COST OVERRUN ISSUE IN CONSTRUCTION PROJECTS: COMPREHENSIVE GLOBAL REVIEW

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ABSTRACT

Objective: This paper aims to consolidate the causes of cost overrun in construction projects reported across a large and fragmented body of international literature into a single taxonomy, and to synthesize the lessons that emerge from a cluster of regional, survey-based empirical studies that test these causes using comparable quantitative methods.

Research Method: The paper adopts a narrative literature review and synthesis approach, drawing on two complementary literature streams: a broad international base of construction cost- and time-overrun studies published between 1954 and 2020 across more than twenty countries, and a focused supplementary set of fourteen survey-based empirical studies conducted in Malaysia, Pakistan, and the United Arab Emirates between 2010 and 2020. In total, 101 unique sources were reviewed and their causative factors classified inductively into ten categories.

Findings: Project and site management emerged as the single most consistently dominant cause of cost overrun across independent studies, countries, and analytical methods, followed by financial management and material-price volatility as a fairly consistent second tier. The relative importance of individual causes, however, was found to shift with institutional context — communication and regulatory delay, for example, ranked far more highly in the Pakistani evidence than in the Malaysian or UAE evidence — and a meaningful share of construction-phase problems traced back to design- and planning-stage decisions.

Originality: This paper is among the first to read a cluster of methodologically comparable Malaysia-Pakistan-UAE survey studies side by side against a broader international literature base, drawing out cross-study and cross-country patterns that are not visible from any single study in isolation.

Keywords: Cost overrun; construction projects; causative factors; literature review; project management.

1. INTRODUCTION

The construction industry occupies a central place in the economic development of every country, generating employment, absorbing investment, and providing the physical infrastructure on which almost every other sector depends (Abedi et al., 2011). Yet the industry is also unusually exposed to cost instability. Construction projects are typically large, long in duration, and dependent on a wide network of designers, contractors, suppliers, and regulatory bodies, any one of whom can introduce a disruption that ripples through the project's budget. It is against this backdrop that cost overrun — the amount by which a project's final cost exceeds its originally approved budget — has become one of the most heavily studied problems in construction management research.

Despite this attention, the literature on cost overrun causes remains fragmented. Individual studies tend to examine a single country, a single project type, or a single stage of the project life cycle, and use their own bespoke lists of candidate factors, which makes it difficult to compare findings or to build a cumulative picture of which causes matter most. Left unaddressed, cost overrun has serious consequences: it

strains client budgets, damages contractor reputations and profitability, delays the delivery of public infrastructure, and — in the case of publicly funded projects — represents a direct cost to taxpayers.

This paper addresses that fragmentation in two ways. First, it consolidates the causative factors reported across a broad international literature into a single ten-category taxonomy, building on and extending the classification schemes proposed by earlier reviews. Second, it looks specifically at a cluster of more recent, methodologically comparable regional studies — largely from Malaysia, with extensions to Pakistan and the United Arab Emirates — that rank these same categories of factors using consistent quantitative techniques, and draws out the lessons that emerge when their results are read together rather than in isolation. The remainder of the paper is organized as follows: Section 2 describes the review methodology; Section 3 provides an overview of the scale and global distribution of the cost overrun problem; Section 4 presents the ten-category taxonomy of causative factors in detail; Section 5 synthesizes the lessons learned across the reviewed studies; and Section 6 concludes.

2. RESEARCH METHODOLOGY

This paper adopts a narrative literature review and synthesis approach, rather than a single-protocol systematic review, because its purpose is to consolidate and compare findings that were themselves generated using heterogeneous methods — case studies, questionnaire surveys, structural equation modelling, and desk-based literature reviews — across a wide range of countries and project types. Applying a single systematic protocol with rigid inclusion and exclusion criteria across such heterogeneous source material would have discarded much of the descriptive, practice-based literature that still carries genuine diagnostic value.

The review draws on two complementary bodies of literature. The first is a broad international base of construction cost- and time-overrun studies, spanning journal articles, conference papers, and postgraduate theses published between 1954 and 2020, covering project experience from more than twenty countries across Asia, Africa, Europe, North America, and the Middle East. These sources were reviewed for the specific causative factors they identified or tested, and each factor was recorded against its source so that factors recurring across independent studies could be identified.

The second is a focused supplementary set of fourteen regional, survey-based empirical studies conducted in Malaysia between 2010 and 2019, with two further extensions applying comparable research instruments to Pakistan (2019) and the United Arab Emirates (2020). These studies were selected for inclusion because, unlike much of the broader literature, they apply directly comparable quantitative ranking methodologies — principally the Relative Importance Index, the Average Index, and, in two cases, Partial Least Squares Structural Equation Modelling — to a shared underlying pool of candidate causative factors. This methodological consistency makes it possible to compare which factors were rated most significant across different countries, project types, and respondent groups (clients, consultants, and contractors) in a way that the broader literature, taken alone, does not easily support.

Together, the two literature streams comprise one hundred unique sources. Factors extracted from both were classified inductively into ten categories using a bottom-up thematic approach: individual causative factors reported across the literature were grouped by their underlying subject matter — for example, design-related causes, estimation-related causes, and so on — rather than adopted wholesale from any single prior classification. This ten-category structure was then cross-checked against nine previously published classification schemes, summarized in Table 1, which independently group the same underlying causes into between four and eight categories; the ten-category structure adopted here can be read as a finer-grained synthesis of these prior schemes rather than a departure from them. Factors and their sources are presented by category in Section 4, and the cross-study patterns that emerge from the regional survey cluster are discussed in Section 5.

A limitation of this approach is worth stating plainly: the review is a narrative synthesis of previously published findings rather than an independent re-analysis of primary data, and its coverage — while broad — reflects the sources available to the reviewers rather than an exhaustive census of every study ever published on the topic. Where a single source appeared to be cited elsewhere in the literature under inconsistent bibliographic details, this is flagged in place rather than silently resolved, so that readers can verify the underlying source independently.

3. GLOBAL PERSPECTIVE ON THE COST OVERRUN PHENOMENON

Cost overrun is not a localized problem confined to any one country or type of project; it is a near-universal feature of construction delivery. Construction can be considered a dynamic industry that is constantly exposed to uncertainty, in large part because a typical building project is multidisciplinary and depends on the coordinated action of a project owner, several professional consultants, one or more main contractors, a network of subcontractors and material suppliers, and a large manpower base — and any one of these stakeholders can introduce a disruption that consequently causes cost overrun. At its simplest, cost overrun is the difference between a project's original approved cost estimate and its actual construction cost at completion (Choudhury & Phatak, 2004), and it typically arises not from a single cause but from a combination of interacting causes that are important to identify precisely because doing so is a precondition for cost-effective project performance (Abdul Rahman et al., 2013b).

The scale of the problem, once measured, is striking. Across a wide sample of transport infrastructure projects, roughly nine in every ten experienced cost overrun, with an average overrun of 28% and considerable variation by region — an average of 25.7% in Europe, 23.6% in North America, and 64.6% elsewhere (Flyvbjerg et al., 2003). National studies tell a similar story: overruns averaged 78% in Germany (Kostka & Anzinger, 2016), exceeded 82% in Canada (Odeck, 2014), and ranged between 5% and 94% in South Africa (Baloyi & Bekker, 2011); in Zambia, more than half of surveyed road projects were affected (Kaliba et al., 2009). This consistency across such different economic and institutional settings suggests that cost overrun is driven less by any single national circumstance than by structural features common to construction project delivery everywhere — a conclusion that motivates the search, pursued throughout the rest of this paper, for causative factors general enough to travel across contexts.

Cost overrun also varies for identifiable reasons even within a single country or client organization. The underlying cost base of any project depends on factors such as its specification, the location of the site, whether it is new-build or refurbishment, its timescale, site-specific characteristics, the accuracy of the original estimate, inflation, fluctuation in the price of raw materials, unforeseen site conditions, the adequacy of available funds, and exchange-rate movements (Amoa-Abban & Allotey, 2014) — and construction projects continue to suffer cost overrun even where sophisticated project management methods and software packages are already in routine use (Olawale & Sun, 2010). Contractors and project managers frequently report that the difficulty lies less in any single decision than in the accumulation of smaller problems — inadequate project preparation, gaps in management and control, over-optimistic budgeting, material shortages, labour shortages, rising material costs, delivery delays, wastage, adverse weather, material loss, site insecurity, and poor communication — each of which contributes incrementally to overall cost variation.

Several classification schemes have been proposed to organize this diversity of causes into a more manageable structure. Cost overrun can be classified, for example, by the degree to which each cause is genuinely uncontrollable versus merely unmanaged — spanning the accuracy of the original estimate, the degree of government regulation, construction completion delays, the number of design changes, and labour-related matters such as availability, skill level, and fringe-benefit costs (Reina & Angelo, 2002) — or by which party is primarily responsible, distinguishing

causes attributable to the contractor, the consultant, the client, and external or other parties (Saidu & Shakantu, 2017), or more simply by whether a cause is compensable or non-compensable to the affected party (Pall et al., 2016), or by whether it originates inside or outside the project organization (Ahmed et al., 2003). Poor cost management and poorly established cost-control systems are widely regarded as the root of many of these problems (Memon et al., 2011), compounded by workforce issues such as the retirement of experienced skilled labour without adequate succession and by weaknesses in project governance, decision-making speed, contract terms, risk management, and cost and schedule control more broadly (Ramanathan et al., 2012).

4. TAXONOMY OF COST OVERRUN CAUSATIVE FACTORS

Building on the classification schemes summarized in Table 1, this review consolidates the causative factors reported across the literature into ten categories, illustrated in Figure 1: design, documentation, and contractual factors; cost estimation and budgeting factors; planning and scheduling factors; project and site management factors; human resource and labour factors; financial and cash-flow factors; materials, equipment, and machinery factors; construction-phase execution factors; communication and coordination factors; and external and environmental factors. Each category is discussed in turn below, drawing on both the broad international literature described in Section 2 and, where available, the regional empirical evidence from the Malaysia-Pakistan-UAE study cluster.

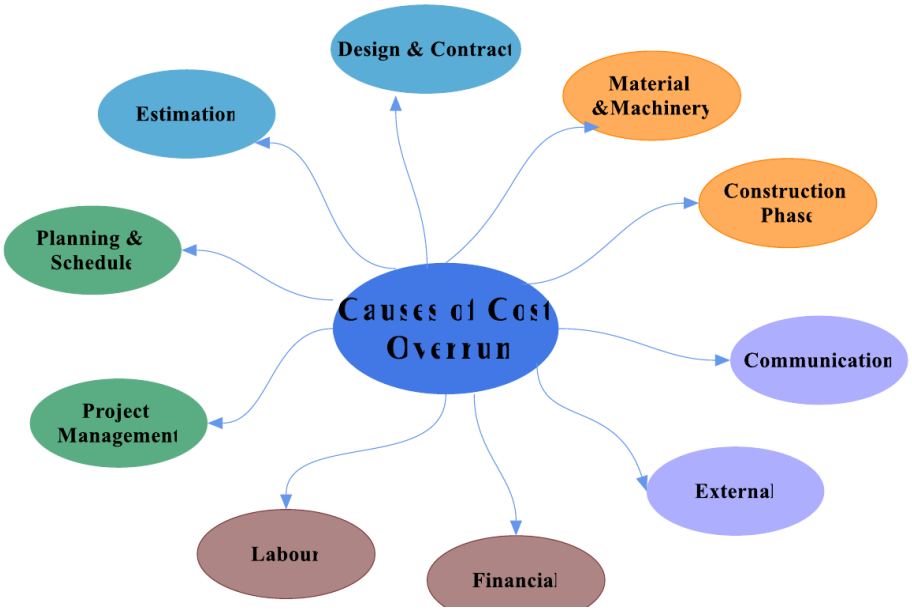

Figure 1. Ten-Category Taxonomy of Cost Overrun Causative Factors Adopted in This Review

4.1 DESIGN, DOCUMENTATION, AND CONTRACTUAL FACTORS

The design stage is where a project's technical scope, drawings, and contractual framework are established, and because decisions made here cascade through every later stage, it is widely regarded as the point in the project life cycle where the largest share of preventable cost overrun originates (Roslan et al., 2015). Errors traceable to the design or contract-management process are considered particularly avoidable, since they could reasonably have been foreseen and addressed before construction began (Azhar et al., 2008). The literature attributes cost overrun at this stage to a wide range of specific causes, including mistakes in the design itself (Ali & Kamaruzzaman, 2010; Nasir et al., 2011), frequent and late design changes (Abusafiya & Suliman, 2017; Alghonamy, 2015; Bekr, 2015; Long et al., 2004; Olawale & Sun, 2010), incomplete design at the time of tender (Jackson, 2002), inadequate pre-construction study (Park & Papadopoulou, 2012), poor coordination between designers and other project parties (Danso & Antwi, 2012), procurement strategies that favour the lowest

bid over technical merit (Azhar et al., 2008; Aziz, 2013), and insufficient time allowed for bid preparation (Iyer & Jha, 2005); taken together, these point to inadequate planning and scheduling, inexperience, poor inter-party communication, scope changes, and delayed decision-making as the critical underlying weaknesses of the design phase (Roslan et al., 2015).

The regional survey evidence adds further weight to these findings. Frequent design changes were rated the single most significant inhibiting factor affecting cost and time performance in surveys of southern and central Peninsular Malaysia (Abdul Rahman et al., 2012; Memon et al., 2012b), and design-and-documentation issues as a group carried the highest overall significance rating of any factor category tested in that same research programme. In UAE infrastructure projects, poor coordination at the design stage and incomplete design at the time of tender were similarly identified as the two most significant design-related causes of cost overrun (Alhammadi & Memon, 2020). A separate case-study review of six Malaysian construction projects found that developer-initiated changes to the building design were, in isolation, the most frequently occurring single cause of schedule and cost overrun among the cases examined (Abdul Rahman et al., 2019) — underscoring that design instability is not merely a theoretical risk but a recurring, empirically observed driver of overrun across independent studies and contexts..

4.2 COST ESTIMATION AND BUDGETING FACTORS

Estimation is the process by which the time, cost, and other resources required to deliver a project are forecast in advance (Larson & Gray, 2011), and it functions as a technical discipline in its own right, requiring detailed information about the project and reliable background data on the likely cost of materials, equipment, and labour in order to produce a realistic prediction (Akintoye, 2000). A number of factors have been shown to affect the accuracy of this process, including project size, the number of competing bidders, project location and type, the length of the contract period, the scope defined at design stage, and the quality of available cost data (Azman et al., 2013). Where estimation goes wrong, the literature attributes the resulting cost overrun to causes such as underestimating the project duration (Memon et al., 2010b), poor estimation of the original project cost (Ali & Kamaruzzaman, 2010), flawed estimation methods (Omoregie & Radford, 2006), inaccurate quantity take-off (Belachew et al., 2017; Enshassi et al., 2009; Sweis et al., 2013), and underestimation by quantity surveyors specifically (Ali & Kamaruzzaman, 2010); of these, the experience and skill level of the individual estimator has been identified as the single most influential factor governing the accuracy of pre-tender cost estimates (Alumbugu et al., 2014).

This picture is corroborated by the PLS-SEM evidence from large Malaysian construction projects, where inaccurate time and cost estimates and inaccurate quantity take-off loaded onto the project-management-and-contract-administration construct, which registered the second-strongest path coefficient of the seven factor groups tested — behind only site management itself (Abdul Rahman et al., 2013a; Memon & Abdul Rahman, 2014b). The convergence of a purely descriptive literature, which identifies estimator skill as decisive, with a statistically modelled one, which identifies estimation-related factors as a major predictor of overall cost performance, lends the estimation category unusual empirical weight.

4.3 PLANNING AND SCHEDULING FACTORS

Effective planning spans every stage of a construction project, from pre-construction through to completion, and conventionally proceeds through seven steps: defining project objectives, identifying the activities required, establishing the precedence relationships between them, estimating the time each will take, determining overall project completion time, comparing the resulting schedule against project objectives, and determining the resources needed to meet those objectives (Russell & Taylor, 2003). Good planning aims simultaneously at several outcomes —

realistic schedules and costs, delivery to defined quality and design standards, efficient use of project resources, adequate health and safety provision, and the satisfaction of stakeholder expectations (Baldwin & Bordoli, 2014) — and three factors in particular have been shown to determine whether planning succeeds: investing sufficient time in planning before work begins on site, maintaining emphasis on schedule monitoring and control once work is underway, and developing sufficiently detailed operational plans for implementation (Faniran et al., 1998). Where planning fails, the literature attributes the resulting overrun to causes such as inadequate planning by the contractor (Salunkhe & Patil, 2014), weak monitoring of cost reports during both pre- and post-contract stages (Naveenkumar & Prabhu, 2016), inadequate planning and scheduling more generally (Abdul Rahman et al., 2013b; Azhar et al., 2008; Bekr, 2015; Nasir et al., 2011), planning and scheduling deficiencies specifically (Frimpong et al., 2003), and insufficient monitoring of project funds (Ramabodu & Verster, 2010).

Incorrect planning and scheduling by the contractor was independently rated among the five most significant causes of cost overrun on MARA large construction projects in Malaysia (Memon et al., 2010a), and inadequate planning and scheduling was one of only two factors found to recur across all four phases of the project life cycle — planning, design, construction, and finishing — in a literature-based classification of thirty-five overrun factors (Ismail et al., 2013), suggesting that planning weaknesses do not merely delay the start of a project but continue to generate cost risk throughout its delivery.

4.4 PROJECT AND SITE MANAGEMENT FACTORS

Project management tools and techniques play a central role in the effective delivery of construction projects (Frimpong & Oluwoye, 2003), and cost management specifically is regarded as a vital component of that discipline, aimed at achieving efficient cost performance through disciplined planning and execution within an agreed budget (Divakar & Britto, 2018). Management-related causes of cost overrun identified across the literature include poor site management and supervision (Abdul Rahman et al., 2013b; Abusafiya & Suliman, 2017; Le-Hoai et al., 2008; Long et al., 2004), poor contractor management more broadly (Frimpong et al., 2003; Koushki et al., 2005), insufficient project management support (Long et al., 2004), weak contract management on the consultant's side (Le-Hoai et al., 2008), inadequate availability of management finance and planning, and poor contract management practice generally (Mansfield et al., 1994); project management leadership specifically has been shown to have a significant impact on overall project management performance (Qureshi et al., 2009).

Of all the factor categories examined in this review, project and site management is the one most consistently identified — across independent studies, countries, and analytical methods — as the single most influential driver of cost overrun. It produced by far the strongest structural path coefficient of the seven factor groups tested in a PLS-SEM analysis of large Malaysian projects, well ahead of financial management, human resource, design and documentation, communication, and materials and machinery factors (Memon & Abdul Rahman, 2014b), and it was likewise the highest-weighted construct affecting budget overrun in a separate PLS-SEM study of projects delivered through management procurement (Abdul Rahman et al., 2013a). Poor site management and supervision was independently rated a high-risk factor for both time and cost overrun during the construction phase specifically (Ismail et al., 2014), the most significant single cause of cost overrun on MARA large projects (Memon et al., 2010a), and among the top-ranked management-related factors affecting UAE infrastructure projects (Alhammadi & Memon, 2020). This convergence across four independent studies, three countries, and two distinct analytical methods is one of the strongest and most consistent findings in the entire body of literature reviewed for this paper, a point returned to in Section 5. Correspondingly, developing more competent project teams and adopting clearer communication channels have been identified as

the most effective measures available for controlling the time and cost impact of poor site management during project execution (Roslan et al., 2014).

4.5 HUMAN RESOURCE AND LABOUR FACTORS

Because a construction project is inherently multidisciplinary, involving the project owner, a range of professional consultants, contractors, suppliers, manpower, and subcontractors, the industry is constantly exposed to the uncertainty that comes from coordinating so many independent parties, which is itself a source of cost overrun. Labour-related causes identified in the literature include the cost of wages and labour services (Amoa-Abban & Allotey, 2014), poor performance by subcontractors (Abdul Rahman et al., 2013b; Olawale & Sun, 2010), shortages of site workers and low labour productivity (Abusafiya & Suliman, 2017; Tejale et al., 2015), shortages of skilled labour specifically (Baloyi & Bekker, 2011), unavailability of sufficiently competent personnel (Tejale et al., 2015), and poor working relationships between management and labour (Memon et al., 2011). A further concern raised in the literature is the gradual retirement of experienced skilled workers without a sufficient pipeline of replacements, which is expected to place continuing upward pressure on labour cost over time.

Shortage of site workers was rated among the top significant cost-overrun factors in independent surveys of southern Malaysia (Memon et al., 2014c) and Pakistan, where shortage of skilled technical personnel specifically was rated among the top three overall factors out of seventy-four tested (Memon et al., 2019). Human resource-related factors also formed the second-strongest predictor of cost performance among the seven factor groups tested in the Malaysian PLS-SEM study discussed in Section 4.4, behind only site management (Memon & Abdul Rahman, 2014b), and were similarly identified — alongside contractor's financial constraints — within the resource-related group of factors affecting UAE infrastructure projects (Alhammadi & Memon, 2020).

4.6 FINANCIAL AND CASH-FLOW FACTORS

Financial strain is one of the most direct routes to cost overrun: clients sometimes lack sufficient funds to complete their projects and, even where funds exist, do not always pay contractors on time as agreed in the contract (Amoa-Abban & Allotey, 2014), while inadequate funding for project financing more broadly has itself been identified as a cause of overrun (Ali & Kamaruzzaman, 2010). Other financially rooted causes documented in the literature include delayed progressive payment (Alghonamy, 2015; Tejale et al., 2015), the state of the wider economy (Ameh et al., 2010), the particular mode of project financing used (Ameh et al., 2010), financial difficulty on the part of the consultant or owner (Le-Hoai et al., 2008; Long et al., 2004), inconsistent cash flow (Nasir et al., 2011), payment problems faced by the contractor, inadequate funding arrangements (Aziz & Hafez, 2013), foreign-currency fluctuation (Ahmad et al., 2013), and difficulties with monthly payment cycles (Frimpong et al., 2003).

Cash flow and financial difficulty faced by contractors has repeatedly emerged, across independent studies, as one of the most dominant single causes of cost overrun in the regional literature: it was rated the single most significant factor affecting cost performance on MARA large construction projects (Memon et al., 2010a), and among the top two or three ranked factors in studies of southern and central Peninsular Malaysia (Abdul Rahman et al., 2012) and of large projects across the southern part of the peninsula (Memon et al., 2012a). Delayed progress payment from the owner and weak financial control on site were likewise rated highly significant financial-management factors in a separate Malaysian budget-overrun study (Memon & Abdul Rahman, 2014a) and among UAE infrastructure projects (Alhammadi & Memon, 2020), suggesting that financial-management weaknesses, like site-management weaknesses, are not specific to any one country's construction sector but recur wherever they have been tested.

4.7 MATERIALS, EQUIPMENT, AND MACHINERY FACTORS

Materials have historically accounted for the largest single share of construction cost: as far back as the 1950s, materials were shown to make up over half the final cost of house building, with labour accounting for less than a third and overheads and profit making up the remainder (Stone & Reiners, 1954), and this cost base remains sensitive to inflation, geographic variation, and the specific terms agreed between subcontractors and suppliers, with rising material and equipment costs typically accompanied by rising interest rates and, in turn, rising overall project cost (Amoa-Abban & Allotey, 2014). The literature attributes materials-and-machinery-related overrun specifically to fluctuation in the cost of building materials (Bekr, 2015; Naveenkumar & Prabhu, 2016; Omoregie & Radford, 2006), government funding constraints affecting material supply (Salunkhe & Patil, 2014), inflation-driven cost increases (Bekr, 2015; Sweis et al., 2013), the high cost of machinery (Azhar et al., 2008), and monopolistic control of material supply by certain suppliers (Enshassi et al., 2009).

This category returns one of the most consistent single findings in the entire regional literature reviewed for this paper: fluctuation in the price of construction materials was rated the single most dominant cost-overrun factor of all those tested in two independent Malaysian surveys conducted several years apart (Memon et al., 2012a; Memon et al., 2014c), and material cost was likewise ranked the top contributor to budget overrun for both small- and large-scale projects in the southern Malaysian states of Johor and Melaka, attributed there specifically to supplier monopolies causing sudden shortages and unpredictable price movement (Memon & Abdul Rahman, 2014a).

4.8 CONSTRUCTION-PHASE EXECUTION FACTORS

Once construction begins, projects enter a continuous cycle of information creation, storage, exchange, revision, and application among the project team, a process complicated by the frequent need to exchange information between project managers, architects, contractors, quantity surveyors, and engineers who are often working from different geographic locations (Chan & Leung, 2004). Execution-stage causes of cost overrun identified in the literature include delay in construction itself (Enshassi et al., 2010), the sheer complexity of the works involved (Olawale & Sun, 2010), mistakes made during construction (Abusafiya & Suliman, 2017), changes to the scope of the project after work has started (Khabisi, 2013; Lee, 2008; Ramabodu & Verster, 2010), additional works not originally scoped (Chang, 2002), the added cost of variation instructions, schedule delay caused by inexperienced technical consultants (Belachew et al., 2017), inadequate monitoring of work progress by the contractor (Memon et al., 2010b), errors during construction that require rework (Memon et al., 2011), generally poor construction practice on the part of the contractor (Tejale et al., 2015), and high transportation cost (Patil & Bhangale, 2016); underlying most of these is a combination of weak cross-team communication, limited contractor experience, inadequate supervision, poor labour productivity, mid-construction changes to design and material specification, and conflicting interests between the professionals involved (Dubois & Gadde, 2002).

Two independent studies confirm that the construction phase, more than any other stage of the project life cycle, is where the largest number of distinct causative factors converge. Of thirty-five overrun factors traced across the planning, design, construction, and finishing phases in one literature-based classification, thirty were found to occur during construction — far more than in any other single phase (Ismail et al., 2013) — and a companion risk-assessment study rating those same thirty-five factors found that the construction phase carried the greatest number of high-risk factors for both time and cost overrun, including poor site management and supervision, incompetent subcontractors, and schedule delay (Ismail et al., 2014). Taken together with the design-phase findings in Section 4.1, this suggests that while construction is where cost overrun most visibly accumulates, a meaningful share of its

root causes are set earlier, at the design and planning stages — an observation returned to in Section 5.

4.9 COMMUNICATION AND COORDINATION FACTORS

Effective communication is one of the core competencies that every party engaged in the management of a construction project needs, given the large number of people involved and the correspondingly high potential for conflicts that can affect the project if communication breaks down (Chan & Leung, 2004; Cicmil & Marshall, 2005; Dubois & Gadde, 2002; Kaming et al., 1997). Beyond this general risk, the literature identifies more specific communication-related causes of cost overrun, including a lack of communication and coordination among key stakeholders (Memon et al., 2010b; Tejale et al., 2015), poor communication between construction parties more broadly (Sweis et al., 2013), and conflict among project participants arising from communication breakdowns (Iyer & Jha, 2005).

The regional survey evidence gives this category particular prominence in at least one national context: lack of communication between parties was rated the single top-ranked factor affecting both time and cost performance in a survey of construction professionals in Pakistan, ahead of all seventy-four factors tested (Memon et al., 2019) — a notably higher ranking than communication received in the Malaysian studies discussed elsewhere in this paper, where information-and-communication-related factors formed a real but comparatively smaller predictor of overall cost performance (Memon & Abdul Rahman, 2014b). Lack of coordination specifically at the design phase was likewise rated the single top design-related factor affecting cost overrun in UAE infrastructure projects (Alhammadi & Memon, 2020). This divergence — communication ranked first in Pakistan but lower down the list in Malaysia and the UAE — is one of the clearest examples in the literature of a causative factor whose relative importance appears to shift with institutional or organizational context, discussed further in Section 5.

4.10 EXTERNAL AND ENVIRONMENTAL FACTORS

Construction projects remain exposed to cost-overrun causes that originate entirely outside the control of the project team. Documented examples include unpredictable weather conditions (Naveenkumar & Prabhu, 2016; Sweis et al., 2013), delay in obtaining forest-clearance approval (Salunkhe & Patil, 2014), government funding constraints (Salunkhe & Patil, 2014), severe storms and consequent flooding (Kaliba et al., 2009), difficult terrain and the emergency works it can necessitate (Al-Hazim & Salem, 2015), fraudulent practice (Ameh et al., 2010; Omoregie & Radford, 2006), unsupportive government policy (Azhar et al., 2008), bribery and corruption (El Nawawy & Abdel-Alim, 2017), political instability (Ahmad et al., 2013), and difficulties around land acquisition and resettlement (Nasir et al., 2011).

Delay in obtaining permits from governmental agencies was independently rated among the top three most relevant factors affecting time and cost performance in the same Pakistani survey discussed in Section 4.9 (Memon et al., 2019) — a finding consistent with the pattern noted there, in which regulatory and coordination-related causes appear to weigh more heavily in some institutional contexts than others. Separately, late handing-over of the site by the developer was identified as the cause of schedule and cost overrun in two of six Malaysian infrastructure and building case studies examined, alongside developer-driven changes to project planning in a further case (Abdul Rahman et al., 2019), underscoring that external causes are not limited to weather or politics but can also originate from the client organization itself.

5. LESSONS LEARNED FROM PREVIOUS STUDIES

Reading the studies reviewed in this paper together, rather than in isolation, surfaces several patterns that are not visible from any single study on its own.

First, project and site management is the most consistently dominant category of cause identified across the literature, and the evidence for this is unusually strong

because it comes from multiple independent studies using different analytical methods. It carried the largest structural path coefficient in two separate PLS-SEM analyses (Abdul Rahman et al., 2013a; Memon & Abdul Rahman, 2014b), was rated the single most significant factor in a ranked survey of MARA projects (Memon et al., 2010a), was flagged as the highest-risk construction-phase factor in a dedicated risk-assessment study (Ismail et al., 2014), and appeared among the top management-related factors in the one non-Malaysian context tested, the United Arab Emirates (Alhammadi & Memon, 2020). Four independent studies, three countries, and two distinct methodologies arriving at the same conclusion is about as strong a convergence as this body of literature offers, and it suggests that of the ten categories reviewed in Section 4, site management is the one where cost-control investment is likely to have the greatest marginal return.

Second, financial and materials-related factors form a consistent second tier. Cash-flow and financial difficulty on the part of the contractor was rated the top or near-top factor in three separate Malaysian studies spanning different regions and project types (Abdul Rahman et al., 2012; Memon et al., 2010a; Memon et al., 2012a), and fluctuation in material prices was rated the single most dominant factor in two further, independently conducted surveys (Memon et al., 2012a; Memon et al., 2014c). Both patterns are consistent with the broader international literature reviewed in Section 3, which identifies financial strain and material-cost volatility as recurring causes well beyond the Malaysian context specifically (Amoa-Abban & Allotey, 2014; Stone & Reiners, 1954).

Third, the relative importance of individual factors is not fixed; it shifts with institutional and regulatory context. Communication-related causes are a clear example: in Pakistan, lack of communication between parties was rated the single top factor out of seventy-four tested (Memon et al., 2019), while in the Malaysian studies discussed throughout this paper communication-related factors, though real, consistently ranked behind site management, finance, and materials (Memon & Abdul Rahman, 2014b). A similar pattern holds for regulatory delay: delay in obtaining government permits featured prominently in the Pakistani findings (Memon et al., 2019) but was largely absent from the top-ranked factors in the Malaysian and UAE studies. This suggests that while the ten-category taxonomy in Section 4 travels well across contexts as a diagnostic structure, the relative weight assigned to each category should be re-tested locally rather than assumed to transfer automatically from one country's findings to another's.

Fourth, root causes and visible symptoms often sit in different project phases. The construction phase is where the largest number of distinct causative factors are observed to occur — thirty of thirty-five factors traced in one classification (Ismail et al., 2013) — yet a meaningful share of those factors, particularly design changes and estimation errors, originate upstream, at the design and planning stages (Sections 4.1 to 4.3). Practitioners who concentrate cost-control effort exclusively on the construction phase risk treating the symptom rather than the cause; the evidence reviewed here points toward earlier, design-stage intervention as at least as important as tighter site-level control once construction is underway.

Fifth, there is a discernible methodological progression within this literature over time. The earlier studies in the regional cluster (2010 to 2012) relied primarily on simple frequency- or mean-rank scoring of survey responses, sufficient to identify which factors respondents considered important but not to establish how strongly each factor actually predicted cost outcomes. The later studies (2013 to 2014 onward) increasingly adopted Partial Least Squares Structural Equation Modelling, which quantifies the relative predictive strength of each factor group rather than simply ranking perceived importance (Abdul Rahman et al., 2013a; Memon & Abdul Rahman, 2014b). This shift matters because it is what allows the convergence noted under the first point above — the finding that site management is the strongest predictor of cost performance, not merely the most frequently mentioned factor — to be stated with real statistical confidence rather than survey-ranking intuition alone.

Finally, this body of literature is comparatively thin on tested solutions. The great majority of the studies reviewed in this paper — including almost all of those summarized in Section 4 — are diagnostic: they identify and rank causes without testing whether any specific intervention actually reduces their impact. Only one study reviewed here goes a step further and links ranked causes to specific mitigation measures, finding that appointing more competent site managers, establishing clearer communication channels, and providing targeted training were the most relevant available responses to poor site management specifically (Roslan et al., 2014). Given how consistently site management emerges as the dominant cause across the wider literature, the comparative scarcity of mitigation-focused research on that same factor is a significant gap, and one that future research in this area would do well to prioritize.

6. CONCLUSION

Cost overrun remains a pervasive and costly feature of construction project delivery, and the evidence reviewed in this paper — drawn from more than one hundred studies spanning more than two decades and construction industries on five continents — confirms that its causes are genuinely diverse rather than reducible to any single explanation. Organizing this evidence into ten categories, spanning design and contractual factors, cost estimation, planning and scheduling, project and site management, human resources, financial management, materials and machinery, construction-phase execution, communication, and external and environmental conditions, provides a structure broad enough to accommodate the full range of causes reported in the literature while remaining specific enough to be useful for prioritizing cost-control effort in practice.

Reading the underlying studies together rather than separately, several conclusions stand out. Project and site management is the category most consistently identified, across independent studies, countries, and analytical methods, as the strongest single driver of cost overrun, followed by financial management and material-cost volatility as a fairly consistent second tier. At the same time, the relative importance of individual factors is not universal: communication and regulatory delay, for example, weighed far more heavily in the Pakistani evidence reviewed here than in the Malaysian or UAE evidence, underscoring that any prioritization exercise based on this taxonomy should be validated against local conditions rather than applied uncritically. The literature also shows a discernible shift over time toward more rigorous, model-based methods capable of establishing genuine predictive strength rather than simple perceived importance, and a continuing scarcity of research that goes beyond diagnosis to test specific mitigation measures.

For practitioners, the practical implication is that cost-control investment aimed at strengthening contractor site management and supervision, together with more disciplined financial planning and closer monitoring of material-price exposure, is likely to address the causes shown most consistently across the literature to drive overrun, while recognizing that design-stage decisions frequently determine problems that only become visible once construction is underway, making early intervention at least as valuable as tighter control once work is on site. For researchers, the most valuable next step suggested by this review is not further diagnostic work — the causes of cost overrun are, by this point, well documented — but rigorous, comparative research testing whether specific mitigation measures targeted at the dominant causes identified here actually reduce cost overrun in practice, and whether the relative importance of each category holds up when tested in countries and project types beyond those covered in the existing literature.

REFERENCES

Abdul Rahman, I., Foo, L. C., Memon, A. H., & Nagapan, S. (2019). Schedule and cost behaviour in construction works of Malaysia. Pakistan Journal of Science, 71(4 Suppl.), 74–77.

Abdul Rahman, I., Memon, A. H., & Karim, A. T. A. (2013a). Examining factors affecting budget overrun of construction projects undertaken through management procurement method using PLS-SEM approach. Procedia - Social and Behavioral Sciences, 107, 120–128. https://doi.org/10.1016/j.sbspro.2013.12.407

Abdul Rahman, I., Memon, A. H., Karim, A., & Tarmizi, A. (2013b). Significant factors causing cost overruns in large construction projects in Malaysia. Journal of Applied Science, 13(2), 286–293.

Abdul Rahman, I., Memon, A. H., Nagapan, S., Latif, Q. B. A. I., & Azis, A. A. A. (2012). Time and cost performance of construction projects in southern and central regions of peninsular Malaysia. Paper presented at the 2012 IEEE Colloquium on Humanities, Science and Engineering Research (CHUSER 2012).

Abedi, M., Fathi, M. S., & Mohammad, M. F. (2011). Major mitigation measures for delays in construction projects. The First Iranian Students Scientific Conference in Malaysia, UPM, Malaysia.

Abusafiya, H. A. M., & Suliman, S. M. A. (2017). Causes and effects of cost overrun on construction project in Bahrain: Part I. Modern Applied Science, 11(7), 20.

Ade, A., Aftab, H., Ismail, A., & Ahmad, T. (2013). Controlling cost overrun factors in construction projects in Malaysia. Research Journal of Applied Science, Engineering and Technology, 5, 2621–2629.

Ahmad, S. A., Issa, U. H., Farag, M. A., & Abdelhafez, L. M. (2013). Evaluation of risk factors affecting time and cost of construction projects in Yemen. International Journal of Management (IJM), 4(5), 168–178.

Ahmed, S. M., Azhar, S., Kappagntula, P., & Gollapudil, A. (2003). Delays in construction: A brief study of the Florida construction industry. Paper presented at the Proceedings of the 39th Annual ASC Conference, Clemson University, Clemson, SC.

Akintoye, A. (2000). Analysis of factors influencing project cost estimating practice. Construction Management & Economics, 18(1), 77–89.

Alghonamy, A. (2015). Cost overrun in construction projects in Saudi Arabia: Contractors' perspective. International Journal of Engineering & Technology (IJET-IJENS), 15(4), 35–42.

Alhammadi, A. S. A. M., & Memon, A. H. (2020). Ranking of the factors causing cost overrun in infrastructural projects of UAE. International Journal of Sustainable Construction Engineering and Technology, 11(2), 204–211. https://doi.org/10.30880/ijscet.2020.11.02.025

Al-Hazim, N., & Salem, Z. A. (2015). Delay and cost overrun in road construction projects in Jordan. International Journal of Engineering & Technology, 4(2), 288.

Ali, A. S., & Kamaruzzaman, S. N. (2010). Cost performance for building construction projects in Klang Valley. Journal of Building Performance, 1(1).

Alumbugu, P. O., Ola-awo, W. A., Saidu, I., Abdullahi, M. M., & Abdulazeez, A. (2014). Assessment of the factors affecting accuracy of pre-tender cost estimate in Kaduna State, Nigeria. Journal of Environmental Science, Toxicology and Food Technology, 8, 19–27.

Ameh, O. J., Soyingbe, A. A., & Odusami, K. T. (2010). Significant factors causing cost overruns in telecommunication projects in Nigeria. Journal of Construction in Developing Countries, 15(2), 49–67.

Amoa-Abban, K., & Allotey, S. (2014). Cost overruns in building construction projects: A case study of a government of Ghana project in Accra. Developing Country Studies, 4(24), 54–64.

Azhar, N., Farooqui, R. U., & Ahmed, S. M. (2008). Cost overrun factors in construction industry of Pakistan. First International Conference on Construction in Developing Countries (ICCIDC–I) "Advancing and Integrating Construction Education, Research & Practice," 4–5.

Aziz, R. F. (2013). Factors causing cost variation for constructing wastewater projects in Egypt. Alexandria Engineering Journal, 52(1), 51–66.

Aziz, R. F., & Hafez, S. M. (2013). Applying lean thinking in construction and performance improvement. Alexandria Engineering Journal, 52(4), 679–695.

Azman, M. A., Abdul-Samad, Z., & Ismail, S. (2013). The accuracy of preliminary cost estimates in Public Works Department (PWD) of Peninsular Malaysia. International Journal of Project Management, 31(7), 994–1005.

Baldwin, A., & Bordoli, D. (2014). Handbook for construction planning and scheduling. John Wiley & Sons.

Baloi, D., & Price, A. D. (2003). Modelling global risk factors affecting construction cost performance. International Journal of Project Management, 21, 261–269.

Baloyi, L., & Bekker, M. (2011). Causes of construction cost and time overruns: The 2010 FIFA World Cup stadia in South Africa. Acta Structilia, 18(1), 51–67.

Bekr, G. A. (2015). Identifying factors leading to cost overrun in construction projects in Jordan. Journal of Construction Engineering, Technology and Management, 5(3).

Belachew, A. S., Mengesha, W. J., & Mohammed, M. (2017). Causes of cost overrun in federal road projects of Ethiopia in case of southern district. American Journal of Civil Engineering, 5, 27.

Chan, S.-L., & Leung, N.-N. (2004). Prototype web-based construction project management system. Journal of Construction Engineering and Management, 130(6), 935–943.

Chang, A. S.-T. (2002). Reasons for cost and schedule increase for engineering design projects. Journal of Management in Engineering, 18(1), 29–36.

Choudhury, I., & Phatak, O. (2004). Correlates of time overrun in commercial construction. In ASC Proceedings of the 4th Annual Conference, Brigham Young University, Provo, Utah (pp. 8–10 Apr).

Cicmil, S., & Marshall, D. (2005). Insights into collaboration at the project level: Complexity, social interaction and procurement mechanisms. Building Research & Information, 33(6), 523–535.

Danso, H., & Antwi, J. K. (2012). Evaluation of the factors influencing time and cost overruns in telecom tower construction in Ghana. Civil and Environmental Research, 2(6), 15–25.

Divakar, K., & Britto, J. (2018). Factors affecting effective implementation of cost management process in construction industry. International Research Journal of Engineering and Technology.

Dubois, A., & Gadde, L.-E. (2002). The construction industry as a loosely coupled system: Implications for productivity and innovation. Construction Management & Economics, 20(7), 621–631.

Durdyev, S., Ismail, S., & Bakar, N. A. (2012). Factors causing cost overruns in construction of residential projects: Case study of Turkey. International Journal of Science and Management, 1, 3–12.

El Nawawy, O. A. M., & Abdel-Alim, A. M. (2017). Identification and assessment of risk factors affecting construction projects. HBRC Journal, 13(2).

Enshassi, A., Al-Najjar, J., & Kumaraswamy, M. (2009). Delays and cost overruns in the construction projects in the Gaza Strip. Journal of Financial Management of Property and Construction, 14, 126–151.

Enshassi, A., Kumaraswamy, M., & Al-Najjar, J. (2010). Significant factors causing time and cost overruns in construction projects in the Gaza Strip: Contractors' perspective. International Journal of Construction Management, 10(1), 35–60.

Faniran, O. O., Oluwoye, J. O., & Lenard, D. J. (1998). Interactions between construction planning and influence factors. Journal of Construction Engineering and Management, 124(4), 245–256.

Flyvbjerg, B., Skamris Holm, M. K., & Buhl, S. L. (2003). How common and how large are cost overruns in transport infrastructure projects? Transport Reviews, 23(1), 71–88.

Frimpong, Y., & Oluwoye, J. (2003). Significant factors causing delay and cost overruns in construction of groundwater projects in Ghana. Journal of Construction Research, 4(2), 175–187.

Frimpong, Y., Oluwoye, J., & Crawford, L. (2003). Causes of delay and cost overruns in construction of groundwater projects in a developing countries: Ghana as a case study. International Journal of Project Management, 21(5), 321–326.

Ismail, I., Abdul Rahman, I., & Memon, A. H. (2013). Study of factors causing time and cost overrun throughout life cycle of construction project. Paper presented at the Malaysian Technical Universities Conference on Engineering & Technology (MUCET), Kuantan, Pahang, Malaysia.

Ismail, I., Memon, A. H., & Abdul Rahman, I. (2014). Expert opinion on risk level for factors affecting time and cost overrun along the project lifecycle in Malaysian construction projects. International Journal of Construction Technology and Management, 1(2), 10–15.

Iyer, K. C., & Jha, K. N. (2005). Factors affecting cost performance: Evidence from Indian construction projects. International Journal of Project Management, 23, 283–295.

Jackson, S. (2002). Project cost overruns and risk management. Proceedings of the Association of Researchers in Construction Management 18th Annual ARCOM Conference, Newcastle, Northumbria University, UK.

Kaliba, C., Muya, M., & Mumba, K. (2009). Cost escalation and schedule delays in road construction projects in Zambia. International Journal of Project Management, 27(5), 522–531.

Kaming, P. F., Olomolaiye, P. O., Holt, G. D., & Harris, F. C. (1997). Factors influencing construction time and cost overruns on high-rise projects in Indonesia. Construction Management & Economics, 15(1), 83–94.

Khabisi, L. J. (2013). Causes and effects of cost overruns in public sector construction projects in South Africa [Master's thesis, University of Johannesburg].

Kostka, G., & Anzinger, N. (2016). Large infrastructure projects in Germany: A cross-sectoral analysis. Springer.

Koushki, P., Al-Rashid, K., & Kartam, N. (2005). Delays and cost increases in the construction of private residential projects in Kuwait. Construction Management and Economics, 23, 285–294.

Larson, E. W., & Gray, C. F. (2011). Project management: The managerial approach. McGraw-Hill.

Lee, J.-K. (2008). Cost overrun and cause in Korean social overhead capital projects: Roads, rails, airports, and ports. Journal of Urban Planning and Development, 134(2), 59–62.

Le-Hoai, L., Dai, L., & Lee, J. Y. (2008). Delay and cost overruns in Vietnam large construction projects: A comparison with other selected countries. KSCE Journal of Civil Engineering, 12(6), 367–377.

Long, N. D., Ogunlana, S., Quang, T., & Lam, K. C. (2004). Large construction projects in developing countries: A case study from Vietnam. International Journal of Project Management, 22(7), 553–561.

Maki, O. (2016). Causes of cost-overrun in construction projects [Unpublished thesis]. Qatar University.

Mansfield, N. R., Ugwu, O. O., & Doran, T. (1994). Causes of delay and cost overruns in Nigerian construction projects. International Journal of Project Management, 12(4), 254–260.

Memon, A. H., & Abdul Rahman, I. (2014a). Budget overrun issues in construction projects of southern part of Malaysia. International Journal of Civil Engineering and Built Environment, 1(1), 1–6.

Memon, A. H., & Abdul Rahman, I. (2014b). SEM-PLS analysis of inhibiting factors of cost performance for large construction projects in Malaysia: Perspective of clients and consultants. The Scientific World Journal, 2014, Article 165158. https://doi.org/10.1155/2014/165158

Memon, A. H., Abdul Rahman, I., & Azis, A. A. A. (2012b). Time and cost performance in construction projects in southern and central regions of peninsular Malaysia. International Journal of Advances in Applied Sciences, 1(1), 45–52.

Memon, A. H., Abdul Rahman, I., & Aziz, A. A. A. (2012a). The cause factors of large project's cost overrun: A survey in the southern part of peninsular Malaysia. International Journal of Real Estate Studies, 7(2), 1–15.

Memon, A. H., Abdul Rahman, I., Abdul Aziz, A. A., Ravish, K. V., & Mohammad Hanas, N. I. (2011). Identifying construction resource factors affecting construction cost: Case of Johor. Paper presented at the Malaysian Technical Universities International Conference on Engineering & Technology (MUiCET 2011).

Memon, A. H., Abdul Rahman, I., Abdullah, M. R., & Abdu Azis, A. A. (2010a). Factors affecting construction cost in Mara large construction project: Perspective of project management consultant. International Journal of Sustainable Construction Engineering & Technology, 1(2), 41–54.

Memon, A. H., Abdul Rahman, I., Abdullah, M. R., & Azis, A. A. A. (2014c). Factors affecting construction cost performance in project management projects: Case of MARA large projects. International Journal of Civil Engineering and Built Environment, 1(1), 30–35.

Memon, A. H., Rahman, I. R., Abdullah, M. R., & Azis, A. A. A. (2010b). Factors affecting construction cost performance in project management projects: Perspective of project management consultant. International Journal of Sustainable Construction Engineering and Technology, 1, 30–35.

Memon, A. Q., Memon, A. H., Soomro, M. A., & Abdul Rahman, I. (2019). Common factors affecting time and cost performance of construction projects in Pakistan. Pakistan Journal of Science, 71(4 Suppl.), 64–68.

Nasir, A. R., Gabriel, H. F., & Choudhry, R. M. (2011). Cost and time overruns in highway projects of Pakistan. Sixth International Conference on Construction in the 21st Century, Kuala Lumpur, Malaysia.

Naveenkumar, G. V., & Prabhu, V. (2016). Factors influencing time and cost overruns in construction projects. International Journal of Innovative Research in Science, Engineering and Technology, 5(4), 6468–6473.

Odeck, J. (2014). Do reforms reduce the magnitudes of cost overruns in road projects? Statistical evidence from Norway. Transportation Research Part A: Policy and Practice, 65, 68–79.

Olawale, Y. A., & Sun, M. (2010). Cost and time control of construction projects: Inhibiting factors and mitigating measures in practice. Construction Management and Economics, 28(5), 509–526.

Omoregie, A., & Radford, D. (2006). Polycentric cultural framework for infrastructure procurement in Nigeria. Proceedings of the 22nd Annual ARCOM Conference. Association of Researchers in Construction Management.

Pall, G. K., Bridge, A. J., Skitmore, M., & Gray, J. (2016). Comprehensive review of delays in power transmission projects. IET Generation, Transmission & Distribution, 10(14), 3393–3404.

Park, Y.-I., & Papadopoulou, T. C. (2012). Causes of cost overruns in transport infrastructure projects in Asia: Their significance and relationship with project size. Built Environment Project and Asset Management, 2(2), 195–216.

Patil, Y. K., & Bhangale, P. P. (2016). Investigation of factors influencing cost overrun in high rise building construction. International Journal of Latest Trends in Engineering and Technology, 6, 338.

Polat, G., Okay, F., & Eray, E. (2014). Factors affecting cost overruns in micro-scaled construction companies. Procedia Engineering, 85, 428–435.

Qureshi, T. M., Warraich, A. S., & Hijazi, S. T. (2009). Significance of project management performance assessment (PMPA) model. International Journal of Project Management, 27(4), 378–388.

Ramabodu, M. S., & Verster, J. J. P. (2010). Factors contributing to cost overruns of construction projects. Proceedings of the 5th Built Environment Conference.

Ramanathan, C., Narayanan, S., & Idrus, A. B. (2012). Construction delays causing risks on time and cost – A critical review. Construction Economics and Building, 12, 37–57.

Reina, P., & Angelo, W. J. (2002). Megaprojects need more study up front to avoid cost overruns. ENR, 249.

Roslan, N., Zainun, N. Y., & Memon, A. H. (2014). Measures for controlling time and cost overrun factors during execution stage. International Journal of Construction Technology and Management, 1(1), 8–11.

Roslan, N., Zainun, N. Y., & Memon, A. H. (2015). Relevancy of factors and mitigation measures in controlling time and cost overrun towards Malaysian environment. Applied Mechanics and Materials, 773–774, 1007–1011. https://doi.org/10.4028/www.scientific.net/AMM.773-774.1007

Russell, R. S., & Taylor III, B. W. (2003). Operations management (4th ed.). Prentice Hall.

Saidu, I., & Shakantu, W. (2017). An investigation into cost overruns for ongoing building projects in Abuja, Nigeria. Acta Structilia, 24(1), 53–72.

Salunkhe, A. A., & Patil, R. S. (2014). Effect of construction delays on project time overrun: Indian scenario. International Journal of Research in Engineering and Technology, 3(1), 543–547.

Stone, P. A., & Reiners, W. J. (1954). Organization and efficiency of the house-building industry in England and Wales. The Journal of Industrial Economics, 2(2), 118–134.

Sweis, G. J., Sweis, R., Rumman, M. A., Hussein, R. A., & Dahiyat, S. E. (2013). Cost overruns in public construction projects: The case of Jordan. Journal of American Science, 9, 134–141.

Tejale, D. S., Khandekar, S. D., & Patil, J. R. (2015). Analysis of construction project cost overrun by statistical method. International Journal of Advance Research in Computer Science and Management Studies, 3(5).

Zewdu, Z. T., & Aregaw, G. T. (2015). Causes of contractor cost overrun in construction projects: The case of Ethiopian construction sector. International Journal of Business and Economics Research, 4(4).