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A Classification Framework for Design-Build Variants from an Operational Perspective

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Abstract

Design-build (DB) is a generic form of construction procurement, and, rather than simply representing a single system, it has evolved in practice into a variety of forms, each of which is similar to, and yet different from each other. Although the importance of selecting an appropriate DB variant has been widely accepted, difficulties occur in

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practice due to the multiplicity of terms and concepts used. What is needed is some kind of taxonomy or framework within which the individual variants can be placed and their relative attributes identified and understood. Through a comprehensive literature review and content analysis, this paper establishes a systematic classification framework for DB variants based on their operational attributes. In addition to providing much needed support for decision-making, this classification framework provides client/owners with perspectives to understand and examine different categories of DB variants from an operational perspective.

Key words

Design-build, operational variations, classification.

1. INTRODUCTION

The construction industry is well known for its highly fragmented organizational structure and it is no coincidence that this is reflected in traditional project organization and procurement arrangements. Over the last two decades, however, the situation has changed considerably, with the emergence of a wide variety of new forms of project organization. Of particular note is the Design-Build (DB) procurement method, which has been demonstrated to be an effective method and has gained in popularity worldwide in recent years (Konchar and Sanvido, 1998; Haque et al., 2001; Hale et al., 2009; Park et al., 2009; Rosner et al., 2009). With DB, *a single entity or consortium is contractually responsible for both the design and construction of a project* (Songer and Molenaar, 1997)

instead of the traditional strict organizational and contractual separation of these functions.

In order to meet different sets of construction circumstances, a number of DB variants have been developed (CIOB, 1988; Masterman, 2002) including joint venture, designer-led, contractor-led, integrated firm, and developer-led arrangements (Beard *et al.*, 2001), each of which has its own set of terminological descriptors. Current studies of DB variants have focused almost entirely on their *structural* differences, which are mainly characterized by the relative contractual arrangements of the parties involved.

Most client/owners, on the other hand, agree that *operational* differences are considerably more important in practice (Beard *et al.*, 2001). These usually relate to the proportion of design undertaken by client/owners or their design consultants (Janssens, 1991) and therefore affect the requirements and workloads of the client/owners. At one extreme (such as the *Turnkey* method), the single focus of interest is the final product, in which it is the contractor's sole responsibility to undertake all the design and construction work involved. At the other extreme (such as in *Develop and Construction*), the client/owner is obliged to provide detailed design and specifications before engaging the design-builder. In practice, a typical DB contract lies between these two extremes, with sufficient design work being undertaken as a vehicle for tendering and contractor selection (Harris and McCaffer, 1995).

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Although the importance of DB operational differences is widely accepted, there is as yet little agreement of their classification. Different rules and terminologies are used and some of the classifications are contradictory. For example, Janssens (1991) and Akintoye (1994) consider *Design and Manage* to be a DB variant, while Masterman (1992), in contrast, refer to *Design and Manage* as a management-oriented procurement system. Quatman (2003) and Gransberg et al. (2006) include *Bridging* as a DB variant. In Beard et al.'s (2001) classification framework however, *Bridging* is not regarded as DB, because it is more akin to traditional *Design Bid Build* and the client/owner is again in the position of warranting the completeness of the design to the bridging contractor. In summary, as Griffith et al. (2003) point out, many of the operational differences in DB in practice have become confused in application. It is clear, therefore, that an agreed comprehensive classification framework will be of great help to deepen the knowledge of DB systems and facilitate the selection of an appropriate DB variant in practice.

Therefore, the objective of this study is to develop a systematic classification framework for DB variants based on the operational differences rather than contractual differences involved. This will add knowledge to the DB philosophy and possibly act as a catalyst for future developments in the field in addition to providing a basis for decision support in the selection process of DB variants in practice.

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2. LITERATURE REVIEW

This section examines previous classifications of DB variants and, through a comprehensive literature review, identifies the underlying logic involved.

Janssens (1991) was one of the first researchers to study this topic and suggested the six most commonly accepted DB variants to be:

1. *Develop and Construct*
2. *DB 1-stage*
3. *DB 2-stage*
4. *Negotiated DB*
5. *Design and Manage*
6. *Turnkey*

The difference between these is mainly related to the proportion of design undertaken by the client/owners or their consultants. From *Develop and Construct* to *Turnkey*, there is a gradual shift of design responsibility from client/owner to DB contractor.

Around the same time, Masterman (1992) identified four principal DB variants, i.e.

1. *Novated DB*
2. *Package Deal*
3. *Turnkey*
4. *Develop and Construct*

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In the *Novated DB*, the client/owner novates its design team to the successful bidder to carry out the detailed design as the contractor's consultant. The fundamental aspect of the *Package Deal* system is that, instead of providing a bespoke design solution to suit the client/owner's specific needs, it uses a proprietary building system that is unlikely to satisfy all of the client/owner's needs. In contrast, the *Turnkey* method usually involves the contractor being responsible for the total project life cycle from design through post-construction functions. With the *Develop and Construct* method, on the other hand, the client/owner develops a proportion of the design before inviting tenders.

According to Akintoye (1994), there are six DB hybrids identified in the construction procurement literature and practice in UK, comprising

1. *Traditional DB*
2. *Package Deal*
3. *Design and Manage*
4. *Design, Manage and Construct*
5. *Novated DB*
6. *Develop and Construct*

where *Traditional DB*, *Develop and Construct*, and *Novated DB* are widely encountered in practice, and with *Design and Manage* and *Design, Manage and Construct* being less prevalent.

Anumba and Evbuomwan (1997) classified DB into two main types: *Direct DB*, and *Competitive DB*. In *Direct DB*, the client/owner negotiates with a single DB contractor,

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while the *Competitive DB* allows for competition between several firms for a given project.

More recently, Beard *et al.* (2001) classified DB into three main categories: *Direct DB, Design Criteria DB,* and *Preliminary Design DB*. These variants differ from each other according to proportions of project information generated and issued by the client/owner. Other variants such as *Design DB, Draw Build, Detail Build* and *Bridging* are not regarded as DB within this framework as they are more akin to traditional *Design Bid Build* and the client/owner is again in the position of warranting the completeness of the design to the bridging contractor. Gransberg *et al.* (2006) also adopt this classification framework, the fundamental basis of which is the percentage of design provided by the client/owner. However, they also include *Design Draw Build, Bridging* and *Novated Design Build* as DB variants.

Griffith *et al*. (2003) further noted that DB could be conceptualized as a continuum ranging from *Pure DB* to *Detailed Developed DB*, which differ in the extent of design and specification development prior to contractor involvement. According to this classification framework, *Design and Manage, Design Management and Construct,* and *Novation* are grouped together into *Detailed Developed DB*.

Xia and Chan (2008) investigated the DB market of the People's Republic of China (PRC), and identified four major DB variants, including *Develop and Construct, Enhanced DB, Traditional DB,* and *Turnkey* - the major difference between these

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categories again being the proportion of design work undertaken by the client/owners or their agents before the bidding stage.

Many other studies continue to simply list DB variants (direct, competitive, Develop and Construct, Package Deal, Turnkey, etc.) but fail to effectively differentiate them from one another. Table 1 provides a summary of previous classification frameworks. The only study that approaches these differences at a more fundamental level is Turner (1999), who claims that consideration of the key variables of

1. who designs,
2. when the design is carried out,
3. who contracts with employer to construct the building

invariably produce the operational ways of procurement.

With this in mind, and in order to establish a comprehensive classification framework, all the references were closely examined in order to outline and assess the rules and logic behind the classifications. The methods used for this and the results obtained follow below.

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3. RESEARCH METHODS

After a comprehensive literature review of the classifications of the DB variants, a content analysis was conducted to examine and compare the different terms involved and

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then to identify the underlying logical rules involved. Content analysis is an observational research method that is used to systematically evaluate the symbolic content of all forms of recorded communications (Kolbe and Burnett, 1991). By simply counting the number of times an activity happens or a topic is depicted, content analysis determines the major facets of a set of data (Fellows and Liu, 2008).

As with most other research methods, content analysis begins with the identification of research questions and sampling strategy. The 19 classification frameworks summarised in Table 1 comprised the sample studied. For the first step of the analysis, the definitions of a total of 37 terms of DB variants were closely examined in order to understand fully their essential meaning. Once all the categories of variants were fully understood, those considered as having a similar meaning but different wording were grouped and incorporated into nine major terminologies. For the next step, the major rules for classification were sought and found to be (1) contract relationships among major project participants, (2) design proportion allocated between client/owners and design-builders, (3) contractor procurement methods, and (4) contract conditions. These rules were then developed further to establish a comprehensive classification framework in which the time horizon of a DB project was taken into consideration in order to facilitate the client/owners' decision-making in each project stage.

4. TERMINOLOGIES AND CLASSIFICATION RULES

The nine major categories arising from the content analysis are shown in Table 2. Upon examination of the implicit rules involved, it was found that these were used for different

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purposes in DB classification. Additionally, many researchers combined different rules to classify the DB system. For example, Akintoye (1994) used "design proportion" and "contracting relationships" to classify DB systems into their six principal variants, while Chan (2003) adopted "design proportion" and "contractor selection method" for their four categories of DB variants. Before proposing a new classification framework, a further investigation was necessary in order to understand fully the classification rules involved. Table 3 illustrates the examination of classification variables.

Please insert Table <2> here

Please insert Table <3> here

Contract relationships

The contractual relationships among the major participants help classify the different delivery systems, such as traditional *Design Bid Build*, *Integrated DB* and *Construction Management*. These describe the comprehensive process by which designers, constructors, and various consultants provide services for the design and construction needed to deliver a complete project to the client/owner (Molenaar, 2009). In what has been termed the "pure form" of DB contracting, the client/owner engages a building contractor at the outset who is then responsible for the design and construction work. In *Design and Manage* contracting, a single organization is appointed to both design the project and manage the construction operations using package contractors to carry out the actual work (Masterman, 1992). Although some researchers list *Design and Manage*

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among the categories of DB variants, this contracting method is normally regarded as a management contracting or management-oriented system.

Design proportion

The proportion of design completed by the client/owner is one of the most fundamental rules for DB classification. From the client/owners' perspective, selecting the appropriate design proportion means they have to decide when to hand over the project to the contractors. For many client/owners however, the selection of an appropriate design proportion is a difficult task. This is because the client/owner should provide neither too many design solutions (that may incur unnecessary fees and limit the contractor's innovation to the design process) nor too little design information (which may impose unnecessary expense on potential contractors and the client/owner may not obtain a satisfactory design solution in the tenders). An appropriate level of design proportion should clearly reflect the needs of client/owners but not compromise the opportunity for design innovation (Innovative Pavement Research Foundation, 2009).

Contractor procurement methods

The selection of a contractor is a critical task in any project, but especially a DB project. There are different levels of competition, from open tendering to single negotiation in the contractor selection process. The *Competitive DB* process mainly comprises one-step and two-step selection. One-step procedures provide for a competitive evaluation of technical proposals, with the contract award decision being based solely on price or qualifications and price. Two-step procedures separate the price from the technical proposals and

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comprise a hybrid approach that seeks to exploit the advantages of negotiation and competition (Hughes et al., 2006). The *Direct DB* process is qualifications-based, which involves the selection of a contractor through negotiation, and the selection of the team is primarily based on qualitative criteria such as past performance, design-builder reputation, and financial stability (Beard et al., 2001; El Wardani et al., 2006).

Specific contract conditions--Novation

Contract conditions (such as payment methods (Lump sum or GMP), contract change conditions, and penalties) establish the specific rights and obligations of the contracting parties. Novation is a new form of contract agreement/obligation wherein the client/owner stipulates the consultants to be engaged by the DB contractor to complete the design and detailing of the project in the post-contract stage (Janssens, 1991). The client/owner can impose such a condition in some DB variants. For example, *Develop and Construct* is the most common variant where novation is applied. The *Novation DB* has been adopted in Australia, U.K. and Hong Kong for several years as an innovative alternative to the basic DB system (Doloi, 2008).

5. A PROPOSED CLASSIFICATION FRAMEWORK FOR DB OPERATIONAL VARIATIONS

Although classification rules were used separately or combined for different purposes of DB classification, it is apparent that that these rules apply to different project stages. Furthermore, the underlying purpose of these classification rules echoes the client/owners' major decisions made during different project stages.

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The contractual relationships are used to differentiate DB with other non-DB methods such as traditional *Design Bid Build*, and *Design and Manage*. These are applied in the project planning stage for the classification of project delivery systems, from which client/owners may choose the most appropriate for their projects. As suggested by many researchers, the selection of project delivery systems is a complex decision-making process, and is a critical task for client/owners to ensure project success (Masterman, 1992; Chan, 2003; Mafakheri *et al*., 2007).

After the client/owner decides to employ the DB method, an important next step is to determine the amount of design work to be undertaken by the client/owners or their design consultants (Janssens, 1991; Beard et al., 2001). At this stage, the design proportion is, for the purpose of assisting the selection of the most suitable DB variant, the most appropriate means for DB classification. This is because, as mentioned earlier, the decision is far from simple. The client/owner should provide neither too much nor too little design information to potential contractors. Therefore, the design proportion is regarded as the most fundamental rule for the classification of DB variants, which mainly include *Develop and Construct, Enhanced DB, Traditional DB* and *Turnkey*.

In the bidding stage that follows, the contractor selection method is used to classify the DB system into different degrees of competition. The DB method provides client/owners with an opportunity for alternative methods of selection. With different contractor selection methods, the design-builder can be selected based solely on qualifications and

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price, or a combination of the two, which are reflected in *Direct DB* and *Competitive DB* approaches. As with the novation agreement, the client/owners should decide whether to include it in the contract. This is because, although the novation contract helps to maintain the consistency of design work, it may prevent the design-builders being innovative (Janssens, 1991).

Overall, these three classification rules apply to different project stages, and can be used for different classification purposes. Even though researchers can adopt any of them to classify the DB variants, it is likely that a classification framework taking the project time horizon into consideration will be more logical and clearer.

Figure 1 shows the proposed framework for the classification of DB variants. This framework adopts the view that DB classification changes with time. The DB variants are classified for three phases of a project, namely the project planning, design, and bidding stages. Moreover, given the condition that many categories of DB variants have different terms used by different researchers, the terminologies adopted in this framework are fully representative, easily identified and widely accepted/used in the construction industry.

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6. DISCUSSION

In the proposed framework, the classification of DB variants changes in different project phases. In the project planning stage, the contractual relationships are mainly used to

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differentiate DB with non-DB delivery systems. Client/owners are obliged to choose one of the systems to deliver their projects. As related earlier, among these categories of delivery systems, some researchers (Janssens, 1991; Akintoye, 1994; Chappell and Powell-Smith, 1999; Carmichael, 2000) list *Design-and-Manage* among the DB variations. However, many agree that this is not strictly a DB system. Chappell and Powell-Smith (1999), for example, describe it as 'simply an architect-led version of the contractor-led construction management', while Masterman (2002) refers to *Design-and-Manage* as one of the management-oriented procurement systems that also include *Management Contracting* and *Construction Management*. Cook (2003), on the other hand, describes the system as combining some of the attributes of DB with those of generic management contracts, and Janssens (1991) identifies two forms of *Design-and-Manage* - one being DB and the other a form of management contract - with the distinction being in the nature of the contract involved. All these add confusion to DB client/owners. As there is no single entity contractually responsible for both design and construction, the *Design-and-Manage* is classified as the non-DB system in this classification framework.

After selecting the DB system, the client/owners or their consultants need to prepare a DB enquiry or other form of solicitation in order to engage a contractor. As mentioned above, the client/owner should decide upon the level of design in the DB enquiry. This is clearly very important for, as the American Association of State Highway and Transportation Officials (2005) point out, the level of conceptual or preliminary design completion prior to appointing a DB contractor influences the degree of success of DB contracting. Similarly, the USA Federal Highway Administration (2006) also advocate

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that, after choosing DB contracting to deliver a particular project, contracting agencies must decide on an appropriate level of preliminary design to initiate the DB contract. To do this, the amount of design should be commensurate with the needs of the client/owners but without overly compromising the opportunities for innovation (Innovative Pavement Research Foundation, 2009). As a result, the decision poses challenges to many client/owners. Furthermore, the selection of design level significantly influences the contractor selection methods used in the following project stage. When minimal design information is provided to potential contractors, the final selection of the DB contractor is usually qualification-based. Conversely, one-step and competitive bidding is often adopted when a large percentage of design work is already completed. Therefore, the design proportion is regarded as the most fundamental rule for the classification of DB operational variations in the new framework. The following section provides a closer examination of the four major categories of DB operational variations in the pre-tender stages.

Classification of DB variants based on different design proportions

At the pretender stage, four major categories of DB variants have been proposed according to the different design proportions that DB client/owners undertake. In *Develop and Construct*, client/owners need to engage their design consultants to do more than 50% of the design work, while the DB contractor is responsible for the remaining design work (construction documentation) and construction. In *Enhanced DB*, client/owners or their design consultants finish 10%~30% of the design work (the scheme design). The DB contractor is responsible for the remaining design development, construction

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documentation and construction. With *Traditional DB*, the contractor takes full responsibility for all the design and construction. The client/owners may prepare the brief/enquiry themselves or leave this to the contractor. In the *Turnkey* method, the contractor provides everything including the commission and/or handover after the construction phase. All that remains for the client/owner to do is simply 'turn the key' to open the door.

Develop and Construct is shorthand for '*develop the detail from the employer's design and construct the works*' (Janssens 1991). The DB client/owner undertakes the design work at least to the design development of the building. For some (Beard *et al.,* 2001), this is not a DB method at all as the client/owner undertakes too much design work (about 50 percent). Although this method may preclude the DB team from any significant creativity and innovation, it is widely adopted by many client/owners to take advantage of DB and the traditional delivery method. In U.K., *Develop and Construct* is widely used in the DB market although DB contractors do not favored it (Akintoye, 1994).

Enhanced DB is an emerging procurement system that has attracted much enthusiasm in Hong Kong in particular. Although the term is not widely used, both Mo and Ng (1997) and Chan (2003) accept it as a genuine DB variant wherein the contractor is contractually responsible for design development, working details and construction work. *Enhanced DB* gives the client/owner greater control, while preserving the time saving advantages of the more pure forms of DB. Furthermore, many of the advantages of *Enhanced DB* that

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are particular to Hong Kong are also considered appropriate in other parts of the world too (Chan, 2000).

With the *Traditional DB,* the design-builder takes full responsibility for design and construction. In terms of design proportions, the DB contractor is responsible for the design work at least up to the scheme/concept design stage. The word 'traditional' is especially designated to this variation to distinguish it from 'DB', which now embraces the whole DB variation spectrum.

For the *Turnkey* method, the contractor provides everything and all that the client/owners have to do is to 'turn the key' to use their buildings. The term *Turnkey* and its concept is widely accepted in the industry and the *Turnkey* method is traditionally applied to major industrial projects (Janssens, 1991). As for the *Package Deal*, although there are minor differences between some different forms, they all share the same type of contracting where the contractor does everything for the client/owner. Therefore, this similar arrangement is incorporated into the *Turnkey* variant.

The *Direct DB* and *Competitive DB*, on the other hand, describe the way in which DB contractors are selected. After seeking requests for proposals, client/owners should apply the appropriate method to solicit the involvement of potential DB contractors. In *Direct DB*, the client/owner negotiates with a single contractor who is responsible for delivering the project. This normally involves a qualifications-based selection, and the potential contractors usually have an established relationship with client/owner involved (Anumba

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and Evbuomwan, 1997). In the *Competitive DB*, client/owners use a one-stage or two-stage selection process to identify and engage appropriate design-builders that are most likely to offer "best value" for the project.

7. CONCLUSIONS

Selecting an appropriate DB variant is critical to project delivery but also poses many challenges to client/owners, and the development of a consistent and coherent framework is clearly an important step in aiding this process. Furthermore, previous research examining DB variants has been largely restricted to their different contractual requirements, while it is clear that the analysis of operational differences supports the decision process better than contractual differences.

The paper has reviewed a number of classification schemes proposed in the literature and examined their applicability to DB variant selection. It explores the implicit underlying classification rules and assesses their utility for the purpose of DB classification, before extending them to develop a new classification framework. In this proposed classification scheme, the DB operational variations are classified according to different contracting relationships, design proportions, contractor selection methods and specific contract conditions at different projects stages.

The research findings provide some practical and theoretical implications. The investigation of the rules implicit in the different extant classification frameworks helps to provide DB stakeholders with guidelines to examine various operational alternatives of

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the DB method. In particular, for those experienced client/owners who have clear project objectives in the early stages, it may be beneficial to provide more scope for design work to design-builders and gain from the innovation and economies of scale that may result. In soliciting expressions of interest from potential DB contractors, therefore, it is recommended to provide performance specifications rather than descriptive specifications. In contrast, inexperienced client/owners are more likely to benefit from the reduced risks involved in engaging a design consultant to define the project scope and complete a certain amount of design work before handing over the project to design-builders. Additionally, the classification rules in different project stages imply that client/owners should make right decisions concerning DB selection, design allocation, contractor procurement, and specific contract arrangements.

Finally, it should be noted that, in addition to a deepened understanding of the DB system, the classification framework adds knowledge to the DB field and is anticipated to provide a benchmark for further research, especially in selecting the appropriate DB variants for client/owners.

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Table 1 Summary of the classification of DB variants

Previous Studies	Design-build operational variations																					
	Develop & construct /Design develop & construct	Design-build 1-stage and DB 2- stage	Negotiated design-build	Design and manage	Turnkey method	Direct design-build	Design criteria design-build	Preliminary design design-build	Competitive design-build	Design and build /Design and construct/Traditional DB / Pure DB	Package deal	Design manage and construct	Novation / Novated Design-build	super-turnkey, design-build-lease	bridging, design draw-build	Enhanced D+C/ Enhanced DB	Detail D+C, Design-develop-and-construct, design-document-and-construct, document-and-construct	Managing contractor	Detail-developed DB	BPF	BOT/BOOT/BOO/ Build-own-mana
CIOB (1988)	√			√																√	
Janssens (1991)	√	√	√	√	√																
Masterman(1992)	√				√					√	√		√								
Akintoye (1994)	√			√	√					√	√	√	√								
Anumba and Evbuomwan (1997)	√					√			√				√								
Mo and Ng (1997)										√			√			√					
Chappell, Powell-Smith (1999)	√			√	√					√	√										
Rowlinson & McDermott (1999)				√	√					√		√									√
Turner (1999)	√				√	√			√	√	√										
Carmichael (2000)				√	√					√							√	√			
Beard et al. (2001)						√	√	√													
Quatman (2001)					√									√	√						
Griffith et al. (2003)	√			√						√		√	√								
Cook (2003)	√				√					√	√								√		
Chan (2003)						√			√				√			√					
Walker and Hampson (2003)					√					√			√								
Hughes et al. (2006)										√	√		√								
Gransberg et al. (2006)						√	√	√					√		√						
Xia and Chan (2008)	√				√					√						√					

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Table 2 Examination of different terminologies

Major terminologies	Definition	Other terms with similar meaning
Design-build	The design-builder takes full responsibility for all the design and construction	Design and construct, traditional design-build, pure design-build
Develop-and-construct	The client/owner selects an architect or engineer to program and partially design the project, usually through design development, which is then developed into detailed drawings by the design-builder	Bridging, Develop-and-construction, Design develop and construct, Detailed design and construct, Design document and construction, Document and construction, Preliminary design design-build, Detailed develop design-build
Enhanced design-build	The client/owner develop the design to a point where the significant planning issues were determined, usually through schematic design, and require tenders to submit a confirming bid based on this design.	Enhanced design-construction, Design criteria design-build,
Novation design-build	The client/owner stipulates the successful contractor to engage his designers to complete the design as the contractor's consultants.	Novated design-build, Novation design and construct
Turnkey	The contractor provides everything including, e.g. commissioning and handover.	Package deal (particularly refers to systems of industrialized building)
BOT	A project financing approach, wherein a private entity receives a concession from the public sector to finance, design, construct, and operate a facility for a period of time stated in the concession contract. It is NOT a delivery method.	BOT, BOOT, BOO, Build-own-manage, Design-build-lease, Design-build-own-operate, Design-build-own-operate-manage
Design and manage	A contractor is appointed to design and mange the subcontracting construction.	Design manage and construct, Managing contractor
Competitive design-build	It allows for competition between several contractors interested in a given project	Design-build of single stage tender Design-build of two-stage tender.
Direct design-build	The client/owner negotiates with a single contractor who is then charged with designing and constructing the required facility	Negotiated design-build

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Table 3 Examination of classification variables

Classification rules	Classification purpose	Operational variations	Project stages
Contract relationships among major project participants	To classify different project delivery systems in project planning stage	Design-bid-build, Design-build, Construction management Design and manage	Planning and definition
Design proportion allocated between client/owners and design-builders	To allocate design responsibilities, and determine when the design is sufficient to hand over to design-builders	Develop-and-construct, Enhanced design-build, Traditional design-build, Turnkey	Design
Contractor selection method	To define the process of selecting DB participants and purchasing their services and goods	Direct design-build, Competitive design-build DB of single-stage tender DB of two-stage tender	Procurement or bidding
Specific contract conditions (Novation contract)	To set specific right and obligations of contracting parties	Novation design-build	

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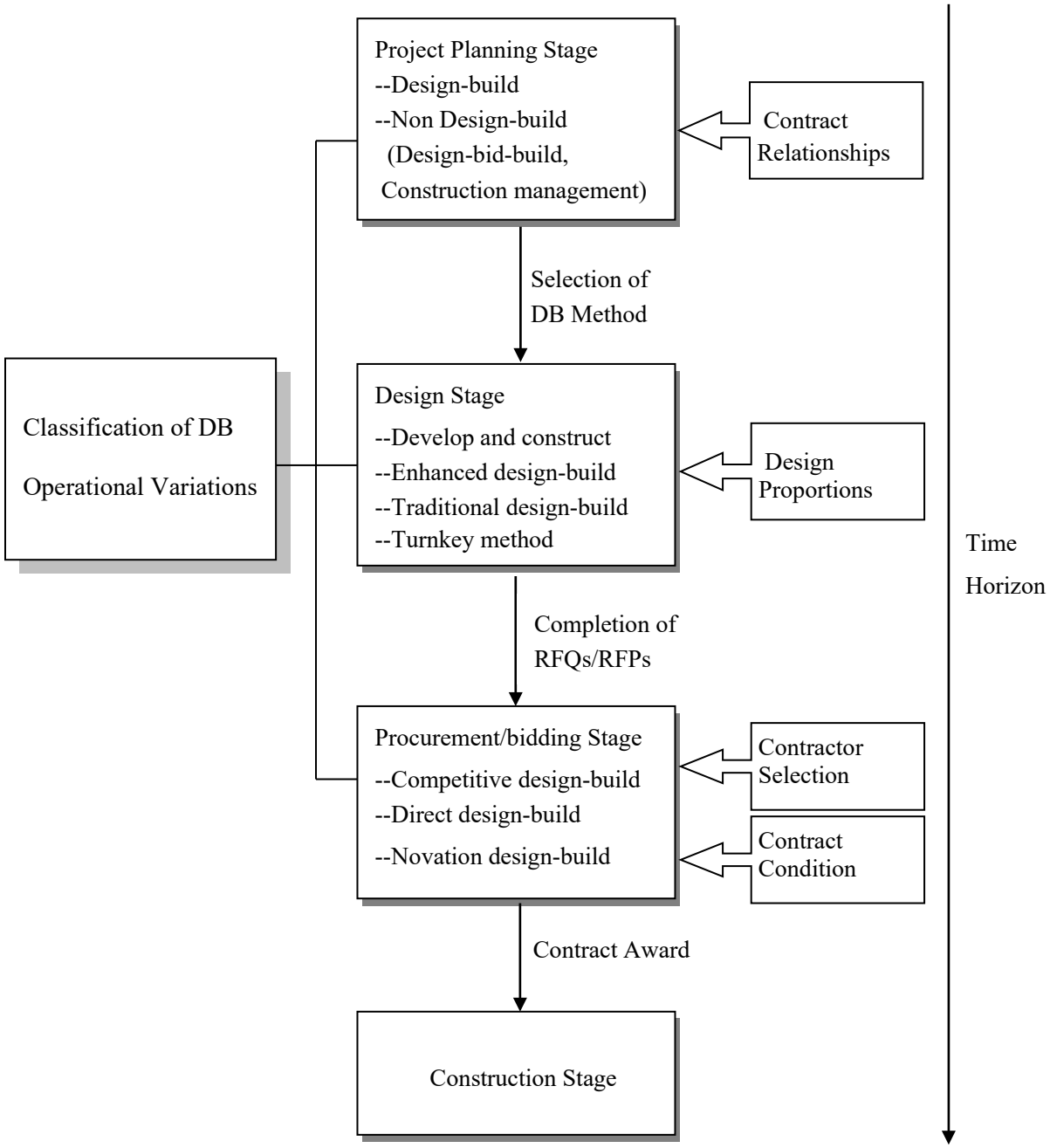

Figure 1 Classification framework of DB variants

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