# FACTORS INFLUENCING VALUE ENGINEERING ADOPTION AMONG THE LIBYAN CONSTRUCTION ORGANIZATIONS: MEDIATING ROLE OF INNOVATIVENESS

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***Abstract***

*The current reconstruction of Libya infrastructure requires the implementation of value engineering (VE) in the Libyan construction industry to minimise waste and efficient use of available resources. This study identifies the influence of organisational culture and the mediating role of organisational innovativeness on value engineering (VE) adoption among construction organisations operating in Libya. This study utilised a causal research design and a quantitative research approach. A probability simple random sampling technique was used to select 375 respondents working in Libya's construction organisations. A total of 242 responses were received, yielding a response rate of 64.5%. A structural equation modelling method of analysis was utilised to test the direct and mediating relationships stated in the hypotheses. The findings showed a significant correlation between organisational culture and VE adoption. Simultaneously, organisational innovativeness mediates the relationship between organisational culture and VE adoption. These findings suggest that the construction industry in Libya needs to consider organisational culture (market culture and adhocracy cultures) and innovativeness to enhance VE adoption across the construction industry. This research complements the existing body of literature on organisational culture, innovativeness, and value engineering.*

**Keywords:** Value Engineering (VE); Organizational Innovativeness; Organizational Culture; Libyan Construction Industry

## *Introduction*

In every country, the construction industry's significant roles cannot be undermined in the development of its economy and the nation as a whole. The significance of this role is determined based on how closely it is related to the economy; therefore, it is different in various countries [1]. The construction industry's contributions to many developing countries are largely evident in the building of current infrastructure, such as roads, railways, airports, and hospitals [2]. In contrast, the contributions of advanced nations are focused on specialised obligations, preservation, and reconstruction. Because the construction sector in Libya is weighed down with various difficulties in dealing with modern construction improvement patterns, this study's findings will raise awareness of the possible factors that influence the adoption of value engineering (VE) among building construction companies in Libya. Apart from the prevalent unemployment problem, poor infrastructural development is the next common problem in Libya [1]. Thus, focusing on the possible factors that can influence the adoption of value engineering (VE) among building construction companies in Libya will provide a solution that will bring about improvement and development in its activities to contribute greatly to the growth of the country's economy.

The recent recession in the global economy has resulted in serious problems that have affected Libya's construction companies since 2011. The Libyan revolution, which spanned between February and October 2011, led to a civil war that resulted in the massive destruction of major infrastructures located across the Libyan cities. A major challenge that the incumbent government will have to address is the reconstruction of all major infrastructures destroyed during the uprising [2]. The Libyan government's intent to embark on reconstruction was demonstrated by the Libyan Reconstruction and Investment Forum, which was held in London's Lancaster House on 26 January 2017. According to the World Bank (2016), approximately USD 200 billion will be needed for Libya's reconstruction projects. With such a huge amount of capital expenditure, the current global financial crises, and the fallen price of crude oil, efficient utilisation of the available funds is crucial to the projects' success to be reconstructed. The intense competition faced by many companies has halted most of their projects [3].

Given the recent recession in the economy, significant construction developments are planned for 2030 [3]. Because the construction industry in Libya is novel to the application of value engineering, it has not been widely utilised [3]. Nevertheless, recent developments in the market point to the fact that value engineering is indispensable to construction works because of its variations in cost, reduction in energy supply, and relevance in the market's growing competition. For these reasons, in the currently established construction procedures, the Libya government requires a more holistic approach to building design which encompasses sustainability that can be integrated into the value engineering process. "Value engineering has been used in the construction industry for decades to achieve better value for projects [4]. If implemented successfully, this group problem-solving methodology can reduce costs while maintaining or improving performance and required quality in a project."

An investigation into value engineering will benefit the construction industry in terms of cost reduction in project work, clarification of the client's goals, improvement in the communication mode, and level of creativity among participants. While the VE application in Libya will significantly impact building construction projects such as reducing un-necessary spending, reducing wastage, and enhancing the value of the projects, its successful implementation does not rest on the contractors alone. This requires the collective efforts of all players in the Libyan construction companies [5]. VE's unique feature involves its functional analysis, optimising the cost and performance using a creative and organised

technique. This is achieved by eliminating or modifying unnecessary costs to a project that does not contribute to the project's functions. Being a multidisciplinary and problem-solving approach, VE is performed by a team of trained professionals using a job plan that details the steps and activities to be performed during the value engineering study.

However, the manner in which VE is applied among construction companies in developing nations is imperfect [6]. This is not only due to the low level of education and training among professionals in evaluating their projects using VE in Libya, but even countries that are familiar with VE are also reluctant to apply it to construction projects because of the uncertainty of its outcomes [7]. This study examines the factors influencing the adoption of VE, which can benefit Libyan construction industry. While the adoption of VE in Libya may significantly benefit the construction industry in reducing unnecessary spending, reducing wastage, and enhancing the value of the projects, the successful implementation of these applications does not rest on the contractors alone. This requires the collective efforts of all players in Libyan construction organisations (Pavlovskis et al. (2017).

## Theory and Hypotheses Development

The resource-based view theory is adopted as a theoretical framework. [8] states that the major assumption of the resource-based theory centres on the company's resources and assets. This theory states that for an organisation to attain maximum achievements, it should effectively construct, maintain, and make the most use of the resources and capacities that are pertinent to the company's business.

Specifically, it is crucial to gain power over the resources and potentials that are vital in accomplishing the company's goals in terms of being more efficient, effective, and productive. These resources and potentials represent the company's most important long-term performance tools [8]. The resource-based theory relies on the principle that the main advantage for a company is the location of the most efficient and operative technique to move resources to the foreign market without losing the value of the resources. Resource value can be described as the level of participation in a company's competitive advantage. In other words, the more resources involved in creating the company's competitive advantage, the more valuable it becomes. As a result, the most difficult task in the process of choosing the entry mode is to choose the entry mode with the ability to shift the company's resources into a foreign market without decreasing the value of the resource [9]. The company will try to define the probability of creating a reasonable advantage in the chosen foreign market by analysing the fit of its own resources (firm-specific) with the selected market's characteristics.

Therefore, the resource-based view theory underscores the organisation's competencies, which are both perfectly mobile and heterogeneous. According to [10] because these resources are unique, they become difficult to imitate. They enable construction organisations to deliver valuable construction products to their clients in one or more market environments. The relevance of the resource-based view theory is based on the fact that value will be delivered in line with the particular and desired resources in a building project and that an organisation's culture is a remarkable strategic resource because of its worth, uniqueness, and immutability [8, 10]. An organisation's capabilities are the key determinants of the strategic choice in sustaining competition, and in some cases, these resources may allow them to create additional clients' worth. In other words, construction organisations need to develop additional value capabilities in construction project delivery, which signifies an influential and beneficial means for them [11].

In line with, the present study focuses on those firms' rare and heterogeneous resources as prospective sources of competitive advantage in construction project

value and delivery [12]. The resource-based view theory is adopted because it explores an organisation's intangible culture that could create awareness of the need for the Libyan construction companies' adoption of value engineering. Extant literature has also indicated that firms' intangible capabilities and organisational culture are unique to organisations; they are also valuable because they have been developed over time, giving them inimitability to gain a more competitive advantage [13].

***Value Engineering***

A technique for evaluating and improving a product, service or process 'value' is called Value Engineering (VE). It is an approach that utilises scores and weights to analyse measurable and non-measurable quantities. VE is an analytical method used to assess the performance and cost of a process or item [14]. It is a comparative analysis that utilises an original or baseline idea and compares it with the proposed alterations of the same idea. Value engineering enables systems and processes to become more affordable while maintaining or exceeding the ratings of previous performance. When utilised correctly, it can merge engineering and psychology to create a solution that enhances the quality of life[15].

Value engineering is a tool intended for optimisation in the engineering sector and has been a very relevant method that has been adopted for a long time. After years of improvements and usage, it has been gradually popularised, adopted, and different private and public economic sectors have benefited, part of which is the construction industry [5, 16, 17]. Presently, it is being adopted by several organisations worldwide to initiate and develop structural projects. As a result, many governments in different countries have enacted laws, making it compulsory for executive agencies to adopt them in their operations. VE has been confirmed to be of great improvement in optimising the life cycle costs of infrastructural projects. Because the use of value engineering has been prevalent among diverse practitioners from different cultures, there have not been consistent and generally accepted definitions and terminologies of VE. However, the underlying mechanisms remain unclear. The following are the commonly adopted terms when referring to VE: value analysis, value engineering, value methodology, and value management. Writers have established that since the original concept behind the technique is carefully implemented in the process, terms may just be irrelevant [5, 16, 17]. To the best of our knowledge, term value engineering (VE) has been adopted. In this study, VE is defined as a management technique that always involves adopting and executing acknowledged tools (the Job Plan) regularly by a multidisciplinary team (the value engineering team). The tools are usually employed to recognise a product, service, or process performance to establish a valuable functional system. Finally, the deployment of tools is meant to provide dependable functionality at a very low cost [18].

Therefore, it is recognised as a process of organising a team whose focus is to evaluate the performance and quality of construction projects to create unpretentious economic substitutions for the clients' requirements. Thus, implementation personnel must possess certain characteristics that will ensure the successful outcomes of adopted value engineering. These qualities include excellent communication skills, sound leadership skills, involvement, and team members' appreciation [19]. Thus, VE improves with multidisciplinary team members. In this manner, the multidisciplinary team(s) utilises systematic procedures that identify the functionality of products/services, decide a functional value, produce genuine substitutions by being innovative, and offer essential services at a reasonably adjusted general cost [20].

In most cases, studies on value engineering focus largely on client briefing, acceptance and practices, measuring performance, decision-making, and driving forces [21]. While many efforts are being made towards the integration of

into project construction in most parts of the developed world, developing countries seem not to have embraced it well. [22] construe that there has been a retardation in Southeast Asia regarding the application of the construction industry's value engineering concept. Professionals and clients have been seeking how value engineering can be applied to reduce the initiated financial cost that might have been caused by needless budgeting at the design, building, and operational steps involved in projects. Nevertheless, most of the published information has focused on pre-construction phases [19, 23]. The author's re-cent research and interview consultants on construction projects that are presently completed showed that for the un-necessary cost to be eliminated to meet up with a set budget, value engineering is very relevant [24, 25]. For this reason, considering the cyclical nature of construction in Libya, there is a serious need for the application of the value engineering approach to improve project construction, and at the same time, achieve improved returns on investments. Factors such as restricted construction schedule, low-profit margins, difficulty, and low standards in the delivery of construction projects have been responsible for the Libya construction industry's inability to compete with the global market. Thus, there is a great need for awareness and sensitisation of the best practices to achieve better values, usually on behalf of construction project proponents. Within the Libyan construction industry context, adequate awareness will hasten the adoption of new technologies, such as value engineering, to improve firms' productivity and competitiveness [3, 19, 23, 26].

*Organizational Culture*

It has been observed that various factors are linked to the influence of value engineering. [20, 27] identified clients' requirements by providing satisfactory performance to end-users, considering their crucial importance in any business success. Studies have also considered product quality (in terms of construction output and services rendered) and the cost of resources (in terms of materials and labour). A systematic process approach that can critically identify problems and continuous monitoring should be identified to achieve better performance in value engineering. In addition to the aforementioned, research that can discover organisational competencies that are germane to the delivery of value engineering in firms should be conducted, especially in unindustrialized countries in which there is inadequate knowledge regarding the reduction of needless cost and at the same time maintaining the value of projects [28, 29].

The culture of an organisation plays a significant role in ensuring lasting success. For this reason, an instrument that is very reliable should be adopted to measure the prevailing culture in an organisation. [25, 30] created an Organisational Culture Assessment Instrument (OCAI) concerning the Competing Values Framework (CVF) to draw out and define the prevailing cultures in organisations. [25, 30] discovered two key measurements whose intersection further produced four types of culture [4, 14, 31]. The four dimensions are as follows: internal focus and integration, external focus and differentiation, flexibility and discretion, and stability and control. They are specified as follows: hierarchy (internal process model), market (rational goals model), clan (human relations model), and adhocracy (open systems model).

The prevailing cultural orientations in an organisation are established by the four key cultures identified by the OCAI. The features of each culture are displayed in Figure 1, as stated by [25]. The dominant culture of organisations placed on the

left side of Figure 1 is that of a prevailing atmosphere where there is a hierarchical structure and policies that aim to create and accomplish the market's aims. The major concern of such organisations is human resource development in an actively flexible manner [23, 24, 30, 32]. The reason for this type of culture could be that the organisations seek to be part of the dynamism taking place outside the organisation, thus necessitating a cross-functional team with a diversity of talents to assure them that they have the capacity to operate effectively. The dominant culture of organisations placed on the right-hand side of Figure 1 has a prevailing cultural atmosphere that tends toward being flexible and being externally focused, viewing efficiency to be inventiveness, progression in productivity, and being able to develop and receive external support.

*Figure 1*

**The Competing Values Framework of Organizational Effectiveness**


Each of the quadrants represents the characteristics that are well suited to an organisation's mode of operation, which depicts their underlying conventions, principles, and standards. All four types of culture are intrinsically peculiar and relevant to their organisations without considering one to be better than the other types [3, 9, 13, 33-36]. Observed that there is a possibility for a combination of the four styles in organisations. However, the values of each may be more obvious in organisations than in other types [9]. The CVF theory has recommended that the type of culture operating in an organisation is closely connected to organisational indicators for effectiveness [34]. In this study, adhocracy and market are adopted because they are closely connected to VE methods operating among construction organisations in Libya [9, 20, 35, 37]

*Adhocracy culture*

The adhocracy culture's main focus is on outward concerns, the flexibility of values, and caution instead of emphasising constancy and power. This culture is typified by being original, creative, risk-taking, self-motivated, and business-oriented. No emphasis is placed on the administrative diagrams and official structure because the individual's role in the organisation is rather flexible [38-41]. Companies with a prevailing adhocracy culture are software development and aerospace organisations. The reason is that their major tasks require that they quickly adjust to new opportunities and then be able to produce innovative products or services.

The peculiarity of the adhocracy culture is that "an idealistic and novel vision induces members to be creative and take risks' [34]. Adhocracy organisations take

pride in being flexible, independent, progressive, and thinking about things [23], leading to invention and high productivity [42-44]. Innovation implies introducing and applying new and novel ideas, processes, products, and procedures within an organisation. Innovativeness provides flexibility to organizations with the intention of choosing alternative ways to practice and satisfy customers with improved performance. The concept of organisational innovativeness has several explanations in different contexts [6, 20, 30]. Conceptualisation offers various possible innovative options, such as new product design and development, service development, new methods of production, determination of markets and alternate new resources, and overall new organisational forms of development. Hence, we propose the following hypothesis:

**$H_1$**: There is a positive relationship between adhocracy culture and value engineering adoption among Libyan construction organisations.

*Market orientation*

This type of culture basically believes that the organisation is a marketplace on its own [25]. Although priority is placed on constancy and power, more emphasis is placed on issues outside the organisation. Issues outside the organisation are seen as threats, thus leveraging the situation to prepare its members for any form of competitiveness to make a profit [23, 45-47]. This culture is typically described as being guided by external influences and competition [25]. Competitive-ness and efficient output are driven through partnering and position to perform fruitful planning and set achievable goals (as means) to attain productive results (as ends). Basically, the employees' driving force to perform and meet the set standards of any organisation's owner is based on the rewards attached to every task.

In this study, market culture and value engineering are treated together, where market culture is postulated to in-fluence the adoption of Libyan construction firms' value engineering. This decision aligns with the previous researcher's submission. In particular, the earlier study indicated that market culture is one of the most powerful internal forces any organisation can utilise to influence its value delivery and improve its competitiveness. According to [41, 43], "market culture defines expectations about behaviour, how work is done, how decisions are made, how social interactions are structured, and how people communicate". Before any strategic plan for value re-orientation and change in any organisation, its members' market culture must be identified, spelt out, and validated [3, 6, 27, 42, 47-50]. Firms' propensity to adopt information technology is mostly determined jointly by the driving force of market dynamics (availability, technological appropriateness, cost, and demand) and the organisational characteristics of the adopting firm. In economists' parlance, the focus is always on the driving force of market dynamics, whereas the organisational, business, and public administration researchers emphasise the latter. Thus, the propensity and capability to adopt information technology provide firms with easier ways to penetrate new markets to discover or create new channels for their products or services and achieve better proximity to their customers. Hence, we propose the following hypothesis:

**$H_2$**: There is a positive relationship between market orientation and VE adoption among Libyan construction organisations.

**Organisational innovativeness as a mediator**

The study on innovativeness, initiated by [39, 51], has become prevalent among many industries, especially in the construction industry. This is because the construction industry is faced with competition from the global market. This situation

has made it necessary for construction organisations to increase their performance level to cope with the technological advancements that have brought about the mode of operations in different businesses [8, 11, 34]. In addition, innovative research in the construction industry is imperative because of the construction industry's aversion to new developments and inadequate commitment to innovation [41, 50, 52]

A very significant feature of adoption research is the introduction of the concept of innovativeness as a mediator to improve the adoption of VE among construction companies. Therefore, innovativeness can be explained as the propensity of an organisation or individual toward the quick acceptance of innovations that are comparable to other social networking members [6, 17, 23, 45, 49, 50], innovation implies introducing and applying new and novel ideas, processes, products, and procedures within an organisation. Innovativeness provides organisations with the flexibility to choose alternative ways to practice and satisfy customers with improved performance. The concept of organisational innovativeness has several explanations in different contexts. In its earliest conceptualisation, [36, 53] offered various possible innovative options, such as new product design and development, expansion of ser-vices, innovative approaches of production, determination of markets, alternate new resources, and overall new organisational forms of development. Salleh, Fareed, [54] operationalized organizational innovativeness as the organization's capability and readiness to innovate. The basis of organisational innovativeness is a new industrial and business-level criterion. According to [26, 39, 42], organisational innovativeness is the same as the organisation's propensity to seek new ideas for developing products, processes, and services. For owners of the industry to benefit from the process of innovation, the action of the individual drivers of the innovative process in the organisation must be recognised in relation to other organisations.

Innovativeness, therefore, means that the adopters of innovation must be fast, and not slow, in the adoption of in-novation that will bring about a great improvement in value engineering, and at the same time be relative to that of the social networking members in the same field [28, 29, 33, 43, 44] identified environmental, technological, and organisational contexts as important contextual elements in the adoption and application of innovation. In their analysis, firms' propensity to adopt information technology is mostly determined jointly by the driving force of market dynamics (availability, technological appropriateness, cost, and demand) and the organisational characteristics of the adopting firm. In economists' parlance, the focus is always on the driving force of market dynamics, whereas organisational business and public administration researchers emphasis the latter. Thus, the propensity and capability to adopt value engineering provide firms with easier ways to penetrate new markets, discover or create new channels for their products or services, and achieve better proximity to their customers.

In conclusion, competitiveness will be better achieved in the Libyan construction industry with process innovativeness, especially in terms of concepts such as lean thinking and agile production within the business process design [54]. Much of the innovative process within construction companies is facilitated by applying value engineering, re-search, technical skills, and industry-specific knowledge to gain competencies in modern production methods and in developing advanced processes. In this study, process innovativeness involves the capability and propensity of Libyan construction companies to implement an innovative construction process in their project delivery to gain a more competitive advantage within the industry.

H3: There is a positive relationship between innovativeness and VE adoption among construction organisations in Libya.

H4: Innovativeness significantly mediates the relationship between adhocracy

and VE adoption among construction organisations in Libya.

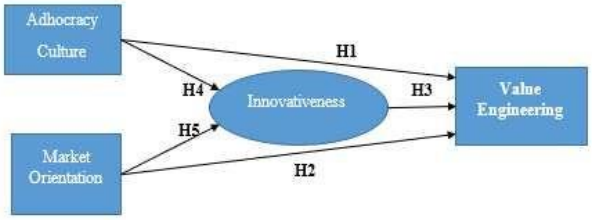
H5: Innovativeness significantly mediates the relationship between market orientation and VE adoption among Libya's construction organisations.

## Research Framework

The role of innovativeness is illustrated in this framework as the variable mediating the association between organisational culture (adhocracy and mart orientation) and VE adoption. These relationships are shown in Fig. 2. The independent variables are adhocracy and market orientation (organisational culture), while VE serves as the variable of interest (or the dependent variable). In addition, this study suggests that innovativeness is a potential mediating variable in the association between independent and dependent variables.

*Figure 2*

**Research Framework**




## Methodology

*Research Instrument*

The initial research instrument was adapted from previous studies. A four-stage Delphi study was conducted to ensure that the adapted instrument was appropriate and suitable for the Libyan context. A back-translation was per-formed before the survey was conducted to ensure a better understanding of the instrument. A 5-point Likert scale ranging from 1 (not true) to 5 (completely true) was used in the questionnaire form.

*Data Collection*

In this study, we used quantitative methods. Data for this research were collected using a questionnaire administered to executive directors, architects, project managers, contractors, and engineers working for Libyan construction organisations. A simple random sampling technique was used to select 375 questionnaires distributed, and 242 questionnaires were eventually retrieved, yielding a response rate of 64.5 %. In identifying critical sustainability factors for improved implementation of Industrialised Building Systems (IBS), [2, 17, 36, 37] distributed a total of 300 copies by post, online survey consultation, and received 115 questionnaires, yielding a 38 per cent response rate.

Hence, the 64.5% response rate received in the current study was therefore considered adequate. A 64.5% response rate was obtained following the recommendations of [2, 17, 36, 37] for a higher response rate. Some of the recommendations included notifying respondents before sending the survey. This

made it possible for a large number of participants to participate in filling the questionnaires. The copies of the questionnaire were accompanied by a letter requesting the targeted audience's consent, stating the benefit of the study, and asking for an endorsement from the main supervisor. Ad-dressed and stamped envelopes were also attached to the questionnaires sent copies to make it easy for the potential respondents to return the completed questionnaire. After four weeks, the questionnaires sent copies were followed up via posts, emails, and calls to those respondents who did not respond. Data collection began on 28 July 2019 and ended on 26 November 2019. The end of the survey was the date that the completed response was no longer received, despite two reminders to those that did not send their responses.

### *Data Analysis*

Structural equation modelling (SEM) was adopted in the research analysis, and Smart PLS software (version 3.0) was employed to ascertain the research model [37, 44]. The PLS path models consist of two groups of linear equations, which include the outer and inner models. The outer model identifies the association between the observed variables and their constructs. Observed variables can be described as indicators, whereas a factor is known as the latent variable. Moreover, the structural model identifies the relationships among constructs.

Additionally, the structural model is made up of endogenous and exogenous constructs and the connections between them. In general, the relationships between constructs can be linear. Sometimes, the model's links can be more composite with mediation or moderation relationships [46]. Once a third construct intercedes between two related variables, it is called a mediation effect. The direct effects (related variable) show a single arrow that joined them, while the mediating effects are linked to sequences of two or more indicators (indirect effects). Mediating effects occur when the independent variable alters the capacity of the two related variables in the model. This study adopted the mediating effects of innovativeness between organisational culture (adhocracy and market) and VE. Most importantly, the outer loading constructs exceeded the standard threshold value of 0.07. An indicator that has not reached the 0.5 threshold value has been deleted.

Nevertheless, loading scores below 0.40, as adopted in several exploratory studies, have been rejected (Wong, 2013). Based on the aforementioned criteria, the lowest value of all loading scores exceeded 0.5 0.40. Descriptive analyses were performed using IBM SPSS version 22 software.

### *The scale of the questionnaire*

This study adapts [47] categorization with little modifications. This study notes that using the same Likert scale interpretation for all the study's variables would generate consistency of the questionnaire indicators, and it will allow for comparability and make response easier for the respondents, so that they are not confused about the differences between the scale elements. Therefore, the interpretation of the Likert
scale values used in this study to define the 5-point Likert scale were 1 = not at all (1.0-1.49); 2 = slightly true (1.5-2.49); 3 = moderately true (2.5-3.49); 3 = mostly true = (3.5-4.49); 5 = completely true (4.5-5.00).

## Findings

*Organizations and Respondent's Profile*

The respondents' demographic data were analysed by descriptive statistical frequency using applied software called IBM SPSS version 22. Data were obtained from the Libyan construction companies. Therefore, employees working in construction companies in Libya were selected as respondents to answer every item given in the questionnaire. Descriptive questions on their views on value engineering among employees of the construction industry in Libya were presented. Of the 375 questionnaires distributed, 242 were eventually retrieved, giving a response rate of 64.5%.

Eventually, a better response rate was achieved because of the investigator's efforts to complete the survey instruments. For instance, the recommendations of Frohlich (2002) were followed to attain a better response rate. Some of the recommendations included notifying respondents before sending the survey. This made it possible for a large number of participants to participate in filling the questionnaires. In addition, copies of the questionnaire were repeatedly sent with an attached cover letter on the front page to appeal to the anticipating respondents that their responses will be utilised only for academic purposes and that they will be treated with the utmost confidentiality.

The respondents' descriptions of their demographic profiles and companies are given below, and the particular demographic features of the companies' representatives who participated in the main survey included their position in the company, work experience, and gender. Those related to their companies include firm ownership, operational location, and the number of employees (workforce), as presented in Table 1.

*Table 1*

**Demographic Profile of the sampled organizations and their Respondents**

| Respondents | Frequency | Percentage% |
|---|---|---|
| **Position in the company** | | |
| Executive Director | 35 | 14.5 |
| General Manager | 28 | 11.6 |
| Head of Department | 33 | 13.6 |
| Project Manager | 35 | 14.5 |
| Engineer | 72 | 29.7 |
| Architect | 39 | 16.1 |
| **Work experience** | | |
| 1-5 Years | 43 | 17.8 |
| Respondents | Frequency | Percentage% |
| 6-10 years | 83 | 34.3 |

| | | |
|---|---|---|
| More than 10 years | 116 | 47.9 |
| **Ownership** | | |
| Government | 67 | 27.7 |
| Private | 175 | 72.3 |
| **Operational Location** | | |
| Across all the three regions | 107 | 44.2 |
| Across two regions | 88 | 36.4 |
| Within a region | 47 | 19.4 |
| **Workforce** | | |
| <100 | 162 | 66.9 |
| 101 – 250 | 52 | 21.5 |
| 251 – 500 | 17 | 7.1 |
| >500 | 11 | 4.5 |

### *2.1 Test for Non-Response Bias*

[48] (p. 5), non-response bias is “the differences in the answers between non-respondents and respondents” and it is assumed that in most quantitative studies, there is always a high probability of underestimating responses due to non-response. Thus, to apply the response rate as a measure of the survey's quality, scholars suggested that it is important to observe whether those respondents at the early stage of the instrument administration gave a significantly different response on the measures compared to the late respondents. The latter was reminded on several occasions before they gave their responses. The procedure was carried out by categorising those who responded within the first 30 days of data collection as early respondents and those who responded after the 30 benchmark as late respondents [11, 40]. After that, the independent sample t-test was employed to compare the early and late respondents on all the variables to check whether there were discrepancies between these two groups by comparing their means. The results are shown in Table 2.

As presented in Table 2, and as suggested by [11, 40], the results of the independent samples t-test revealed that the significance values of Levene's test for equality of variances are greater than 0.05, for all variables. The response of the early respondents, who willingly responded to the survey, was not significantly different from the responses of late respondents. Thus, it can be concluded that non-response bias is not a concern in this study.

*Table 2*

**Results of Independent-Samples T-test for Non-Response Bias**

| Variables | Group | N | Mean | SD | Levene's Test for Equality of Variances | |
|---|---|---|---|---|---|---|
| | | | | | F | Sig. |
| Product Innovativeness | Early response | 157 | 3.44 | .81 | .022 | .881 |
| | Late response | 85 | 3.60 | .84 | | |
| Process Innovativeness | Early response | 157 | 3.61 | .76 | .999 | .319 |
| | Late response | 85 | 3.82 | .83 | | |
| Business Innovativeness | Early response | 157 | 3.62 | .69 | .513 | .475 |
| | Late response | 85 | 3.84 | .83 | | |
| Information Technology | Early response | 157 | 3.82 | .68 | .337 | .563 |
| | Late response | 85 | 3.99 | .70 | | |
| Adhocracy | Early response | 157 | 3.78 | .67 | .002 | .963 |
| | Late response | 85 | 3.86 | .71 | | |
| Market Orientation | Early response | 157 | 3.73 | .68 | 3.023 | .084 |
| | Late response | 85 | 3.90 | .61 | | |
| Value Engineering | Early response | 157 | 3.75 | .68 | 1.353 | .246 |
| | Late response | 85 | 4.05 | .59 | | |

***Common method variance test***

Common method variance refers to the variances that are related to the measurement method adopted in a study which could cause systematic measurement error, leading to bias estimation of the true relationship among the variables [49]. The common method variance test is an important analysis in self-reporting surveys or polls (where respondents give their opinion without researchers' influence) to avoid relationships between variables being inflated [13, 16, 34]. One of the remedial procedures adopted in this study to reduce the common method variance effects was to notify the respondents that there were no wrong or right answers and assure them that their responses would be confidential and will only be used for academic purposes only. Second, to further reduce biases in this study, the questionnaire draft was equally improved to avoid ambiguous wording. All the questionnaire items were further improved to ensure that the words were written in a straightforward language that the respondents could easily understand.

Again, the discriminant validity (as indicated in Table 5) does not indicate any

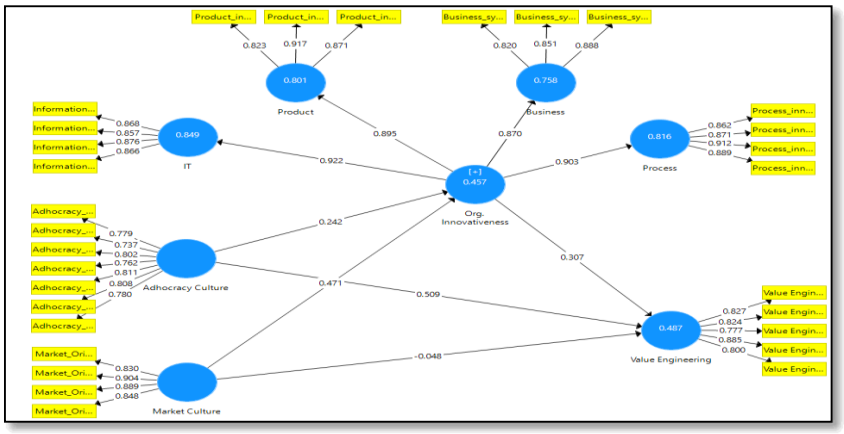
extreme correlations among the varia-bles, as the common method variance mostly results in extremely high correlations [13, 16, 34] Based on these assumptions, it can be concluded that common method variance bias is not a major problem in this study, and the findings support the proposed measurement model in the PLS-SEM.

*Measurement Model Assessment (Outer Model)*

The hypothesized model's estimation was performed using the PLS-SEM method and the statistical software SmartPLS 3 (Ringle et al., 2014). PLS-SEM is widely accepted modelling technique since last decade as it is a non-parametric technique of testing research model [10, 24, 30, 46]. This is a non-parametric, multivariate approach adopted to determine path models with hidden variables (Ridgon, 2016). Furthermore, the analytical process involves using PLS-SEM, which contains two steps that can be adopted to accurately calculate the dimensions and structure of the model [10, 24, 30, 46] A deletion of one item was done out of the thirty-one items because the loadings were not up to the threshold value. Finally, 30 items with loadings of 0.737 and 0.917 were retained (Fig. 3. and Table 3).

*Figure 3*

**Evaluation of Measurement Model through PLS Algorithm Construct Reliability and Validity**




The adoption of Cronbach's suggested alpha coefficients of 0.60 criterion was accepted as average reliability, while an instrument with a high-reliability standard indicated a coefficient of 0.7. However, it has been suggested by Hair that .70 should be the minimum value for a composite reliability coefficient [7, 19, 29, 33, 52].

The Cronbach's alpha range of the adopted variables (from 0.805 to 0.895) is displayed in the table above. The constructs of the CR scores were as follows: business innovativeness =0.889, information technology =0.924, process innovativeness =0.866, product innovativeness =0.904, value engineering =0.913, market culture =0.924, and adhocracy culture =0.917. They all indicated a very high internal consistency above the 0.7 recommended criterion, thereby confirming the appropriateness of the scales, CR = composite reliability, AVE = average variance extracted [3, 34, 47].

*Table 3*

**Construct Reliability and Validity**

| Second-Order Constructs | Construct | Items | Outer Loading | Cronbach's Alpha | rho_A | CR | AVE |
|---|---|---|---|---|---|---|---|
| Organisation Innovativeness | Business Innovativeness | BS1 | **0.820** | 0.813 | 0.815 | 0.889 | 0.728 |
| | | BS2 | **0.851** | | | | |
| | | BS3 | **0.888** | | | | |
| | Information Technology | IT1 | **0.868** | 0.890 | 0.89 | 0.924 | 0.752 |
| | | IT2 | **0.857** | | | | |
| | | IT3 | **0.876** | | | | |
| | | IT4 | **0.866** | | | | |
| | Process Innovativeness | PRC1 | **0.862** | 0.805 | 0.809 | 0.866 | 0.568 |
| | | PRC2 | **0.871** | | | | |
| | | PRC3 | **0.912** | | | | |
| | | PRC4 | **0.889** | | | | |
| | Product Innovativeness | PRD1 | **0.823** | 0.841 | 0.845 | 0.904 | 0.760 |
| | | PRD2 | **0.917** | | | | |
| | | PRD3 | **0.871** | | | | |
| | Value Engineering | VE1 | **0.827** | 0.881 | 0.887 | 0.913 | 0.678 |
| | | VE2 | **0.824** | | | | |
| | | VE3 | **0.777** | | | | |
| | | VE4 | **0.885** | | | | |
| | | VE5 | **0.800** | | | | |
| | Market | MO1 | **0.830** | 0.891 | 0.896 | 0.924 | 0.754 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Culture | MO2 | **0.904** | | | | |
| | | MO3 | **0.889** | | | | |
| | | MO4 | **0.848** | | | | |
| | Adhocracy Culture | AC1 | **0.779** | 0.895 | 0.9 | 0.917 | 0.613 |
| | | AC2 | **0.737** | | | | |
| | | AC3 | **0.802** | | | | |
| | | AC4 | **0.762** | | | | |
| | | AC5 | **0.811** | | | | |
| | | AC6 | **0.808** | | | | |
| | | AC7 | **0.780** | | | | |

Factor loadings and average variance extracted (AVE) were assessed to ascertain the convergent validity of the constructs. Convergent validity is the "extent to which a measure correlates positively with alternative measures of the same construct" (Hopkins et al., 2008). The average variance extracted (AVE) constructs ranging from 0.568 to 0.760 were accepted instead of the 0.50 threshold value, indicating that more than 50 per cent of the constructs' variances were explained [37]. In addition, almost all the constructs' outer loadings were beyond the least 0.70 threshold value (Table 4).

*Table 4*

**Cross Loading**

| Items | AC | BI | IT | MC | Process | Product | Value Engineering |
|---|---|---|---|---|---|---|---|
| **AC 1** | **0.779** | 0.387 | 0.480 | 0.576 | 0.503 | 0.514 | 0.662 |
| **AC 2** | **0.737** | 0.359 | 0.366 | 0.511 | 0.345 | 0.415 | 0.401 |
| **AC 3** | **0.802** | 0.411 | 0.408 | 0.553 | 0.419 | 0.449 | 0.486 |
| **AC 4** | **0.762** | 0.311 | 0.393 | 0.542 | 0.383 | 0.436 | 0.546 |
| **AC 5** | **0.811** | 0.428 | 0.500 | 0.678 | 0.446 | 0.522 | 0.514 |
| **AC 6** | **0.808** | 0.399 | 0.456 | 0.697 | 0.437 | 0.443 | 0.470 |
| **AC 7** | **0.780** | 0.407 | 0.470 | 0.713 | 0.386 | 0.410 | 0.474 |
| **BI 1** | 0.460 | **0.820** | 0.715 | 0.491 | 0.692 | 0.649 | 0.483 |
| **BI 2** | 0.385 | **0.851** | 0.628 | 0.359 | 0.492 | 0.555 | 0.317 |
| **BI 3** | 0.412 | **0.888** | 0.741 | 0.463 | 0.520 | 0.563 | 0.330 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **IT 1** | 0.477 | 0.767 | **0.868** | 0.564 | 0.644 | 0.662 | 0.329 |
| **IT 2** | 0.482 | 0.660 | **0.857** | 0.561 | 0.636 | 0.653 | 0.425 |
| **IT 3** | 0.503 | 0.684 | **0.876** | 0.594 | 0.679 | 0.593 | 0.480 |
| **IT 4** | 0.498 | 0.723 | **0.866** | 0.569 | 0.58 | 0.675 | 0.422 |
| **MC 1** | 0.647 | 0.418 | 0.533 | **0.830** | 0.444 | 0.493 | 0.474 |
| **MC 2** | 0.694 | 0.404 | 0.562 | **0.904** | 0.473 | 0.537 | 0.505 |
| **MC 3** | 0.693 | 0.523 | 0.653 | **0.889** | 0.573 | 0.639 | 0.483 |
| **MC 4** | 0.673 | 0.443 | 0.532 | **0.848** | 0.424 | 0.480 | 0.449 |
| **PI 1** | 0.456 | 0.527 | 0.623 | 0.487 | **0.862** | 0.730 | 0.524 |
| **PI 2** | 0.414 | 0.572 | 0.587 | 0.448 | **0.871** | 0.661 | 0.492 |
| **PI 3** | 0.483 | 0.614 | 0.667 | 0.471 | **0.912** | 0.707 | 0.490 |
| **PI 4** | 0.544 | 0.658 | 0.706 | 0.552 | **0.889** | 0.717 | 0.573 |
| **PrI 1** | 0.538 | 0.550 | 0.703 | 0.641 | 0.601 | **0.823** | 0.496 |
| **PrI 2** | 0.508 | 0.658 | 0.666 | 0.546 | 0.764 | **0.917** | 0.526 |
| **PrI 3** | 0.488 | 0.603 | 0.580 | 0.447 | 0.711 | **0.871** | 0.487 |
| **VE 1** | 0.559 | 0.462 | 0.453 | 0.468 | 0.530 | 0.527 | **0.827** |
| **VE 2** | 0.557 | 0.405 | 0.359 | 0.387 | 0.435 | 0.470 | **0.824** |
| **VE 3** | 0.484 | 0.26 | 0.349 | 0.421 | 0.468 | 0.428 | **0.777** |
| **VE 4** | 0.599 | 0.395 | 0.456 | 0.581 | 0.546 | 0.534 | **0.885** |
| **VE 5** | 0.496 | 0.291 | 0.330 | 0.393 | 0.435 | 0.400 | **0.800** |

Note: AC, adhocracy culture; MC, market orientation; PRI, product innovativeness; PI, process innovativeness; BI, business innovativeness; IT, information technology; VE, value engineering adoption. Discriminant Validity

Discriminant validity is “the extent to which a construct is truly distinct from other constructs by empirical standards” [7]. The discriminant validity evaluation was carried out by utilising two criteria with cross-loadings, as For-ner-Lacker suggested. The discriminant validity evaluation was performed using the standards recommended by [30, 45] in the second approach. To achieve discriminant validity, the square root of each AVE construct must have a higher correlation than that of the construct with other latent variables. Therefore, this is indicated in Table 4, indicating that the discriminant validity is adequate [37].

*Table 5*

**Discriminant validity results based on Fornell-Larker criterion**

| Items | Adhocracy | Business | IT | Market | Process | Product | Value Engineering |
|---|---|---|---|---|---|---|---|
| Adhocracy | **0.783** | | | | | | |
| Business | 0.494 | **0.853** | | | | | |
| IT | 0.565 | 0.818 | **0.867** | | | | |
| Market | 0.780 | 0.517 | 0.660 | **0.868** | | | |
| Process | 0.538 | 0.673 | 0.732 | 0.555 | **0.884** | | |
| Product | 0.586 | 0.694 | 0.745 | 0.623 | 0.797 | **0.871** | |
| Value E. | 0.658 | 0.447 | 0.477 | 0.551 | 0.589 | 0.577 | **0.823** |

**Note:** Diagonals (bold) represent the square root of the average variance extracted, while the other entries represent the correlations.

### *Assessing the Structural Model (Inner Model)*

The parameters adopted to determine how well the hypothesised data were supported were called the coefficient of determination (R2 values) and path coefficients (beta values, ß) [31-37]. The creation of t-values and standard errors to establish statistical significance was achieved through a bootstrapping process with 5,000 interactions. As clarified by the model's independent variable, the model's predictive accuracy was measured by R2, and thus represented the vari-ance percentage of the dependent variables. In contrast, the degree of change in the dependent variable with reference to each independent variable is indicated by the path coefficients (ß) (Figure 4 and Table 6)

***Figure 4***

**Evaluation of Structural Model through PLS Bootstrapping**

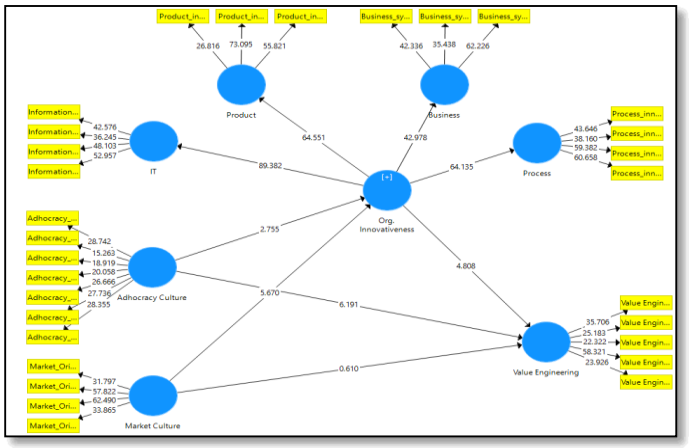


*Table 6*

**Results of Bootstrapping for Structural Model Evaluation**

| Hypoth. | Path | Beta (ß) | Std Error | T Statistics | P Values | Findings |
|---|---|---|---|---|---|---|
| H1 | Adhocracy Culture -> Value Engineering | 0.508 | 0.082 | 6.191 | 0.000 | Significant ** |
| H2 | Market Culture -> Value Engineering | -0.047 | 0.079 | 0.610 | 0.542 | Not Significant |
| H3 | Org. Innovativeness -> Value Engineering | 0.308 | 0.064 | 4.808 | 0.000 | Significant ** |

Note: **Significant at 0.05 (p-value), **significant at 1.65 (t-value), *significant at 0.1 (1 - tailed).

To statistically confirm the significance of the path coefficients, the researcher combined bootstrapping techniques with SmartPLS 3. Verification of the T-Values with each path coefficient was carried out by utilising the bootstrapping technique and the subsequently generated P-values (Table 6). The findings reveal that H1, adhocracy culture, is posi-tively significant to VE in construction organisations in Libya (β = 0.503, t = 6.191, p=0.000), but H2, market culture, is not significant in Libyan construction organisations (β = -0.047, t = 0.610, p=0.542). The results presented in Table 5 in-dicate that H3, Org. innovativeness is positively significant for VE in construction organisations in Libya.

*Mediation Analysis*

[46] stated that another significant assessment of a structural model is the evaluation of the direct and indirect relationships between exogenous and endogenous latent variables [33, 54]. A mediating or moderating analysis should be conducted to evaluate the direct and indirect relationships. The assessment of the significance of the mediating relationships is done in this section in line with the theoretical perceptive given by the organisation, which states that innovativeness is a mediating feature that has an influence on value engineering in construction companies (Figure 5 and Table 7).

*Figure 5*

**Evaluation of Structural Model through PLS Bootstrapping for Mediator**

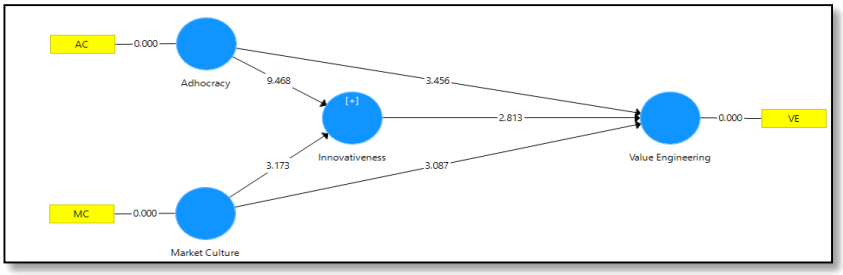


*Table 7*

**Results of Bootstrapping for Mediator**

| Hypoth. | Path | Beta (ß) | Std Error | T Statistics | P Values | Findings |
|---|---|---|---|---|---|---|
| H4 | Adhocracy*Org.Innov. -> Value Engineering | 0.634 | 0.067 | 9.468 | 0.000 | Significant * |
| H5 | Market Culture*Org.Innov. -> Value Engineering | 0.232 | 0.072 | 3.173 | 0.002 | Significant * |

Note: (Org.Innov) Organizational Innovativeness

However, the t-tests resulting in the structural model show that the PLS path has a significant indirect coefficient between adhocracy culture, organisational innovativeness, and value engineering, and that there is a significant indirect coefficient between market culture and organisational innovativeness and VE. These path coefficient statistics indicate that a significant direct effect exists between organisational innovativeness dimensions and VE. Thus, in conclusion, organisational innovativeness plays a full mediating impact between adhocracy culture, market culture, and VE in Libya's construction organisations. A detailed description of the mediation analysis is provided in Table 7.

### *Coefficient of Determination ($R^2$)*

After examining the path coefficients' significance and relevance, a determination of the structural model's descriptive capability was performed. The coefficient of determination examined the explanatory power $R^2$ values (Hair et al., 2016). $R^2$ indicates the total variance in the following endogenous constructs described by the model: adhocracy culture, market culture, organisational innovativeness, and value engineering (Wong, 2013). The description recommended by Chin for endogenous latent constructs in the inner model is as follows: $R^2$ values of 0.67, 0.33, and 0.19. are regarded as substantial, moderate, or weak, respectively [33, 54]. The results in Figure 4 indicate a substantial model with $R^2$ =0.457 or 45.7% of the variance in organisational innovativeness, $R^2$=0.487 or 48.7% variance in value engineering. Hence, with reference to the recommendation of Chin, the variance in organisational innovativeness can be considered moderate. The $R^2$ value for value engineering of 0.487 was interpreted as a moderate model.

### Result and Discussion

The current investigation has identified the correlation between adhocracy culture, market culture, and VE adoption with the mediating role of organisational innovativeness. After evaluating structural equation models with statistical, empirical, and conceptual evidence, there is evidence that organisational innovativeness plays a fully mediating role between market culture and VE elements among construction organisations in Libya. Regarding the direct relationship between the predictors (i.e. the independent variables) and the criterion variables (i.e. the dependent variables), the results indicate the statistical

significance of four out of the five hypothesised paths. In H2, the direct relationship between market culture and VE in the Libyan construction industry was tested. The finding of H2 suggests that market culture is not significant for VE adoption among construction organisations in Libya (β = -0.047, t = 0.610, p=0.542). The statistical results do not show any evidence of the influence of organisational culture on VE adoption among Libya's construction organisations.

The results of the PLS path model show that the adhocracy culture of construction firms is significantly and posi-tively associated with VE adoption. Hypotheses 1 and H1 which test the direct relationship between adhocracy culture and VE adoption (β = 0.503, t = 6.191, p=0.000), are supported. H3, which examines the relationship between organisa-tional innovativeness and VE adoption among construction organisations in Libya, is supported. This result suggests that organisational innovativeness has a positive relationship with VE adoption among construction organisations (β = 0.064, t = 4.808, p=0.000).

The findings in this research are consistent with most previous studies that examined the influence of organisa-tional culture on adopting new concepts or practices, such as VE [18,28, 39] examined the influence of a firm's structure and culture on innovativeness among housing developers in Malaysia. It was found that adhocracy and market culture have a strong and positive influence on the innovativeness of housing developers in Malaysia. [54] examined the relationship between organisational culture and the innovativeness of logistics companies in Malaysia

It was found that adhocracy and market culture have a strong and positive influence on the innovativeness of logistics companies. [18, 54] examined the factors driving Malaysian construction firms' ecological sustainability. Their findings showed that organisational culture (adhocracy and market) has a strong and positive association with ecological sustainability.

This research does not support the findings of, which focused on the shipbuilding industry. [18, 54] examined the moderating role of external factors on the relationship between organisational culture and resources and the innovativeness of shipbuilding companies in Malaysia. Contrary to most previous studies on organisational culture, it was found that organisational culture does not enhance shipbuilding companies' innovativeness. The shipbuilding industry's nature might be a major factor in the negative correlation found between organisational culture and innovativeness in the Malaysian shipbuilding industry.

*Theoretical Contribution*

The theoretical contribution is that it provides a better understanding of the relationship between organisational culture (adhocracy culture and market culture) and VE with the mediating role of organisational innovativeness. This study has focused on expanding this call to examine the direct influences of an organisation 's culture (adhocracy culture and market culture) by investigating the mediating influences of organisational innovativeness on the correlation between VE and organisational culture. The results of this research can contribute to the Libyan construction industry's understanding of the appropriate introduction and implementation of VE.

The relationships between the constructs were elucidated using PLS-SEM. Canonical correlation, multiple regression, and multivariate analyses were performed using this method. This research also contributes to the methodology by measuring each latent variable's properties using PLS-SEM path modelling. Specifically, the measurement of the properties of the latent variables, including convergent validity and discriminant validity, was systematically evaluated. Three

(3) properties were examined in this study: 1) the discrete reliability of items, 2) average variance explained (AVE), and 3) composite reliability for each latent variable. Convergent validity was measured using AVE values for the latent variables. Discriminant validity was assessed by correlating the latent variables to the square roots of the AVE. The assessment of the outputs for the cross-loading matrix was made to support the discriminant validity in the conceptual model. To conclude, this study adopted the best vigorous approaches (PLS path modelling) to determine the properties of the latent variables demonstrated in the conceptual model.

### *Practical Contribution*

The findings of this study make several practical contributions to engineers, project managers, stockholders, contractors, and team members in the construction industry. The research findings suggest that there is an undeniable propensity for value engineering adoption in construction companies for setting goals, monitoring and evaluations, collection, and suitable storage of materials. Hence, the avoidance of damage by proper handling of materials, efficient and appropriate use of construction materials, and minimisation of the use of non-renewable materials employed in the construction industry in Libya is high; thus, there is a need to adopt value engineering.

Additionally, organisational culture (adhocracy culture and market culture) and organisational innovativeness (product, process, marketing, and IT innovativeness) of construction companies significantly influence the efficiency and effectiveness of value engineering adoption among construction companies in Libya. This implies that efficiency among construction companies in Libya can be enhanced when chief executives, managers, and other stakeholders seriously consider these efficiency factors. In implementing this research's findings, the government should encourage organisational culture and resources that promote proper value engineering among construction companies in Libya.

From a practical perspective, organisational innovativeness (product, process, marketing, and IT innovativeness) can be introduced in future intervention techniques by focusing on organisational culture (adhocracy culture and market culture) that can improve the adoption of VE within the Libyan construction companies. Moreover, evaluating innovative programmes and intervention techniques can improve the value engineering features of Libyan construction companies by evaluating organisational culture using a new reflective scale. Even though these propositions can be employed in a university context, they can also be used in other organisational bodies. Organisational innovativeness was also incorporated in this study's model as a mediating variable to explain better and understand how organisational culture (adhocracy culture and market culture) correlates with value engineering. Thus, concerning the findings and discussions, this study makes several practical contributions to the field of value engineering, organisational innovativeness, and organisational culture.

Moreover, construction companies should excel in value engineering in the process of their involvement with other strategies and practices to be successful and obtain their desired goals. In addition, insights have been provided to public and engineering companies in Libya and Africa. Industries in other African countries can replicate this study for further advancement.

## Conclusion

This study attempts to narrow the gap in the field of VE adoption. The results of this study have contributed to academia in the following ways: the model of the study extends the resource-based view theory by examining the relationship between organisational culture (adhocracy culture and market culture) and VE with the mediating role of organisational innovativeness in the Libyan construction industry. Most studies have not paid much attention to associating organisational culture factors based on the literature on adhocracy culture and market culture with the moderating role of organisational innovativeness.

This study narrowed the existing gap in VE and its antecedent factors. In addition to the theoretical contributions provided, this study's findings also provide important practical implications for construction organisations and other construction policymakers. To enhance the adoption of VE in the Libyan construction industry, the government should encourage innovativeness across the industry. This study found that innovativeness enables both adhocracy and market culture to enhance the adoption of VE in the Libyan construction industry. Interestingly, innovativeness alone has a strong and significant influence on the adoption of VE in the Libyan construction industry. A major limitation of this study is the cross-sectional data collection method. Future research could use a longitudinal data collection method and consider other organisational factors that could enhance VE adoption in the Libyan construction industry. This study examines adhocracy and market culture as internal organisational factors. Future re-search may examine other internal and external organisational factors.

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