

Management of stakeholders requirements in DBFMO-projects

Requirements management process in PPP-context evaluated

Ronald den Hoed, student SEPAM LUD at TPM – Technical University Delft – R.denhoed@student.tudelft.nl

Abstract

There is a growing acknowledgement that the requirements management process in the definition-phase of real estate projects is a crucial factor which significantly influences the total performance and problems in realized buildings can often be traced back to the management of this process. Many initiatives are conducted to analyse and improve the current practice but the process performed is still perceived as ‘inadequate’ or with numerous limitations. This knowledge is mainly based on experiences gained in context of traditional procurement projects and no studies are focussed on critical factors related to the requirements management process performed in DBFMO-projects. We present the findings of a qualitative case study research which evaluated the process performed in the context of DBFMO-projects in the Dutch real estate sector to increase the knowledge on how the requirements management is performed; which variables influence the performance of this process and if the knowledge from traditional procurement is relevant for this context. The study learned that the knowledge derived from the context of traditional procurement is relevant for the PPP-context, in addition to the enrichment of the available knowledge-base on the performance of the requirements management process performed in real estate projects. Further research in the practice is required to provide the establishment of a “best-practice” and the quantitative analysis on the variables influencing the performance of the requirements management process.

Keywords: Requirements management process, public-private partnerships, performance-based briefing, DBFMO, real estate projects

1. Introduction

DBFMO¹ procurement is regarded as an attractive Public-Private Partnership (PPP) mode for project procurement in the real estate or construction sector of the Netherlands (Straub, Prins, & Hansen, 2012; Rijksgebouwendienst, 2011; Leiringer, 2003). The use of private finance; bundling of project performance components; and new governance assumptions are regarded as the key element of PPP modes as DBFMO for better economic efficiency and on-time delivery of construction projects (Hodge, Greve, & Boardman, 2010; Akintoye, Hardcastle, Beck, Chinyio, & Asenove, 2003; Delmon, 2011; Iossa, Spagnolo, & Vellez, 2007). Central in the project delivery is that the private contractor or consortium is responsible for the realization and management of the real estate object based on a set of requirements provided by the public client. The integral character of the projects requires the public actor to define the requirements on the real estate in an early stage of the project by means of performance-based briefing (Leiringer, 2006; Straub, Prins, & Hansen, 2012; Zeegers & Ang, 2007; Ang, Wyatt, & Hermans, 2001). This use of performance-based briefing and the integral character of the contract are claimed to enable the private actor to be innovative and use their knowledge to create solutions that best serve the client’s need (Li & Akintoye, 2003; Hodge G. , 2010; Hodge & Greve, 2007; Delmon, 2011).

The formulation of the stakeholders’ requirements for DBFMO-projects is performed by the public stakeholders in the requirements management process in the definition-phase of the real estate project to create insight in the top-level

¹ Design, Build, Finance, Maintain & Operate.

system requirements (Ang, Wyatt, & Hermans, 2001; Zeegers & Ang, 2003). There is a growing acknowledgement that this process is a crucial factor which significantly influences the total performance of real estate projects (Barret & Stanley, 1999; Chan, Scott, & Lam, 2002; Chan & Chan, 2004; Emes, Smith & Marjanovic-Halburg, 2012); and problems in realized building can often be traced back to the management of this specific process (Shen, Li, Chung, & Hui, 2004; Lam, Chan, & Chan, 2008; Ahmad, Adnan, Bari, & Adb Rashid, 2011). Therefore, to achieve a satisfactory result of the project it is essential that proper requirements management is managed to achieve full acquisition of knowledge on the stakeholders' aspirations for the project which is realized by the private sector (Yu, Chan, Chan, Lam, & Tang, 2010; Miron & Formoso, 2003).

Many initiatives are conducted to analyse and improve the requirements management practice (Arayici, Ahmed, & Aouad, 2006; Barrett, Stanley, & Sexton, 1999; Kamara, Anumba, & Evbuomwan, 2000; Kamara, Anumba, & Evbuomwan, 2001) but the current process performed is still perceived as 'inadequate' (Shen, Li, Chung, & Hui, 2004) or with numerous limitations (Yu, Chan, Chan, Lam, & Tang, 2010; Tang L., Shen, Skitmore, & Cheng, 2013). Limitations relate to incomplete and inconsistent requirements due to incomplete information on stakeholders requirements; misunderstanding and misinterpretation of requirements; inadequate time allocated for the process; lack of client/end-user involvement; failure to manage end-user expectations; and lack of requirements flexibility (Yu, Chan, Chan, Lam, & Tang, 2010; Yu A., 2006; Bahill & Henderson, 2004; Barrett, Stanley, & Sexton, 1999; Tang L., Shen, Skitmore, & Cheng, 2013). However, it is observed that these limitations are primarily based upon experiences in the context of traditional procurement projects and limited knowledge for this process in a PPP or DBFMO-context is available (Yu A., 2006). The most recent study of Tang *et al.* (2013) identified that no studies focused on critical factors related to the PPP requirement management process. Due to the integral character of PPP it is expected that the project characteristics influence the performance of this process significantly (Tang L., Shen, Skitmore, & Cheng, 2013) which requires the performance of empirical studies on the performance of PPP-projects by public organisations (Hodge, Greve, & Boardman, 2010; Yu A., 2006; Hammerschmid & Ysa, 2010).

This paper presents findings of a graduation study we performed to increase the knowledge on how the requirements management process is performed in DBFMO real estate projects by a public organisation in the Netherlands, and which variables influence the qualitative performance of this process. The goal of this research is to identify elements which significantly influence the qualitative performance of this process and is based on knowledge gained in studies on the process in context of traditional procurement projects. This research is performed to examine whether this knowledge is relevant for the DBFMO-context and whether this can be enriched by performance of an empirical study in this PPP context. Section Two describes the research method selected which describes how the available theoretical knowledge is used in the research projects. Section Three presents the theoretical framework used in the assessment of the empirical knowledge in the research project. Section Four presents the output and findings of the performed research project. Section Five presents the conclusions and further research topics are formulated in Section Six.

2. Research method

Since there is a limited number of studies and projects in the DBFMO-context available in the Dutch real estate sector, the research methodology adopted in evaluating the requirements management involved a 'qualitative' research

method, the exploratory case study approach. The case study on the requirements management process integrates the analysis of the process of DBFMO-projects managed by the Rijksgebouwendienst, the Dutch governmental housing agency. It is required that it incorporates a theory or framework based on academic literature relating to the object under investigation (Leiringer, 2003; Eisenhardt, 1989; Yin, 2003). In an exploratory case study it is expected that a theoretical framework is formulated which is used as a basis for analysis. Yin (2003) and Eisenhardt (1989) introduced propositions which are derived from relevant parts of the academic theory related to the object of study. These propositions are theoretical statement that provides an initial explanation of the object of study and are used in comparison with the empirical data to formulate theories and findings.

By means of an extensive literature study a theoretical framework is formulated which integrates the a priori specification of variables – independent variables in the research project – which are stated to significantly influence the performance of the requirements management process. By formulation of propositions this makes claims on how these variables relate to the dependent variable which is defined as the overall performance of the requirements management process. As it is expected that the theoretical knowledge on the process in the context of PPP-projects is somewhat limited (Chan, Scott, & Lam, 2002; Yu A. , 2006; Tang L. , Shen, Skitmore, & Cheng, 2013) these variables and propositions serve as initial perspectives which we to assess the empirical data in order to enrich the knowledge on this process, in general and in the context of DBFMO-projects. The formulated variables and propositions are tested by means of the case study which is performed on DBFMO-projects of the Rijksgebouwendienst. The cases selected are three significantly different DBFMO-projects from the portfolio of the Rijksgebouwendienst. For each of the cases we conducted multiple interviews with delegates who were active in the process. To increase the subjectivity and quality of the data we interviewed both delegates of the Rijksgebouwendienst as delegates of other stakeholders as project owners, clients and end-users.

3. Theoretical framework

Due to the complex nature of buildings, massive information in different forms at various levels and from different perspectives of needs and desires are relevant for the construction project at hand (Yu, Chan , Chan, Lam, & Tang, 2010; Kamara, Anumba, & Evbuomwan, 2000). Requirements management is perceived to be the overall process in which the requirements of the stakeholders towards an new real estate object are defined, elicit, analysed, translated, organized and documented (Kamara, Anumba, & Evbuomwan, 2000; Yu, Chan , Chan, Lam, & Tang, 2010). Central in this process is the identification of the requirements which are result of the relation of the stakeholders and clients towards the real estate object (Miron & Formoso, 2003; Tang L. , Shen, Skitmore, & Cheng, 2013). The understanding of stakeholders' requirements – both functional and performance terms – is the first and foremost step in developing the scope of the project and thereby the substance of the OS document for DBFMO-projects (Lam, Chan, & Chan, 2008). Clients or stakeholders are defined as "the particular entity including all stakeholders who have the right in imposing requirements to the end-product or facility." (Bahill & Dean, 1999)

In order to perform requirements management effectively, the public stakeholder who performs this process must realize that "the process must be seen as a process and not an event" (Barret & Stanley, 1999) in which the interaction between the end-users/project owners and the client's professional advisor determines the quality of the output of the

process (Castell, 2005; Ahmad, Adnan, Bari, & Adb Rashid, 2011; Miron & Formoso, 2003). To provide a suitable output the performance of the process is influenced by a high number of variables identified in the academic literature in the context of traditional procurement projects. By using this knowledge we identified six variables which are integrated in the theoretical framework of the research project in order to assess the process performed in the context of DBFMO-projects. These variables; their expected relation towards the performance of the process; and their defined proposition towards the overall performance of the process is shortly discussed in the remainder of this theoretical framework.

Experience of team with process

The level of experience of the team has a significant relation to the quality of the performed process (Ahmad, Adnan, Bari, & Adb Rashid, 2011; Tang L. , Shen, Skitmore, & Cheng, 2013; Yu A. , 2006) and its relevance cannot be overemphasized (Ahmad, Adnan, Bari, & Adb Rashid, 2011). An adequate level of experience of the experts is expected to result in the fact that they are able to guide the stakeholders in the process, helping them understand their project objective, and helping to safeguard the teamwork within the project organization for a better requirements management process (Ahmad, Adnan, Bari, & Adb Rashid, 2011). In retrospect, an inexperienced client/end-user may find it difficult to describe their organization to the professional organization and they are not always sure of the requirements (Yu, 2006; Barret & Stanley, 1999).

Commitment & Resistance towards the process

The complex and iterative process requires a shared understanding and commitment in a group of stakeholders (Shen, Li, Chung, & Hui, 2004). The commitment of the stakeholders is characterized by the level of support from top management of the stakeholder's organisation, promptness of decision-making and the providence of full time representative (Ahmad, Adnan, Bari, & Adb Rashid, 2011). Stakeholders' commitment to the process indisputably yields a positive result on the performance of integrated contract projects as D&B (Chan, Scott, & Lam, 2002; Chan, Scott, & Lam, 2002; Arayici, Ahmed, & Aouad, 2006). However, end-users, project owners and other stakeholders can have little incentives to participate or want to be involved in the requirements management process of the project (Yu, Chan , Chan, Lam, & Tang, 2010).

Roles of stakeholders

Properly management of stakeholder involvement is one important factors which determine the success of the process (Kamara, Anumba, & Evbuomwan, 2000; Yu, Chan , Chan, Lam, & Tang, 2010; Ang, Wyatt, & Hermans, 2001; Tang L. , Shen, Skitmore, & Cheng, 2013). The project brief development is largely influenced by the clients and end-users and it is of significant importance that the roles of stakeholders in the process are adequately managed. This entails the clear definition of both the roles and responsibilities of each stakeholder in the process to encourage the active participation of these stakeholders (Yu, Chan , Chan, Lam, & Tang, 2010). The literature study revealed that stakeholders' knowledge on their responsibility and their position in the process is determined as a success factor for the process.

Consideration of multiple perspectives

It is important to consider the multiple perspectives as a result of multiple stakeholders (Ferreira, Lima, Formoso, & Leite, 2007) as "when you try to discover the requirements for any kind of product the difficulties are even more

complex because the source of the requirements is not just one person, it is all of the people who are stakeholders in the projects.” (Robertson, 2001) One problem of current requirements management practices relates to the fact that proper end-user involvement in the process is lacking (Yu, Chan , Chan, Lam, & Tang, 2010; Kamara, Anumba, & Evbuomwan, 2001). Without engaging the end-users in the process an important input for the process is lost and they are likely to be left with long-term dissatisfaction towards the project (Barrett, Stanley, & Sexton, 1999; Barret, Hudson, & Stanley, 1999). In addition, to increase the quality of input for the user requirements input of multiple information sources must be considered in order to discover the requirements of the stakeholders (Robertson, 2001). Cheong *et al.* (2003) stated on this subject that it is important in this process that it captures the requirements of all of the employees who make up this “stakeholder”, by means of for example user groups.

Methods used for collection of information

“In order to achieve a satisfactory result of the real estate project, full acquisition of knowledge on client’s aspirations in both tangible and intangible form would be a critical step in construction projects.” (Chan, Scott, & Lam, 2002) To discover, identify and specify requirements from different sources there is a need for various techniques (Robertson, 2001). These techniques, requirements “trawling” techniques, are used ideally in a structured framework which is used as a basis to discover the different types of requirements (Kamara, Anumba, & Evbuomwan, 2000). It is presumed that a minimal use of these techniques decreases the qualitative performance of the process.

Knowledge on formal procedures of process

Tang *et al.* (2013) stated that a framework should be developed preceding the performance of the requirements management process which is accepted by the relevant stakeholders. This framework entails the procedure which is used as a basis for the formulation of the performance-specifications. The application of a formal procedure would guide the experts in the process and can be used to enable a learning process on its effectiveness.

Table 1 - Propositions for variables

Variable	Proposition
Experience of team with process	Experience of the project organisation with performance of output-specification process in DBFMO projects will improve the performance of the process.
Commitment & Resistance towards process	Stakeholders who are strongly committed to the process and project will improve the performance of the process by their participation in the process.
Roles of stakeholders	Clear definition of roles and responsibilities of delegates in project organisation will benefit the success of the requirements management process.
Consideration of multiple perspectives	Incorporating multiple perspectives – from stakeholders and within stakeholders – improves the input for the formulation of the requirements by increase of understanding of requirements.
Methods used for collection of information	Usage of a variety of requirements “trawling” techniques will create a comprehensive perspective on the stakeholders requirements due to the enrichment of information input.
Knowledge on formal procedures of process	Knowledge on the formal procedure required for the performance of the process will benefit the performance of the requirement management process.

4. Findings of research

Experience of team with the process

The case study confirmed the importance of the level of experience of the project organisation with the performance of DBFMO projects and performance-based briefing. This variable is further conceptualized in the level of acceptance of the DBFMO-concept; experiences gained in traditional procurement projects; knowledge on required processes in

requirements management process; and knowledge on substance of performance-based briefing concept. The framework predicted that the experience of the delegates of the project-organisation will improve the performance the process, as this influences the performance of the process on several ways. The case study indicated the importance of a significant level of experience of the delegates in the project team but it is observed that the mindset used for the performance of the process is also influenced by experienced gained in performance of traditional procurement projects. The case study also found proof for the importance of experienced delegates of end-users for performance of the process. It is predicted that the level of experience of the delegates determine their ability to define their requirements. The inexperienced delegates in the project organisation found it difficult to provide information from a collective perspective and mainly formulated this from an individual perspective. This confirms the predicted relation, but it can be expanded as the experience of the delegates influences the level they are able to accept and work within the boundaries of the responsibility. Examples are found in the case study of delegates who – as a result of their inexperience and limited acceptance of the use of DBFMO as mode of procurement – negatively influenced the process as they wanted to obtain more control on the process.

Commitment and Resistance of Stakeholders

The theoretical definition of the variable and proposition is limited and can be extended for DBFMO-projects. It is predicted that a high level of commitment of the stakeholders will improve the performance of the process. This is the result of active participation of stakeholders; promptness of decisions-makers; and support from top-management which determines the quality of information during the process. The study acknowledges these elements and the importance of commitment of stakeholders towards the process. One element which needs to be considered in relation to this variable – and which is not discussed extensively in the theoretical framework – is the influence of the hierarchical structure and the decision-making process in the project organisation. A lack of commitment to the process can result in the fact that the decision-making process is slowed down and the progress of the requirements management process is decreased. Therefore, the causal relation of the variable is not only acknowledge, it is also extended by identifying the hierarchical decision to use DBFMO; the lack of knowledge of the stakeholders with DBFMO and concept of performance-based briefing; and the limited identification of the end-users with the process as the main sources of resistance towards the requirements management process. As result of the lack of knowledge of the stakeholders – clients and end-users – with the DBFMO and performance-based briefing concepts; they assume to have little control and influences on the requirements management, design and project-outcome. On this resistance, it is learned that it is of importance that incentives are created for the stakeholders so that they cooperate in the projects. This is defined in the literature on process management as the “the need for a sense of urgency.” (de Bruijn, ten Heuvelhof, & in 't Veld, 2002) This means that the stakeholders must be convinced that the requirements management process is performed to serve their interest and problems, and that it is in their best interest to actively cooperate in the process.

Roles of Stakeholders

The importance of the clear definition of roles and responsibilities of delegates in the project organisation is acknowledged as this positively influences the qualitative performance of the process. The risk is apparent that the managing party has difficulty in finding the balance between “satisfying the client” and “managing the process

properly.” In retrospect, the progress of the process is negatively influenced when an inexperienced end-user is provided a central role in the project organisation which he is incapable to perform. This confirms the theoretical statement that a clear definition of roles to the stakeholders – based on their capabilities, experience and position – safeguards the control of the process and thereby its progress. Despite the fact that no hierarchical categorization can be made based on this qualitative research, the importance of the roles and responsibilities of the stakeholders in the process is acknowledged in the case study. The performance of the process – both in process, organisational and methodology concepts – is highly dependent on both the organisations who participate in the process and the delegates who represent these public organisations in the process. The role of the stakeholders was perceived in the literature fell short in describing the significant influence of the individual and organisational preferences.

The initially defined proposition is not only confirmed but factors are identified for this variable for its further conceptualization. These variables are observed to be the (1) level of structural and considered definition of roles and responsibility; (2) level of acceptance of roles and boundaries of responsibility by stakeholders; (3) level of consequent performance of roles by managing professionals; and (4) level of mandate of delegates of the stakeholders. These factors are perceived to influence the performance of the process in relation to the roles of the stakeholders in the process. It is important to mention that the level of experience of the stakeholders determine the manner how they perform their provided role in the process as it is observed that – for example – the delegates of the end-users find it difficult to work within the pre-set boundaries of their responsibilities and when these aren’t safeguarded the qualitative progress of the process can decrease. Next to a clear definition and management of the roles of the different participants, the level of mandate of delegates in the process is learned to be an important factor. A top-down and structure approach of the decision-making on the subjects and detail of the subject can be an effective approach for the providence of information input for the project organisation when performed adequately. The findings illustrate that this proper management closely relate to the level of mandate that is provided to the delegates. When this mandate is not properly managed this can result in a negative influence by the hierarchical structure on the progress of the requirements management process.

Consideration of multiple perspectives

The structural integration of multiple perspectives in the process positively benefits the process, but not only through an increased input of information as the study indicates that this is also influences the process as active integration of stakeholders increases the support and commitment of these stakeholders. This in its turn increases the stakeholders perception that they can influence the process. Despite this positive character of the active integration of stakeholders and different delegates of one stakeholder, it is perceived that the effort can be diminished when the stakeholders cannot relate to the substance of the process. This can be related to the lack of requirements traceability in the process. This concept refers to the ability to describe and follow the life of a requirement, in both a forwards and backwards direction (Gotel & Finkelstein, 1994) and is not discussed to a significant extent in the literature on requirements management. An requirements is traceable if “(1) the origin of each of its requirements is clear and if (2) it facilitates the referencing of each requirement in future development or enhancement documentation.” In the observed practice this is perceived to be an difficulty but which negatively influences the performance of the process.

Methods used for collection of information

The definition of the proposition for this variable is too narrow since it only related to requirements “trawling” techniques which assume active interaction with stakeholders. The study learned that in this process of the projects the methods used for collection of information can be categorized in active and more passive methods. On the use of the requirements “trawling” techniques it is concluded that the proposition could not fully be assessed during the study. In one project it is observed that the project organisation actively used techniques as user groups, interviews, excursion and surveys but no value judgement can be related to whether this increased the perception on their requirements. The use of these projects had a positive influence on the process and providence of information by the stakeholders – as presented in the discussion of the previous variable – and thereby it can be expected that this increases the perception on the stakeholders’ perception. However, it is acknowledged at this point that the empirical data on this variable was limited and it can be expected that more methods are used in the projects but which are not fully expressed by the respondents since they don’t fully realize when these are applied in the process. On the use of passive document – Design Specification and Ambition Document – it is learned that their use can negatively influence the performance of the process if not properly managed. This observation is used to extent the initial framework and it is observed that the use of these documents has a relation to the expectation of the stakeholders which perform the formulation.

Knowledge on formal procedures of process

The proposition stated that the use of a structural formal procedure in the process benefits the performance of the process. The study learned that this can be confirmed in the DBFMO-projects of the Rijksgebouwendienst. This statement is based on the fact that it is observed that the current quality system, the performance of the requirements management process and formulation of the substance of the OS document lacks a structural approach. This resulted in significantly different OS document top-level information over the projects which is perceived as a negative result. At the same time this differentiation of output of the process means that the knowledge development of the private consortia active in the DBFMO projects is limited. Therefore, the use of a structural and formal procedure to perform the process not only influences the performance of the process itself, it also influences the learning capacity of the stakeholders and the total quality of the DBFMO-projects. Aside of these statement, it must be mentioned that the limited level of application of a structural process derived from – for example – the Nordic Five-level structure is also the result of the limited knowledge of the delegates in the project organisation on this subject.

5. Discussion and Conclusions

The main contribution of this research project is that insight is provided in the performance of the requirements management process in the context of DBFMO-projects Before this research was performed descriptions and definition on variables influencing the performance of the requirements management process were available, however they were perceived to be derived from studies performed in the context of traditional procurement projects. By reflecting this knowledge on the process performed in DBFMO-projects of the Rijksgebouwendienst, the research not only provides valuable insight for the Rijksgebouwendienst on their performance of this process, but also relevant knowledge and insights on the identified variables in the context of a DBFMO-project. By means of the empirical findings of the case

study we concluded that all of the propositions and variables – defined with knowledge on the process in the context of traditional procurement projects – are relevant for the requirements management process in the context of DBFMO-projects. However, a significant notion is that the definition of the variables are for all instances limited and by means of the research on the exemplary DBFMO-projects of the Rijksgebouwendienst the research enables a further definition of their relation towards the qualitative performance of the process. By means of this conceptualization the limited knowledge on the overall performance of the requirements management process in the context of DBFMO-projects but also traditional procurement projects is further enriched.

The reader of this paper must be reminded that the case study is performed in order to investigate how the requirements management was performed by means of a theoretical framework. The output of this case study give, therefore, to some degree a limited view on the process as the case study is performed based on the variables identified and the experience of the researcher to evaluate this kind of process. It is expected that when another perspective was used for evaluation other findings would be formulated on the performed process. Nonetheless it is observed that some critical elements in relation to the variables are identified which play a significant role in the qualitative performance of the current process and from which the theoretical knowledge can benefit. No statements are made on the hierarchical importance of the variables on their relation towards the quality of the process. Next to that no statements on the relation of the requirements management process towards the overall quality of the projects since this is influenced by more factors then only the performed requirements management. However, by acknowledging these elements and by improving the weaknesses and expanding the strengths a requirements management process can be realized which safeguard the critical elements identified in the academic knowledge.

6. Further research

Our main recommendation with regard towards future research is to further research the relation of the variables towards the qualitative performance and how this influences the overall performance of the real estate project. As this research doesn't made any statements an hierarchical relations it is envisioned that a more quantitative research can be performance to gain insight in the relations of the factors towards the performance of the process. In addition, the development of a "best-practice" of the process can provide an significant enrichment of the knowledge-base on the object of study.

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