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EFFECT OF IMPLEMENTING SUSTAINABLE MANAGEMENT PRACTICES ON CLAIMS MITIGATION IN CONSTRUCTION PROJECTS

RITA AWWAD and ZEINA THABET

Civil Engineering Department, Lebanese American University, Byblos, Lebanon

The fragmented management of traditional construction projects, which mainly lacks the integration of project processes, results in schedule delays and cost overruns which often lead to client dissatisfaction, quality defects, and a raise in safety-related accidents. As a result, claims and disputes are most likely to arise between the contracting parties that can be extremely expensive and may severely impact the project performance. Numerous studies have investigated the impact of integrating sustainable management practices (SMPs) in construction projects on specific project performance objectives, such as cost, time, and quality; however, there is a need to investigate the effect of implementing SMPs on claims and dispute resolution. This research aims to fill the existing literature gap by identifying correlations between implementing SMPs and the frequency and severity of claims and disputes that may arise in construction projects. To achieve this goal, 25 SMP and 13 common construction claims were extracted based on an extensive literature review. A 5 point Likert-scale questionnaire was developed and administered to construction professionals to explore the aforementioned correlations. A total of 93 responses were received through online data collection. The research results demonstrate that empowering communication and collaboration among project stakeholders at early stages of the construction phase can significantly mitigate the occurrence of claims. This paper contributes in providing construction professionals with recommendations to improve construction sites' performance and reduce claims.

Keywords: Sustainability, Project management, Construction claims, Sustainable practices.

1 INTRODUCTION

Construction projects are often characterized by their uniqueness, complexity, and uncertainty making them vulnerable to risks, disputes and severe fluctuations in budget and time constraints (Zaneldin 2006). In general, the fragmented management of traditional construction projects results in schedule delays and cost overruns which often lead to client dissatisfaction, quality defects, increase in risk factors (e.g., unforeseen site conditions, poorly drafted contracts, change orders, poor project management), and raise in safety-related accidents (Tommelein *et al*. 1993, Awwad *et al*. 2016b) . As a result, claims and disputes are most likely to arise between the contracting parties (Shaikh *et al*. 2020). The average of claim and dispute incidents in all construction projects is between 10 and 30% and the cost for resolving such undesirable conflicts varies from $4 to $12 billion or more per year (Gebken and Gibson 2006). According to Seo and Kang (2020), construction claims avoidance has been regarded as a main target for proper management of construction projects. Several studies have conducted investigations on claims

and suggested different approaches to control the frequency and severity of their occurrence (i.e., pre-contract negotiation, project delivery method, contract type, partnering and trust, detailed risk analysis shared and discussed with different project's stakeholders) (Aibinu 2009, Awwad *et al*. 2016a, Hashem *et al*. 2018); however, no previous study investigated the effect of implementing SMPs on claims and dispute resolution. This research work aims to fill the existing literature gap by identifying correlations between implementing SMPs and the frequency and severity of construction claims and disputes. To achieve this goal, a comprehensive literature review is carried out to investigate the main SMPs that could resolve some common types of construction claims. In addition, empirical data are retrieved from traditional construction projects completed in the last ten years in the Middle East and North Africa (MENA) region and analyzed to extract the frequency, severity and impact of claims on project's objectives (i.e., cost, time). Then, a questionnaire is developed and distributed among professionals to validate the impact of SMPs on claims resolution.

2 LITERATURE REVIEW

Examining the different types and causes of claims is an essential task that may help in resolving them (Ren *et al*. 2003). Several research studies have classified claims into different types. For instance, Moura and Teixeira (2006) identified 8 types of claims as follows: cease of contracts, variation in costs and quantities, acceleration, suspension of works, change in starting and completion dates, force majeure, delays, and change orders. Furthermore, different studies have designated several causes of claims, such as imprecise and ambiguous data in contract papers, delays due to design errors, differing site conditions, variation orders, oral change orders by owner, contractor's inadequate management skills, contractor financial problems, defective contractor's work quality, among others (Zaneldin 2006). Other scholars have suggested strategies for claims' mitigation during construction, for instance, appropriate management of contracts, precise execution of project's plans and schedule, proper data documentation and tracking of records (Hassanein and El-Nemr 2008), pre-contract negotiation (Aibinu 2009), stakeholders' involvement' at early project stages (Creed and Paek 2009), partnering agreements between stakeholders, and proper value engineering processes (Creed and Paek 2009, Seo and Kang 2020). Nevertheless, despite the number of studies that are suggesting resolutions to reduce the occurrence of construction claims, there is no existing research study that analyzes and evaluates the performance of construction projects in relation to claims and disputes based on the implementation of sustainable management practices throughout the project's life-cycle.

Several studies highlight the importance of engaging construction project management with sustainable development (Saad *et al*. 2019). The incorporation of sustainable management practices into construction projects considerably enhances its successful delivery within adequate cost and time margins (Robichaud and Anantatmula 2011). To this end, it becomes significantly important to identify key strategies that can be introduced into traditional project management's basic principles of planning, supervising, assessment, and decision making to help improve the project outcome overall quality. Critical sustainable management practices have been mentioned in previous studies as important key factors that promote sustainable development realization in projects (Shen *et al*. 2010, Robichaud and Anantatmula 2011, Liu *et al*. 2016). This study is based on the selection and classification of critical sustainable management practices indicated by previous publications. The aim of this research is to provide construction management professionals with recommendations to improve construction sites' performance and reduce claims through the identification of SMPs that can considerably enrich the project's outcome quality while delivering it within adequate time and cost margins.

3 DATA COLLECTION

3.1 Empirical Data on Claims

This study entails data from 10 executed construction projects in the MENA region. The 10 projects include 165 claims, and the contracts varied in size from $750,000 to $45,000,000. The contracts were awarded during the past 10 years. The summary of the empirical data on the aforementioned projects' claims is represented in Table 1.

Table 1. Empirical data on claims from 10 construction projects in the MENA region.

Project #	Project Type	Contract Bid ($)	# of claims	Cost of Claims ($)	Expected completion time (days)	Time Extension (days)
1	Residential Tower – Excavation phase only	10,516,981	12	4,367,043	335	310
2	Commercial Buildings	43,308,580	33	16,321,745	615	665
3	Residential Villa	1,550,700	8	630,000	560	425
4	Residential Building	4,625,340	20	1,720,610	780	330
5	Residential Villa	1,356,840	10	340,210	430	180
6	Commercial Resort	15,642,870	40	4,730,980	880	890
7	Residential Building	2,150,000	14	66,000	765	52
8	Residential Building	850,000	9	68,000	615	115
9	Hospital Building	20,165,000	14	66,000	820	240
10	Residential Building	750,000	5	50,000	460	122

3.2 Questionnaire

The initial phase of the research started with a thorough literature review resulting in the identification of 13 claim types that frequently arise in construction projects and 25 critical SMPs distinguished throughout three phases of the project's lifecycle (feasibility, design, and implementation). The findings of the data collected from literature review contributed in the formation of a comprehensive questionnaire. The survey population consists of developers, contractors, consultants, project managers, and architects engaged in the establishment of construction projects in the MENA region. The web-based questionnaire consists of two main sections, demographics about respondents and assessment of the degree of effectiveness of each SMP on a set of different claims associated to it. The measurements were on a five point Likert-scale; namely: 1=strongly ineffective, 2=ineffective, 3=neutral, 4=effective and 5=strongly effective to assess the influence of SMPs on claim mitigation. As a result, a total of 93 respondents fully completed the survey.

4 RESULTS AND DISCUSSION

The data represented in Table 1 indicates that claims are seen in almost all construction projects. Also, more than half of the projects showed more than 40% time extension of the expected project duration, with two projects reaching 100% time extension, and about half of the projects indicated a 30% increase in the initial contract bid. This reveals that traditional construction management practices need to be adjusted for the sake of risk minimization and to optimize the delivery of cost efficient sustainable projects. Table 2 summarizes the characteristics of the respondents and indicates that the majority of them are contractors having work experience that ranges between 10 and 20 years with adequate knowledge in sustainable projects.

Table 2. Statistical data on respondents' characteristics.

Characteristics of respondents	Sub-characteristics	%	Characteristics of respondents	Sub-characteristics	%
Professional affiliation	Developer	19	Region of operations (multiple countries can be selected)	Lebanon	65
	Contractor	44		Kingdom of Saudi Arabia	26
	Consultant	14		United Arab Emirates	26
	Project manager	20		Qatar	23
	Architect	3		Kuwait	17
Years of work experience	Less than 5	5		Jordan	14
	5 to 10	17		Oman	9
	10 to 15	37		Syria	9
	15 to 20	31		Egypt	5
	more than 20	10	Type of projects	Residential	46
Involvement in sustainable projects	never been involved	10		Commercial	23
	involved in projects with some sustainable features	42		Infrastructure	31
			Company size	very small (less than 10 staff)	5
				small (less than 50 staff)	19
	involved in certified green projects	48		medium (between 50 and 249)	28
				large (more than 250)	48

The relative importance index (RII) was employed in this study to demonstrate the ranking of the practices based on their level of importance in regards to claim mitigation. The RII formula is shown in Eq. (1).

$$\text{RII} = \sum_{i=1}^{5} Wi/(A \times N) \quad (1)$$

Where RII = relative importance index; W_i = weight given to each practice by respondents ranging from 1 to 5; A = maximum weighting (i.e. 5); and N = total number of survey respondents. Three different SMPs showing highest RII values in reference to the main claim that it extremely affects in the three different project phases are represented in Table 3. Table 3 indicates that respondents allocated higher influence on claim mitigation for practices at the implementation phase. This may be due to the possibility that most claims appear at the implementation phase of the project. The results also show that it is highly recommended to use digital technologies such as Building–Information Modeling (BIM) in the design phase and to empower communication and collaboration among project stakeholders at early stages of the construction phase. To achieve this, mobile project management applications and cloud-based project control systems can be utilized to accelerate communication among team members on sites. The aforementioned systems shall be synchronized with sensors, wearable devices, and desktop monitors to perform continuous records and updates tracking. It can be also perceived that the most two claim types that can be resolved are design error and delay claims. The results imply that the majority of the identified practices could be very useful for stakeholders to maintain low claim levels. Furthermore, the highlighted results introduce stakeholders to a set of SMPs that can act as a basis for sustainable achievement in construction sites.

Table 3. Relative Importance Index of SMPs on Claim's Mitigation

Project Phase	Sustainable Construction Management Practice	Claim Type	RII
Feasibility	Identify the environmental goal; assign green certification level, and the amount of initial capital and funds to invest in green resources.	Contract ambiguity	0.85
	Employ a skilled green building consultant/project manager having sufficient experience to deal with sustainability concepts and market needs	Design error	0.87
	Establish a design charrette (intense period of design and planning activity) that includes representatives from internal stakeholders (structural engineer, architect, mechanical and electrical engineer, building contractor, environmental engineer, real estate consultant, etc.) as well as key external stakeholders, including community councils and nearby property owners. The end-result report of this charrette provides a reference to guide the consequent design and construction phases of the project.	Design error	0.91
Design	Use digital technologies such as Building–Information Modeling (BIM) in the design phase that can create a full 3D model early in the project in addition to precise budgeting and scheduling. This improves coordination with material suppliers, diminishes conflicts and miscommunication, and improves design and planning outcomes.	Design error	0.93
Implementation	Properly select the project delivery method (Design-Build, Construction Management Agency at Risk, Integrated Project Delivery), the procurement method (Open bid, prequalification, one-stage request for proposals, two-stage request for proposals), and the contract type (Lump sum, cost-plus, Guaranteed Maximum Price) that best suits sustainable projects.	Contract ambiguity	0.89
	Allocate project's sustainable specifications clearly in contracts, and enforce governmental incentives and bonuses for implementing SMPs and achieving sustainability targets.	Safety and Health	0.78
	Commence execution phase with a kickoff meeting to firmly introduce the project construction plan and spread sustainable education and knowledge among on-site construction personnel.	Delay	0.92
	Empower communication and collaboration among project stakeholders at early stages of the construction phase. To achieve this, mobile project management applications and cloud-based project control systems can be utilized to accelerate communication among team members on site.	Delay	0.94
	Shift from traditional on-site construction to a valuable offsite prefabrication to amplify the production rate, maintain products' high quality, save time and money, and reduce waste production.	Extension of time	0.9

5 CONCLUSIONS

This paper aims at providing recommendations on how to prevent/reduce construction claims through the engagement of SMPs into the projects' processes and phases. The paper started by examining empirical data of 10 different projects in the MENA region and found that stakeholders are undertaking enormous amount of losses in terms of money and time due to claims and disputes. As a remedy to that, this paper studied the impact of implementing SMPs on project claim mitigation during the feasibility, design, and construction stages. Based on the survey results, the most two effective sustainable practices are: (1) Empower communication and collaboration among project stakeholders at early stages of the construction phase, and (2) Use digital technologies such as Building–Information Modeling (BIM) in the design phase that can create a full 3D model early in the project as well as conduct precise budgeting and scheduling.

References

Aibinu, A. A., *Avoiding and Mitigating Delay and Disruption Claims Conflict: Role of Pre-contract Negotiation*, Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, 1(1), 47-58, February, 2009.

Awwad, R., Barakat, B., and Menassa, C., *Understanding Dispute Resolution in the Middle East Region from Perspectives of Different Stakeholders*, Journal of Management in Engineering, 32(6), 05016019, November, 2016a.

Awwad, R., Shdid, C. A., and Tayeh, R., *Agent-Based Model for Simulating Construction Safety Climate in a Market Environment*, Journal of Computing in Civil Engineering, 31(1), 05016003, 2016b.

Creed, S. J., and Paek, J, H., *Risk Index Model for Minimizing Environmental Disputes in Construction*, Journal of Construction Engineering and Management, 135, (1), 0733-9364, January, 2009.

Gebken, R. J., and Gibson, G. E., *Quantification of Costs for Dispute Resolution Procedures in the Construction Industry*, Journal of Professional Issues in Engineering Education and Practice, 132 (3), 264–271, July, 2006.

Hashem, M. S., Mehany, M., Bashettiyavar, G., Esmaeili, B., and Gad, G., *Claims and Project Performance between Traditional and Alternative Project Delivery Methods*, Journal of Legal Affairs and Dispute Resolution in Engineering and Construction, August, 2018.

Hassanein, A. G., and El-Nemr, W. M., *Claims Management in the Egyptian Industrial Construction Sector: a Contractors' Perspective"*, Engineering, Construction and Architectural Management, 15 (5), 456-469, May, 2008.

Liu, H., Skibniewski, M. J., and Wang, M., *Identification and Hierarchical Structure of Critical Success Factors for Innovation in Construction Projects: Chinese Perspective*, Journal of Civil Engineering and Management, 22, 401-416, April, 2016.

Moura, H., and Teixeira, J. C., *Taxonomy of Construction Claims*, 1st ICEC & IPMA Global Congress on Project Management, April, 2006.

Ren, Z., Anumba, C., and Ugwu, O., *Multi-Agent System for Construction Claims Negotiation*, Journal of Computing in Civil Engineering, 17(3), 180–8, July, 2003.

Robichaud, L., and Anantatmula, V., *Greening Project Management Practices for Sustainable Construction*, Journal of Management in Engineering, 27(1), 48-57, January, 2011.

Saad, M. H., Nazzal, M. A., and Darras, B. M., *A General Framework for Sustainability Assessment of Manufacturing Processes*, Ecological Indicators, 97, 211-224, February, 2019.

Seo, W., and Kang, Y., *Performance Indicators for the Claim Management of General Contractors*, Journal of Management in Engineering, November, 2020.

Shaikh, H. H., Zainun, N. Y., and Khahro, S. H., *Claims in Construction Projects: A Comprehensive Literature Review*, Earth and Environmental Science, 498, 012095, May, 2020.

Shen, L. Y., Tam, V. W., Tam, L., and Ji, Y. B., *Project Feasibility Study: The Key to Successful Implementation of Sustainable and Socially Responsible Construction Management Practice,* Journal of Cleaner Production, 18(3), 254-9, February, 2010.

Tommelein, I. D., Dzeng, R. J., and Zouein, P. P., *Exchanging Layout and Schedule Data in a Real-Time Distributed Environment*, Computing in Civil and Building Engineering, 947-954, ASCE, January, 1993.

Zaneldin, E. K., *Construction Claims in United Arab Emirates: Types, Causes, and Frequency,* International Journal of Project Management, 24, 453–459, July, 2006.