

Risks for consulting engineers on design-build construction projects in South Africa

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Abstract:

This paper aims to investigate the risks for consulting engineers on design-build (DB) construction projects in South Africa by synthesizing existing literature on known risks with knowledge about the roles that consultants play in the DB process. Consultants typically fulfill one of four roles in the DB process, namely as criteria consultant, bridging consultant, oversight consultant or designer-of-record. The paper identifies that in these roles, a consultant may be exposed to 24 unique risks. Many of these risks are inherited through contractual agreements with other parties and may therefore not be obvious, especially to consultants who are inexperienced with the DB process. The unfair distribution of risks among the project participants is also of concern. Fortunately, many of these risks can be mitigated by building good professional relationships based on trust, transparency, and collaboration. Early risk identification and effective risk management continue to remain important aspects as well. It is therefore recommended that consulting engineers actively work to improve their professional communication skills, whilst also focusing on well-established risk management best practices, for success in the future. Existing literature extensively explores the risks that DB projects hold for contractors and project owners, and to whom these risks should be allocated. However, little is written about the risks that consulting engineers face during the DB process. This paper addresses that knowledge gap, with a particular focus on South Africa as a case study. The knowledge thus presented may help both experienced and inexperienced consultants to successfully participate in DB construction projects.

Keywords:

Construction, consultant, design-build, procurement, risk

1 Introduction

Literature reveals that design-build (DB) contracting is increasingly used internationally, in both the private and public sectors as owners look for a single point of responsibility when doing design and construction work (Banik et al., 2003; Crossman, 2018; Gransberg et al., 2006; Grobler & Pretorius, 2002; Ilori & Talukhaba, 2017). Banik et al. (2003) however considers DB to be a high-risk procurement method for both owners and contractors unless the risks are adequately identified, investigated, and managed from tender preparation through

to construction. Banik et al. (2003) further assigns DB contractual risks to either the owner or the contractor without ever referencing the role of the consultant in DB contracts.

Nguyen & Nguyen (2020) investigated the risk factors which influence the successful implementation of DB projects in Vietnam, a developing country. Their research identified 28 risk factors, but throughout the paper, there is no mention of the consultants' roles and/or associated risks. Ilori & Talukhaba (2017) argue that DB contracts are not correctly implemented in South Africa, also a developing country, due to a general lack of understanding of this procurement method. They find that the risks of design management and control is usually allocated to the DB entity, but is then passed onto the designer-of-record (DOR) consultant.

The book, *Preparing for Design-Build Projects* (Gransberg et al., 2006) provides insight into the changes and different roles for consultants in the DB process (in comparison with traditional procurement models). They find that designers are significantly affected by the DB process as the designer must decide whether it will remain on the owner's team or join forces with a construction contractor. Very little information is however provided about the risks associated with these changes and/or different roles (Gransberg et al., 2006).

In summary, existing literature has extensively explored the risks that DB projects hold for contractors and project owners, and to whom these risks should be allocated. However, little is written about the risks that consulting engineers face in the various roles that they play in the DB process. This paper addresses that knowledge gap via tables 4 - 7, and in doing so, may help both experienced and inexperienced consultants to successfully participate in DB construction projects.

This paper aims to investigate the risks for consulting engineers participating in design-build (DB) construction projects in South Africa by synthesizing existing literature on known risks with knowledge about the roles that consultants play in the DB process.

In support of its aim, the paper's objectives are to:

1. Summarise the known risks for contractors and project owners in the DB process.
2. Review the roles that consulting engineers play in DB projects.
3. Identify the specific risks that consultants may unknowingly face in the DB process.

2 Research Methodology

This paper is based on the synthesis of existing literature and would therefore be considered as a desktop study.

2.1 Design

The fundamentals, advantages, disadvantages, and best practices of the DB process are well documented and therefore not repeated in this paper (Banik et al., 2003; Crossman, 2018; Design-Build Institute of America, 2014; Galloway, 2009; Gransberg et al., 2006; Grobler & Pretorius, 2002; Ilori & Talukhaba, 2017; John et al., 2011; Lam et al., 2012; Marshall, 1999; Nguyen & Nguyen, 2020; Songer & Molenaar, 1997).

Existing literature has extensively explored the risks that DB projects hold for contractors and project owners, and to whom these risks should be allocated. These known risks within the DB process are summarised in chapter 3. Whilst chapter 4 identifies the main roles that consulting engineers typically play within DB construction projects. Finally, findings are synthesised from the above information whereby the paper identifies 24 unique risks that consultants may unknowingly face in the DB process (chapter 5).

2.2 Limitations

This paper focuses on the contractor as the main DB party, who then employs consultants for its design services as this is commonly the case in South Africa and other developing countries. It does however not evaluate court, mediation, or arbitration cases, nor owner's requirements or requests for proposals.

Other procurement forms (such as engineer-procure-construct (EPC), turnkey, design-build-finance (DBF), build-operate-transfer (BOT) etc.) might be based on similar principles to DB and therefore involve similar risks. However, this paper only focuses on the pure/classic DB process.

Griffith et al. (2012) estimate that 49% of DB construction projects in the UK include novation, despite its potential for conflicting interests as well as poor quality standards in many instances of its use. Novation risks were therefore included/kept in the findings, although further research is recommended to investigate the frequency of its occurrence in South Africa and other developing countries.

3 Known Risks within the Design-Build Process

Tables 1 to 3 provide a summary of the known risks per project phase as identified from existing literature, the sources that mentioned the risk(s) and the entity to which the risk will likely be allocated. The risks primarily focus on contractors and project owners, with little written about the risks for consulting engineers.

Table 1: Risks identified within the design-build process (Contracting phase)

Risk	Risk Allocation	Reference
Time pressure from contractors to deliver designs after novation, could compromise design quality	Novated designer	Griffith <i>et al.</i> (2012)
The need for Joint Ventures with international contractors on complex projects due to skills shortage (especially in developing countries)	DB entity	Nguyen & Nguyen (2020)
Design management and control*	DB entity, Designer-of-record	Ilori & Talukhaba (2017)
Lack of performance ability by the novated design team	Owner & DB entity	Ng & Skitmore (2002)
Inadequate allowance for design fees resulting in poor quality design and/or poor relationships	Owner & DB entity	Ng & Skitmore (2002)
As a result of novation and resulting time pressures, alternatives and innovative solutions are not carefully considered	Owner	Ng & Skitmore (2002)
Delays in project approval and licensing	Owner	Nguyen & Nguyen (2020)

Risk	Risk Allocation	Reference
Delay in service agreements	Owner	Tran & Molenaar (2012)
Delay in environmental approvals	Owner	Tran & Molenaar (2012)
Interest rate fluctuations	Owner & DB entity	Nguyen & Nguyen (2020)
Deficient design and/or technical specifications	DB entity	Nguyen & Nguyen (2020)
Obtaining other agency approvals	Owner	Tran & Molenaar (2012)
Delays in right-of-way (ROW) process	Owner	Tran & Molenaar (2012)
Delays in completing utility agreements between the owner and applicable Authorities	Owner	Tran & Molenaar (2012)
Geotechnical investigation	Duty dependent	Tran & Molenaar (2012)
Unclear or ambiguous contract documents	Owner & DB entity	Tran & Molenaar (2012) Mead (2007)
Defined and non-defined hazardous waste	Owner	Tran & Molenaar (2012)
Inability of a party to secure appropriate insurance for allocated risks	Owner & DB entity	Mead (2007)
Less communication between the designer and the owner can lead to design deficiencies	DB entity	Nguyen & Nguyen (2020)

* Especially risky when the RFP requires the contractor to provide all design work without relying on any documents provided by the owner (Currie, 2021), or when the contractor has to sign a novation agreement (Mead, 2007)

Table 2: Risks identified within the design-build process (Planning and procurement phase)

Planning and procurement Phase		
Risk	Risk Allocation	Reference
Inadequate scope definition	Owner	Tran & Molenaar (2012) Grobler (1999)
Inequality in bargaining power due to competitive markets resulting in inappropriate risk allocation	DB entity	Mead (2007)
Cost considerations can threaten the independence and integrity of the design function	DB entity	Grobler (1999)
Designing at risk before novation, resulting in poor quality tender drawings and specifications	DB entity	Griffith <i>et al.</i> (2012)

Table 3: Risks identified within the design-build process (Construction phase)

Construction Phase		
Risk	Risk Allocation	Reference
Delay in award of tender / access to site	DB Entity	Mead (2007)
Changes to design or specifications	Duty dependent	Nguyen & Nguyen (2020)
Poor relationship between the contractor and designer due to novation	DB Entity	Ng & Skitmore (2002)
Third-party delays during construction	Duty dependent	Tran & Molenaar (2012)
Unexpected utility encounter	Duty dependent	Tran & Molenaar (2012)
Construction QC/QA	Duty dependent	Tran & Molenaar (2012)
Differing site conditions	Duty dependent	Mead (2007)
Differing site conditions	Owner & DB entity	Crossman (2018)

As seen in tables 1 to 3, most literature only refers to the risks of the two main parties to the DB contract. It should however be noted that the consultant will inherit some of the above risk through its contract with the owner and/or the design-builder. A need therefore exists to identify such risks and better inform consultants.

4 The Roles of Consulting Engineers in Design-Build Projects

Gransberg et al. (2006) outline possible roles of the consultant in the DB process as follows. A DB criteria consultant works with the project owner to develop the RFP at the onset of the process. This tends to differ from traditional contracts as these consultants specialise in the DB field, and are knowledgeable in writing conclusive project-based performance criteria.

A DB bridging consultant plays a larger role in project's design development (up to 15 – 50% completion) to communicate the owner's intent to the design-builder. It is important to recognise that the designer-of-record, who owns the detailed design, is part of the design-builder team and not a bridging consultant.

If novation is specified in the contract, the professional services contract between the owner and the DB bridging consultant will typically include a novation clause. The RFP will then also include novation as a requirement of the DB contract, and subsequently the DB bridging consultant will become the Designer-of-record.

An Oversight consultant assists the owner with design reviews and construction supervision. The oversight consultant may already be involved when defining the RFP. This role is commonly performed by construction management consultants and may also be referred to as the employer's engineer, owner's engineer or the independent engineer.

A Designer-of-record (DOR) is a key part of the DB construction team and is responsible for the detailed design, drawings and specifications that are technically accurate and of high quality. The DOR plays an important part in the preparation of the project proposal: having to complete a critical portion of the design work (often at risk) before the design-builder can price and submit their project proposal.

It is worth noting that the DOR faces particularly high risk during the construction phase and must therefore supply/maintain the relevant professional liability insurance. This might however not always be feasible: especially for very large projects. This is due to the DOR typically being responsible for all design decisions prior to them being approved for construction, including the work of any subconsultants, subcontractors or suppliers. The DOR could also be made responsible for construction quality control and must ensure that it adheres to the project drawings and specifications.

The DB procurement method holds several advantages over more traditional procurement methods and may therefore become more common in developing countries in the future. Consulting engineers who would like to enter the DB space, will therefore first need to decide whether they will join the owner's or the contractor's team in one of the above roles. The risks that consultants might face in the above roles will however have a major influence on

how/where they will be able to safely position themselves. The following section lists such possible risks for DB consultants.

5 Findings

Synthesizing the knowledge gained from the study, the paper finds that the risks can be allocated to consultants in each of the various DB roles. The information is presented in Table 4.

Table 4: Risk categories

Category of risks	Risks
Risks for design-build criteria consultants	Inadequate scope definition, and unclear or ambiguous contract documents which can lead to variations and/or claims.
	Delay in granting of service agreements that will enable the design consultant to start with geotechnical investigations, land surveys, cost estimating, environmental studies, planning, testing, or whichever services may be required to develop the preliminary designs and/or specifications to the owner's requirements (depending on assigned responsibilities).
	Delays in project approval and licensing (if the consultant is made responsible).
Risks for design-build bridging consultants	Designing at risk before novation, resulting in poor quality tender drawings and specifications.
	Difficulty in management and control of the design under novation.
	Delay in granting of service agreements that will enable the DOR to start with geotechnical investigations, land surveys, cost estimating, environmental studies, planning, testing, or whichever services may be required to develop the preliminary designs and/or specifications to the owner's requirements (depending on allocated responsibilities).
	Delay in environmental approvals (if this is the consultant's responsibility). Preliminary design may need to be changed if the environmental approval is late and requires such changes.
	Unclear owner's requirements or design intent, which can lead to variations and/or claims.
	Inability to secure appropriate insurance for allocated risks.
	Differing site conditions to what was originally anticipated (depending on allocated responsibilities).
Risks for design-build oversight consultants	Unclear or ambiguous contract documents (in drawings, specifications and/or design intent) resulting in design review responsibility risk if design issues are not picked up early on, and the owner needs to request changes, which will cause extension of time (EOT) and cost for the Contractor. The owner might hold the consultant responsible.
	Construction QC/QA: Depending on how the owner's requirements are written, the oversight consultant might be employed by the contractor, who might overrule the consultant on quality control issues.
Risks for the DB designer-of-record	Working on designs for proposals at risk, especially when there is no stipend payable for unsuccessful proposals. The DOR has the highest risk in terms of effort and money lost if the tender is not accepted.
	Inequality in bargaining power due to competitive markets resulting in inappropriate risk allocation.
	Delay in service agreements that will enable the DB entity to start with geotechnical investigations, land surveys, cost estimating, environmental studies, planning, testing, or whichever services might be required to

	develop the initial design and/or specifications to the owner's requirements (depending on responsibility allocations).
	Inconclusive geotechnical investigations could lead to inferior initial designs and claims from the contractor for any losses he suffers.
	Cost considerations could threaten the independence and integrity of the design function.
	Lack of design management and control, especially where the designer is responsible for the quality and correctness of all designs and quality of works by the entire DB team.
	Deficient, unclear, or ambiguous contract documents (in drawings, specifications and/or design intent) leading to costly redesign.
	Inability to secure appropriate insurance for allocated risks.
	Less communication between the designer and the owner can lead to design deficiencies.
	Unexpected utility encounter that might influence the design, creating rework which might not be allowed for in the consultant's fees. It might also lead to increased construction costs.
	Being overruled by the contractor on construction QC/QA, if the designer is made responsible for quantity on site.
	Differing site conditions could necessitate design changes which could also increase construction cost. Depending on who is made responsible for the site investigation, this could lead to claims against the consultant's PI insurance.

The construction industry is highly fragmented, and no two projects are alike. It should therefore be noted that the above risks to consultants will have to be evaluated by thorough review of the contractual conditions and responsibility allocations in the DB contract(s) relevant to a particular role and/or project. This is especially important in cases where the various role-players are not experienced in the best practice implementation of DB projects. Following a proven risk management approach with experienced project leaders from the start of the project, is also highly recommended.

Fortunately, many of the above risks can be successfully mitigated or effectively managed through building good professional relationships based on trust, transparency, and collaboration...attributes which are already required as per DB best practices (Design-Build Institute of America, 2014; Gransberg et al., 2006).

Good relationships are however built on good communication. Good professional communication can improve project outcomes in terms of client satisfaction, as well as overall time, cost & quality (Jurgens & Matchett, 2018). Consulting engineers will therefore need to realise the value of good communication, and actively work to improve their own communication skills, if they wish to be successful in the future.

6 Conclusion and Further Research

In conclusion, existing literature is not specific about the risks that consulting engineers face in the design-build (DB) construction process, often referring only to the risks of the owner

and the main DB contractor. This paper addresses that knowledge gap. DB procurement offers several benefits and may therefore become more common in developing countries in the future. Consultants need to decide whether they will join the owner's or the contractor's team, as well as determine which risks they are willing and/or able to accept. Only then will they be able to safely position themselves accordingly. Consulting engineers typically play one of four main roles in the DB process, namely as a criteria consultant, bridging consultant, oversight consultant or designer-of-record. In these roles a consultant may be exposed to 24 unique risks as shown in tables 4 – 7. Many of these risks are inherited through contractual agreements with other parties and may therefore not be obvious or known, especially to consultants who are inexperienced with the DB process. Fortunately, many of these risks can be mitigated by building good professional relationships based on trust, transparency, and collaboration. It is therefore recommended that consulting engineers actively work to improve their professional communication skills, whilst also focusing on well-established risk management best practices, for success in the future.

Finally, it is recommended that the list of 24 identified risks be validated and/or expanded via selected interviews with experienced DB practitioners. A broader industry survey of consulting engineers on the topic would also yield valuable insights.

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