Managing project scope creep in construction industry

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Managing Project Scope Creep in Construction Industry

Abstract

Purpose – Project scope creep is a nightmare and nearly intolerable task. Most project managers struggle to curtail the expanse and degree of scope creep. This study examines different likely project scope creep factors associated with the construction industry projects.

Design/methodology/approach - After many brainstorming sessions with construction stakeholders, several project scope creep factors were identified. Then, a detailed survey was executed in big construction projects of the United Arab Emirates (UAE). The data were analyzed using exploratory factor analysis (EFA) and confirmatory factor analysis (CFA).

Findings - The results derived and validated five conspicuous factors leading to project scope creep. Respectively, the highest and the lowest impact on project scope appears to be imposed by tasks/specifications and complexity/uncertainty.

Practical implications - It offers crucial support to the project stakeholders in scrutinizing different factors that stand as hurdles to project success and allows them to seek remedies to resolve them.

Originality/value - It is among the first study in the region that identifies and validates the factors that hinder construction project success.

Keywords: Projects, Project management, Scope creep, Construction industry, UAE

Paper type Research paper

1. Introduction

Construction projects are the basic and important ingredient for any country's economic growth as they fulfill the needs of the nation by providing accommodation, transportation, and social infrastructure (Prasad, et al., 2018). So, amounting to 7–10% of gross domestic product (GDP), the construction industry is considered one of the key drivers of any national economy (Voordijk *et al.*, 2000; Mustaffa, 2012). This consideration has resulted in an increasing demand for enhanced organizational and project performance, pushing businesses and organizations to look for ways to safeguard project success in all industries. Consequently, managing project scope plays a key role in achieving the project's goals successfully. Considered the best solution to eliminate any ambiguity and uncertainty, scope management is the process that ensures only the work required to accomplish the project is done (Dekker & Forseluius, 2007). The mismanaged scope is hence an outcome of planning shortages during the various phases of the project, which in turn are the result of an unclear definition of scope, incomplete scope, scope documents not being finalized, and not sharing scope statements. This outcome results in scope changes, which negatively affect the time, cost, and quality or risk level of the project, causing what is known as "scope creep" (Dekker & Forseluius, 2007). Project scope creep is "the tendency for a project to extend beyond its initial boundaries" (Integrated Management Systems, 2007). Projects can be delayed, become more expensive, and provide less functionality, or they may even completely fail (Janssen *et al.*, 2014).

Project scope creep is a dreaded thing that can happen on any project, wasting money, decreasing satisfaction, and causing the expected project value to go unrealized (Ajmal *et al.*, 2019). Most projects seem to suffer from scope creep, and both project teams and stakeholders are regularly frustrated by it

(Larson & Larson, 2009). More specifically, in construction projects, cost, time and quality measures are the main determinants of project success (Becker *et al.*, 2014). While this is the case, it is reported that more than half of construction projects experienced cost and time overruns, even in the presence of different strategies to address those problems (Shehu *et al.*, 2014). These issues are reflected in a poorly defined project scope, which is among the leading causes behind project failure (Bjarnason *et al.*, 2012; Sethia & Pillai, 2013a; Sethia & Pillai, 2013b).

Although it is been contended that successfully managing project scope is a major determinant of project success, the problem continues to exist, so there is a need for more investigation of the issue to highlight the causes of projects exceeding their schedules and budgets (Business Monitor International (BMI), 2013; Flyvbjerg, 2014; McKinsey Global Institute, 2016). Literature has pointed to the factors that lead to project success; however, as far as the researchers are aware, no previous research has addressed the interrelationships of these factors (Project Management Institute, 2017; Sanchez *et al.*, 2017). Moreover, little research has investigated failed projects to identify the causes of their failure, which calls for more research efforts in this area, especially on the causes of project scope creep and the interrelations among those causes (Alami, 2016; Project Management Institute, 2017).

This is a serious issue in countries that rely heavily on construction as a major contributor to their economies, such as the UAE. As a fast-developing country, the UAE has been capitalizing heavily on the construction industry, which contributes significantly to national growth (AlKuwaiti *et al.*, 2017). According to a study conducted by the Dubai Chamber of Commerce, the construction industry's contribution to the UAE GDP was 10.6% in 2008 and 10.3% in 2011. The national construction industry's contribution of $319.1 billion makes it the largest in the region. Furthermore, it is expected to grow from 11.1% to 11.5% between 2015 and 2021 (Constructionweekonline, 2015). The growth of construction is driven by Expo 2020 and population growth, which both increase the demand for residential and commercial property in the country (Dubai Chamber of Commerce, 2012; John, 2018).

Therefore, this study aims to expand the literature on project management by exploring the different possible causes of project scope creep. In particular, based on public sector construction projects, this study presents an exploratory/confirmatory study of the factors that lead to project scope creep in the construction sector of the United Arab Emirates (UAE). Given the country's heavy reliance on the construction industry, the country can't bear the consequences of failed projects. Furthermore, delays in project execution are not in the best interest of the industry, as they are accompanied by additional costs. Thus, the objective of this study is two-fold:

1. To identify and validate the relationship among dominant factors that cause project scope creep in the UAE's construction projects by employing Exploratory Factor Analysis (EFA); and,
2. To empirically test the impact of these factors on project scope creep by introducing a Second-Order Confirmatory Factor Analysis (CFA) model.

The study is organized as follows: a literature review is conducted in section 2 to describe the notion of project scope and scope creep, the possible causes of scope creep, and insights on the construction sector in the UAE. Section 3 presents the research methodology of this study. The findings are reported and discussed in sections 4 and 5 before the study concludes with section 6.

2. Literature Review

2.1. Project Scope and Scope Creep

The concept of the "project" has been expanded from managing individual projects that are based on a set of well-defined goals to managing portfolios of interdependent projects (Atkinson *et al.*, 2006). Delivering projects with the desired benefits on time and within budget affects project success and reflects project efficiency (Serrador & Turner, 2015; Badewi, 2016). While project scope is defined as the work that should be carried out following certain specifications and features to deliver a product, a well-defined scope is critical for project success (Project Management Institute, 2000; Atkinson *et al.*, 2006). Using the inputs of all relevant stakeholders, managing project scope, right from the early stages of the project, incorporates the development and declaration of the project's goals, cost, schedule, tools, resource requirements, methods or procedures, project boundaries, excluded activities, deliverables, and relevant acceptance conditions, as well as constraints and assumptions (Project Management Institute, 2000; Wang, 2002; Fageha & Aibinu, 2013). The level of project scope inclusiveness can affect project design and outcomes and, therefore, the decision of whether or not to continue with the project (Kähkönen, 1999). It should start earlier during the pre-project planning process to allow identification and analysis of the risks associated with the project and the approach to executing the project to avoid any key changes that can harmfully affect project performance (Gibson *et al.*, 2006).

The lack of understanding or defining project scope at the beginning of the project is the main reason for project failure (Mirza *et al.*, 2013). Poor scope management referred to as "scope creep" or "requirement volatility" is any change or deviation from the initial goals of a project (Barry *et al.*, 2006; Thakurta *et al.*, 2009; Mantel *et al.*, 2010). It is "the tendency for a project to extend beyond its initial boundaries as a result of changes that may occur because of adding features and functionality in project scope without addressing the effects on time, costs, and resources, or without customer approval." If an expansion of scope is approved, then it is not scope creep (Integrated Management Systems, 2007; Project Management Institute, 2008).

Scope creep is frenzied and unanticipated changes in clients' expectations and requirements as a project is carried out (Neimat, 2005). It is a change that happens gradually and informally, without altering due dates or making modifications to the budget, or the propensity for a project to prolong outside its original limitations (Hussain, 2012). It puts pressure to deliver more than what was approved initially (Gurlen, 2003). Scope creep occurs as an incremental extension of the project's scope, for instance, with superfluous work requirements without the essential reformation to the cost or schedule (Retana, 2014). Despite, systematic meetings with clients and questionnaires still, the most common issue is customer dissatisfaction (Helms, 2012; Teye Amoatey & Anson, 2017). Bronstein (2010) postulated that scope creep is mostly steady and not detected instantaneously as apparently insignificant change requests are made by the client that the project team receives to make the sponsor contented but ultimately it is converted into a substantial issue.

Changes in the project might be due to internal factors, such as improper or partial scope definition, unsatisfactory input from stakeholders where the feedback of one or more project participants is purposely or accidentally absent, and differences in participants' perspectives (Sharma & Lutchman, 2006). They could also result from external influences, such as unpredictable economic cycles, price fluctuations, and competition (Heywood & Smith, 2006). By working on unapproved features, a project team puts time into the unauthorized modifications. The work to integrate these modifications must typically be done within the original time and budget approximations, leaving less time for permitted parts of the scope. Ultimately, permitted features do not get completed, and the outcome is not what was commissioned. Or, there could be time and cost overruns to finish the authorized parts of the scope (Larson & Larson, 2009).

One of the major aspects of project scope creep is time and cost overrun (Flyvjberg et al., 2018). Mostly, in the management of construction projects, when time overruns, it possibly stimulates cost overruns (Famiyeh et al., 2017). Though, the cost and time of construction projects can overrun not essentially from environmental factors only but also because of poor project scope management. Many researchers from different countries have been trying to identify the main causes of cost and time overrun as each country has particular culture and guidelines (Sweis et al., 2019). But it is still unclear how cost and time overrun is known, what factors categorically cause them, how the factors that cause them are interconnected and how to avoid them. This has led to a big problem among all the stakeholders like policy makers, investors, construction practitioners, researchers, and the general public (Flyvjberg et al., 2018).

The causes of scope creep frequently relate to problems with understanding (e.g., conflicting requirements), behavior (i.e., of project members and users), and actions (i.e., project management decisions) (Kotonya & Sommerville, 1998; Davis *et al.*, 2008). The effect of scope creep is found to be pronounced on project quality (Nurmuliani *et al.*, 2004). Scope creep has several consequences on overall project success, such as various requirement changes, quality issues, project delays, changing or cancellation in plans, not meeting customer expectations, lack of communication, and reduced motivation. (Kumari & Pillai, 2014). Therefore, project scope comprehensiveness in defining goals and objectives is a key success factor of projects (Collins & Baccarini, 2004). To ensure project scope definition comprehensiveness, the project's internal and external participants need to sufficiently reveal their requirements during the scope definition process (Heywood & Smith, 2006). Moreover, the scope of the project should be understood by all participants, and any changes in scope need to be curtailed, or at least controlled, as failing to do so would expose the whole project to failure (Ward, 1999; Kerzner, 2006).

Time and cost overruns have been related to critical failure factors that are frequently outlined to uncertainties and design issues in the construction projects (Asiedu and Alfen, 2016; Love et al., 2019). Moreover, vague project scope definition contributes to time and cost overruns for most projects (Asiedu and Gyadu-Asiedu, 2019). Therefore, the capability to assess the probability of time and cost overruns is the key to managing the project scope creep.

2.2. Construction Industry and Project Scope Creep

The construction industry plays an important role in the socio-economic growth of any country as the accomplishments of the sector strongly prompt the attainment of the national development agenda by providing occupation to the general people, amenities, and infrastructure for all other businesses (Myers, 2013). The construction industry has been recognized as a vibrant industry that is persistently facing uncertainties in its budgets, processes, and technology (Gharaibeh et al., 2020). These uncertainties in conjunction with other factors such as project complexity and the augmented involvement of stakeholders, contribute to the complexity in handling any construction project and resulting in time and cost overruns (Halpin, 2011; Gharaibeh et al., 2020). Even though there have been developments in the management of the construction industry, but the difficulties of cost and time overruns are still serious and dominant subjects in the industry (Parvan et al., 2012; Perera and Dewagoda, 2021). Usually, changes in construction projects occur to revise or correct the design, or scope of work (Alnuaimi et al., 2010). One of the frequent changes in the construction industry is the design change (Mohamad et al., 2012). Design changes would unavoidably influence the strategic success criteria, namely cost, time, and quality (Owalabi et al., 2014; Naji et al., 2020).

Present construction megaprojects cope with many designs, engineering, and construction specifications driven by persuasive expectations of stakeholders, which enact to increase the complexity of project management processes (Ershadi et al., 2021). A multifaceted project environment is pigeonholed by interdependent sub-systems, the participation of numerous stakeholders, and overlapping segments (Widforss and Rosqvist, 2015). Consequently, the level of project complexity increases when the project scope is not clearly defined and later on there are multiple changes made in the project (Bakhshi et al., 2016; Rostami et al., 2017).

The administration of construction projects is multifarious as it involves several uncertainties related to design/specification/customer requirements/communication (Love et al., 2002). The key objective of project management is to complete the project deliverables to accomplish the set objectives, hence within budget, on time, and within scope (Khattak and Mustafa, 2019; Asiedu and Ameyaw, 2020). Despite the contribution of construction projects in the growth of many countries, the literature shows that most of them fail to accomplish their expected objectives, and even in some cases, they are completely failed. Consequently, researchers have been keen to recognize and assess factors that account for failure (Damoah and Kumi, 2018).

As, completing on time and budget is a challenging task for almost all construction project managers in today's competitive global World (Ciccarelli, 2012). In the past, construction projects have issues of cost overrun (cost escalation), even in the massive projects where all stakeholders are involved in the planning stage for years (Hussain, 2012). The outcome for most of the construction projects is not ever the matching as formerly premeditated because of unstable and developing project scope (Hussain, 2012; Ajmal *et al.*, 2019). In the initial stages of any construction project, owners, and contractors, each have a conferred attention in defining the full project scope. But, as the project progresses, scope creep can go unobserved, progressively goes its way into a project's scope as prospects change and cause major destructive damages (Ciccarelli, 2012). Ultimately, these damages to construction companies fall into three basic areas: augmented liabilities, reduced profitability, and impaired reputations (Lamont, 2013).

The adverse effects of scope creep on construction projects have been communicated by numerous scholars (Adam *et al.*, 2017). One of the main concerns of scope creep in construction projects is that they push the project schedule and budget beyond its original plans (Agyekum-Mensah and Knight, 2017). Projects take extended time and cost, not only due to the additional direct effort to deliver supplementary functionality but since the project will stall whereas new requirements are being defined (Dixon, 2006). It is also observed that scope changes unfavorably influence labor productivity (Hanna and Gunduz, 2004). Scope changes repeatedly cause substantial disorders to a construction project, which may reduce labor productivity, and construction quality standards can be compromised overall (Tse and Love, 2003).

According to Teye Amoatey & Anson (2017), scope creep can cost up to four times compared to preliminary costs. These costs may contain delayed compensations and decreased return on investment, augmented maintenance costs, and added anticipated damage (Gurlen, 2003). A quantitative valuation of the cost and time effect of deviation on construction projects witnessed that deviations had a major influence on project cost and time overruns and accounted for nearly 80% and 65% congruently of the cost and time overruns, for the projects studied (Oladapo, 2007). It can be likely, if a project gets extended than estimated to finish caused by scope creep, then it will take lengthier before the earnings can be realized (Simushi & Wium, 2020). Additionally, if a project goes uncontrolled attributable to all the changes, it may get canceled, and in case it gets canceled, the company will pay for a loss on what it paid out on the project (Asiedu & Adaku, 2019). Madhuri *et al.* (2014) established that late project completion is connected with scope creep in construction projects. Also, as scope creep escalates, the time needed for carrying out project upsurges than anticipated (Simushi & Wium, 2020).

2.3. Issues of Scope Creep in the UAE's Construction Industry

The construction industry is one of the most booming industries in the whole world, both in developed and developing economies (Economy Watch, 2010). It plays a critical role in creating new jobs, driving economic growth, and, hence, contributing to the country's GDP (World Economic Forum, 2018). The global construction industry represented approximately 13% of the global GDP in 2013 and is projected to increase to 15% by the year 2020 (Schilling, 2013). Moreover, construction output is expected to expand by 85% to $15.5 trillion worldwide by 2030 (Caulfield, 2015).

In the United Arab Emirates, the construction industry is one of the largest contributors to national growth (AlKuwaiti *et al.*, 2017). As one of the most rapidly growing economies in the Middle East, the country has experienced enormous investments in the construction industry during the past few years, directed at infrastructure, residential, office, retail, hospitality, healthcare, and leisure construction projects (Dubai Chamber of Commerce, 2012; Driessche, 2016). The country's construction market ranks first in the GCC, recording the highest construction project value of $319.1 billion in 2011, with a projection to make an 11.5% contribution to UAE GDP in 2021, driven by Expo 2020, tourism, and population growth, which increase the demand for residential and commercial property units in the country (Dubai Chamber of Commerce, 2012; Driessche, 2016; John, 2018).

However, the UAE's construction sector has been suffering from delay issues, which have increased construction costs (Faridi & Sameh, 2006; Mpofu *et al.*, 2017). Reports reveal that construction projects worth $89.9 billion were on hold in 2017 and 50% of the construction projects in the UAE encounter delays and are not completed on time. (Faridi & Sameh, 2006; Abbas, 2017). Among the top reasons for such delays are delays in approval for drawings, inadequate early planning, and slowness of the owners' decision-making process (Faridi & Sameh, 2006).

A successful construction project is said to have accomplished its technical performance, maintained its schedule, and remained within budget (Frimpong *et al.*, 2003). Unfortunately, due to various reasons, project successes are not common in the construction industry (Ahmed *et al.*, 2003). In 2014, more than half of construction project owners worldwide suffered one or more underperforming projects. Only 31% of construction projects came within 10% of the budget and just 25% within 10% of original deadlines from 2012 to 2014. (Schwartz, 2015). Delays in project execution are usually accompanied by cost overruns, which have a detrimental effect in terms of adversarial relationships, mistrust, and cash flow problems, even in the gigantic projects where hundreds of people are involved in the planning stage for years (Ahmed *et al.*, 2003; Hussain, 2012).

Scope creep is the current leading cause of project failure globally (Hussain, 2012). Virtually, every mega construction project in the world is running overdue and over budget (Schneider, 2017). However, the literature falls short of defining project scope creep and its causes in the context of the UAE, which urges further research to highlight the causes of projects exceeding their schedule and budget and to reduce the number of project failures (Business Monitor International (BMI), 2013; Schwartz, 2015). This is especially important in a country that has its eyes on modernization and development, such as the UAE. (Business Monitor International (BMI), 2013)

2.4. Factors of Scope Creep

Raising awareness of the causes of project scope creep would help provide proper remedies to the dilemma, and would contribute to improved organizational performance, thereby enhancing competitive advantage (Integrated Management Systems, 2007; Martens *et al.*, 2018). Potential scope creep factors such as complexity, uncertainty, opposing stakeholder requirements, lack of top management support, and resistance can be identified and established from the literature (Pinto & Mantel, 1990; Yeo, 2002; Daniels & La Marsh, 2007; Nelson, 2007; Lu *et al.*, 2010; Ajmal *et al*., 2019). In this section, we present the key causes of project scope creep.

Project Complexity / Uncertainty

As construction projects get bigger, their complexity grows exponentially (Schwartz, 2015) Project complexity is identified as the leading cause of project failure (Hass, 2009; Project Management Institute, 2014). The literature has been addressing project complexity in-depth in an attempt to frame the concept and help project managers make more informed and proactive decisions to achieve project goals successfully. Despite those efforts, the concept is still vague because of its comprehensiveness (Klir, 1985; Sinha *et al.*, 2001). However, complexity in projects is categorized into: sociopolitical, environmental, organizational, infrastructural, technological, and scope complexity (Baccarini, 1996; Bosch-Rekveldt *et al.*, 2011; Nguyen *et al.*, 2015). It is due to the involvement of various levels in an organization that the tendency of project creep is high, leading to time and cost overruns. (Shapiro & Lorenz, 2000; Konrad & Gall, 2008) Such concerns lead to an attempt to quantify the complexity of projects. Complexity Level (CL) is one of those measures that aim to systematically quantify overall project complexity (Nguyen *et al.*, 2015). While this is not an easy task, project managers emphasize this critical process to identify potential difficulties and make informed decisions in terms of project prioritizing and resource allocation (Vidal *et al.*, 2011; Project Management Institute, 2013).

Project complexity could be characterized by uncertainty (Williams, 1999). The more complex a project, the more uncertainty it creates. Sources of uncertainty in projects are uncertainty that is associated with estimating the cost, duration, and quality of planned activities; uncertainty associated with the presence of multiple project parties, each of whom has different objectives and motivations; and uncertainty associated with stages of the project life cycle (Atkinson *et al.*, 2006). It was found that, when a project is exposed to a higher level of uncertainty, collaboration serves as a driver of project performance, whereas opportunism acts as a barrier against it (Um & Kim, 2018).

Tasks/Specifications

The requirements and specifications processes aim to define, analyze, and document the main business needs of the project, and those needs are formally documented during the specification step so they can be communicated to the relevant stakeholders (L. Daniels, 2000; Rahmesh & Madhavan, 2000). The requirements include functional user requirements (what the software will do, and what is applicable for enhancement projects), nonfunctional requirements (that outline how the project must meet quality and performance constraints), and technical requirements (the physical implementation requirements, such as team skills, tools support…, etc.) (Dekker & Forseluius, 2007).

A major challenge in project management, however, is the failure to proceed through the project stages with well-defined specifications. This issue arises from insufficient performance during the early stages of design and planning, which contributes to the consequent poor performance of the project as a whole, adversely affecting the project cost, time, and quality (Atkinson *et al.*, 2006). The poor identification of project requirements and specifications stems from unclear organizational business strategy, unclear goals or the lack of ability to adhere to the goals that were set, and the lack of skills to meet the required organizational goals (Kumari & Pillai, 2014).

While the requirements specification is an important document that captures all these relevant features and functions (Kumari & Pillai, 2014), complete and documented user requirements are the core of scope management, and should comprehensively describe the objectives for the project and the goals, functionality, and details required for the development team to fulfill the vision of the customer (Dekker & Forseluius, 2007). Similarly, incomplete or ambiguous specifications would expose the whole project to continuous changes, leading to project failure (Mirza *et al.*, 2013; Kumari & Pillai, 2014). It is, therefore, important to keep the requirements specification updated and approved by the respective stakeholders; a challenging task considering the time that should be spent collecting and analyzing customers' needs. (Kumari & Pillai, 2014; Alami, 2016)

Risk

Risk receives great attention as it is generally considered a threat to the achievement of project objectives (Atkinson *et al.*, 2006). The failure to establish a proper risk assessment and planning process to foresee and deal with the potential events that may occur or evolve in a business environment would expose the whole project to detrimental consequences (Besson & Rowe, 2001; Nguyen *et al.*, 2015). Common risk management practices frequently fail to report the sources of problems in the project because these practices do not integrate all the stages of the project life cycle (Atkinson *et al.*, 2006; Tsiga *et al.*, 2017).

Thus, early risk identification would help team members deal with concerns and issues in a more informed manner. Risk assessment, then, should take place to evaluate risk items that might have a potential impact on the project. After that comes a risk mitigation strategy, which aims to reduce or avoid risk for each item with a high probability (Integrated Management Systems, 2007). Factors that help in project risk management are classified into two categories. First, hard aspects incorporate initiation, identification, assessment, response planning, and response implementation. Then, soft aspects include risk communication and attitude, monitoring, and review (Didraga, 2013; R. Rabechini & Carvalho, 2013; Almajed & Mayhew, 2014).

Communication

Being the most influential factor in project success, communication has always been a challenge in the overall project because it is attributed to human behavior. Communication gaps among the stakeholders; the customers, and project teams can lead to setting poor, incomplete requirements and can cause scope creep (Phua, 2005; Integrated Management Systems, 2007; Bjarnason *et al.*, 2012). Difficulty in coordination between the parties is one of the factors that contribute to delay (Assaf *et al.*, 1995; Mpofu *et al.*, 2017). Moreover, lack of communication with stakeholders might affect the overall project success, as their inputs are ignored, and they are not frequently informed of the key updates in the project (Integrated Management Systems, 2007; Kumari & Pillai, 2014).

For example, a study was conducted to examine two construction projects in Saudi Arabia. One of the projects was struggling with delays at the design stage for more than four years due to some changes in the project location and requirements, while the other project grappled with conflicts between the project's stakeholders on requirements that led to many changes in the scope of work at the construction stages. Poor communication between stakeholders was a major source of the problem in both projects (Fageha & Aibinu, 2013).

Therefore, communication facilitates agreement among involved parties about the project requirements and execution. A communication plan has to be developed to make the most effective use of the people involved with the project and to resolve any difficulties that arise smoothly. Such an established plan would limit confusion and build rapport and trust. If a communication plan has not been developed or is not being followed, individuals may not have key information on which to base project decisions (Integrated Management Systems, 2007).

Customers (End-Users)

Customers or end-users play a crucial role in project success as their clear vision of the project's objectives leads to the project requirements' comprehensiveness (Kumari & Pillai, 2014). The failure to clarify stakeholder expectations and priorities at an early stage of the project results in ill-defined project scope (Atkinson *et al.*, 2006; Nik & Kasirun, 2011; Ogwueleka, 2012). Besides, insufficient user involvement is the reason behind project failure (Standish Group Report, 2018).

Incomplete project definition can occur when the input of one or more stakeholders is intentionally or unintentionally omitted, while at the same time inputs from others dominate (Sharma & Lutchman, 2006). Clients' requests or contractors' inability to deliver based on the expectations of the client are two factors that affect the scope of the project, leading to evolvement of the scope, and eventually, to scope creep (Sylvester *et al.*, 2011). Moreover, conflict and controversies about the implementation of a project can arise if stakeholders are inadequately engaged and their concerns and expectations are not managed well (Olander & Landin, 2005; Fageha & Aibinu, 2013).

Consequently, project scope definition is critical for enhancing stakeholders' satisfaction and successful project implementation (Heywood & Smith, 2006). Project managers and decision-makers have to develop a well-defined project scope that satisfies stakeholders' expectations and concerns (Fageha & Aibinu, 2013). Key stakeholders and customers must be identified during the development of the project scope. They should also be engaged in the project scope definition to maximize positive inputs and minimize detrimental attitudes by taking into account the needs and requirements of all project stakeholders (Mirza *et al.*, 2013; Alami, 2016; Di Maddaloni & Davis, 2018).

Figure 1 summarizes the causes of project scope creep as highlighted in the literature:

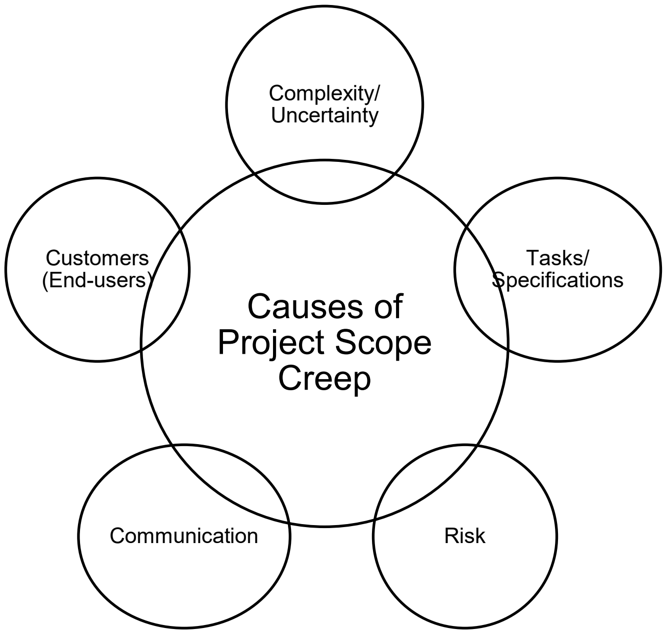


Figure 1: Causes of Project Scope Creep

3. Research Methodology and Design

This study adopts a quantitative methodology to generate a pool of items for a scale that aims to identify and validate factors of project scope creep. As it aims to develop a reliable instrument for determining the factors that lead to scope creep within the construction industry, the process can be divided into three phases: brainstorming sessions (semi-structured interviews), data collection, and testing/validating of the measurement scale. This multistage methodology has been adopted from Sila (2005), Hair *et al.*, (2006), Khan et al., (2018) and Ajmal *et al.*, (2019).

The first phase adopts an exploratory approach to collect empirical data from construction projects in the UAE. Semi-structured interviews were conducted with construction experts from major public sector construction projects in the emirates of Abu Dhabi and Dubai to explore and identify the several factors that lead to project scope creep. The interviewees were asked to report both internal and external factors that might cause poor scope management. This is an important step in developing scale items to measure the causes of project scope creep, considering that the literature is fragmented, within the context of a developing region, such as the UAE. The opinions of the interviewees were then used to develop a pilot study. With the help of field experts and university researchers, this pilot study helped us restructure, refine and improve the items in our instrument. This way, the pilot study helped us validate the measurement instrument in order to highlight the issues related to scope creep. The results of this first phase (brainstorming sessions) have been published in Ajmal *et al.*, 2019. They explored the commonality of various stakeholder views in the factors that hinder project success. Employing the stakeholders' theory, they highlighted the major causes of scope creep as communication, technical complexities, specifications and environmental uncertainties.

In the second phase, a quantitative methodology was adopted based on the pilot study results. A detailed, 30-questions survey was developed and executed in ten big public construction projects of the UAE to investigate respondents' view of the factors that cause a project to run beyond its budget, schedule, and specifications using a five-point Likert scale (Hair *et al*., 2005). The questionnaire was administered using the internet survey tool Survey Monkey and sent to 250 project managers, and 155 responses were received from the respondents working in the construction field with several years of experience. The demography of these respondents is described in Table 1 below:

Table 1 – Respondents' detail

	Count	Percentage
Management Level		
Top management	125	80.65%
Middle management	30	19.35%
Years of Experience		
More than 10 years	85	54.84%
Between 5 and 10 years	49	31.61%
Less than 5 years	21	13.55%
Domain of Work		
Administration	45	29.03%
Procurement	59	38.06%
Operations	51	32.90%

The third phase was to test these responses. We used Principal Component Analysis (PCA) to explain the maximum amount of common variance with the smallest number of explanatory constructs (factors or latent variables). These factors represent clusters of factors that correlate highly with each other. A Cronbach's Alpha (α) of 0.950 showed that the responses are reliable enough for further analysis. Confirmatory Factor Analysis (CFA), was then used to assess and validate constructs that describe project scope creep. This three-phase methodology is depicted in Figure 2 (Khan et al., 2018).

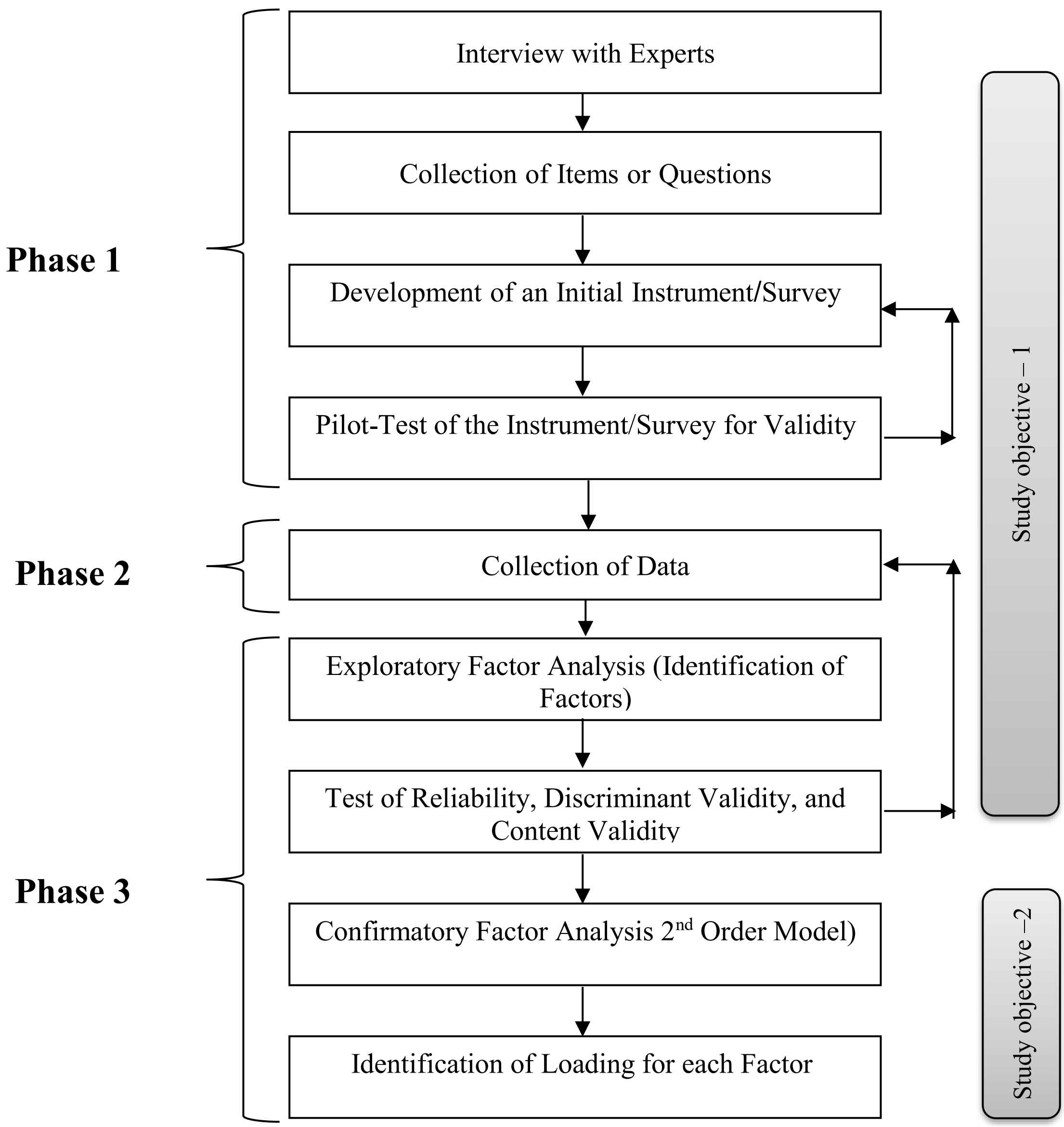


Figure 2. Steps of Design/Methodology of Research with Objectives

4. Analysis and Results

4.1. Exploratory Factor Analysis (EFA)

This analysis was used because several conditions must be met before testing whether the items are suitable for analysis. One of the tests is the Kaiser-Meyer-Olkin Test (KMO) and Bartlett's Test of Sphericity. The results are shown in Table 2.

Table 2 – KMO Test and Bartlett’s Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		**0.917**
Bartlett’s Test of Sphericity	Approx. Chi-Square	3290.580
	Df	435
	Sig	0.000

The Kaiser-Meyer-Olkin Test (KMO > 0.50) shows that these items are suitable for factor analysis and there is no serious multicollinearity in the data (Field, 2013). Bartlett's Test of Sphericity (Sig. <0.05) showed that the correlation between items is sufficient to run the factor analysis. After the two tests, EFA was used with the principal component analysis (PCA) extraction method and Varimax rotation on the 30-item instrument. PCA is one of the several techniques used for dimension reduction. The number of factors to retain was based on a combination of methods (e.g., eigenvalue >1.0, scree plot) and the theoretical salience of the rotated factors. Items should preferably load greater than 0.40 on the relevant factor and less than 0.40 on all other factors (Stevens, 2012). No item was dropped from the analysis, as all meet the above criteria. Thus, EFA results (Table 3) in a rearranged set of the items originally obtained from the brainstorming sessions (phase 1).

Factor patterns and items' loadings are presented in the following Rotated Component Matrix (Table 3). The next step is to look at the content of questions that load highly on the same factor to try to identify common themes. The questions that load highly on factor 1 ~~seem to~~ relate to matters related to the nature of the project; therefore, we ~~might~~ label this factor complexity/uncertainty. The questions that load highly on factor 2 all ~~seem to~~ relate to the requirements identification; therefore, we ~~might~~ label this factor tasks/specifications. The questions that load highly on factor 3 all ~~seem to~~ relate to the risks in the project; therefore, we ~~might~~ label this factor risk. Similarly, the questions that load highly on factor 4 all ~~seem to~~ relate to the challenges imposed due to communication; therefore, we label this factor communication. Finally, the questions that load highly on factor 5 all ~~seem to~~ relate to the challenges of end-users; therefore, we ~~might~~ label this factor customers. The framework explains 66.626% of the variance in the causes of project scope creep.

Table 3 – Rotated Component Matrix

Items		Complexity/ Uncertainty	Tasks/ Specifications	Risk	Communication	Customers
Q20	A high number of external contractors and vendors	0.856				
Q19	A high number of internal functions	0.833				
Q17	A complex work breakdown structure (WBS)	0.81				
Q23	A high degree of customization	0.778				
Q27	Variety of distinct knowledge bases	0.773				
Q21	High level of technological novelty	0.756				
Q16	Frequent changes in client/user requirements	0.754				
Q22	Degree of inputs in suppliers' equipment	0.75				
Q25	Degree of user/customer involvement in the design	0.74				
Q24	Clarity of project goals and objectives	0.736				
Q26	Impact of the embedded software in the product/system	0.707				
Q18	Degree of compliance with regulatory requirements	0.589				
Q14	An overlap among tasks		0.816			
Q15	A requirement for several instructions and approvals		0.806			
Q13	Chronological order of task in execution.		0.7			
Q12	Variation in task-requirements.		0.556			
Q10	The precision of language in the project specification		0.467			
Q2	Lack of defining the sources, categories, and events of risk			0.789		

Q1	Lack of defining the probabilities and consequences of risks			0.697		
Q3	Lack of defining responsibility and authority for performing the risk management			0.672		
Q4	Involvement of external consultants for identifying risks			0.622		
Q9	Lack of a plan for responding to the most critical risks			0.603		
Q11	Lack of mitigation strategies and contingency plans for risks			0.435		
Q29	Delay in a project due to lack of formal communication plan				0.759	
Q30	Lack of IT/Internet resources for the exchange of information				0.712	
Q28	Lack of an open forum for communication among stakeholders				0.702	
Q5	Failure in addressing the concerns of the affected stakeholders				0.523	
Q6	Change in the requirements from the customer					0.603
Q8	Ambiguity in customer's requirements					0.595
Q7	An error in defining the scope of the project in the contract					0.553
	Average Variance Extracted (%)	25.615%	11.999%	11.510%	10.385%	7.117%
	Construct Reliability (Cronbach Alpha)	0.949	0.837	0.838	0.858	0.662

4.2. Internal Consistency and Content Validity

The degree of consistency of responses over a construct is referred to as its reliability. The reliability coefficient, Cronbach's, is generally used for this test. As shown in Table 3, the Cronbach's α for the five latent constructs of social sustainability range between 0.662 and 0.949. These results show that the suggested constructs exhibit good psychometric properties.

Convergent Validity

As shown in Table 3, the items in each construct converge well for further analysis. Items load on the intended constructs with standardized loadings > 0.5, and the total average variance extracted (AVE) > 0.5. (Hair *et al.*, 2006)

Discriminant Validity

Discriminant validity is the degree to which different latent constructs and their indicators can be distinguished from the other constructs and their indicators (Bagozzi *et al.*, 1991). For calculating the discriminant validity, all the items should have higher loadings on their assigned constructs than any other constructs. Furthermore, the mean shared variance should be below 0.50. Alternatively, the square root of the AVE for each construct should be greater than any correlation estimate (Fawcett *et al.*, 2014). As shown by the values in Table 4, the five constructs are conceptually distinct.

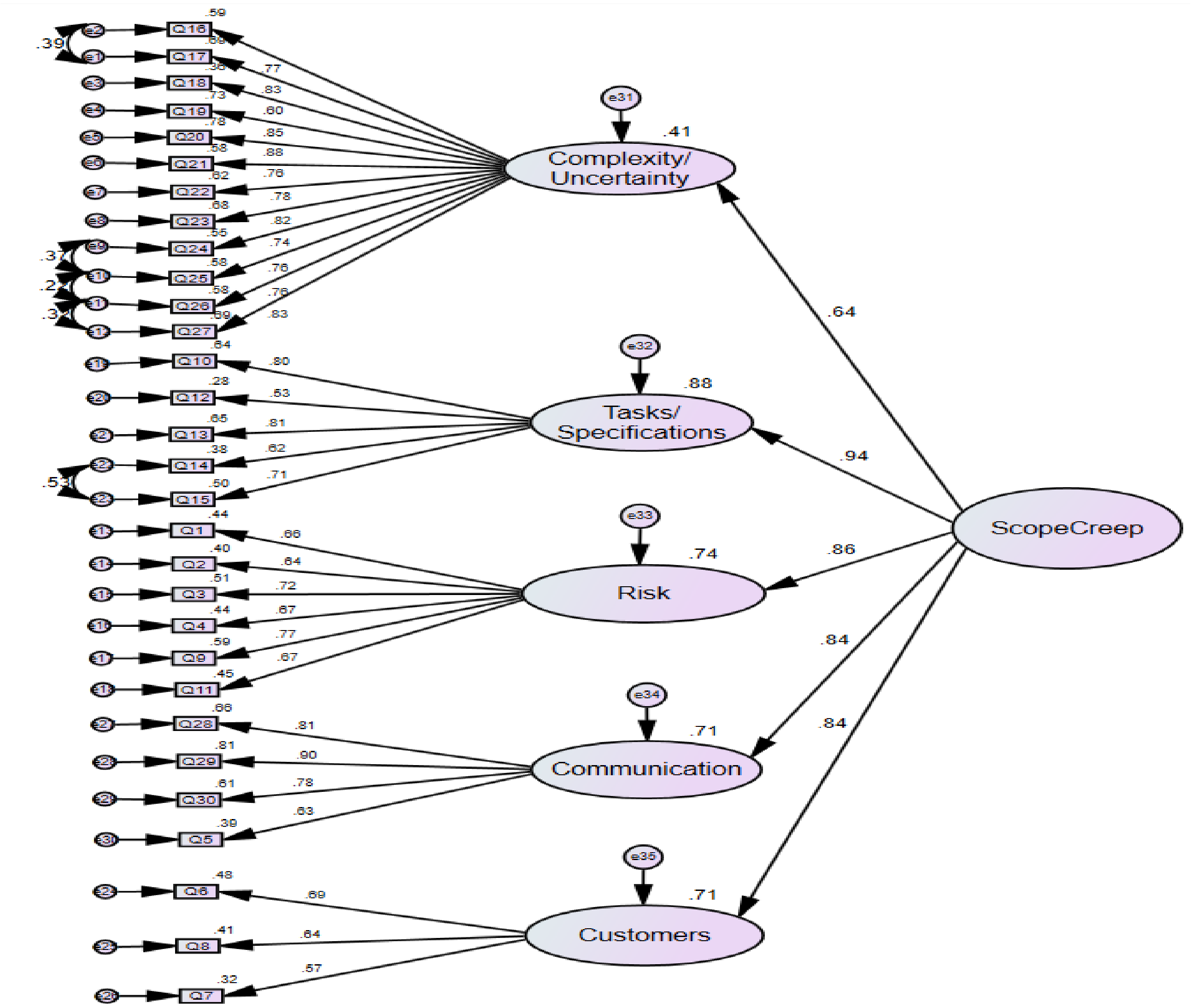
Table 4 – Discriminant Validity Test

	(1)	(2)	(3)	(4)	(5)
Complexity / Uncertainty (1)	**0.949**				
Tasks / Specifications (2)	0.388	**0.837**			
Risk (3)	0.511	0.515	**0.838**		
Communication (4)	0.421	0.579	0.482	**0.858**	
Customers (5)	0.353	0.357	0.397	0.243	**0.662**

4.3. Confirmatory Factor Analysis (CFA)

The exploratory factor analysis in this research has identified *complexity, uncertainty, tasks, specifications, risk, communication, and customers* as *a priori* factors of project scope creep in the construction industry. In the second-order model, project scope creep may be operationalized, where the five factors are governed by a higher-order factor (i.e., *scope creep*). The results of the model estimation are shown in Figure 3.

The CFA test of the second-order model (or structural model) implies that a higher-order latent factor (i.e., scope creep), governs the correlations among the five factors and produces acceptable goodness of fit (Hair *et al.*, 2006). The impact of all five factors on scope creep is significant. It can be seen that the highest and the lowest impact on project scope appears to be imposed by tasks/specifications and complexity/uncertainty, respectively.



$\chi^2 = 726.507$ DOF = 395

CMIN/DOF = 1.839 CFI = 0.893

TLI = 0.882 RMSEA = 0.074

Figure 3 – Second-order measurement model for project scope creep factors

5. Discussion and Implications

This study identifies and validates the factors that lead to project scope creep in the construction industry in the UAE. While the industry occupies an unparalleled position, driving the country's economic growth, construction project practitioners seem to be struggling to finish projects within their boundaries. Although several factors were highlighted in the literature, a dearth of research in the present context is noted, making it difficult for professionals and researchers to understand the issues contributing to scope creep within the construction sector in the UAE, preventing them from fruitfully undertaking successful project management approaches in both practice and research.

Filling this gap, this study stands as one of the first studies with a roadmap to push additional research in this important area. The present research is intended to broaden the knowledge base of project management by providing empirical evidence of how UAE-based construction companies can execute projects successfully. More specifically, it addresses factors that cause a project to run beyond its budget, schedule, and performance requirements.

As for its methodological contribution, it offers crucial support to project stakeholders in scrutinizing different factors that stand as hurdles for project success and in allowing them to seek remedies to resolve them. Furthermore, the study helps project managers to improve their knowledge in managing project scope creep. Using 155 responses from construction projects in the emirates of Abu Dhabi and Dubai, the measurement scale demonstrates a good convergent and discriminant validity. The exploratory analysis results in five factors, i.e. complexity/uncertainty, tasks/specifications, risk, communication, and customers. Concerning the factors of scope creep for construction companies, the model predicts 66.626% of the variance in responses about project scope.

The estimated coefficient of 0.94 between "tasks/specifications" and scope creep suggests that the variation in task requirements, and the overlap among those tasks, have a direct impact on project scope. This finding is consistent with the earlier literature (Mirza *et al.*, 2013; Kumari & Pillai, 2014). For project scope to be effectively defined and understood, managers have to make sure that tasks and specifications are identified in the scope, taking into consideration the inputs of all related stakeholders.

On the other hand, "complexity/uncertainty" has the lowest impact, though significant one, on project scope creep. One explanation might be that construction projects are complex and dynamic systems by nature, and project managers are aware of such issues. But might arise as there is no guarantee that all complex and uncertain matters would be covered comprehensively in the scope of the project before execution (Vrijhoef & Tong, 2004).

In-depth prevention of scope creep is a very difficult, and near impossible task (Asiedu *et al.,* 2017). However, project managers should make every effort to minimize the expanse and magnitude of scope creep (Gurlen, 2003). To minimize scope creep, Clark (2014) recommended that a project manager has to be heedful from the planning stage of the project. It is also imperative to recognize the client's needs and vision even in advance (Clark, 2014). Recognizing all project requirements is an additional approach to curtailing scope creep (Fageha & Aibinu, 2016). Clark (2014) postulated that there should be transparency about the goals and objectives of the project in the preliminary design and planning stage. Requirements must be precise and unambiguous, like what the outcome is to be delivered (Turk, 2010). Also, all requirements must be feasible, attainable, viable, quantifiable, and certifiable, and articulated in enumerated terms that are understood by all the stakeholders (Prasad *et al.,* 2018). Also, the project priorities to the project drivers must be understood (Asiedu & Adaku, 2019).

Systematic scrutiny should be in place to evaluate the effect of a change bid because they may adversely influence a project and thus project managers have to prudently scrutinize the change to assess whether it is within or outside of the scope of the original requirements (Sarkar, 2010). Additionally, they must also recognize how the requested change can influence the three priorities of the project, specifically, scope, schedule, and cost. Furthermore, managers and regulatory authorities should:

- mitigate the impact of all the factors from a holistic perspective;
- avoid disregarding the interdependent relationship between scope creep factors;
- adopt a comprehensive attitude to project management in the construction industry; and
- enhance the channels of communication to enhance the level of quality in projects, especially in developing countries.

6. Conclusion, Limitations, and Future Research Directions

This study has provided an investigation of the contemporary research landscape in the hunt for the causes that determine cost overruns and time delays in construction projects, especially, because of project scope creep. The prevailing trend is to think over project cost overruns and delays as kinds of risks. However, it is imperative to accentuate that mutually cost overruns and delays are consequences of project scope creep that occurs as an outcome of certain internal or external factors (company and client). So, the classification of certain factors causing scope creep and finally project delays and cost overruns as outcome simplifies the project risk management process. While, it is not likely to entirely eradicate these project scope creep factors, but it should be likely to alleviate them by identifying and managing them proactively. Accordingly, this is, established on the notion that the greatest importance of the project is continuously pursued. Undeniably, the rapport between individual rational and the project approach is not exclusively harmonious. Consequently, it is on the whole a challenge in construction projects where project-related choices rattle with judgments engrained in individual rationales that are not essentially established on a project cost-benefit analysis.

So, this study is an effective instrument for identifying and validating the factors that affect the efforts of project stakeholders toward project success. Practitioners need to be preemptive about the risks and threats in their current and future projects. Knowing the areas of focus would help the UAE's construction professionals scrutinize different factors that stand as obstacles to satisfying project performance criteria and allow them to overcome these hurdles.

This study does come along with certain limitations that entice future research in

- examining the framework in other sectors and organizations in the region
- revisiting the framework in other countries around the world
- validating and enhancing the results for service and manufacturing industries.

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