Challenges of Post-Disaster Reconstruction Projects: An Empirical Investigation According to Project Management Knowledge Areas

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Successful management of post-disaster reconstruction projects (PDRPs) can ensure the efficient use of resources and lead to improved outcomes. The literature on PDRP management is yet in its embryonic stage and systematic research efforts are necessary to address the topic. Paper compares the challenges faced in conventional projects to those in PDRPs according to project management knowledge areas, through an analytical evaluation of the interdependencies between different areas of expertise. A descriptive-exploratory research was designed and qualitative data from interviews with 11 managers with PDRP experience from different countries were analysed. Cause-and-effect relationships between the factors leading to 'frequent changes in scope,' 'time overruns,' 'cost overruns,' and 'low quality' were identified. Outputs suggest that managing stakeholders, risks and communications appears critical to cope with an evolving scope, while procurement management has a significant impact on project outcomes due to resource scarcity.

Keywords: project management, post-disaster reconstruction, knowledge areas, iron triangle

INTRODUCTION

Post disaster reconstruction projects (PDRPs) involve the "the modification, conversion or complete replacement of an existing facility that involves expansions, additions, interior renovation, or upgrading the functional performance of a facility" (Attalla et al. 2004). PDRPs aim to restore essential services and life support infrastructure to normal, while they may also provide valuable opportunities to build back better and transform the disaster areas into sustainable communities in the long term (Ophiyandri et.al, 2013, p.236, Barakat, 2003, p.1). The conventional construction processes, however, may be inadequate especially in the case of large-scale disasters, which generally require a higher degree of coordination effort to achieve project targets (Le Masurier et al., 2006). The process can be quite complex due to the variety of project types, urgency of planning with limited financial resources, a multi-stakeholder environment (Mojtahedi and Oo, 2017, p. 842; Lin et al, 2017, p. 913), and the need to use unconventional procurement methods (MacAskill and Guthrie, 2017). Community vulnerability, time pressure and uncertainty may add to complexity (Lin et al, 2017, p.913). However, research studies that focus on the management of disaster recovery projects is quite limited (Mojtahedi and Oo, 2017, p. 841). "The project management literature has little to say about its application to disaster management, and disaster management literature has little

to say about project management" (Walker et al, 2017, p. 855). There is a growing interest toward a better understanding of PDRP, as part of a global concern for increasing resilience at all levels.

The 'Iron Triangle' and Beyond

Project management knowledge areas provide an extensive guide on the management of the different aspects of projects, which are expected to be integrated by a project manager within the realm of each project. Project Management Institute (PMI) defines ten major knowledge areas including the management of scope; time; cost; quality; procurement; human resources; communications; risk; stakeholders; and integration. Each knowledge area is described by its component processes, practices, inputs, outputs, tools, and techniques. According to many professionals, the objective of any project is to achieve the desired quality, as described by its stakeholders, considering its primary constraints including budget, cost and scope - 'The Project Management Triangle' ('The Triple Constraint' or 'The Iron Triangle'). Keeping all other factors constant, project managers can trade between these constraints, while changes in one constraint will necessitate changes in other constraints. Scholars, however, criticize the 'triple constraint' perspective due to its ignorance of the project managers' limited control over the external factors, which may easily change the balance between scope, cost, time and quality (URL1), or due to project managers' incapability to balance all the objectives and requirements of stakeholders in a project (Kalkman and de Waard, 2017, p. 890). Due to the unique features of a project, the focal point of 'the triangle' may be settled in different ways and the level of expertise needed regarding different knowledge areas and the associated tools and the techniques necessary may also change, for which the interdependencies between different areas of expertise can be critical.

Managing PDRPs

Peculiarities of the PDRPs originate from a variety of factors such as the relatively large number of stakeholders that are to collaborate in a turbulent environment (LaBrosse, 2007); the complex interactions of social, technological and economic factors (Ibid.); and the need for a cultural perspective to address the peculiarities of the disaster-affected areas (Baroudi and Rapp, 2011, p. 17). PDRPs typically deal with a high level of uncertainty and complexity; many local and international organizations compete for scarce resources, and the donors who finance the projects may ask for quick results due to a desire for normality (Hidayat and Egbu, 2010, p. 1271). After examining various PDRP failures across the world, Wardak et al. (2012, p. 292), identify five major common factors behind failures: problems with community participation; relocation issues; fraudulent use and the waste of project funds; and the ignorance of local needs and culture. According to Lin et al (2017, p. 913), "time pressure is the main factor which makes disasters unique, distorts the conventional project management practice that would work under normal circumstances, and calls for a more "contextualized application of project management methodologies." Kalkman and de Waard (2017, p. 890) argue that the linearity and rationality assumptions of the conventional PM should be questioned in the chaotic environment of PDRPs, where it is difficult to set clear goals and boundaries, define tangible end products, and establish well-working monitoring and control mechanisms in an hierarchical way. The involvement of stakeholders and providing flexibility, the authors contend, can be more highly valued than control. Kalkman and de Waard (2017) suggest a right balance between trust and control, and a comprehensive combination of contractual requirement and informal relationships for the success of PDRPs, where stakeholder management plays a central role. Considering the critical role of soft resources such as community participation and trust, implementer capacity, transparency and accountability, and institutional support, Vahanvati and Mulligan (2017, p. 805-806) call for a process-oriented, rather than just an outcome-oriented approach for evaluating PDRP success. They highlight research findings which support the adoption of agile approaches, in terms of building capacity within communities, which goes beyond the scope of a single project. Kalkman and de Waard (2017, p. 890) and Walker et al (2017, p. 885) also support the agility perspective for PDRPs where "a series of relatively small tasks are defined and implemented incrementally as the situation demands, in a flexible and adaptive manner, rather than as part of a fully pre-planned process."

METHOD

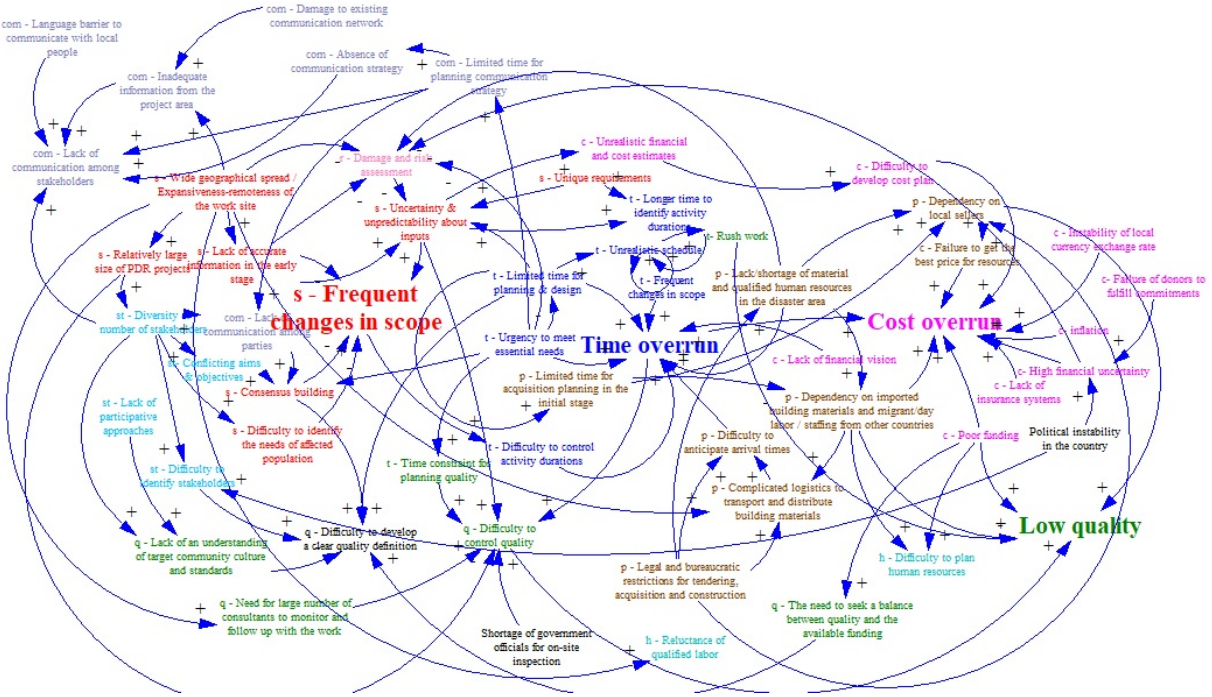
To investigate the challenges of PDRPs, a highly structured questionnaire was delivered to projects managers with PDR experience (The questionnaire is available at URL2). Open-ended questions allowed respondents to provide in-depth feedback on their PDRP experiences, including both the challenges faced and how they are responded on the field. Due to space limitations, this paper reports findings concerning the former. Authors adopted a purposive sampling strategy to approach managers from different countries and organizations (Table 1). Skype, face-to-face and telephone interviews were arranged by the corresponding author. Data collection efforts included also site visits to Jordan, in February 2017, and to Lebanon, in March 2017. The former visit aimed to approach the participants of an international conference on Yemen, where many PDR experts and donors gathered. The corresponding author was able to gather data from experts from international NGOs, Islamic Development Bank, World Bank, United Nations, governmental agencies and local organizations. The second visit to Lebanon aimed to interview project managers who took role in the post-war reconstruction of the country. The author met with university professors who gave consultancy to the Lebanese government together with UN-Habitat Office, and the contractor companies which was responsible for the reconstruction projects.

TABLE 1
CHARACTERISTICS OF RESPONDENTS

Code	Types Of Projects Involved	On Behalf Of	Geographical Location	Years Of Experience with PDR Projects	Organization
A	• Infrastructure/ Residential	• NGOS	• Middle East	20	UNOPS
B	• Residential	• NGOS	• East Asia and Pacific	10	International NGO
C	• Infrastructure/ Residential	• Government Public institutions	• Middle East	5	Islamic Development Bank
D	• Infrastructure	• Government Public institutions	• Middle East	34	United Nations Development Program
E	• Infrastructure	• Contractors Subcontractors	• Central Asia	2	University
F	• Industrial	• Contractors Subcontractors	• Middle East	2	Construction Company
G	• Residential	• NGOS	• Middle East	4	United Nations
H	• Infrastructure/ Residential	• Contractors Subcontractors	• Middle East	2	UN-Habitat
I	• Infrastructure/ Residential	• Government Public institutions	• Middle East	12	Small & Micro Enterprise Promotional Services
J	• Infrastructure/ Commercial/ Residential	• Government Public institutions	• Middle East	16	Reconstruction Fund
K	• Infrastructure/ Residential	• Government Public institutions	• Middle East	10	Ministry of Public Works and Highways

A qualitative content analysis was conducted to identify the themes (challenges) which correspond to different project management knowledge areas. While the 'Project Management Triangle' was a central focus, the remaining knowledge areas were analysed to understand their interrelationships and combined impact on the triangle. Perceived cause-and-effect relationships between the factors leading to 'frequent changes in scope,' 'time overruns,' 'cost overruns,' and 'low quality' were identified. Outputs were visualized by using Vensim, which is a simulation software for developing and analysing models (see http://vensim.com). Once the relationships between themes or variables are identified manually by arrows, the 'Causes Tree' tool of Vensim automatically produces the 'Causes-Tree(s)' for the interrelated themes.

FIGURE 1
SCREENSHOT FROM VENSIM - IDENTIFICATION OF INTERRELATIONSHIPS BETWEEN THEMES



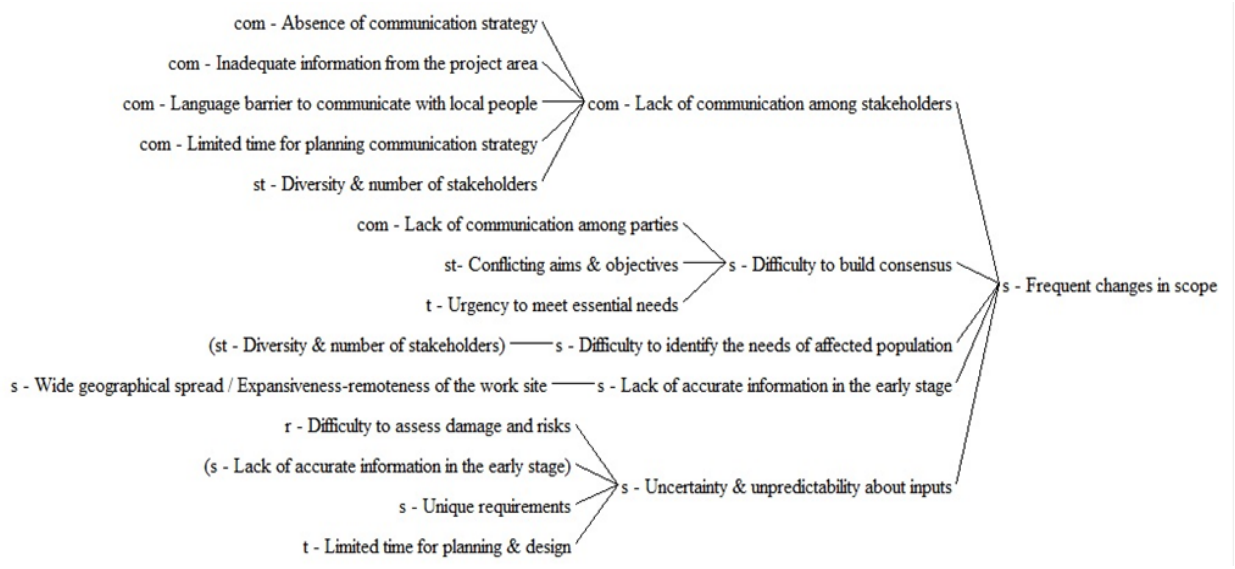
FINDINGS

Scope Management

According to Figure 2, main causes that lead to frequent scope changes in PDRPs include the following: difficulty to build consensus at the initial stage of a PDRP due to the urgency to meet essential needs; the conflicting aims and objectives of a large number of stakeholders and lack of communication among them, which makes it difficult to identify the needs of affected population; lack of accurate information in the early stages as a result of wide/expansive work site; and a high level of uncertainty that stem from a diverse set factors including the lack of/difficulty to conduct a damage and risk assessment; limited time for planning and design; and the unique requirements of projects. Project managers placed particular emphasis on the interrelationships of scope management with time management; stakeholder management; risk management and communication management. "Scope was constantly evolving as the project progressed. Initial damage assessment scope was created but constant updating was required as more extensive investigations occurred. It was very difficult at the beginning as the scope started small and continued to grow. This was of course concerning to the many stakeholders involved in this project…Discerning exactly

what scope was disaster related vs non-disaster related during reconstruction was difficult to discern but turned out to be very important at project completion" (D)

FIGURE 2
CAUSES TREE FOR FREQUENT SCOPE CHANGES

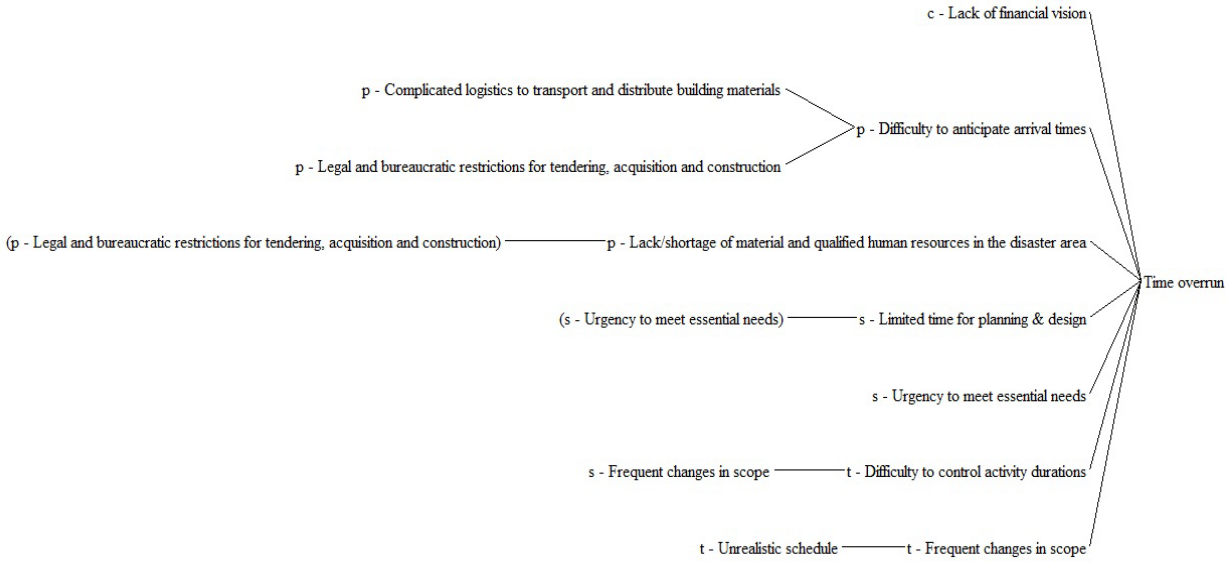


* com: communication; st: stakeholder; s: scope; t: time

Time Management

According to Figure 3, main causes that lead to time overruns in PDRPs include the following: lack of financial vision; difficulty to anticipate the arrival times of building materials due to complicated logistical requirements and legal/bureaucratic restrictions; lack/shortage of human and non-human resources in the disaster area; limited time for planning and design due to the urgency to meet imminent needs; and the difficulty to control activity durations as a result of frequent changes in scope. Project managers placed particular emphasis on the interrelationships of time management in PDRPs with procurement management, scope management and cost management (Figure 3). "Shortage in local resources, and dependency on donors, who, in many cases, do not deliver on their commitments [is a challenge] … The procurement regulations and laws, and government regulations for purchasing, which require large amounts of time during implementation" (K). "As scope was constantly evolving, schedule and resource requirements were always changing. Being in a PDR restricted area it was difficult to add additional resources if required…" (L).

FIGURE 3
CAUSES TREE FOR TIME OVERRUNS

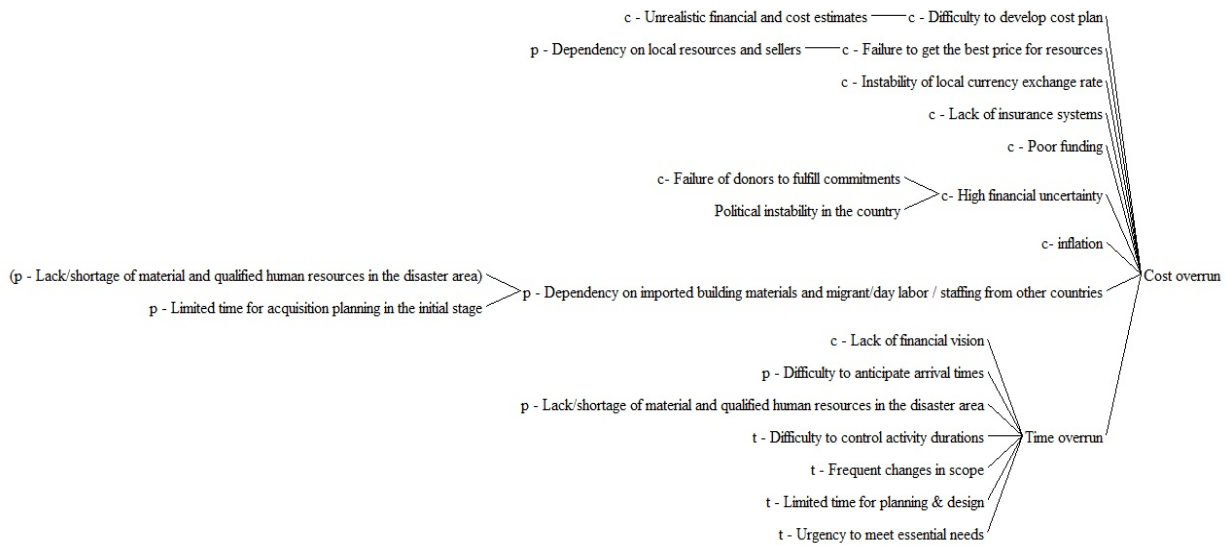


* c: cost; p: procurement; s: scope; t: time

Cost Management

According to Figure 4, main causes that lead to cost overruns in PDRPs include the following: Difficulty to develop cost plans due to unrealistic estimates; failure to get the best prices for resources due to dependency on local sellers, as well as on imported building materials and migrant/day labour and staffing from other countries; instability of local currency exchange rates; lack of insurance systems in the economically less developed countries; poor funding; high financial uncertainty due to the failure of donors to fulfil their commitments and the political instability in the country; and inflation and time overruns. Project managers placed particular emphasis on the interrelationships of cost management in PDRPs with procurement management and time management (Figure 4). "Insufficient time during design stage did not allow us to properly plan the required purchases. Hence we mainly depended on local sellers who most of the time provided higher prices." (F). "Scope [is] constantly evolving and therefore cost estimates are always changing…Cost control was extremely difficult due to the push to have the facility up and running as quickly as possible led to over resourcing in many areas…Difficult restrictions imposed at the time of PDR made it difficult to anticipate when items were to arrive. This effected schedule and costs. It was also hard to receive responses from sellers due to the remote nature and restrictions in place for access onsite at the time." (L).

FIGURE 4
CAUSES TREE FOR COST OVERRUNS

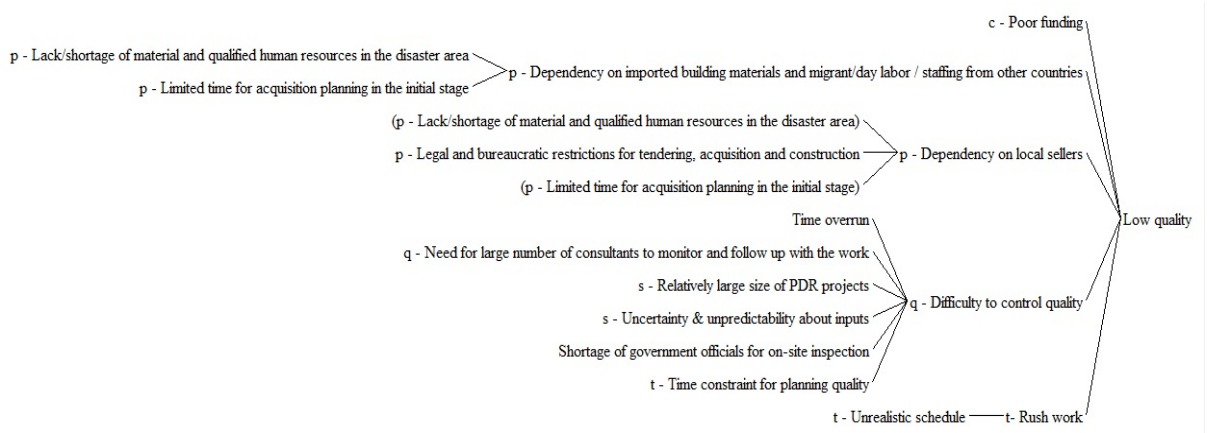


* c: cost; p: procurement; t: time; s: scope

Quality Management

According to Figure 5, main causes that lead to low quality in PDRPs include the following: poor funding; dependency on imported building materials and migrant/day labour and staffing from other countries due to the lack/scarcity of material and non-material resources in the local market and the limited time for planning in the initial stage; dependency on local sellers; difficulty to control quality due to several factors as shown in Figure 5, and rush work as a result of unrealistic schedule. Figure 5 shows that project managers placed particular emphasis on the interrelationships of quality management in PDRPs with procurement management; time management; scope management and cost management. "Challenges in reconstruction projects relating to total quality management increase the bigger the project gets because there is an inability to carry out total monitoring and evaluation of the quality." (K). "…The expansiveness of the worksite means that a large number of consultants are needed to monitor and follow up with the work. Implementing through the beneficiaries, who do not have enough experience, has a negative effect on the work that is carried out." (J).

FIGURE 5
CAUSES TREE FOR LOW QUALITY



* c: cost; p: procurement; q: quality; t: time; s: scope

DISCUSSION

Tabulation of findings suggests that managers with an extensive PDR experience highlight especially the critical relationships between i) procurement management with time-cost-and quality, and ii) scope management with risk-stakeholder-communication management (Table 2). Procurement management and risk-stakeholder-communication management areas deserve attention within the context of PDRPs, in terms of their impact on the basic elements of the PM 'Iron Triangle,' including scope, time, cost, and quality. These main findings are elucidated below within the light of previous research findings on PDRPs. It is typical of PDRP environments that many local and international organizations and donors compete for scarce resources (Hidayat, B and Egbu, C, 2010, p. 1271). Resource management in a PDRP depends on multi-stakeholder collaboration, donor management and government intervention, and the improvement of tools and policies to allow market adaptability (Chang et al, 2010, p. 247–259). Procurement strategy should be part of the long-term sustainability efforts and contribute to local communities and economies in the disaster- affected areas (PMI, 2005:28, McGee, 2008, p. 551). Design solutions should support appropriate types of construction and building materials (Silva, 2010, p. 13; Barakat 2003), and consider recycling and re-use options where available. The shortage or decimation of resources in the local construction market may require their import, slow down the construction process (Green et al, 2007, p. 311-335), significantly increase costs (Steinberg, 2007, p. 150–166) and put local, traditional building techniques at risk (Barakat, 2003, p. 29). Assessment of local capacity can be a critical element of the procurement strategy (Barakat: 2003, p. 34). Long bureaucratic procedures for getting legal approvals, restrictions for construction materials, and the shortage of government officials necessary for monitoring and controlling construction work can affect the estimates for activity durations (Kennedy et al, 2008; Alexander, 2004). Qualitative evidence presented in this study also shows that complicated logistics to transport and distribute resources is the result of a set of factors including the legal and bureaucratic restrictions for acquisition, wide geographical spread or remoteness of the work site, and the dependency on imported building materials and staffing from other countries due to resource shortages and the limited time available for planning in the initial stage. Accordingly, procurement management has a critical impact on the project management triangle; more specifically on time, cost, and quality management in a PDRP environment. Integrated management of stakeholder relationships, risks and communications is imperative to managing an evolving scope in PDRPs. Recognition of the expectations of different stakeholders is a valuable asset for managers to develop context-specific project strategies, especially when the "the ends and means [scope] of projects are constantly redefined based on the interaction of participating organizations" (Artto et al, 2008). Researchers have shown that ensuring the active participation of stakeholders is a means to develop a

consensual project scope definition (Jafari, 2008) Apart from the operational plans, the sustainability plan should be a critical element for developing scope definition in a post-disaster setting and outlining how the disaster victims will continue to sustain themselves when the implementing agencies depart (PMI, 2005). More recently, Mojtahedi and Oo (2017, p. 841) reported that stakeholders with power, legitimacy and urgency attributes perform better in the disaster recovery processes, where the socio-economic and transport infrastructure conditions have mediating effects. Equally important is the establishment of a strong and reliable line of communication and information system in post-disaster situations to make people aware of existing opportunities for participation (Sadiqi et al, 2017:900). Lack of community capacity, gender issues, lack of professional competence in NGOs, government policies and practices, and lack of adequate security can be barriers to community participation in PDRP settings (Ibid.).

TABLE 2
INTERRELATIONSHIPS OF PM KNOWLEDGE AREAS

Knowledge Areas	Scope	Time	Cost	Quality
Scope		X		
Time	X		X	X
Cost				X
Quality		X		
Procurement		X	X	X
Risk	X			
Stakeholder	X			
Communication	X			
Human resources				
Integration				

From a broader perspective, findings support Vahanvati and Mulligan (2017, p. 802) who argue that the significant impact of external stakeholders on PDRP outcomes requires a boundary spanning approach in terms of understanding the sustainability-related impacts of a PDRP, beyond its technical scope. As researchers have shown, low-cost and community-based procurement strategies may not be put into place when a disaster reduces the capacity of a community. External resource dependency may negatively affect the technical scenarios if choices are to be made between traditional building technologies and industrialized solutions, where the time pressure to meet urgent needs may dictate the latter. Calls for a more context-specific and agile approaches to PDRP management (e.g., Walker et al, 2017, p. 855; Lin et al, 2017, p. 913; Kalkman and de Waard, 2017, p.890), when project managers have a limited control over the external factors, appears highly relevant in terms of considering the unique features of each project and handling contradictory situations. Due to the close relationship between the agility concept and the evolving scope of a PDRP, managing risks, communications and stakeholders appears critical to obtain successful outcomes.

CONCLUSIONS

The conventional PM processes may be inadequate to address the peculiarities of PDRPs. The 'Project Management Triangle' was re-visited with a PDRP lens and the interdependencies between various PM knowledge areas were analysed within the special context of PDRPs. Since the components, practices, inputs, outputs, tools and techniques vary for different PM knowledge areas, such interdependencies can be critical to set priorities in different settings. Understanding the peculiarities of PDRPs in relation to PM methodology is of particular value for the managers of future projects and other decision makers, especially in the economically less developed world, which have limited resources and capacity to handle complexities. Findings provide also insights into how the special circumstances such as the post-disaster environments affect the conventional project management processes.

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