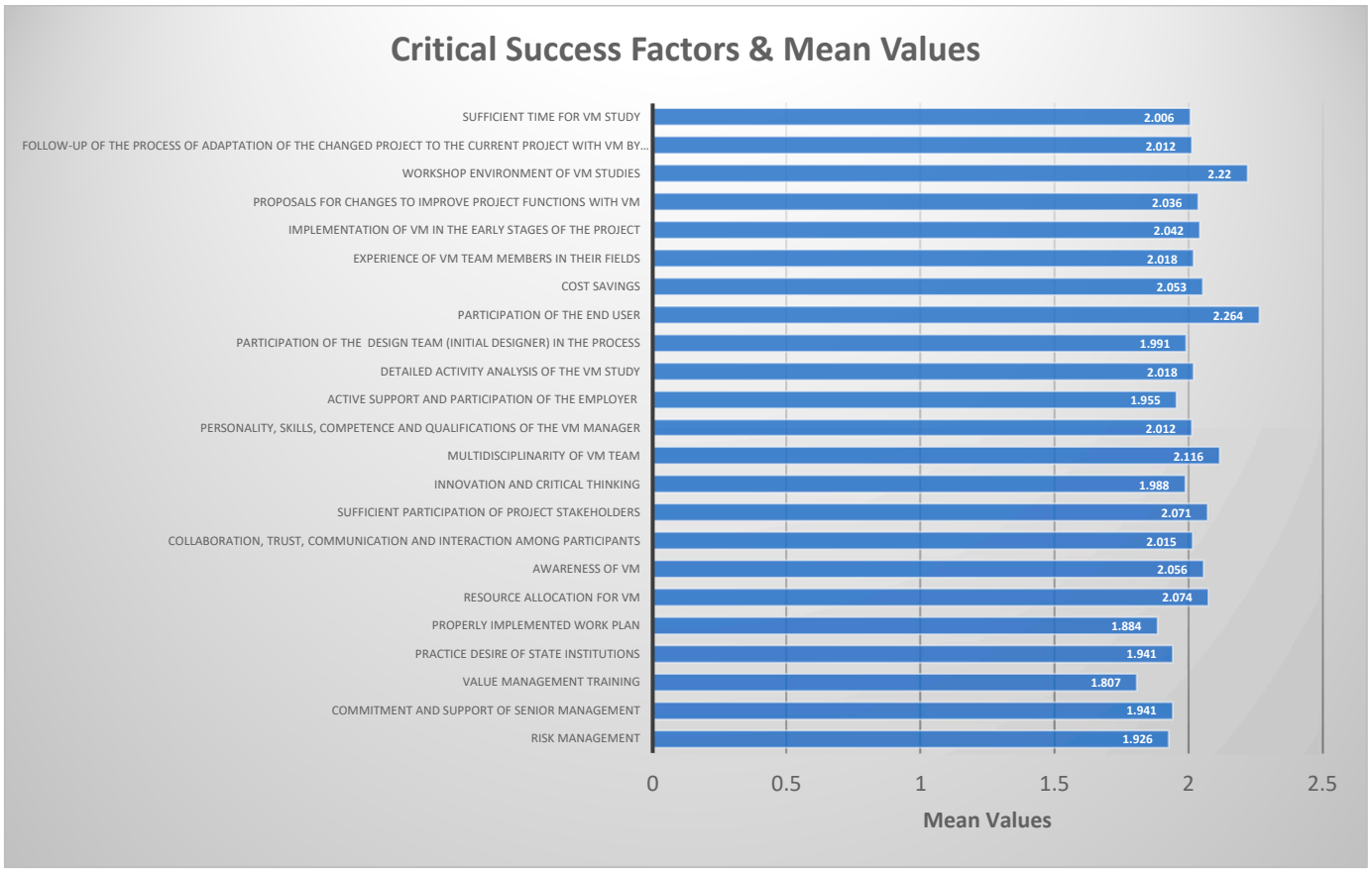


Figure 3. Critical success factors and mean values.

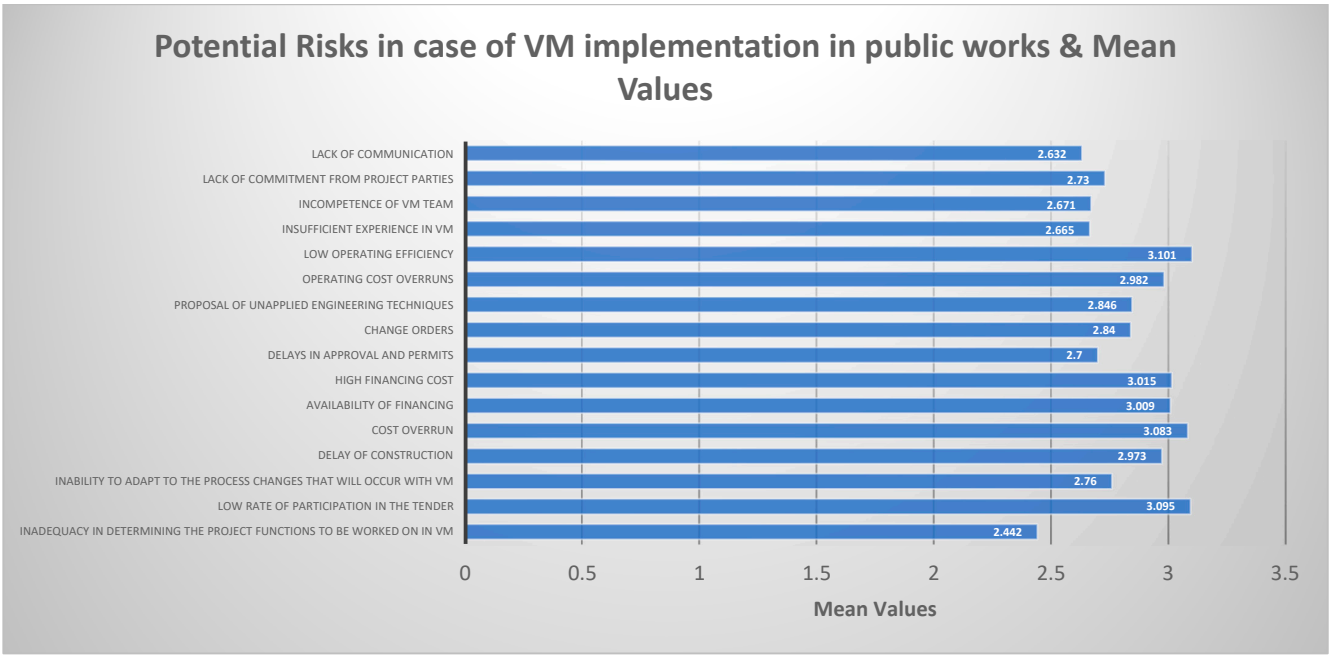


Figure 4. Potential risks in case of VM implementation in public works and mean values.

In addition, an analysis of the responses from participants based on various variables revealed significant differences related to their fields of study and professional experience. However, it was found that educational attainment, job position, and project budget did not have an impact on the responses. The significant variables were examined in detail.

Table 4 and Figure 5 illustrate the influence of participants' fields of work on their responses regarding the barriers to implementing value management (VM) in public works. There is a notable difference among all factors in relation to the field variable. Furthermore, it is evident that contractors and designers perceive the identified barriers as more serious compared to those working in academia, public affairs, and consultancy. In other words, contractors and designers view the application of value management in public projects as more challenging than professionals in academia, consultancy, and the public sector.

Table 4. Significant relationships between barriers to implementation of VM in public works and participant fields.

No	Barriers to Implementation of VM in Public Works	Field	n	$\bar{x}$	Ss	sd	F	*p* Value
1.	Lack of best practices	Academic	11	1.91	1.221	4	4.558	0.001
		Public Sector	31	1.81	0.910			
		Consultant	79	2.47	1.239			
		Contractor	187	2.76	1.421			
		Design	29	2.72	1.162			
2.	Multifunctionality of projects in VM implementation	Academic	11	2.00	1.414	4	2.684	0.042
		Public Sector	31	2.61	1.647			
		Consultant	79	2.89	1.396			
		Contractor	187	3.21	1.632			
		Design	29	2.90	1.175			

Table 4. *Cont.*

No	Barriers to Implementation of VM in Public Works	Field	n	$\bar{x}$	Ss	sd	F	*p* Value
3.	Insufficient information about VM	Academic	11	1.36	0.505	4	3.431	0.000
		Public Sector	31	1.81	1.046			
		Consultant	79	2.04	1.171			
		Contractor	187	2.40	1.405			
		Design	29	2.10	1.081			
4.	Lack of support and active participation from the employers and stakeholders in VM studies	Academic	11	1.73	0.647	4	2.064	0.015
		Public Sector	31	2.13	1.088			
		Consultant	79	2.15	1.026			
		Contractor	187	2.47	1.301			
		Design	29	2.38	0.979			
5.	Absence of contract provisions for the obligations and incentives related to VM implementation	Academic	11	1.91	1.136	4	3.749	0.008
		Public Sector	31	1.97	0.948			
		Consultant	79	2.01	1.068			
		Contractor	187	2.53	1.333			
		Design	29	2.21	1.048			
6.	Inexperience and inadequacy of contractors designated to implement VM	Academic	11	1.73	0.905	4	3.173	0.004
		Public Sector	31	1.77	0.845			
		Consultant	79	2.13	1.304			
		Contractor	187	2.45	1.304			
		Design	29	2.14	0.990			
7.	Conservative attitudes of the project/design teams	Academic	11	1.82	0.603	4	3.02	0.00108
		Public Sector	31	2.23	1.117			
		Consultant	79	2.25	1.276			
		Contractor	187	2.69	1.344			
		Design	29	2.62	1.015			
8.	Contractors' lack of investment, supportive policies, and human resources for the VM group and the VM team	Academic	11	1.73	0.467	4	4.409	0.000
		Public Sector	31	1.84	0.898			
		Consultant	79	2.00	1.209			
		Contractor	187	2.51	1.301			
		Design	29	2.31	1.039			

Table 4. *Cont.*

No	Barriers to Implementation of VM in Public Works	Field	n	$\bar{x}$	Ss	sd	F	*p* Value
9.	Shortage of VM experts	Academic	11	1.45	0.522	4	7.869	0.000
		Public Sector	31	1.55	0.810			
		Consultant	79	1.90	0.942			
		Contractor	187	2.51	1.369			
		Design	29	2.21	0.940			
10.	Lack of cooperation and interaction between the project design	Academic	11	1.55	0.522	4	5.215	0.000
		Public Sector	31	1.94	0.929			
		Consultant	79	2.14	1.206			
		Contractor	187	2.64	1.354			
		Design	29	2.21	0.978			
11.	Inexperience of the VM team in accurately estimating costs	Academic	11	2.00	0.632	4	3.872	0.003
		Public Sector	31	2.00	1.095			
		Consultant	79	2.15	1.188			
		Contractor	187	2.66	1.363			
		Design	29	2.31	1.004			
12.	Inadequate experience of VM team members	Academic	11	1.91	0.539	4	3.125	0.007
		Public Sector	31	1.94	1.124			
		Consultant	79	2.09	1.134			
		Contractor	187	2.50	1.259			
		Design	29	2.17	1.002			
13.	Unqualified VM team manager.	Academic	11	2.00	0.632	4	2.428	0.019
		Public Sector	31	2.00	1.183			
		Consultant	79	2.19	1.262			
		Contractor	187	2.60	1.450			
		Design	29	2.52	1.326			
14.	Ideas and alternatives that may arise with incomplete information in the early stages of the work plan	Academic	11	2.09	0.944	4	2.879	0.023
		Public Sector	31	2.19	0.980			
		Consultant	79	2.20	1.223			
		Contractor	187	2.66	1.265			
		Design	29	2.34	1.173			

Table 4. *Cont.*

No	Barriers to Implementation of VM in Public Works	Field	n	$\bar{x}$	Ss	sd	F	*p* Value
15.	Difficulties that may be encountered in generating and evaluating alternatives for problem-solving in VM implementation	Academic	11	2.45	0.934	4	3.015	0.018
		Public Sector	31	2.26	1.064			
		Consultant	79	2.37	1.211			
		Contractor	187	2.87	1.417			
		Design	29	2.62	0.979			
16.	Time required to conduct VM studies	Academic	11	2.00	0.775	4	3.328	0.003
		Public Sector	31	2.35	1.380			
		Consultant	79	2.47	1.348			
		Contractor	187	2.91	1.447			
		Design	29	2.34	1.010			
17.	Lack of VM technical norms, standards, and guidelines	Academic	11	1.55	0.522	4	4.621	0.001
		Public Sector	31	2.03	1.354			
		Consultant	79	2.20	1.265			
		Contractor	187	2.70	1.370			
		Design	29	2.34	1.045			
18.	Lack of legislation on VM implementation	Academic	11	1.55	0.522	4	4.533	0.000
		Public Sector	31	2.00	1.366			
		Consultant	79	2.04	1.115			
		Contractor	187	2.58	1.413			
		Design	29	2.59	0.983			

Table 5 and Figure 6 highlight significant relationships between critical success factors and the participants' fields of work. It was found that three factors—namely, the proper implementation of work plans, awareness of value management (VM), and the experience of VM team members in their respective fields—show higher mean values among contractors and designers compared to participants from academia, the public sector, and consultancy.

Table 5. Significant relationships between critical success factors and participants' field.

No	Critical Success Factors	Field	n	$\bar{x}$	Ss	sd	F	*p* Value
5.	Properly implemented work plan	Academic	11	1.45	0.522	4	3.851	0.007
		Public Sector	31	1.74	1.154			
		Consultant	79	1.72	0.715			
		Contractor	187	1.93	0.877			
		Design	29	2.38	1.147			

Table 5. *Cont.*

No	Critical Success Factors	Field	n	$\bar{x}$	Ss	sd	F	*p* Value
7.	Awareness of VM	Academic	11	1.64	0.674	4	2.104	0.040
		Public Sector	31	1.74	0.773			
		Consultant	79	2.00	0.961			
		Contractor	187	2.11	1.012			
		Design	29	2.34	1.203			
18.	Experience of VM team members in their fields	Academic	11	1.82	0.751	4	2.552	0.039
		Public Sector	31	1.84	1.003			
		Consultant	79	1.89	0.832			
		Contractor	187	2.05	0.912			
		Design	29	2.45	0.985			

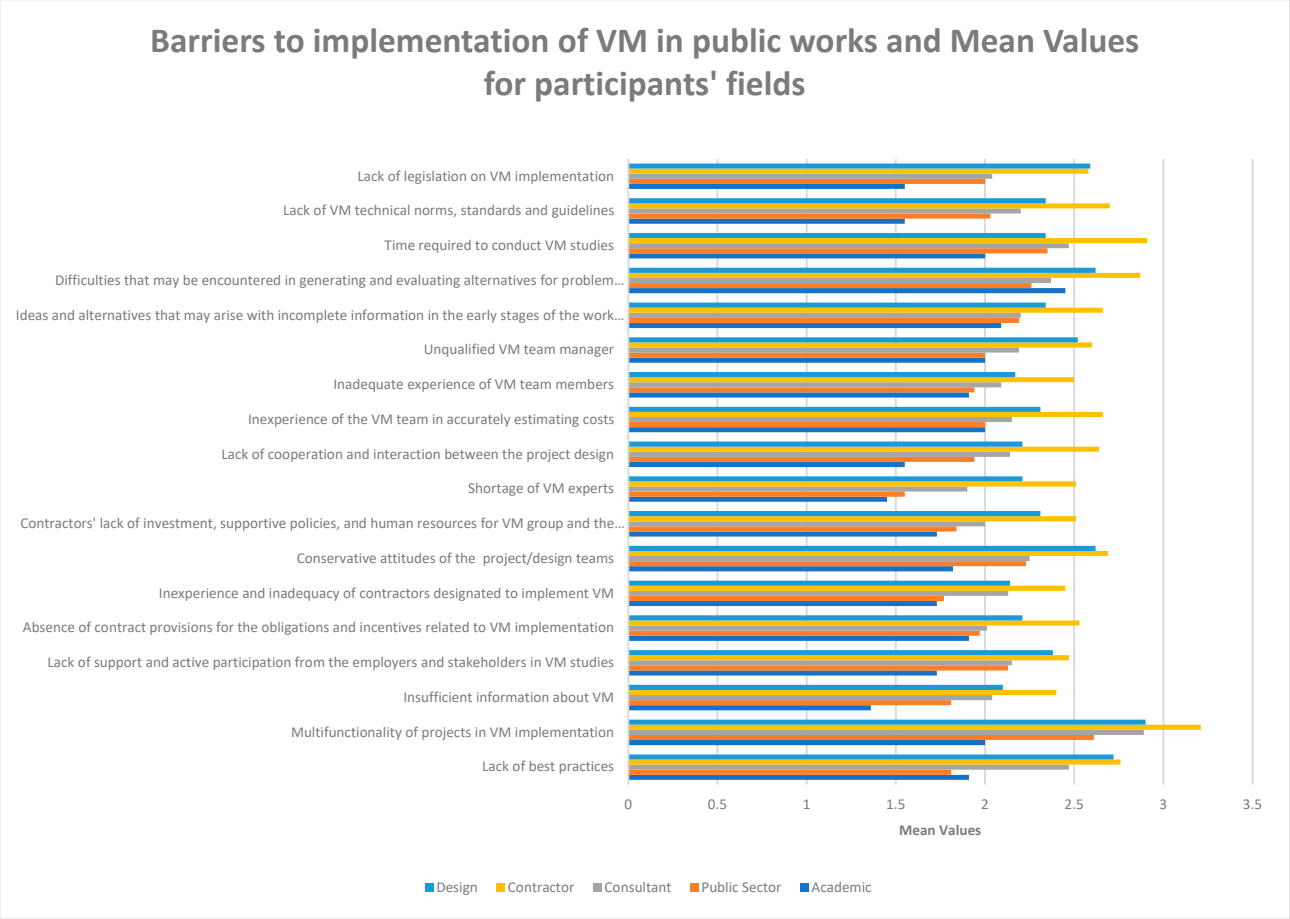


Figure 5. Barriers to implementation of VM in public works and mean values for participant fields.

Table 6 and Figure 7 present significant relationships between potential risks associated with VM implementation in public works and the participants' fields. It reveals four potential risks that are perceived as more critical by contractors and public sector employees than by those working in academia, consultancy, and design. These risks include: inadequacy in determining the project functions to be addressed in VM, inability to adapt to changes brought about by the VM process, lack of commitment from project parties, and lack of communication.

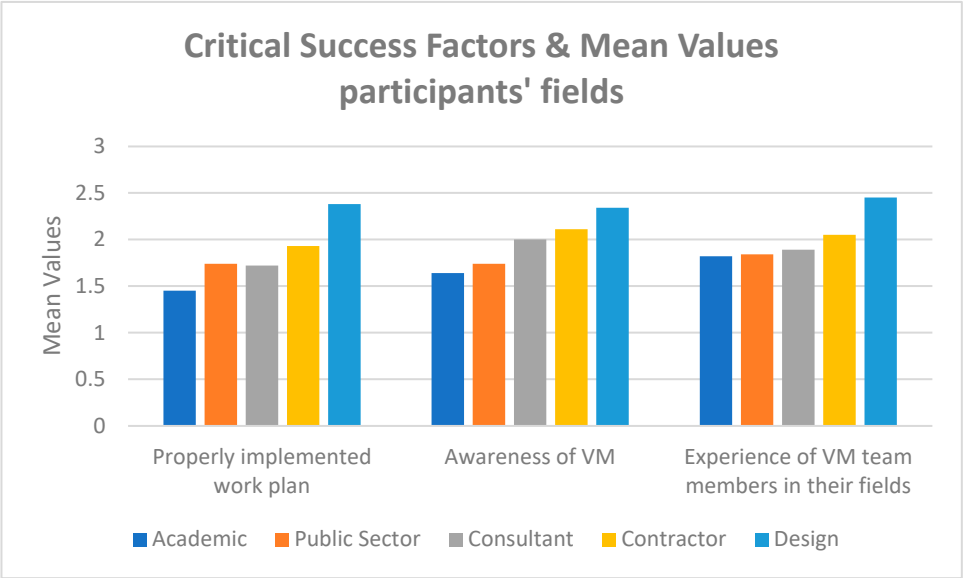


Figure 6. Critical success factors and mean values for participants' fields.

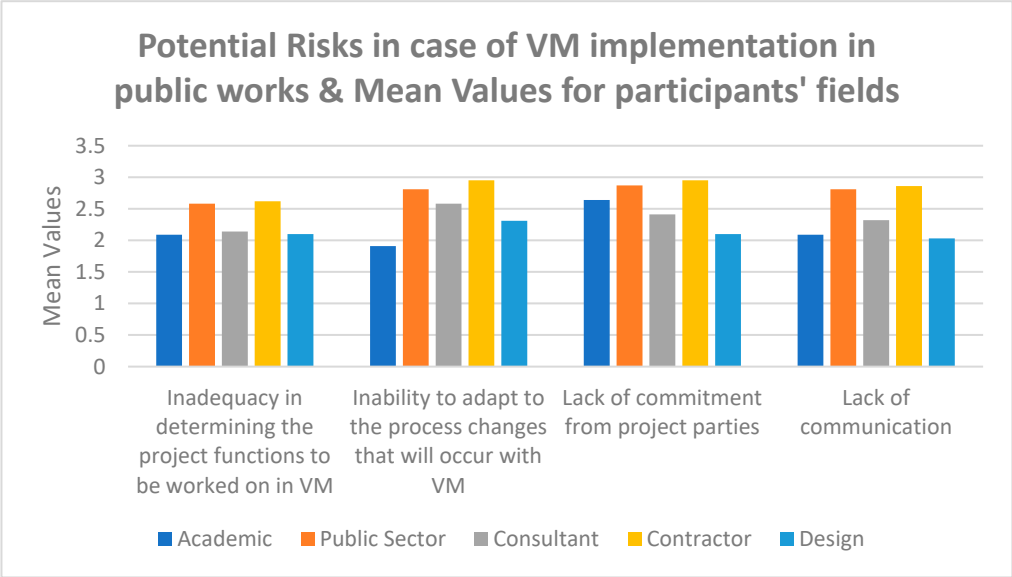


Figure 7. Potential risks in case of VM implementation in public works and mean values for participant fields.

According to Table 7 and Figure 8, which present significant relationships between critical risk factors and work experience, four critical risk factors are closely linked to participants' work experience. These factors include a properly implemented work plan, sufficient participation of project stakeholders, the multidisciplinarity of the value management (VM) team, and the experience of VM team members in their respective fields. The analysis reveals that a properly implemented work plan is more crucial for less experienced participants, while sufficient participation of project stakeholders, the multidisciplinarity of the VM team, and the experience of team members are more vital for those with more experience.

Table 6. Significant relationships between potential risks in the case of VM implementation in public works and participant fields.

No	Potential Risks in Case of VM Implementation in Public Works	Field	n	$\bar{x}$	Ss	sd	F	*p* Value
1.	Inadequacy in determining the project functions to be worked on in VM	Academic	11	2.09	1.044	4	2.348	0.039
		Public Sector	31	2.58	1.708			
		Consultant	79	2.14	1.206			
		Contractor	187	2.62	1.485			
		Design	29	2.10	1.047			
3.	Inability to adapt to the process changes that will occur with VM	Academic	11	1.91	0.831	4	2.752	0.003
		Public Sector	31	2.81	1.579			
		Consultant	79	2.58	1.247			
		Contractor	187	2.95	1.568			
		Design	29	2.31	1.039			
15.	Lack of commitment from project parties	Academic	11	2.64	1.502	4	3.033	0.004
		Public Sector	31	2.87	1.727			
		Consultant	79	2.41	1.214			
		Contractor	187	2.95	1.716			
		Design	29	2.10	0.939			
16.	Lack of communication	Academic	11	2.09	0.831	4	3.469	0.001
		Public Sector	31	2.81	1.778			
		Consultant	79	2.32	1.286			
		Contractor	187	2.86	1.663			
		Design	29	2.03	0.944			

Table 7. Significant relationships between critical risk factors and work experience.

No	Critical Risk Factors	Work Experience	n	$\bar{x}$	Ss	sd	F	*p* Value
5.	Properly implemented work plan	Lower than 10 years	124	1.90	0.905	2	0.05	0.046
		Between 11–20 years	114	1.88	0.933			
		More than 20 years	99	1.87	0.877			
9.	Sufficient participation of project stakeholders	Lower than 10 years	124	2.06	0.961	2	0.03	0.027
		Between 11–20 years	114	2.06	1.058			
		More than 20 years	99	2.09	0.991			
11.	Multidisciplinarity of VM team	Lower than 10 years	124	2.10	1.039	2	0.03	0.036
		Between 11–20 years	114	2.12	1.098			
		More than 20 years	99	2.13	0.965			
18.	Experience of VM team members in their fields	Lower than 10 years	124	2.00	0.902	2	0.04	0.042
		Between 11–20 years	114	2.04	0.977			
		More than 20 years	99	2.02	0.857			

Table 8 presents the responses to questions concerning awareness levels, the value management (VM) process, legislation, and other relevant issues. In this section of the survey, a total of 15 questions were posed to assess participants' understanding of VM, its legislative framework, and its implementation across various aspects. The results indicate that most participants lack extensive experience and possess only partial knowledge about VM. However, they agree that VM is vital for enhancing the value of construction projects and achieving cost savings. Additionally, participants believe that contractors and designers should be the primary stakeholders responsible for managing VM costs.

Another noteworthy point is that while Turkish standards have introduced VM legislation, participants are not fully informed about these regulations.

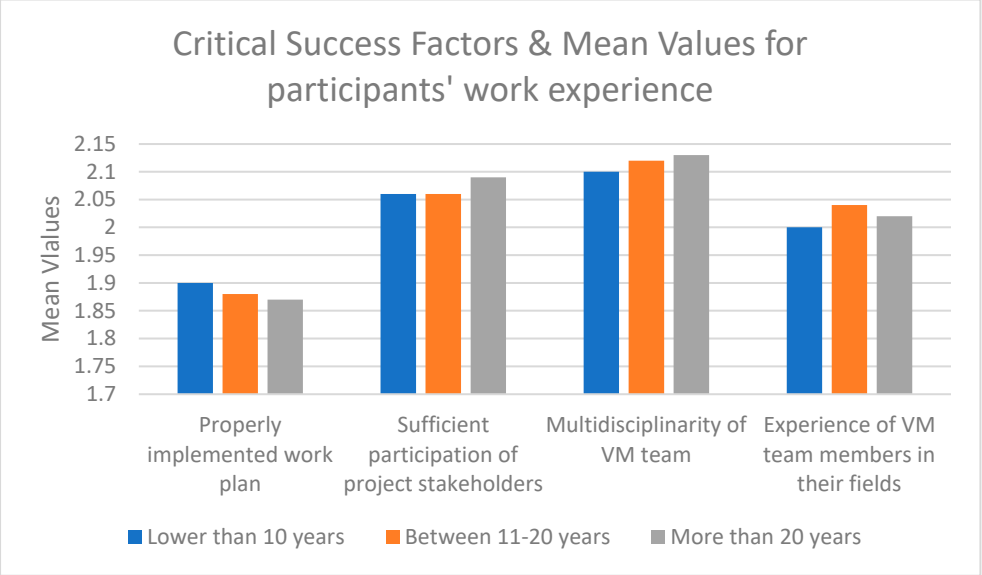


Figure 8. Critical success factors and mean values for participants' work experience.

Table 8. Responses to questions regarding awareness level, VM process, legislation, and other issues.

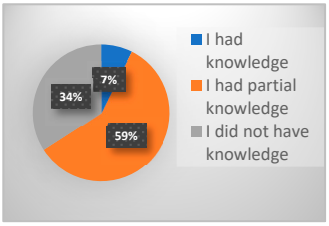
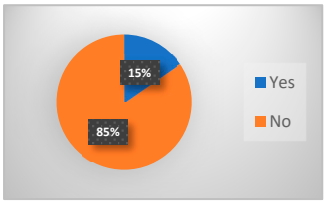
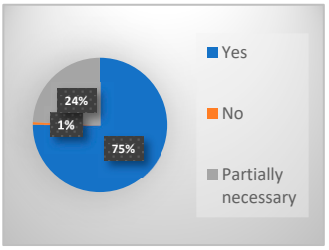
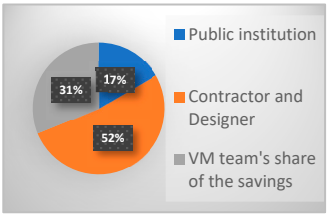
Questions	Responses	%	Graph
1. Did you have any prior knowledge of the Value Management (VM) methodology or its application tool, Value Engineering (VE), before participating in this survey?	I had knowledge	7.42%	
	I had partial knowledge	58.46%	
	I did not have knowledge	34.12%	
2. Have you ever worked on or participated in any project where Value Management (VM), Value Analysis (VA), or Value Engineering (VE) was applied?	Yes	15.43%	
	No	84.57%	
3. Do you think that the application of this method in public construction tenders is necessary?	Yes	75.07%	
	No	0.59%	
	Partially necessary	24.33%	
4. If Value Management (VM) is implemented in public construction tenders in our country, who do you believe should cover the expenses of the VM team?	Public institution	16.62%	
	Contractor and Designer	52.23%	
	VM team's share of the savings	31.16%	

Table 8. *Cont.*

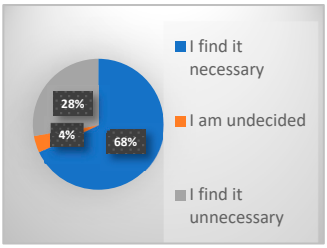
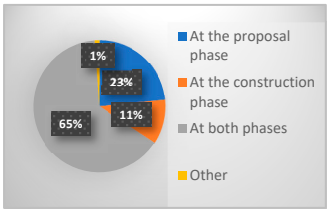
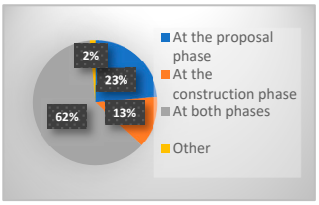
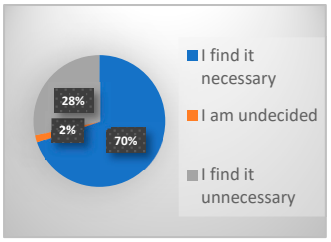
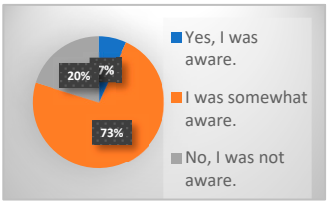
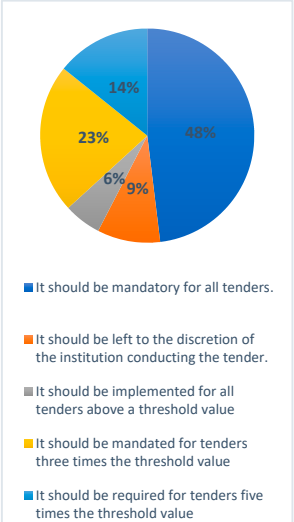
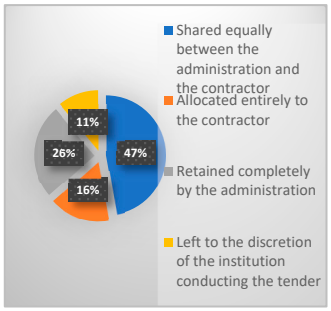
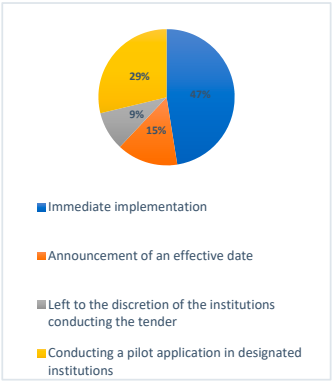
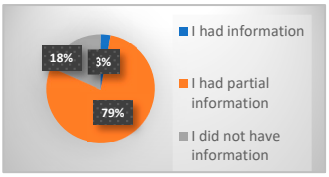
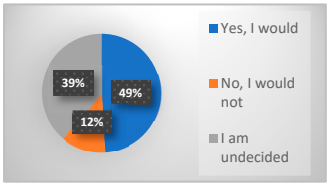
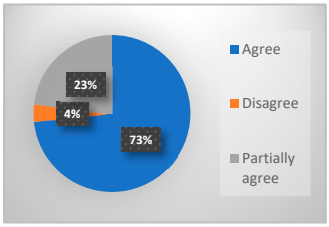
Questions	Responses	%	Graph
5. If Value Management (VM) is implemented in public construction tenders, what are your thoughts on including the cost savings achieved through VM at the tender proposal stage within the tender legislation?	I find it necessary	67.95%	
	I am undecided	4.15%	
	I find it unnecessary	27.89%	
6. If Value Management (VM) is implemented in public construction tenders, at which stage of the project do you think its application would be most beneficial?	At the proposal phase	23.44%	
	At the construction phase	10.68%	
	At both phases	64.69%	
	Other %	1.19	
7. If Value Management (VM) is implemented in public construction tenders, which method do you believe is more applicable given the implementation costs and associated risks?	At the proposal phase	23.44%	
	At the construction phase	13.35%	
	At both phases	61.72%	
	Other	1.49%	
8. If Value Management (VM) is implemented in public construction tenders, what are your thoughts on considering benefits such as cost reduction and more efficient use of time, alongside the social benefits of the project areas where VM is applied?	I find it necessary	69.73%	
	I am undecided	1.78%	
	I find it unnecessary	28.49%	
9. Were you aware that the European Union standards concerning the Value Management (VM) methodology have been harmonized and published by TSE?	Yes, I was aware.	6.82%	
	I was somewhat aware.	73.00%	
	No, I was not aware.	20.18%	
10. How do you believe the inclusion of VM in public tenders should be legislated?	It should be mandatory for all tenders.	48.07%	
	It should be left to the discretion of the institution conducting the tender.	9.50%	
	It should be implemented for all tenders above a threshold value	5.64%	
	It should be mandated for tenders three times the threshold value	22.55%	
	It should be required for tenders five times the threshold value	14.24%	

Table 8. *Cont.*

Questions	Responses	%	Graph
11. In the legislation concerning the implementation of VM in public tenders, how do you think cost savings should be shared between the administration and the contracting company?	Shared equally between the administration and the contractor	47.18%	
	Allocated entirely to the contractor	16.32%	
	Retained completely by the administration	25.52%	
	Left to the discretion of the institution conducting the tender	10.98%	
12. If the implementation of VM is made mandatory in public tenders, what do you think the transition process should entail?	Immediate implementation	47.48%	
	Announcement of an effective date	14.54%	
	Left to the discretion of the institutions conducting the tender	9.20%	
	Conducting a pilot application in designated institutions	28.78%	
13. Did you have any information about the Value for Europe training and certification umbrella organization before this survey?	I had information	2.97%	
	I had partial information	78.64%	
	I did not have information	18.40%	
14. If Value for Europe is implemented in public tenders, would you consider becoming a member of the National Value Management Association/Organization that will be established for training and certification?	Yes, I would	48.96%	
	No, I would not	12.17%	
	I am undecided	38.87%	
15. Do you think that if Value for Europe is implemented in the Turkish construction sector, the international market share of our contractor companies could increase?	Agree	73.29%	
	Disagree	3.56%	
	Partially agree	23.15%	

4. Discussion

The application of value management in public construction projects can provide numerous benefits and serve as an example for private sector projects as well. Many studies in the literature highlight these advantages. For instance, the work by Galipogulları and Atabay [38] indicated that the VM approach resulted in a 6% financial saving for the construction company and a 17% reduction in work time. This study aims to identify the barriers to implementing VM in public projects, the critical success factors for VM, and the potential risks that may arise if VM is applied in these projects.

One of the most significant issues hindering the implementation of VM in public projects in Turkey is the inherent complexity of these projects, which often involve multiple functions. This complexity can lead to various challenges among professionals in the construction sector. Specifically, misunderstandings and misperceptions regarding value management persist among clients and construction professionals [19]. Additionally, VM can be time-consuming, and evaluating the alternatives necessary for VM can pose difficulties. The data from this study indicate that the main challenges in applying VM in public projects particularly affect contractors and designers. With the introduction of VM, design changes occur, leading to an increased workload for designers. Furthermore, poor design can result in higher operating costs [32]. Insufficient time to adapt to changing designs may lead to inadequate designs and unforeseen additional burdens. Although VM may be perceived as a profitable system for contractors, deviating from the project can entail various risks.

Key critical success factors for the effective implementation of value management (VM) include active participation from end users, a collaborative workshop environment, and a multidisciplinary approach within the VM team. Each of these components is essential for achieving success. It is important for contractors and designers to focus on the proper execution of work plans, possess a thorough understanding of value management, and ensure the experience of VM team members, as this aspect is particularly crucial compared to other participants. The study further indicated a correlation between work experience and critical success factors. A well-executed work plan holds greater importance for less experienced participants, while sufficient participation from project stakeholders, the diversity of the VM team, and the experience of team members are more critical for those with greater experience.

The studies identify several key barriers to adopting value management (VM) in construction projects. These include inadequate training and facilitation skills, a lack of appropriate guidelines and legislation, limited experience with VM, a shortage of qualified experts, uncertainties in contract awards, insufficient management control, perceived political influence in procurement, unrealistic contract stipulations, and deficiencies in contract documents and cost estimations [29,30]. This study aimed to investigate the potential risks associated with the implementation of value management (VM), specifically in public works. The findings indicate that low operational efficiency, a low rate of participation in tenders, and cost overruns are considered significant risks. In contrast, challenges related to identifying project functions to prioritize in VM, ineffective communication, and insufficient experience with VM are not viewed as major concerns. Additionally, the study highlighted that contractors and public sector employees are particularly impacted by risks such as inadequately determining the project functions to be addressed in VM, difficulties in adapting to changes introduced by the VM process, lack of commitment from project stakeholders, and poor communication.

The analysis of the survey data has also revealed participants' knowledge and opinions about the value management (VM) methodology and related topics. The findings show that most participants do not have a sufficient understanding of the VM methodology and the value engineering (VE) tool. Several studies in the literature also confirm this lack of awareness [25,27,41]. This suggests that the VM methodology has not been widely adopted, resulting in a low level of awareness. Consequently, there is a pressing need for additional information, training, and awareness initiatives focused on VM and DM. Furthermore, a significant proportion of participants are unaware that European Union standards have been harmonized with the VM methodology and published by TSE [42,43]. To enhance awareness and the practical application of these standards, it is essential to prioritize

information dissemination activities. This approach will better support stakeholders aiming to comply with the standards while effectively utilizing the VM methodology.

The survey results indicate a range of opinions regarding the distribution of cost savings related to the implementation of value management (VM) in public procurement. Most respondents prefer an equal sharing of these savings between the administration and the contractor. However, some advocate for the entire amount to go to the contractor or remain solely with the administration. This diversity of perspectives highlights the varying interests and expectations of stakeholders involved. To address this, it is essential to establish clear regulations concerning the sharing of cost savings in the tender legislation and to consider different allocation options. Additionally, it has been noted that a significant number of survey participants lack awareness of the Value for Europe training and certification umbrella institution. This suggests that the institution has not been adequately promoted, leading to a knowledge gap among participants regarding Value for Europe training and certification. It is essential for institutions and stakeholders involved in the Value for Europe initiative to actively promote the Value for Europe framework and to inform participants effectively. This approach will enhance awareness and understanding of the Value for Europe methodology. Furthermore, participants should be made aware that European Union standards are harmonized and published by the TSE. By doing so, adherence to the Value for Europe methodology in alignment with these standards will be encouraged, ultimately leading to improved quality and efficiency in projects.

5. Conclusions

This study mainly investigated the applicability of value management in the construction industry by addressing barriers, critical risk factors, and potential risks during VM implementation in public works. The research also focused on the awareness level, legislation, and other relevant topics by utilizing a quantitative survey. The study emphasized the role of contractors, designers, and public sector employees in the implementation of VM in public works and the main challenges that would be faced by different stakeholders in the construction industry. Therefore, it is crucial to understand how to prepare well and implement VM in public construction projects.

The survey results indicated that the Value for Europe methodology and value engineering are not yet widely implemented. This presents a significant opportunity for development. Stakeholders involved in the industry, academics, contractors, project managers, and technical staff should place greater emphasis on the DM methodology and incorporate this approach into their projects. By doing so, the project value will increase, cost savings will be realized, and project success rates will improve.

Currently, the level of knowledge among participants regarding the VM methodology and its tools is low. Additionally, there is limited awareness of European Union standards, and opinions regarding the sharing of cost savings vary. It is essential to prioritize awareness and information initiatives in these areas, clarify standards and legislation, and make the VM methodology a fundamental aspect of all projects. This shift will facilitate the implementation of more efficient, sustainable, and value-oriented projects.

This study has some limitations and alternative considerations. Primarily, it was conducted to provide a general overview of the value management (VM) methodology; therefore, it does not include detailed technical information or specific examples regarding its application. The objective was to raise awareness among participants about the VM methodology and to explain its fundamental principles. Additionally, this research is based on survey data, which relies on the participants' self-reported information. As a result, there may be uncertainties regarding the accuracy or objectivity of some responses, influenced by personal biases, misremembering, or individual perceptions. Furthermore, the clarity

and comprehensibility of the survey questions could impact how participants respond. The sample texts and information provided in this study are presented in a general format that may need to be tailored to specific organizations or sectors. For effective implementation of the VM methodology in their own organizations or projects, participants may require more detailed guidance or expert consultation.

Given the existing limitations and alternatives, further studies and applications are essential to thoroughly assess the potential of the DM methodology. It is crucial for participants to gain a deeper understanding and application of the DM methodology within their own organizations or projects. To facilitate this, organizing a more comprehensive training session or workshop on the DM methodology is recommended. Such an event can enhance participants' understanding and skills in effectively applying the methodology to real-world projects. Additionally, more extensive research and field studies are needed to evaluate the effectiveness of the DM methodology more comprehensively. By analyzing the results of applying the DM methodology across different sectors, projects, and organizations, we can gain valuable insights into its advantages, challenges, and effective implementation strategies. Moreover, it is vital to expand current legislative studies on the DM methodology and incorporate it into public procurement legislation. This integration would promote the broader adoption of the DM methodology in public construction investments, ultimately contributing positively to the country's economy.

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Informed Consent Statement: Informed consent was obtained from all individual participants included in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author due to (specify the reason for the restriction).

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