

# The Role of the Project Manager in Delivering Design-Build Projects

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**Abstract.** The purpose of this study is to determine the roles and responsibilities of the project manager on Design-Build projects, in the context of projects completed in the Built Environment in the large metropolises of South Africa, as well as to study the factors that influences success on these projects. Utilising data obtained from interviews with relevant project managers, the components of success in projects and the success factors ensuring project success is compared with those components and factors found in the literature. The outcome of this comparison provides a summary of the differences in the roles and responsibilities of project managers appointed by clients and contractors respectively, as well as the links between project success components and factors. The application of these results guides the project manager to successfully deliver Design-Build projects.

**Keywords:** Design-Build · Project management · Project success components · Project success factors · South Africa

## 1 Introduction

The role of the project manager (PM) in Design-Build (DB) projects has been defined in the theory, but in practice it is implemented in two distinct manners. According to [7], DB projects involve two main parties; the client and the DB contractor. However, it is not clear whether there is any difference in the success of these projects when the PM is appointed by the client as opposed to when the DB contractor acts as the PM.

There are several advantages for the client in using the DB method of project delivery. Not only is there a singular point of responsibility that seems to result in a reduction in liability for the client, the research conducted for this study has demonstrated that the DB project delivery method lead to the early establishment of cost and project schedule, a reduction in the total project cost, a reduction in claims, as well as constructability considerations forming part of the design process [9].

These listed advantages lead to the question of what factors contribute to a successful project in terms of cost, schedule and quality. Studies previously established success factors of DB projects ([1]; [2, 3]; [5]; [8] and [9]), where a list of factors was grouped to find the groupings that had the biggest impact on project success. A PM studying

these factors will then be able to focus on these groupings of factors to ensure successful delivery of projects.

The appointment of DB contractors is seemingly becoming more ordinary in the Built Environment of South Africa, an industry that contributed 4% to the GDP of South Africa in 2017 [14]. This equates to a roughly R50bil industry, with projects controlled by PM's ranging between R40mil for the Sanlam offices in Sandton to the Saldanha Steel Plant at R800mil as found in [4]. The study pertaining to DB projects revealed that little research is available with regard to the success rate of DB projects in South Africa or the effect on project success by the PM.

The objective of the study is to determine the roles and responsibilities of the PM on Design-Build projects, as well as to determine the factors that influences success on projects. The study will be in the context of projects completed in the Built Environment in the large metropolises of South Africa.

The strategy followed for the research study include using a case study to form the initial theory that will be subsequently tested with theory gleaned from the literature. This strategy is referred to as an indicative case study in [13] and is described as research that starts off by data collection to find more information on a specific phenomenon, the case being studied when referring to a case study approach, and thereby building, or generating theory. Inductive research can therefore be surmised as theory development through the observation of empirical data. Semi-structured interviews were the chosen data collection instrument, with four respondents interviewed. These respondents were a homogenous sample of PMs working on projects in the Built Environment.

## 2 Roles and Responsibilities of Project Managers on DB Projects

The literature study was centred on the research objectives and is clear on the understanding of what a PM's role is on projects. In [15], management is defined as planning, organising, leading and control, with the scope being that of the time, cost and quality parameters of a temporary endeavour (i.e. the project). There are additional concerns of what is required to successfully lead a DB project, the most notable being the additional skillset of both design and construction management [5].

During the interviews, it was important to establish whether the use of DB projects was on the rise in the target population, since it establishes the need for the research in a field exhibiting growth. The four respondents affirmed that the number of DB projects is growing, but noted that the use is still hampered by a lack of knowledge of the specific project delivery method. It is therefore possible to state that the purpose of this study is validated, insofar that more contributions to the body of knowledge regarding the use of DB projects in South Africa are required.

In general, the type of DB projects managed by the respondents ranged from heavy industrial and commercial projects, to transportation projects, as well as municipal water projects. These were in both the private and public sectors. Some examples of these projects are (projects classification in terms of type and sector shown in brackets):

- ī Manufacturing Plants (heavy industrial, private);
- ī Hospitals (commercial, public);

- ï Post-tension concrete slab contracts (commercial, private);
- ï Road concession (transport, public);
- ï High-rise buildings (commercial, private); and
- ï Water connections and pump stations (municipal water, public).

It should be noted that the respondents concluded that the highest prevalence of DB projects in South Africa took place on concession type projects for roads, and construction of new bridges, with a slower uptake in industrial and commercial projects. Due to respondent 2, the design element of road projects being a lot more uniform across different projects when compared to commercial buildings such as modern high-rise office buildings.

The next area of DB projects explored, was the roles and responsibilities that the PM's performed during the project. In order to investigate whether there were any differences in the roles performed, the roles and responsibilities of both the client's PMs and the DB contractor's PMs were defined during the interviews. Comparing the responsibilities listed in Table 1, it can be surmised that certain roles are similar, but the responsibilities for these roles differ between the differently appointed PM's. The roles that align, but

**Table 1.** Contradictions in responsibilities for the various roles performed by PM's.

Roles	Responsibilities	
	PM Appointed by Client	PM Appointed by Contractor
Scope	Capture client brief. Develop scope statement. Track milestone progress.	Manage changes to scope.
Procurement	Compile list of qualified DB contractors. Administer tender process. Assist client in appointing capable contractor for executing work.	
Schedule	Define timelines.	Ensure project is delivered on time.
Budget	Define project budget. Determine/adjudicate the cost of changes to project budget.	Deliver project within budget. Sign payment certificates.
Quality		Project delivered to client's expectations.
Mediation and Claims	Assess and adjudicate claims from contractor. Manage variation orders. Mediate conflict.	Submit variation orders for changes to project scope. Issue claims to client.
Risk	Establish risk register. Manage occupation dates.	Manage the identified risks.
Design		Ensure design team delivers what client requested. Issue information to site on time. Coordinate information between disciplines.
Construction		Constructing what is required. Manage deadlines to ensure compliance to client's timeline requirements.

that have different responsibilities are scope, schedule, budget, quality, mediation and claims, and risk. The differences in responsibilities for each of these roles will need to be compared in order to assess whether there is any definite difference in the roles and responsibilities for the PM's appointed by either the client or the contractor. In comparing these different responsibilities, it is possible to surmise that the client-appointed PM in general has responsibilities that establishes the mandate of the contractor-appointed PM. This mandate refers to the internal deliverables.

### 3 Project Success Components

The definition of success used in the research study included the components of cost, schedule, quality, stakeholder satisfaction, benefits to owning organisation and long-term impacts, whilst mention was made to terms such as risk-, procurement management, communication and integration of disciplines, management of human resources and scope of the project [11].

These components of success can be critiqued in either an objective manner, as is the case for cost, schedule, quality and risk, or in a subjective manner, as is the case for stakeholder satisfaction, benefits to the owning organisation, perceived long-term effects, as well as communication and integration of disciplines. During the interviews, the respondents were requested to name the components of success and these were compared to the information gleaned from the literature. The components of cost, time and quality were excluded from the discussion, as these components were mentioned by the respondents during the definition of the roles and responsibilities. The components introduced by the respondents were:

Risk; Procurement; Stakeholder Satisfaction; Benefits; Long-term effects; Communications; and Information Schedules.

The information obtained in the literature review was utilised to set up the conceptual framework for the project success components, with the framework used to compare the information gleaned from the interviews conducted during the case studies. However, the only new component identified by the respondents was that of the procedure of utilising an information schedule, while the rest of the information corroborated the components identified as per the literature review. A new framework is therefore proposed with the addition of the item discussed above (referred to as information management); the proposed framework for components of project success in DB projects culminating from this study is indicated in Fig. 1 below.

### 4 Project Success Factors

The success factors for DB projects have been discussed in several studies and well established in the literature ([1]; [2, 3]; [5]; [8] and [9]). The assumptions made in these studies that there are numerous factors that influence the success of projects, most of them either directly attributable to the PM (for instance project, design and construction management competencies) or manageable by the PM (for instance scope statement and project control). It is of interest to verify if the factors compare well with the practical information that will be gleaned from the exploratory stage of the research.

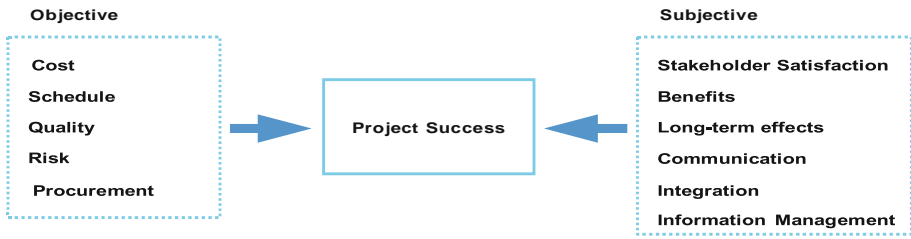


Fig. 1. The components of project success framework Adapted from [11].

The factors were obtained by requesting the respondents to list the project success factors as deemed important; these factors follow from the previous tenet discussed, i.e. the measures of success. As before, the information from the literature review was utilised to form the conceptual framework summarising the project success factors and updated by incorporating the factors gathered from the empirical data. Figure 2 is a summary of the success factors that the PM can control in order to ensure the successful delivery of DB projects.

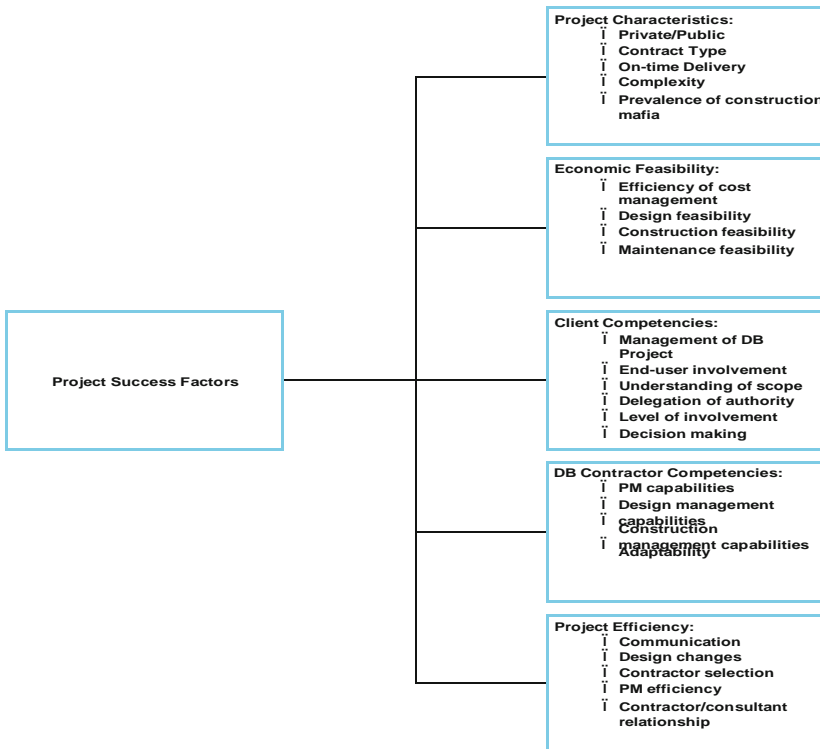
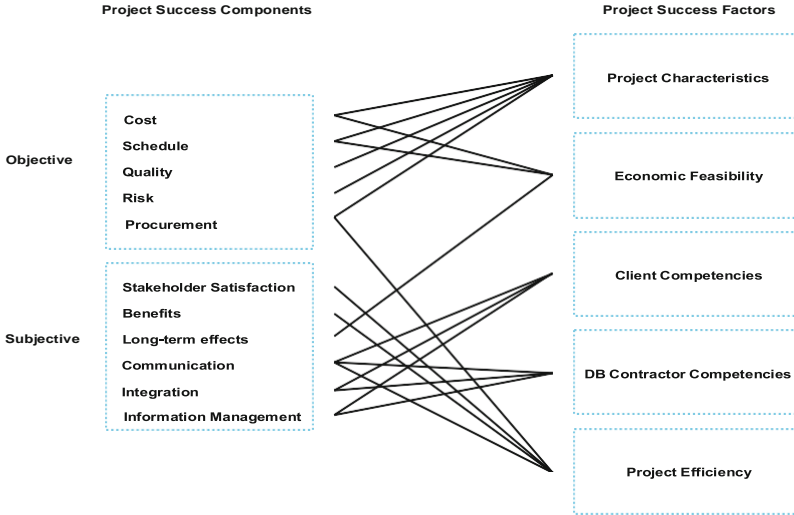


Fig. 2. Summary of project success factors Adapted from [1–3, 5 8] and [9].

## 5 Linking Project Success Components and Factors

The final tenet discussed is the links between the success components and factors as established by the respondents. These links further aid the comparison between the literature and the empirical data gathered during the interviews and finalised the inductive research conducted during the study and is illustrated in Fig. 3 below.



**Fig. 3.** The links between project success components and project success factors

Figure 3 illustrates the following links. The first link that can be made is that all of the objective components of project success are linked to the Project Characteristic success factor. It can be surmised that this is indicative of the importance of managing the iron triangle, as well as the risks and procurement strategy of the project. The iron triangle as proposed by [11] relates to the traditional measurement of project success and includes the cost, schedule and quality components. In terms of this study, the importance of the objective components of success is established, since this link implies that the PM can increase the likelihood of successful project delivery by focusing on managing the project characteristics. Further to this, the respondents had all referred to the importance of the iron triangle on project success and suggested that the management of the project characteristics identified by the respondents would contribute to the success delivery thereof, in doing so linking to the theory identified in the literature review.

The elements of the first success factor grouping, Project Characteristics, as listed in Fig. 3 are as follows:

Private/Public sector; The contract type; On-time delivery of the project; Project complexity; and The prevalence of the construction mafia.

It should be noted that reference to the sector and contract type does not only refer to the fact that this is a factor that can be utilised at the outset of the project to determine whether the DB project delivery method will be suitable, but refers to nuances of the

sector and contract to consider. For instance, the relevance of the PPPFA is important to take into account when managing public sector projects, whilst [10] refers to contract type as metaphors for the different project delivery methods; a fixed price contract in this case is not necessarily suitable for DB projects.

The second success factor grouping is Economic Feasibility. This grouping expectantly links to the cost and schedule components; however, it was interesting to note that long-term effects is linked. The respondents were all in agreement that this refers to the importance of viewing the project holistically over its entire lifespan, which, when compared with the literature indicates that the theory and empirical data relates well for this link. It is important to note that the long-term effects relate to the environmental impacts of the project, the sustainability element of the project, profitability as soon as the end-product of the project is completed, as well as the effect of operations and technology over its lifetime.

The Client Competencies success factor links to the communication, integration and information management components of success. It is interesting to note that these three items are all related, since communication between parties relate to the integration that is required, whilst management of information relates to communicating information to the relevant parties timeously. However, the respondents also indicated that communication as a client competency doesn't only refer to verbal communication, but to the ability of the client to document the project requirements in a clear and concise manner. It is important to note that in this case, the PM cannot directly manage the list of factors under the Client Competencies group, but these are factors that the PM must take cognisance off in order to aid them to better manage the client and indirectly improve the chances of delivering the project successfully.

In relation to the discussion above, DB Contractor Competencies indicates the same links as Client Competencies and therefore indicates the importance of these subjective components in delivering DB projects successfully. However, in this success factor grouping the competencies rather refer to the design and construction management capabilities of the PM. It is important to note that the PM should not act in both these rolls but should rather integrate the construction and design teams; the results from the interviews indicate clearly that the factors refer to the integration competency. This is indicated in the link to the integration component that was established during the literature review; the deduction is that the literature and empirical data relates well.

The last success factor grouping is Project Efficiency. From Fig. 3, the links between Project Efficiency and the project success components is illustrated as procurement, stakeholder satisfaction, benefits and communication. The respondents mostly noted the importance of the relationships between the different parties when it comes to delivering the project successfully. These relationships are between the client and DB contractor, as well as between the contractor and consultant working together as the DB contractor (type II and III DB contractors). It is clear that the relationship between the client and DB contractor links to the procurement component, whilst the stakeholder satisfaction link will be influenced by the relationship between the different parties acting as the DB contractor. The PM should therefore ensure that these relationships remain in good stead during the course of the project, in doing so the chances of delivering the project successfully is increased.

## 6 Conclusion and Recommendations

The aim of the study was to determine the roles and responsibilities of the PM on DB projects, as well as to determine the factors that influences success on these projects. These projects were to be specific to the Built Environment of the large metropolises in South Africa. The study of the literature pertaining to DB projects revealed that little research is available with regard to the success rate of DB projects in South Africa or the effect on project success by the PM. The proposed research study aimed to contribute to the Project Management body of knowledge, specifically related to DB projects and the successful delivery thereof, by attempting to resolve the following research questions:

- What are the roles and responsibilities of PMs in DB projects?
- What are the success factors for DB projects?
- How are PMs utilised on DB projects conducted in the large metropolises of South Africa?

The final conclusion, that resolves the research question, is as follows.

The roles and responsibilities of PMs in DB projects compared well between the literature and the empirical data; the summary of these roles and responsibilities in the context of projects conducted in the large metropolises of South Africa is indicated in Table 2. Table 2 not only satisfies the first research question but alludes the manner in which PMs are utilised on DB projects, specifically in the context of projects in South Africa. Since there are two parties that can appoint the PM on DB projects, the study concludes that the client-appointed PM in general has responsibilities that establishes the mandate of the contractor-appointed PM. Therefore, the below responsibilities are in effect a summary and final conclusion for both the responsibilities of the PM's appointed by the client and contractor.

The second research question resolved to determine the success factors for DB projects. In proving this question, it was important to first establish frameworks for success components (Fig. 1) and success factors (Fig. 2), where after these two were linked in order to compile a framework that assists PM's to deliver DB projects successfully. The framework is presented in Fig. 3. The PM can therefore identify a project success component that requires intervention on the project under consideration and chart the link to the appropriate project success factor that can be influenced to improve the delivery of the project successfully. These project success factors are only indicated as a group in the framework presented in Fig. 3 and should be read in conjunction with Fig. 2, to determine the appropriate project success factor to influence.

To finally conclude, the summaries of Table 2 *The Roles and Responsibilities of Project Managers in DB Projects conducted in the Large Metropolises of South Africa* and Fig. 3 *The Links between Project Success Components and Project Success Factors* answers the three research questions of the study. The study presents a list of roles and responsibilities of PM's utilised in DB projects in South Africa, as well as a framework to be used by PM's to influence factors of project success.



**Table 2.** The roles and responsibilities of PMs in DB projects conducted in the large metropolises of South Africa.

Roles	Responsibilities
Scope	Capture client brief. Develop scope statement for project. Manage changes to scope. Track progress of milestones.
Procurement	Compile list of qualified DB contractors. Administer tender process. Assist client in appointing capable contractor.
Schedule	Define timelines of delivery. Ensure project is delivered on time.
Budget	Define project budget. Determine or adjudicate the cost of changes to project budget. Deliver project within budget. Sign payment certificates.
Quality	Project delivered to client's expectations.
Watching brief	Appoint consultants to review submittals from contractor.
Stakeholders	Manage the various parties influenced or affected by the delivery of the project on behalf of the client.
Mediation and Claims	Assess and adjudicate claims from contractor. Mediate conflict. Manage variation orders. Issue claims to client. Submit variation orders for changes to project scope.
Risk	Establish risk register. Manage occupation dates. Manage the identified and defined risks.
Design	Ensure design team delivers what client requested. Issue information to site on time. Coordinate information between disciplines.
Construction	Constructing what is required. Manage deadlines to ensure compliance to client's timeline requirements. Keeping pressure on the team on site.

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