An extended literature review of organizational factors impacting project management complexity

Abstract

Project complexity has been widely researched in the project management literature. However, little attention has been given to the complexity of the managerial task, including preparing the project manager to understand and respond to that complexity. With this paper, we aim to contribute to the literature of project management complexity. Following a systematic literature review, we provide insights into the concept of project management complexity, and identify a set of eight organizational factors that impact project management complexity. These factors are interconnected and dynamic due to relationships among stakeholders. Therefore, we have utilized a project network approach in order to provide a framework that facilitates the grouping and visualization of the organizational factors. Our findings show first, that the concept of project management complexity is equal to managerial complexity, and second, the possible complicated situations created by the interconnection of the factors, as well as their possible impact. Rather than providing a prescriptive list of factors, the contribution of this paper is to clarify the concept of project management complexity, to determine the potential impact of the organizational factors in the managerial task, and to gain better understanding on the situations created by the interconnectedness and dynamic of factors in relation to the project network actors. This work is aimed to help the project manager to reduce the managerial complexity by acquiring awareness and understanding of complicated situations.

1. Introduction

Managing complexity is an important subject for managers and organizations because the complexity of projects is growing and seems to be unavoidable (H. R. Maylor, Turner, & Murray-Webster, 2013). This complexity relates to objects and people (Haider & Haider, 2012), and is this last the one that is more difficult to manage. People's notions, perceptions, interests, and capabilities, are the source of organizational factors, and consequently, of complicated situations that make more difficult or complex to manage projects. This complexity requires a project manager that not only has the technical knowledge to run the project, but a manager that is prepared to deal with these organizational factors and thus, able to find responses to reduce, remove, and cope with complexities that impact the managerial task. We think that the first step to get this preparedness is to gain awareness and understanding of project management complexity.

This paper has been developed as a literature synthesis. Our main purpose is to provide the project manager with a better understanding and awareness of the key organizational factors and their impact on the project development. Additionally, we have approached this subject from a project network perspective to facilitate the classification of these organizational factors. This paper main goal is to identify and analyze a set of organizational factors and the complicated situations that impact the project management complexity.

2. Method

The literature review was conducted in a systematic manner. Our starting point was the definition of the paper's scope, limiting it to organizational factors impacting project management complexity. Consequently, we found necessary to follow a drill-down procedure, starting from the wider topic of complexity in project management literature and reaching the more specific topic of organizational factors impacting project management complexity.

We used three databases to conduct the search of literature. These are; The Norwegian University of Science and Technology's database (Bibsys), Engineering village, and Proquest. The search key words and the results obtained from each database are shown in table 1. The search was limited to articles between the years of 2000 and 2013, and within the Project Management Literature. For each search result, we reviewed the title and abstracts of the articles to select the ones that contributed to achieve the objective of the paper. We focused on finding cases of study and exploratory researches that provide examples of which factors and how these factors impact the project management complexity. However, we early became aware that we would have to infer these impacts from the cases, as these were not stated explicitly.

Table 1. Number of total and relevant literature in each database

Keywords and strings	NTNU		Engineering Village		Proquest	
	Total	Relevant	Total	Relevant	Total	Relevant
"Project Complexity" and "organizational factors"	18	3	0	0	50	2
"Project Complexity" and organizational factors	204	5	9	1	434	1
"Project Complexity" and organizational elements	178	3	8	2	327	1
"Project management Complexity"	18	1	6	1	20	3
"Managerial complexity" and " project management"	21	1	4	0	35	1
"Sources of complexity" and " project management"	2	0	13	3	42	0

The final selection was done after reading thoroughly the initial selection of articles. We also found necessary to include other articles of complexity previous to the year 2000, as they were mentioned in several occasions in the literature and constitute some of the most important articles in the general topic of complexity in project management literature. The final literature used to develop this paper is composed by a set of 22 articles, organized in three main categories as shown in the table 2 below:

Table 2 *Final literature selection*

Category	Number of Articles
Project Complexity	7
Project Management Complexity and/or Managerial Complexity	2
Examples/Cases of organizational factors/elements impacting project management complexity/managerial complexity	13

3. Findings and discussions

We begin exploring the definitions of project complexity and project management complexity in project management literature. Our aim is to clarify how the literature differentiates between the concepts. Next, we present the classifications of project complexity and project management complexity in line with the most important organizational factors suggested in the literature. To develop our analysis, we have approached this subject from a project network perspective (Holmen & Pedersen, 2003), and grouped accordingly the organizational factors that we have subtracted from the sample of articles. We end this section explaining and analyzing those factors.

3.1. Project Complexity and Project Management Complexity

In the literature, there is indeed a distinction between the concepts of project complexity and project management complexity; nevertheless out of the 22 articles reviewed, only Bosch-Rekveldt, Jongkind, Mooi, Bakker, and Verbraeck (2011) provide a clear differentiation. In general, most of the authors refer to the term project management complexity but they do not define it (e.g.,(Chronéer & Bergquist, 2012; H. Maylor, Vidgen, & Carver, 2008).

According to Bosch-Rekveldt et al. (2011), **"**project management complexity is seen as a subset of project complexity, e.g. the part of project complexity related to managerial complexity"(p. 729). From this definition we take two important points: First, project management complexity is the same as managerial complexity, and second it is embedded into the concept of project complexity. With regard to this last point, H. Maylor et al. (2008) argue that little attention has been given to the complexity of the management task within the project complexity literature. Therefore, the authors (ibid) aim to answer the question of "what makes a project complex to manage?" (p.17), and identify dimensions of managerial complexity and the factors impacting it.

3.2. Classification of complexity

When it is about classifying types of complexity, proposing frameworks and listing factors, the focus, once again, has been on project complexity rather than on project management complexity. We summarize in table 3 the literature and the corresponding classification of project complexity.

Table 3 Classification of project complexity in the project management literature

Author	Type of project	Classification of project complexity	Number of factors/ components contributing to project complexity
Baccarini (1996)	Construction	Organizational and technological complexity both in terms of differentiation and interdependency	N/A
Williams (1999)	General	Structural (number of elements, interdependence of elements), and uncertainty (in methods and in goals)	N/A
Kim and Wilemon (2003)	NPD	Technological, Market, development, marketing, organizational, intraorganizational, and other.	N/A
Xia and Lee (2004)	IS development	Organizational and technological both in structural and dynamic dimensions	20 Complexity components
Geraldi, Maylor, and Williams (2011)	General	Structural, uncertainty, dynamics, sociopolitical, and pace	N/A
Bosch-Rekveldt et al. (2011)	Engineering	Technical, Organizational, and Environmental complexity (TOE framework)	50 elements
He, Luo, Wang, Li, and Zhao (2012)	General	Technological, organizational, environmental, cultural and informational complexity.	28 factors

On the other hand, H. Maylor et al. (2008) propose the MODest framework of managerial complexity . H. Maylor et al. present various factors stating them as questions, and group them in five dimensions of perceived managerial complexity: Mission, Organization, Delivery, stakeholders, and team. Recently, H. R. Maylor et al. (2013) suggested a Complexity Assessment Tool (CAT) where 32 factors are classified as structural or sociopolitical complexities. Emergent complexities are also presented, these arise when structural or sociopolitical complexities change.

3.3. Organizational Factors and Their Characteristics

A common point in the previous frameworks is that organizational related factors appear to strongly impact the complexity of the project. Xia and Lee (2004) identify structural organizational factors such as support from top management and users, skill proficiency, as affecting the most project performance. Bosch-Rekveldt et al. (2011) found that size related aspects to be dominant factors, for example number of stakeholders and number of different project management methods and tools. In He et al. (2012) , four out of the five factors which have the biggest influence are organizational related; these are cross-organizational interdependence, multiple stakeholders, number of organizational structure hierarchy, and project's team trust, the remaining factor is diversity of technology. H. Maylor et al. (2008) and H. R. Maylor et al. (2013) do not provide a ranking of factors. H. Maylor et al. (2008) present an important finding with regard to the "right amount of a factor" (p. 18). They found that having too much or too little of a factor increases the managerial complexity, for example lack of senior management support vs. interference by senior management; this phenomenon is represented by a "U curve" (p. 23).

A question that arose when reviewing those frameworks was if managing a project would become more complex just because of the mere existence of those factors. In the literature several authors (e.g.,(Hussein, 2012; Hussein, Pigagaite, & Silva, 2014; H. Maylor et al., 2008; McLeod & MacDonell, 2011; Whitty & Maylor, 2009) argue that what really makes project more complex to manage is not having those factors in the project per se. Instead, it is their interconnectedness, interaction, and their temporal and changing nature what impacts managerial complexity. According to H. Maylor et al. (2008), the structural complexity gives a static view of the project and its environment; it is the interconnection between factors that give rise to complexity beyond those individual factors. Moreover, there are interaction effects between elements, for example interaction complexity in interdependencies and relationships between stakeholders. Consequently, H. Maylor et al. (2008) explain how those factors are an initial condition with some temporary stability as each of them has an associated element that involves change, referred as dynamic element. In the same vein, Whitty and Maylor (2009) state that managerial complexity is the result of individual structural elements, their interaction, and the dynamic effects of each of them changing and interacting once again. McLeod and MacDonell (2011) present factors that influence project outcomes in software development systems. McLeod and MacDonell argue that the factors involve complex interrelationships and interactions, they vary dynamically in importance and influence during the project life cycle, and for this reason a factor can be significant in specific phases of the project; in other words the factors are temporal in nature. Hussein (2012) incorporates the term situations to address the interconnectedness, interaction and dynamics of factors. Situations are the result of having several factors on the project management effort, for example factors or singular elements are the number of stakeholders, diversity of culture, and diversity of skills levels, but the primary component of complexity is in reality the combinations of those elements and other constrains, these combinations create complicated situations.

As we have shown, different classifications of complexity and generic lists of factors are suggested in the literature, however as McLeod and MacDonell (2011) state "prescriptive lists of generic factors also imply that these are independent, universally applicable, and of equal importance" (p. 43) , then focusing only on using these lists would give a static view of the managerial complexity . We have already presented the emphasis given in some literature on the interconnectedness, interaction and dynamics of factors as the real source of managerial complexity. Thus, we propose to view the project from a project network perspective. This approach facilitates the visualization of the interconnectedness, interaction and dynamic of organizational factors in relation to project's stakeholders.

3.4. Organizational Factors. Identification Based on the Researched Literature

Based on a sample of 13 articles, we have identified a set of eight organization factors that impact project management complexity. Our purpose is to provide the reader with insights into and better understanding of the possible consequences of those factors, as well as the reasons behind their occurrence; thus, helping the manager to reduce managerial complexity. In table 4 we present the factors and list the corresponding literature on which we have based the analysis.

In this section we present three organizational factors that arise within the performing organization. These are related to project members competences and individuals' personal characteristics. We have categorized these factors into three groups (project organization, sponsor /owner organization and the environment. This classification is based on the theory of network horizon described by Holmen and Pedersen (2003)

Table 4 List organizational factors and literature reference

Area	Organizational factors	Literature reference
Project organization	Lack of project management competences	Hertzum (2008)
		Chronéer and Bergquist (2012)
		Kim and Wilemon (2003)
		Huang and Wu (2010)
	Sociocultural diversity	Small and Walker (2010)
		Müller, Spang, and Ozcan (2009)
Network horizon	Top management fails to perform its roles in the project: Support, commitment, understanding and oversees	Huang and Wu (2010)
		Hussein and Hafseld (2013)
		McLeod and MacDonell (2011)
		Pigagaite, Silva, and Hussein (2013)
	Rigid hierarchical organizational structure	Hussein and Hafseld (2013)
	Lack of organization process assets	Huang and Wu (2010)
	Organizational culture challenges	Hertzum (2008)
		Hussein and Hafseld (2013)
		Pitsis, Clegg, Marosszeky, and Rura-Polley (2003)
Environment	National culture	Small and Walker (2010)
		Small and Walker (2011)
		Ma, Liu, Feng, Shan, and Peng (2009)

3.4.1. Organizational factors within the project organization.

3.4.2. Lack of project management competences.
The lack of project management competences has been recognized in the literature as an element impacting managerial complexity (H. Maylor et al., 2008), but also the situations that this factor contributes to create are listed as complexity elements, for example not having control over project resources (H. Maylor et al., 2008; Xia & Lee, 2004) and not having tools support (H. Maylor et al., 2008). These previous elements are also the result of lack of top management support. Nevertheless, in this section, we focus on the lack of project management competences.

Hertzum (2008) provides an example of the previous elements: A project team failed to control project progress status because the project manager was not good at following milestones and controlling the project, and the team did not have project control tools to track progress and testing procedures of the project deliverables. The team members relied on their own sense of progress and informal communication, which resulted in unnecessary rework.

Project management competency also encompasses the ability to integrate or bridge competences. Chronéer and Bergquist (2012) identify this integration as a source of managerial complexity in process industrial R&D projects. According to Chronéer and Bergquist, the interconnectedness of product and process development is the main source of project complexity in R&D. Therefore, this requires a project team capable to perform and handle the integration of product and process development.

3.5. Sociocultural diversity in the project team.

Cultural diversity is widely regarded as a factor impacting project complexity and managerial complexity, appearing in the form of number of different languages, nationalities, and variety of perspectives (e.g.,(Bosch-Rekveldt et al., 2011; He et al., 2012; H. Maylor et al., 2008; H. R. Maylor et al., 2013). The previous are considered structural factors or elements. We suggest that their interaction creates the situation that impacts project management complexity: Uncertainty and ambiguity in perceptions, understanding, and ways of doing.

Müller et al. (2009) looked at how the national characteristics affect the decision making in joint German-Swedish project teams. The study reveled that German team members are more open for change, take faster decisions, and experts dominate the decisions making process, whilst Swedish team members are less formal and the process is more transparent as they display more informal work attitudes. These differences can then lead to difficulties and conflicts if the project manager, project team members, and also top management are not aware of them. Consequently, the authors highlight the importance of training programs to prepare managers and the team for these cultural differences.

3.6. Organizational factors within the project network horizon.

These factors relate to relevant and irrelevant stakeholders, hereby we include users and owner in this area of the network. We only focus on these stakeholders because in the sample of articles we used, the impact of factors related to other stakeholders was not addressed.

3.6.1. Top management fails to perform its roles in the project: Support, commitment, understanding and oversees.

Top management support has been recognized as a critical success factors in projects. Pinto (2010) says that this factor impacts the level of organizational resistance to change, and that it involves aspects such as allocation of resources and project management's confidence. With this regard, Huang and Wu (2010) conducted a study in hi-tech Taiwanese industries finding out that corporate environmental commitment, in the form of environmental policy and top management support, positively influence the level of innovation and financial performance in green new products development. We find the previous study relevant to the subject of managerial complexity because a barrier in the implementation of environmental management systems (EMS) either to support internal improvement project or product development, is the resistance to complexity (Kirkland & Thompson, 1999); some reasons behind are the organization limited capabilities (Kirkland & Thompson, 1999); and/or lack of analytic tools and procedures to make decisions related to environmental issues (Handfield, Sroufe, & Walton, 2005).

Top management support becomes then critical to change this mindset and to provide the necessary training and resources so that the organization gains confidence, develops environmental consciousness and adopts environmental strategies. On the other hand, lack of top management support generates resistance to change. An example is presented by Hussein and Hafseld (2013), here top management failed to align the project to a higher level objective because they did not include it as part of an ongoing reorganization, which would have reduced the resistance of the organization. Even more important was the attitude that top management showed towards the project implementation.

The previous examples go in line with McLeod and MacDonell (2011). The authors emphasize on the importance of top management in projects as it plays various roles in the organization, for example influencing attitudes, encouraging user participation, creating a positive context for change, overseeing the development of the project, managing political conflicts, and ensuring the availability of resources. Similarly, in Hussein and Hafseld (2013), top management failed to follow up the project because they were not qualified to steer and control the

project, as they did not have project governance competences. Furthermore, they did not understand at all what a project is about, its complexities, purpose and potential benefits, to such an extent that they assigned as project managers people with out project management competences, only based on their technical expertise.

3.7. Rigid hierarchical organizational structure.

The project complexity associated to organizational structure has been described in terms of number of hierarchical levels and number of formal organizational units, and the interdependence between those units (Baccarini, 1996; He et al., 2012). H. Maylor et al. (2008) includes the project/organization fit as a factor of managerial complexity, this refers to the mismatch between the project and organization, and also the customer's organization structure, for example if the project is delivered to a non-project based organization. On a similar vein, Small and Walker (2011) mention that the dynamics of the current business environment requires rapid responses, which has led to a shift from traditional functional structures to more flatter organizational structures.

This mismatch can be illustrated in the form of a very rigid hierarchical organizational structure for the project setting. In Hussein and Hafseld (2013), the project was multidisciplinary in nature but it was developed in a functional organization , which complicated the communication and sharing of knowledge between the departments. In addition, functional managers were only concerned with their own needs, defined what was important in the projects, and competed against projects to get resources allocated and to prioritize projects' tasks. This was a lost battle for the project managers because they did not have real authority.

3.8. Lack of organization process assets.

The organizational process assets set the rules, define the organizational goals and the means to achieve them, so that the individuals know how to act to avoid inconsistencies and conflicts. Not having these kind of assets can be seen as well as a reflection of top management involvement and governance competences. Then, without these assets, the managerial task becomes difficult because the organization would lack boundaries and frameworks for managerial action and ethical decision-making (Müller, 2009).

Huang and Wu (2010) identify the need of environmental policy to develop green products because it defines the organization's environmental aims, targets and structure of action. It is necessary to have an explicit, clearly defined environmental strategy linked to the corporate strategy, so that the managers commit to environmental compliance and also can plan, set objectives, and commit resources according to the corporate governance.

3.8.1. Organizational culture challenges.

Organizational culture is the unwritten rules of behavior that are shared within an organizational setting (Hussein & Hafseld, 2013). It includes shared values, beliefs, and experiences, collective identity, and common understandings and interpretations. These aspects not only shape the behavior of individuals but also project outcomes, for example positive outcome is facilitated in an organizational culture based on consensus where communication and conflict resolution are encouraged (McLeod & MacDonell, 2011). We suggest then that the task of managing the project becomes more complex or it is facilitated by organizational culture factors.

We have identified the following organizational culture related factors impacting project management complexity; Conformist working culture; Not having a shared project organizational culture ; Not understanding the shared project culture; Not sharing information; Short term focus; Fear to be punished and Fear to loose control

In a conformist culture the individuals focus on doing only what they know the best. This complicates the managerial task because many activities remain unattended or ignored. Furthermore, the individuals resist performing those as they fear failure and loose of control, or simply because they do not want to invest time and effort. For example in Hertzum (2008) a project team, in addition to their lack of requirements management competences, did not make effort to get more detailed information from users because they feared loosing control over the project if they elicited requirements beyond their capabilities and resources. Furthermore, to gain a sense of project progress, they focused on getting the final deliverable done, ignoring or doing badly other important activities such as developing requirements documents, and project documentation. This factor goes in hand with a

short term perspective, the individuals do not assess the future benefits of performing an activity now, instead they ignore it because it requires extra time and work; this is illustrated again in Hertzum (2008) when a project team did not invest on knowledge sharing with other colleagues in the project and organization. A different reason behind a conformist culture is presented by Hussein and Hafseld (2013) , in this case the organization rewarded loyalty and stigmatized as uncooperative anyone who tried to provide critical comments, or to stick-out. Then, people learned to remain silence when having different opinions or comments, otherwise they would risk be punished by top management, for example by cutting project resources. This creates an organization that resists changes, first because of the fear to be punished or stigmatized, and second because changes represent a threat to their status quo, they fear to loose power. Then, the individuals show behaviors such as holding information to sabotage the project implementation.

Pitsis et al. (2003) present case of how a shared project culture reduces complexity. The case was an infrastructure fast-track project where many stakeholders were involved (partners, contractors, community, government), and characterized by high degree of ambiguity and uncertainty. The project was managed as an alliance using an innovative organization collaboration approach: A shared culture that envisioned a "future perfect" (p.577) was deliberately designed, agreed upon and communicated, even a list of values statements was developed where the core values were the "best for project" and a "no-blame culture" (p.576-577). This culture was intended to reduce ambiguity by encouraging commitment to have excellent staff, long-term community relations, and thinking creatively and finding solutions instead of blaming others. Then, the complexity of managing the project was reduced because a positive organizational environment of commitment, long term perspective, collaboration and communication was developed.

Difficulties could arise if individuals do not understand a shared culture. In the previous case some project team members misunderstood the "no-blame" value because they interpreted the need of accountability as equal to blaming. Also, the commitment to good long-term relationships with the affected communities brought difficulties because the project gave them voice in decisions making but did not create responsibility.

3.9. Environment.

In this section we included national culture because a project is embedded into and performed in social context. This context has a national culture that impacts the relationships between actors in the network, and due to the dynamic changing position of actors in the network, it is necessary to place this factor at a higher level than the network horizon.

Back to Hofstede's six dimensions, we suggest that the specific characteristics of the national culture impact managerial complexity because the project manager could face conflicts, ambiguity and misunderstanding as the relationships are shaped by potentially opposite cultural characteristics. In Small and Walker (2010) we can notice how the degree of power distance impacted the project. According to Hofstede (2013) an arabic national culture (Saudi Arabia) scores very high in power distance (80), therefore the following aspect are expected in the organization and context: Centralization, defined hierarchical levels that reflects inequalities, employees are told what to do and have an autocrat leader. Then, the project became even more complicated because of "the way in which authority, power influence and legitimacy was perceived by organizational stakeholders" (Small & Walker, 2011), p. 394) . Consequently, the authors (ibid) suggest that in a social complex project (diversity), in a political complex environment (national culture) as the case study was, the project manager should be capable of "tap into the power lines". This means that, he/she must have the ability to exert power on the interconnections of stakeholders, because he/she is embedded in a context of interconnected realities; at the same time, the project manager should use that ability to generate change "with responses that are adaptive, flexible and profoundly conscious" (Small & Walker, 2011), p. 397).

4. Conclusions

Our findings show that there is little focus on project management complexity. However, we were able to find a distinction between the concepts, and provide a definition of project management complexity. According to our

findings, project management complexity is equal to managerial complexity, and refers to the complexity of the task of managing the project. Secondly, we presented briefly the classifications of project complexity and project management complexity, and indicated if the articles propose a list of factors affecting the complexity of projects or the managerial task. Once again, we found limited literature related to project management complexity. Along with these findings, we presented the most important factors or elements impacting complexity suggested in the literature. These factors are mainly organizational related, such as users and top management support, number of stakeholders, and project team skills. Third, based on a sample of 13 articles, we subtracted a set of eight organizational factors that impact managerial complexity. We presented these factors using a project network approach in order to have a framework to group the factors, and facilitate a visualization of their dynamic and interconnected nature resulting from the relationships among project stakeholders. Table 5 is a summary of these factors, the possible situations that contribute to create, and their possible impact on the project development.

Table 5. Summary organizational factors, possible situations and consequences

Area	Organizational Factor	Possible Situations	Possible Impact
Project organization	Lack of project management competences	Lost control over project status	Failure to integrate processes and knowledge
		Inadequate or lack of tools, procedures, methods	Failure to communicate and cooperate
		Incompetent project team members	Unnecessary rework
	Sociocultural diversity in the project team	Uncertainty and Ambiguity	Conflicts and misunderstanding among the project team members
Network Horizon	Top management fails to perform its roles in the project: Support, commitment, understanding and oversees	Resistance to change	Failure to gain user commitment
		Lost control over project status	Failing to align project strategy with corporate strategy
		Inadequate or lack of tools, procedures, methods	Failure to steer and control
		No balance authority- responsibility	
	Rigid hierarchical Structure	Power and authority conflicts	Inappropriate prioritization of projects
			Inappropriate allocation of resources
			Confused / unmotivated project team
	Organizational culture challenges	Resistance to change	Accountability issues
		Poor requirements management	Failure to communicate and cooperate
		No balance authority- responsibility	
	Lack of organization process assets	No frameworks and boundaries for managerial action and ethical decision making	Conflicts and inconsistencies
			Ethical issues
Environment	National Culture	Complicated relationships	Conflicts and misunderstanding

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