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Developing a Diamond Framework Model Based on "Integration" of Project Success Measures for Construction Project Management in Yemen

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ABSTRACT

The most prominent obstacle facing the construction industry in Yemen is mismanagement. Developing appropriate tools, approaches, and standards for managing construction projects will contribute effectively to the development and prosperity of the Yemeni construction industry. This study aims to provide the tools, approaches and standards for project management based on the opinions of the Yemeni advisory bodies. It presents an Integrated Cost, Quality, Time, and Scope (ICQTS) diamond framework model by developing the traditional triangle model in project management providing a practical contribution to researchers and companies working in the construction industry. The study uses a descriptive and analytical approach through a comprehensive literature review followed by a field study using a designed questionnaire distributed to the relevant Yemeni advisory bodies. The study concluded with the development of the traditional triangle model resulting in the introduction of the diamond framework model in the management of construction projects. Integration management was found to have a strong impact on project success presenting the framework model as an easy and flexible tool that unifies and integrates the processes and roles in the project and directing it towards achieving project stakeholder objectives. The literature largely neglects the impact of integration management in the various models and is mostly overlooked. Inclusion of integration management in the presented model will highlight measures of project success stressing the need to integrate and

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manage them together. Future studies may research the differences in the opinions of construction companies.

Keywords: Diamond framework, ICTQS framework, project management, traditional triangle model, Yemen construction industry

INTRODUCTION

Construction projects are unique including the number of parties involved, project complexity and large circulating information. Therefore, construction projects face several challenges that may lead it to stagger (Alwaly & Alawi, 2020). Deficiencies and inefficiencies are frequent issues in the construction industry in all countries of the world, including Yemen, which is considered one of the least developed countries in the construction industry (Alawi et al., 2016; Alawi & Masoud, 2018). A group of studies have examined the factors of failure in the construction industry in Yemen concluding that poor construction project management is the main problematic factor in the construction industry in Yemen (Alaghbari et al., 2018; Al-Sabahi et al., 2014; Gamil & Rahman, 2020). Therefore, developing project management concepts, methods and tools will contribute to improving project management performance (Angarita & Gallardo, 2018).

The traditional triangle is considered one of the most important models in project management, providing a set of project success measures (scope, time, cost, and quality). Recently, however, practitioners and researchers have studied metrics of project success keeping in mind the achievement of project goals from a stakeholder perspective (PMBOK, 2017). Measuring project success is one of the difficult tasks facing researchers and practitioners in project management (PMBOK, 2017) due to the lack of a standard definition of project success as well as unavailability of a specific methodology for measuring it (Kermanshachi, 2016). Mir and Pinnington (2014) and Wateridge (1998) add that few interested in project management seriously think about measures of project success. Wells Jr (1998) laments the lack of interest in defining project success and sufficing to do so only in generic terms. Davis (2014) and Lim and Muhammad (1999) presented a vision for project success through partial and total measures, as the partial measures included time, cost, quality, performance, and safety. The total measures include the partial measures and the actual benefit of the project at the operational stage. The study by Westerveld (2003) supports the traditional triangle method in measuring project success according to the constraints of scope, time, and cost. However, Heravi and Ilbeigi (2012) found that several projects that did not achieve the iron triangle project measures were considered successful as they achieved project stakeholder goals. An example are the North Sea projects performed in the seventies. They suffered cost and time overruns but were considered successful projects since the project stakeholders' objectives were not related to time or cost measures. Ika (2009) and Shenhar et al. (1997) support the view that project success measured by

the extent of adherence to the constraints in the traditional triangle means the project is managed efficiently but neglecting achievement of stakeholder objectives means the project did not meet their expectations. Mir and Pinnington (2014) and Wateridge (1998) indicate that the focus of project managers is generally limited to short-term measures related to project operational constraints to the detriment of long-term metrics related to project stakeholder objectives. Hence the need to develop project management concepts, tools, and measures that will improve construction project management performance in the short and long-terms to achieve both traditional measures as well as project stakeholder objectives.

Adding new measures to develop the traditional triangle model has become a necessity to support the traditional project success metrics. It is also necessary to search for modern methods that keep pace with the recent developments in the concept of project success and to address the shortcomings of the traditional triangle model when managing project implementation. Several studies have indicated the importance of adding other metrics to those of the traditional triangle model (Cao & Hoffman, 2011; Ika, 2009; Nicholas & Steyn, 2017; Shenhar et al., 2001; Silvius et al., 2017; White & Fortune, 2002). These studies confirmed the survival of the main project success metrics of the traditional triangle project. Other researchers indicated the need to add new measures to match the requirements of the current construction industry to improve project management performance since the current traditional triangle model is insufficient to monitor all processes (Atkinson, 1999; Ong et al., 2018).

Therefore, this study seeks to bridge the gap in the literature and aims to:

1. Perform a literature review of the subject matter;
2. Conduct a field study and analyze the responses to develop a new framework model to enhance construction project management performance;
3. Develop a new framework model based on incorporating integration to the traditional triangle model to achieve unification and coordination between all operations and activities in the project and directing them towards achieving project stakeholder objectives.

The new diamond framework model introduces a new idea in construction project management by not relying solely on the traditional project success metrics as constraints but as measures that are traded between them through the addition of "integration" as a new measure. This is to achieve project success from project stakeholder perspective. This study shall present the innovative ICTQS framework model by providing:

1. A comprehensive literature review;
2. The methodology of the study performed and sampling;
3. Questionnaire design and data collection;
4. Data analysis, integration, and triangulation;
5. Results and discussion; and
6. Summary and recommendations.

The result is to achieve the main aims and objectives of the study and to propose a practical framework model in construction project management in Yemen based on the responses of those in the Yemeni construction industry to enhance project management performance.

METHODS

This section shall outline the methodology and methods used. The methodology started with a comprehensive literature review followed by development of the questionnaire and performing the pilot study on the it. The questionnaire was distributed to the respondents and collected, analyzed, and results triangulated with the literature to arrive at the conclusions and development of the Diamond Framework Model. The following subsections provide the steps and details of the methodology and field study.

Literature Review

The literature review incorporated the traditional project metrics and models and the developments thereafter as provided in the following subsections.

The Traditional Triangle Model in Project Management. The traditional triangle model in project management is considered one of the first models to be used on a large scale as it defined the traditional project success measures and the relationship between them. It is still used as a basic reference for many researchers and practitioners in the field of project management. Many studies have used it. It is considered the focus of metrics affecting the success or failure of projects and is used to control project constraints.

Several models providing the main project success factors have evolved from the traditional triangle model shown in Figure 1. In 1969 Martin Barnes explained the factors of "time", "cost", "quality" and the relationship between them by drawing a triangle named

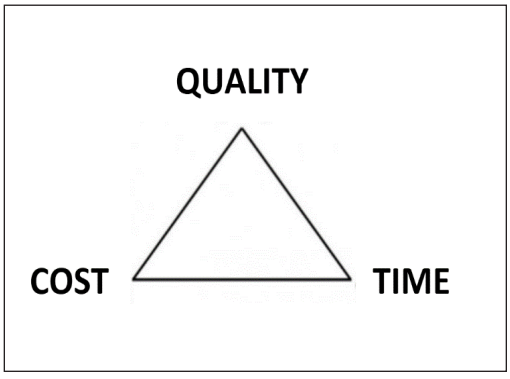

Figure 1. Project triangle model
Source. Barnes (2007)

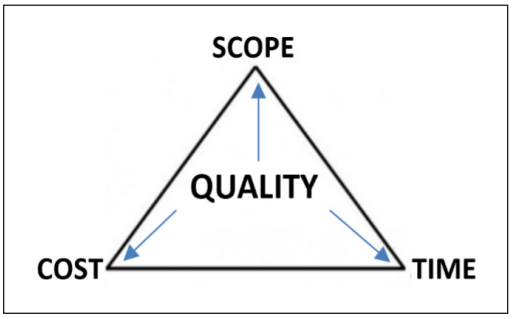

Figure 2. The traditional triangle model in project management
Source. Demirkesen and Ozorhon (2017), Wyngaard et al. (2012)

the "project triangle" (Barnes, 2007). The purpose of this triangle was to illustrate the importance of balancing the three measures to improve project performance and monitoring.

The project triangle model was the building block that researchers built upon to develop measures of project success (Figure 1) (Bennett, 2003; Dobson, 2004; Frame, 2002; Hamilton, 2001; Turner & Simister, 2000). The traditional triangle model in the field of project management emerged representing the main factors of project management success: scope, time, cost, and quality (Figure 2) (PMBOK, 2017).

Developments of the Traditional Triangle Model in Project Management. During the eighties, Barnes (1988) developed the project triangle model and established a new measure, "performance", replacing it with "quality" and named the new model the "goals triangle". Other researchers developed the project triangle model into various models, either by adding or changing measures of project success. Among these models is the "tetrahedron" model (Figure 3) that was referred to by Atkinson (1999). Marasco (2004) came out with the "pyramid" model (Figure 4) and Wideman (2004) presented the "quadrupeds" model (Figure 5). Felician (2011) came out with the "iron hexagon" model (Figure 6) and Ebbesen and Hope (2013) presented the "Iron Box" model (Figure 7).

Researchers have named the various models, including the "project triangle" (Devaux, 1999; Major et al., 2003), "triple constraints" (Bennett, 2003; Dobson, 2004; Frame, 2002; Hamilton, 2001; Turner & Simister, 2000), and "the project pyramid" (Marasco, 2004). The basic building blocks of the models (Orr, 2007) remained the "traditional triangle" (Atkinson, 1999), "the golden triangle" (Lock, 2007; Ong et al., 2018), "the triangle of goals and trade-offs" (Barnes, 1988; Williams, 2002), "the square root" (Atkinson, 1999), indicators of success (Williams, 2002), the traditional iron triangle (Figure 8) (Caccamese & Bragantini, 2012), the iron hexagon (Felician, 2011), and the iron box (Ebbesen & Hope, 2013).

When analyzing these models, it is noticed that there is a difference in the types of the measures provided in them except for two measures that were fixed in most models: namely,

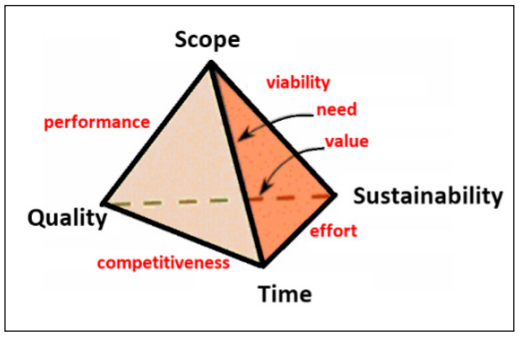

Figure 3. Tetrahedron model
Source. Atkinson (1999)

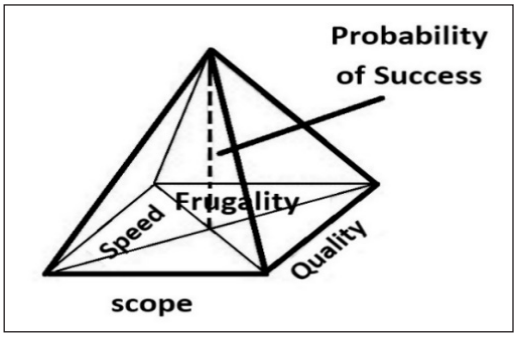

Figure 4. Project pyramid model
Source: Marasco (2004)

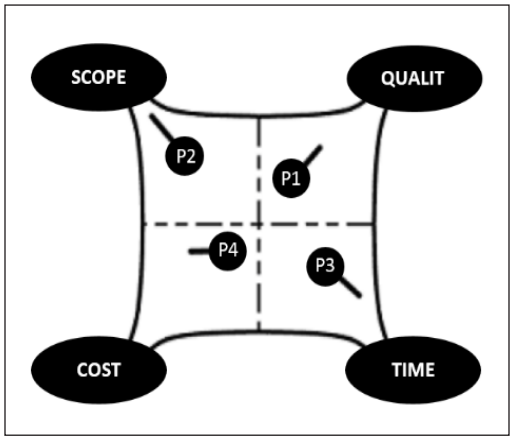

Figure 5. Quadrilaterals model
Source. Wideman (2004)

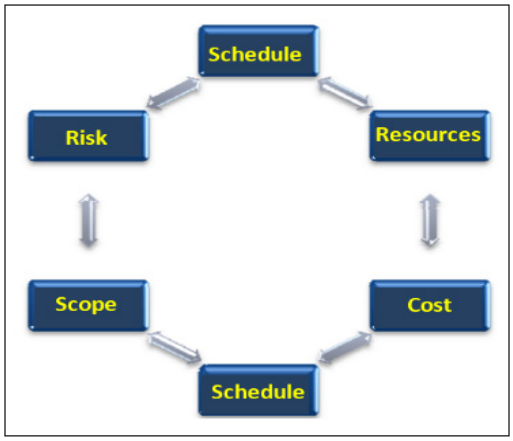

Figure 6. The Iron Hexagon model
Source. Felician (2011)

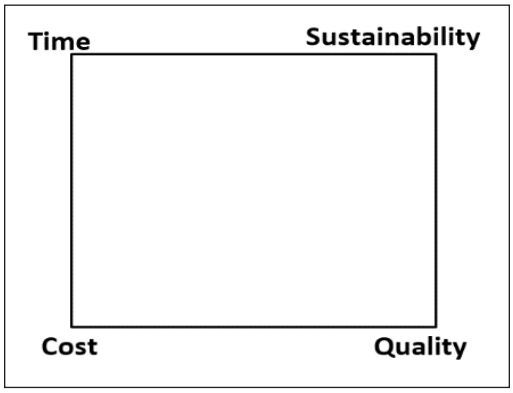

Figure 7. Model of the Iron Box
Source. Ebbesen and Hope (2013)

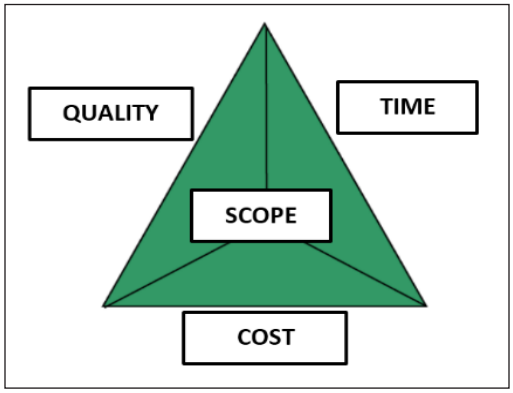

Figure 8. The Traditional Iron model
Source: Caccamese and Bragantini (2012)

"time" and "cost". Some studies referred to these measures as "schedule" and "budget" (Vahidi & Greenwood, 2009). Over the past fifty years researchers have conducted several studies in the field of project management through which they reached several measures and factors affecting the success of the project (Atkinson, 1999; Caccamese & Bragantini, 2012; Felician, 2011; Nicholas & Steyn, 2017). The development of the model during the last five decades is presented in Table 1.

From Table 1, it is noted that the "traditional triangle model" has been at the forefront of project success measures during the three periods. This model has been the reference and the basis for measures of project success. It can be considered the foundation model on which researchers built on in their studies to achieve traditional success measures. Several alternative measures have been proposed as illustrated in Table 2.

Table 1
Measures and success factors of the project from 1960 until now

Periods / Measures & success factors	Period 1 1960s-1980s	Period 2 1980s-2000s	Period 3 2000s - until now
Success measures	"The traditional triangle model" Time, cost, and quality	Traditional Triangle plus: Customer satisfaction, benefits for the organization (ORG), end user satisfaction, benefits for stakeholders, benefits for project staff.	The traditional triangle model: The strategic objective of client organizations and business success, end-user satisfaction, benefits for stakeholders, benefits for project personnel, symbolic and rhetorical assessments of success and failure**.**
Success factors	Anecdotal lists	Lists of CSFs + set of frameworks.	More comprehensive CSF frameworks, symbolism, and rhetoric of success factors
Confirmation of the study	Project management success	Project / product success	Project / product, portfolio, program success, narration of success and failure

Source. Nicholas and Steyn (2017)

Table 2
Traditional measures and some alternative standards

Project / Traditional measure & standard	Project of triangle model	Project of trade-offs	Project of success / failure
Traditional Measures	Time, cost, scope, quality / performance	Time, cost, scope	**Time, cost, scope, quality/ performance**
Examples of standards recommended presented by Orr (2007)	Specifications, risks, people, resources, exclusion, speed, external environment, information The system, benefits to the organization, benefits to the stakeholder community.	Quality, external environment, management, and project team, Outlook, Resources, Reliability, Control, Service, Response, reputation, market position, profit.	**Various stakeholders Success criteria, customer satisfaction The external regulatory environment Project managers, team members.**

Source. Orr (2007)

Integration Role in Projects Success. Several studies have indicated the importance and role of "integration" in the success of projects. The study by Demirkesen and Ozorhon (2017) concluded that integration management has a noticeable effect in improving project management performance. This helps achieve the stakeholder project objectives. In their

study, Asif et al. (2010) concluded that "integration" is an approved process to improve the structure of the administrative system and contributes to meeting the requirements of stakeholders. Demirkesen and Ozorhon (2017) and Eisner et al. (1993) also indicated that integration management is one of the most important elements in systems engineering. The study introduced a concept called "integration engineering" that includes environmental operability, requirements and interfaces and testing and validation of the work program as essential elements. The study also indicated the main elements of integration management such as schedule, cost calculation and documents which are the basic components of systems engineering. The researchers imply that project integration management is a prerequisite for the correct coordination between project activities as it impacts on project success.

Studies have shown that there is an important role for effective integration in project management success (Berteaux & Javernick-Will, 2015; Halfawy & Froese, 2007; Ozorhon et al., 2014; Ospina-Alvarado et al., 2016; Tatum, 1990). The Project Management Guide also identified the ten main areas of project management knowledge, and among these areas, project integration management is the first area. This includes planning, assembly, standardization, and coordination processes for integrated project management (PMBOK, 2017).

Comment. The period in which the traditional triangle model appeared until today has been accompanied by significant technological changes and developments. For example, computers and software, structural robots, and artificial intelligence. have affected various aspects of life in general including the construction industry. This has led to the development of measuring project success to include the project's achievement of project stakeholder objectives. This has also contributed to emergence of modern management approaches to keep pace with these changes through the development of project management processes and tools. Therefore, adding new measures to improve the traditional triangle model has become a necessity to support the traditional project success metrics. It is also necessary to research modern approaches that keep pace with the development of project success metrics addressing aspects of deficiencies in the traditional triangle model.

It is noticeable that each measure of project success in the traditional triangle model deals with a specific aspect of project management. For example, the measure of "time" relates to estimation and management of time for project implementation. Each measure handles one aspect of the project except for the quality measure that affects, and is affected by, other measures (e.g., time and cost). Furthermore, the metrics shown, as well as other metrics not shown in the traditional triangle are interrelated. Therefore, these metrics need a new measure that achieves integration between them to achieve the goals from the stakeholders' perspective to enhance the probability of achieving project objectives and project success.

The following points are evident from previous studies:

1. The traditional triangle remains the basis for measuring project success;
2. The current measures of project success are insufficient and there is a need to develop the traditional triangle model by adding other measures;
3. Direction of measuring project success includes achieving project stakeholder objectives;
4. Integration has a positive effect on the project success and performance and assist in achieving the project stakeholder objectives;
5. Integration is an important measure for unifying and coordinating the processes and roles in the project and directing them towards project success and the achievement of its objectives.

Research Approach and Design

The researcher conducted a field study in which the main hypothesis was tested through a questionnaire designed by the researcher specifically for this purpose, taking advantage of the PMBOK (2017). The questionnaire was evaluated by a group of academics and practitioners specializing in project management. The advisory bodies that manage construction projects in Yemen were targeted and selected by simple random sampling. The data was collected, analyzed and results obtained. Figure 9 illustrates the methodology and steps used in the study.

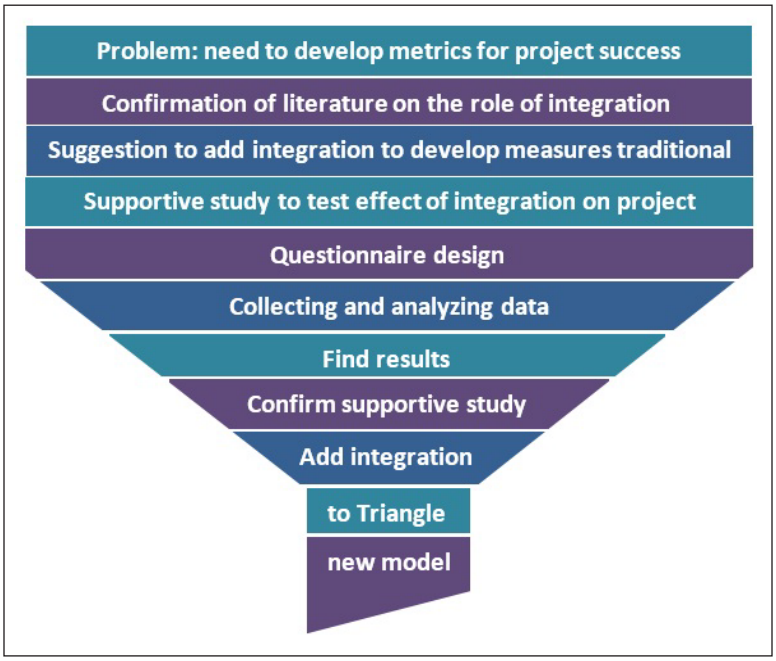

Figure 9. A drawing showing the methodology and steps used in the study

The Study Sample

The target sample included the agencies in charge of managing construction projects in the Republic of Yemen, which numbered 674 according to the database of the Ministry of Industry and Trade (2020). To obtain a statistical representative sample, Equation 1 was used according to Hogg and Tannis (2009) as follows:

$$n = \frac{m}{1 + \left(\frac{m-1}{N}\right)} \quad (1)$$

Whereas:
(m) unlimited sample size,
(N) limited sample size,
To find the value of (m), Equation 2 was used:

$$m = \frac{z^2 \times p \times (1-p)}{\varepsilon^2} \quad (2)$$

Whereas:
(z) The value indicates the level of confidence (for example: 2.575, 1.96, and 1.645 represent the confidence levels at 99%, 95%, and 90%, respectively),
(p) The degree of variance between elements of the target sample (0.5),
(Ɛ) Maximum point selection error.

Using a confidence level of 95% and a level of significance at 5% when the sample size is not specified, the estimation of the value of (m) is clarified by applying Equation 2 as follows:

$$m = \frac{(1.96)^2 \times 0.50 \times (1-0.50)}{(0.05)^2} \approx 385$$

When conducting the survey one engineer was targeted for each consulting body with a total of 674 engineers making the total number of the selected sample, (N) equal to 674. Thus, the size of the sample required to make the work successful out of the total target sample can be calculated by applying Equation 1 as follows:

$$n = \frac{385}{1 + \left(\frac{385-1}{674}\right)} = 245$$

Questionnaire Design

The questionnaire was designed to test a main hypothesis H1. Effectiveness of "integration management" has a direct and positive effect on "project success measures". Figure 10 presents a link between integration management and project success measures, as the questionnaire consisted of three main sections:

1. Information about the consulting bodies, including age, job, years of experience, training courses, methodology used, number of employees, and number of projects;
2. The variables related to achieving the requirements of integration management (the independent variable) included: the development of the project charter, the integration of the project management plan, the integration of directing and managing the project operations, the integration of project knowledge, the integration of follow-up and control of project work, the integration of change, and the closure of the project or the stage;
3. The variables of project success measures in the traditional triangle are: scope, time, cost, and quality, which are usually considered project success metrics (PMBOK, 2017). The second and third sections of the questionnaire were prepared based on the Project Management Manual (PMBOK, 2017) issued by the American Project Management Institute.

As stated previously, the questionnaire was evaluated by a group of specialized academicians and practicing experts to ensure its effectiveness and suitability for the purpose of the study. This pilot study was conducted to ensure the questionnaire is practical for the purpose of the study.

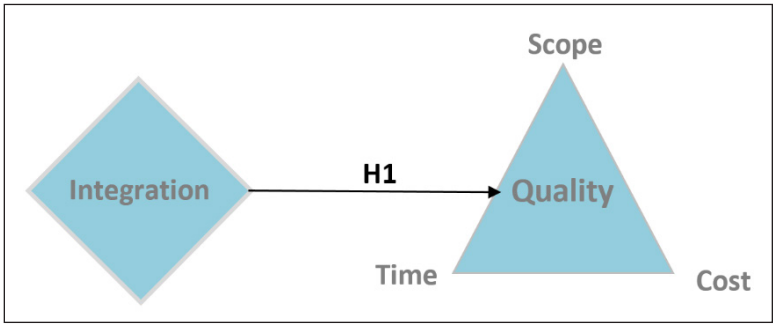

Figure 10. A link between integration management and project success measures

Methods for Data Collection

An online questionnaire was designed and administered to ensure obtaining the required sample size of 245. A simple random sample of 523 questionnaires were delivered and 235 responded on time. 18 questionnaires were excluded because they were not completed

properly. The total number of questionnaires that were used in the analysis was 217 questionnaires, which constitutes 88.57% of the required sample size.

Study Tool Scale. The researcher used a five-point Likert scale for the responses of the study sample as shown in Table 3.

Table 3
Likert scale

Response	Very High	High	Medium	Low	Very Low
Class	5	4	3	2	**1**

When the engineer (respondent) selects the score (5) for the response it was "very high" and the relative weight in this case is 100% and relative weights for responses are as provided in Table 4 (Likert, 1932).

Table 4
The relative weight

Serial	Verbal Appreciation	Relative weight (from – to)	The rate is 100%
1	Very High	4.20-5.00	**100%**
2	High	3.40-4.19	**85.1%**
3	Medium	2.60-3.39	**68.5%**
4	Low	1.80-2.59	**49.8%**
5	Very Low	<1.79	**< 30%**

After performing the validity and reliability test of the questionnaire, the researcher used the calculation of the correlation coefficient, the regression analysis, and the regression variance to test the hypothesis. The results of the analysis of the quantitative data confirmed the effect of integration on project success. This is consistent with the qualitative data obtained from the literature review.

Data Analysis

The data was entered and analyzed through the SPSS Version 23 (Statistical Package for the Social Sciences) program. The researcher tested the validity of the internal consistency, (i.e., the consistency of each axis of the questionnaire) by calculating the correlation coefficients between each axis and the total degree of the axis itself. The results are that the correlation coefficient between each of the paragraphs of the axis and the total score of the axis itself is a function of a significance level value of $\alpha = 0.05$, making the axis true to what was measured.

The stability of the questionnaire is an important characteristic of the study tool and is intended to show that it should give the same results if they are redistributed again under

the same conditions. This means stability in the results obtained from the questionnaire would not change significantly in the event of repeating distribution on the same sample. During certain periods of time, the researcher verified the stability of the study's resolution through the Cronbach's Alpha Coefficient method where the results indicated that all study axes are stable as the internal consistency of all axes reached (0.9590), which is a high value. The higher the value of (Alpha Cronbach), approaching one, the more the internal consistency increases. As for the normal distribution of data test, the researcher did not perform it because the number of questionnaires exceeded thirty questionnaires. Therefore, the data is considered normally distributed (Daher, 2018).

Integration and Triangulation of the New Framework Model

Triangulation mainly aims to strengthen the methodological structure of scientific research. The researcher used multiple methodologies and tools to research the topic to improve the validity of the results. Achieving integration between the different methods and data sources is important to form a complete picture of the topic, as each complement completes the other. Integration assumes that quantitative and qualitative methods do not study the same reality. Each focus on a specific angle. Quantitative data aims to clarify the effect of integration on project success and the development of the framework model in an objective way. The qualitative data obtained from the literature review was about the traditional triangle model, its development, the need to develop it, and the impact of integration on project success. Both the quantitative data obtained from survey responses and the qualitative data obtained from the literature show a good fit. The ICTQS framework model is validated from both sources of data.

RESULTS

The questionnaire collected data on the study sample, which was varied in terms of the employer. It was found that the responses to the questionnaire were: 51.6% are from government agencies, 15.2% are from engineering offices, 13.4% are from contracting companies, and 5.1% are from consulting firms. 74.2% of the respondents were top-level managers, while 25.8% of the respondents were engineers. The results showing the level of success and the level of achieving the requirements of integration management are provided in Table 5.

Table 5
The level of integration management and project success

Serial	Variable	Mean	Standard deviation	Level
1	Integration	3.36	0.74	**Medium**
2	Project success	3.32	0.64	**Medium**

It is noticeable that the arithmetic average of the level of achieving the requirements of integration management reached (3.36) with a degree (average) and the standard deviation (0.744). As for the variables of integration management, they were distributed between medium and high degree, where the arithmetic mean of the variable was less than (3) and of relative importance 56.60% and a standard deviation (1) relating to knowledge management. Relating to project closure, the highest mean is (3.62), standard deviation (0.9210) and relative importance of 72% indicating the importance of reviewing all project works and documents before project completion. As for the variables of the project success, the arithmetic mean of all the axes reached (3.32) with a degree (average) for all variables and the standard deviation (0.64). The arithmetic mean of the least variable was (3.2), relative importance of 64%, and a standard deviation (0.717) relating to the schedule variable. Furthermore, the highest arithmetic average is (3.38), standard deviation (0.73) and relative importance of 67.6% relating to the cost management variable showing that project managers are more successful in cost management.

To obtain the relationship between achieving the integration management requirements and the success of the project, the correlation coefficient, the regression analysis, and regression variance were calculated. The value of the correlation coefficient was (0.87) at a significance level (0.00) indicating the existence of a positive, statistically significant relationship, after which an analysis test was used. By simple linear regression, the value of the total correlation coefficient was 0.87, the value of the coefficient of determination was 0.76, and corrected determination coefficient of 0.76 indicating that achieving the integration requirements explains 76% of the changes in the dependent variable. The value of the significance level of 0.00 for the F-test. A value (less than 0.05) means there is an effect attributable to the achievement of integration requirements on the success of the project. This means that there is statistical significance, and accordingly, we accept the hypothesis that states: Effectiveness of "integration management" has a direct and positive effect on "project success measures".

Through the value of the estimate, it becomes clear that the relationship is positive, and is (0.76). This means that integration management affects 76% of the variance in the success of the project (Figure 11) where the results were obtained from the field study confirming

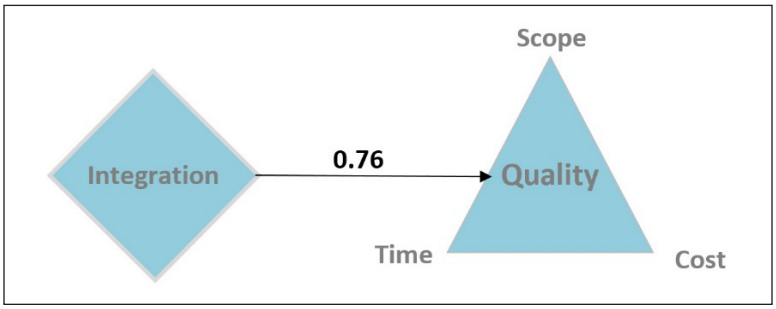

Figure 11. The path parameter between integration management and project success metrics

the important role that integration management plays in the success of the project. We can say that integration management is an important measure of the success of the project. This measure has been developed in the diamond framework templat

Proposed Framework

Based on the literature review and the results of the field study that confirmed the effective role of integration management in the success of the project, the researcher developed a modern framework model. This is based on adding integration to the project success metrics in the traditional triangle and developing a new model.

There is no doubt that the measures and factors that the researcher has reached, in addition to the measures of project success in the traditional triangle model, have an impact on the success of a project. The measures of project success in the literature seem to pinpoint certain success measures without due regard to others. The traditional triangle model needs a comprehensive measure that connects and unifies the various project success measures to achieve project stakeholder goals.

Each measure of project success in the traditional triangle model is separate by itself and deals with a certain aspect in project management apart from the quality measure which affects other measures. This effect remains limited in the framework for achieving quality requirements in the project. Therefore, the need for a new measure that incorporates various operations and controls outcomes remains. Activities necessary to integrate, standardize and direct project management processes and activities to achieve project objectives is not clear in the various models. Furthermore, a gap remains between the PMI and the models provided in the literature. It further lacks incorporation of the various stakeholder perspectives.

Project success can be expressed as the level the project has achieved objectives from stakeholder perspective. In the current models' project success depends on the trade-offs between the measures related to project management, which are "scope", "time" and "cost". The trade-offs may be for calculating one measure at the expense of the other two based on the priority given. The project objectives determine the priority which may be for project time when time is the priority. When the cost is a priority, the focus is competition on price. The priority may be for scope when the main objectives are the characteristics and features. There is a tradeoff and balance that needs to be addressed, not only between the three measures, but incorporating other measures and factors. The need for a metric that handles trade-offs between the various project success metrics to achieve project stakeholder goals emerges.

The measure of "integration" can bridge this gap. It includes the integration and standardization of all other measures, processes and activities in project management and ensures a proper trade-off between all measures to achieve project objectives. "Integration"

is defined as "managing operations as well as activities for identification, grouping, standardization and coordination of the various operations of the project in the project management plan" (PMBOK, 2017).

Few previous studies have touched upon adding the "integration" measure to the traditional project success measures "scope", "time", "cost", "quality" to develop the traditional triangle model in project management. This is even though "integration" is one of the most important factors affecting project success and is considered the first area of knowledge in project management (PMBOK, 2017). It is concerned with the performance of the project as a whole and through it the project management plan is developed including all knowledge areas in project management.

Given the main role of integration management in project success and its close link with performance, this study aims to develop measures of project success in the traditional triangle model. It proposes a new and comprehensive framework to improve the performance of project management by relying on development of the traditional triangle model by adding the measure of "integration" to the measures of "scope", "time", "cost", and "quality". "Integration" includes a set of processes, activities and roles that ensure identification, definition, compilation, standardization, and coordination of the various operations of the project in the project management plan. This will probably lead to achieving the goals in line with the expectations of the stakeholders, as well as continuously monitoring and developing performance.

The above clearly demonstrates that the "integration" measure can be considered the fifth metric that will support the four traditional project success measures through which the traditional triangle model for project management is developed into a new model. The new model is a "Diamond" shape consisting of four peaks. On the four peaks there are the measures "scope", "time", "cost", and "quality" with the fifth measure "integration" at the heart of the Diamond as shown in (Figure 12).

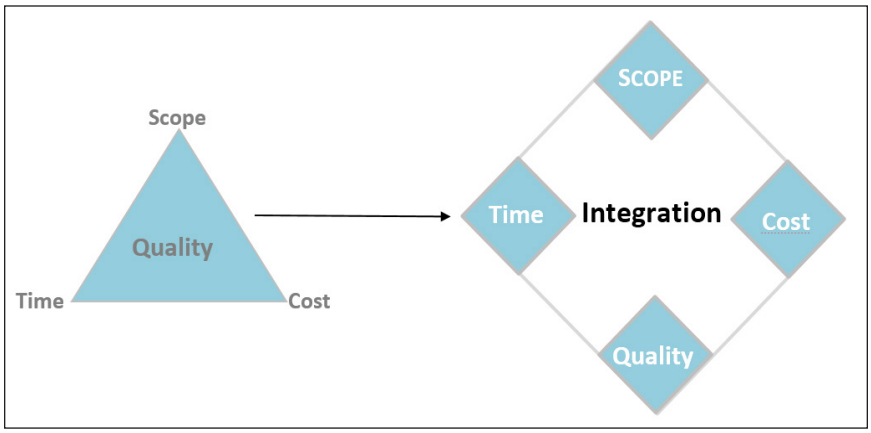

Figure 12. Developing ICTQS Diamond Framework Model for Project Management

Benefits of 'Integration' in the ICTQS Diamond Framework

The benefits of integration are evident through the processes of integration management, as it has a relationship with the elements and stages that have a significant impact on the project's path. Some of the benefits can be summarized in the following points:

1. Integration processes support performance monitoring and contribute to its continuous development through comprehensive planning for all areas of project management. It develops plans based on lessons learned, as well as through the process of continuous business orientation and making corrections at an early stage of project implementation based on periodic performance reports and stakeholders' expectations.
2. Integration supports knowledge in its two parts, "explicit knowledge" and "tacit knowledge". This is done by introducing activities and techniques through which knowledge is integrated between the project team and the continuous development of the areas of knowledge deficiencies within the project team. This ensures that the necessary knowledge is available to the project team at an early stage from the start of the project, especially those relating to the expectations of the stakeholders about the project. This is what continuously enhances the project's performance.
3. Integration is also concerned with controlling the change orders, which is one of the main influences on the progress of the project and the success of its objectives from stakeholder perspective. Its proper management in a way that avoids the project many of the risks affecting the constraints of the project is required.
4. Integration manages the project closing phase and ensures that the initial receipt and final handover, updating and archiving of documents to improve future performance. Furthermore, it verifies stakeholder satisfaction and achieving goals from their perspective to ensure that no risks occur after the closing phase.
5. Integration endeavors to reduce ambiguity and uncertainty, which are problems facing the project team, especially the expectations of the beneficiaries. Success in achieving the project objectives according to the expectations of stakeholders is particularly important. It requires skills to elicit the desires of stakeholders and reach their expectations about the project and is what is achieved through integration management.

DISCUSSION

The research seeks to expand the conceptual boundaries of project management and to provide greater links between research and practice (Winter et al., 2006) until reaching an effective measure of project success, as success is always subjective. The proposed framework was developed by quantitative data obtained through a survey verifying the effect of integration management on project success. This has revealed the great impact

of integration management on the success of the project. This is consistent with other studies which concluded the existence of a critical role for integration management on project success (Asif et al., 2010; Berteaux & Javernick-Will, 2015; Halfawy & Froese, 2007; Ospina-Alvarado et al., 2016; Ozorhon et al., 2014; Silvius et al., 2017; Tatum, 1990). However, we find some differences between the results of the current study and the results of the study by Silvius et al. (2017) which concluded that quality management was the most influential measure on the success of the project. Cost management was the most influential on the success of the project in the current study showing the benefit of developing measures of project success to arrive at metrics that effectively reflect the success of the project.

The benefits of the Diamond Framework can be summarized in the following points:

1. The diamond framework is considered a modern, disciplined, and accurate tool for measuring the success of construction project management.
2. The model works to improve and develop a set of rules and behaviors in managing construction projects in accordance with modern principles of project management.
3. The project team assists in evaluating project management and identifying potential gaps in project management to avoid their negative impacts.
4. The model contributes to enhancing project management performance in all areas by integrating all processes and roles and directing them towards achieving project stakeholder goals.
5. The model provides an improvement for project success metrics in a simple form that can be easily understood.
6. The framework helps make trade-offs between the traditional project constraints geared towards achieving project stakeholder goals.
7. The framework supports knowledge management to continuously develop tools and administrative and technical skills to keep pace with changes and developments.

CONCLUSION

After more than fifty years from the emergence of the traditional triangle model in project management, it has become important to develop it considering the challenges facing the construction industry in the twenty-first century (Barnes, 2007). Among these challenges is the achievement of project stakeholder objectives. From the data collected from the survey and the analysis performed, the need to develop project success measures in the traditional triangle became clear. Adding integration to project success metrics will contribute to achieving project goals and improving performance in general. This study aimed to develop the diamond model grounded in the data. Based on the data the developed model relies on developing the shape and measures of the traditional triangle model in project management by adding "integration".

The study concluded by the development of the traditional triangle model and the introduction of the Diamond Model (ICTQS) for construction project management, which is a "Diamond" shape consisting of four peaks. On the four peaks, there are the measures of "scope", "time", "cost", and "quality". The fifth measure of "integration" is at the heart of the diamond where the author concludes that there is a significant impact of integration management on project success based on the fit between the quantitative and qualitative data. Integration enhances the effectiveness of the proposed framework model as a mechanism for project operation and measuring and evaluating project performance. It is also a tool to support the project team in overcoming the problems facing construction project management in Yemen and developing the Yemeni construction industry. The new idea is not based on considering the measures of scope, time, and cost as constraints, but as measures that are traded between them through the new "integration" measure to achieve project success from the project stakeholder perspective.

The study was restricted to studying the opinions of advisory bodies in Yemen. Future studies could address construction companies to study any differences. The researcher recommends continuing the creative development of the traditional triangle model in construction project management. This may be done by reviewing the measures of project success and the relationship between them and the influence on each other to assist the success of construction projects. The study needs further testing to clarify the impact of the implementation of the Diamond Action Framework (ICTQS) on the performance of construction project management and its importance in achieving project stakeholder objectives.

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