JAPANESE DESIGN-BUILD:
AN ANALYSIS OF ITS UNIQUENESS BASED ON RESPONSIBILITY AND RISK ALLOCATION IN CONSTRUCTION CONTRACTS

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Abstract

Japanese Design-Build (DB) is unique and different from the DB implemented in other parts of the world, especially in advanced western countries like the US and UK. The purpose of this research study is to analyse the uniqueness of Japanese DB, based on allocation of responsibility and risk in the standard construction contracts. A comparative analysis was carried out to ascertain the similarities and differences between Japanese DB contract and Japanese traditional as well as western contracts as represented by the standard contract forms of the American Institute of Architects and the Joint Contracts Tribunal. Contract clauses are extracted and broken down into eight elementary components in order to clarify the responsibility statement. For each responsibility, the appropriate project phases (whether pre-design, design, construction or completion of each responsibility), risk contained in the responsibility and degree of each party's involvement were indicated. To make the three contract series with different configuration structures comparable, ten headings of contractual issues were established. The comparative analysis revealed that the differences between Japanese and western contracts basically revolve around the clarity of the responsibility description, the process and approach of decision making, and the degree of involvement by the Owner. The finding supports the hypothesis that the Japanese DB contract does not properly represent the actual Japanese DB; instead, it suggests that the Japanese DB is closer to the Japanese Traditional method. The hypothesis that the Japanese DB is nothing like the DB in other global DB standard contracts, as represented by the AIA-DB and JCT-DB, was also verified. It has been validated that the Japanese DB is close to the Construction Manager as Constructor of the AIA. The Management Contract of the JCT is found incomparable to the Japanese DB due to different risk placements despite being designed for the single responsibility of contracting construction contracts. Based on a comparative analysis, contractual issues and allocation of responsibility and risk (which are essential for a standard contract for inclusion in a future Japanese DB contract) are highlighted.

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List of Abbreviations

AIA	American Institute of Architects
BCS	Building Contractors Society
BMM	Benchmarking and Metrics
CE	Control Estimate
CM	Construction Management
CMA	Construction Manager as Adviser (contract form)
CMC	Construction Manager as Constructor (contract form)
CMr	Construction Manager
CMrC	Construction Manager as Constructor
DB	Design-Build
DBB	Design-Bid-Build
DBr	Design-Builder
DQI	Design Quality Indicators
GC	General Contractor (Genecon)
JCT	Joint Contracts Tribunal
JFFCA	Japan Federation of Four Construction Association (JFFCA)
KPI	Key Performance Indicators
MC	Management Contract/ Management Contracting
MCr	Management Contractor
WC	Works Contracts
WCr	Works Contractor
R&D	Research and development
TPQ	Total product quality
TR	Traditional
GMP	Guaranteed Maximum Price
UK	The United Kingdom
US	The United States

Chapter 1

Introduction

This first chapter describes the uniqueness of Japanese DB which serves as a background to and motivation for this research study. Subsequently, it lays out the framework, scope, objectives and hypotheses that guide this research. The structure of the thesis will allow for an overview of the overall flow of this study.

1.1 Background to and motivation of the research study

(a) The unique characteristics of the Japanese Design-Build

Design-Build (DB), along with Design-Bid-Build (Traditional method) is the most prevalent project delivery method in Japan. The DB being implemented in Japan (Japanese DB) is different from the DB that is implemented in other parts of the world, especially in advanced western countries like the US and UK. The level of complexity and risk of DB projects distinguishes the Japanese DB from its western counterpart. In the US, DB is typically applied in low-risk construction project. In Japan, however, DB is mostly applied in large and complex construction projects (Ando, 2011). DB is rarely adopted in Japanese Public Construction Works except for challenging projects (Saito, 1999). The higher capability of the general contractor (Genecon, GC) or Design-Builder (DBr) in providing full design and construction services as well as the risk-taking attitude of the owner and DBr are another two key characteristics that make the Japanese DB unique when compared to its western counterpart (Ando, 2011). Figure 1.1 depicts these three unique characteristics.

The characteristics of the Japanese DB have been shaped in conjunction with the formation of certain customs and institution within the Japanese construction industry during a period of economic growth of the 20th century. During that period, the GC willingly incurred the risks of constructing high quality facility or building at a price with small or no profit in the first (few) projects with one or more owners (Ando, 2011). It is said that during that period, the agreed contract price allowed for reasonable changes to be made for free (Sjoholt, 1999). All these strategies are to please the owner and to gain the owner's trust which is a prerequisite for securing one project after another from the owner. With such a good long-term relationship with the owner, transaction risks inherent in every project transaction with the owner can be minimised. In order to be able to construct a facility or building at the quality and price requested by the owner, and yet still be able to make a reasonable profit, the GC has to find ways to come up with a better quality product at a lower price. This provides an impetus to the involvement and investment of the big GCs in research and development (R&D) activities made possible through their huge and advanced research institute. With the initial objective of reducing defects in their products, their R&D has expanded into innovation and into the broader scope of other construction-related fields of research. Scientists and specialists from a broad range of disciplines are employed with the objective of enhancing the capability of curbing and resolving any problems or possible risks they may face in their projects (Ando, 2011).

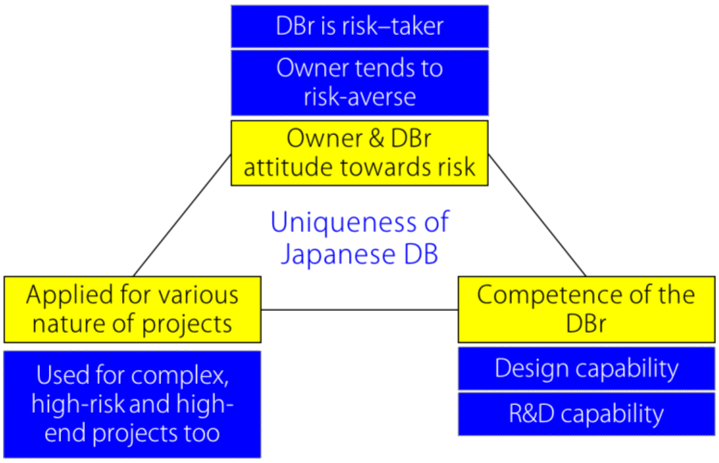

Figure 1.1: Unique characteristics of the Japanese DB

In Japan, the capability to design is a prerequisite for the GC, even in the Traditional method. The owner employs an architect to prepare the design and specification which generally tend to be incomplete and uncertain. The owner and his architect prefer to avoid taking any risks related to the design. Instead, the GC is given the trust as well as the risks to complete the design and specification. Therefore, it is necessary for the GC to increase his design capability by employing architects and other designers. A higher level of design capability becomes more critical for DB projects, especially where the design and specification are fully prepared by the GC. By having an in-house design team who is allowed to partly or fully produce the design and specification, the GC has the flexibility to specify the project pursuant to his best knowledge and skill so as to satisfy the owner's requirement with minimum exposure to risks. The risks arising from a design prepared by the owner's architects can be eliminated. Consequently, a better profit margin for the Contractor and better benefit through a harm-free design for the owner can be achieved (Ando, 2011). In the West, particularly in the US, the GC, except in DB contract, does not perform design work except when required to provide shop drawings and, where necessary, design for a portion of the work through a licensed design professional based on the performance and design criteria specified by the owner's architect (AIA, 2007).

As has been discussed so far, the owner tends to be averse rather than take the risk. This risk-aversion attitude underpins the custom whereby the owner heavily relies on the GC. As to the project brief, the default is for the owner to come to the GC with an uncertain or imperfect brief or without any brief at all. This is sensible in Japan but not in the West, where providing a clear project brief is one of the owner's critical obligations (Ando, 2011). According to Yashiro (1999), Japanese large-size clients tend to provide imperfect project brief, especially in the case of design-build projects with specific GCs with whom they have had long-term relationships. The clients expect that the GC would understand their implied requirements. Having deliberately considered the input by the GC, who has advanced knowledge on project management as well as technical issues, clients could then finalize the project brief so as to benefit innovative construction technology. The design and construction services offered by the GC also covers planning, budgeting, scheduling and other construction management services necessary for execution of the construction project. The GC never specifies the costs of these complementary management services; instead, the costs (fees) are dispersed in the contract price as a sort of hidden cost (Sjoholt, 1999). The owner perceives this complement services as provided for free by the GC. Therefore, the owner is not eager to hire management consultants for a service which has been offered by the GC for free. Besides, the owner is accustomed to the practice of the GC doing everything for him (Ando, 2011).

The established custom and institution previously described have proven to be appropriate and successful for Japan which experienced tremendous growing market conditions. However, the desirable growth period did not last for long, as the Japanese economy fluctuated since the late 1990s towards a rather slow growth, followed by stagnation conditions and only in recent years reached sustained recovery. This economic landscape has shifted Japan's construction industry, which remains one of Japan's most significant industries even today, from a supply-driven market to a demand-driven one. Earlier, Yashiro

(1999) and Furusaka et al. (2002) highlighted that Japan's transforming economy and diverse client demands would intensify pressure to change the procurement system in Japan. The clients seek a project delivery method that is appropriate for innovative construction technology with reasonable adaptability and transparent costs under the competition of general contractors instead of relying on a specific contractor with a long-term relationship (Yashiro, 1999). The demand and needs for sophisticated building technology are also increasingly complex and diversified. All these changes and factors necessitate rethinking and restructuring the Japanese DB in terms of how it can be optimized with the appropriate characteristics and project conditions in a changing market. At the same time, it is important to appreciate its advantageous features for possible application in such market conditions.

(b) Standard construction contract for the Japanese DB

In other well-established and sophisticated construction industry like the US and the UK, project delivery systems have tremendously evolved over the years. The project delivery methods have been developed and diversified to deal with the different ways of key players such as owners, contractors and consultants view, accept and wish to allocate risks. Design-bid-build (Traditional), Design-Build (DB), and Construction Management (CM) are the three principal project delivery systems used in the US and the UK. CM-at-risk in the US and Management Contract in the UK are common variants of the CM delivery system in which the contractor has functional responsibility as consultant or adviser to the Owner. Specific standard contract forms have been established for each project delivery system based on a consideration of the attitude of contracting parties toward risk, the nature and scope of the contract, and the variety of projects.

As previously mentioned, Japan's Traditional and DB are the two dominant project delivery systems. In spite of the fact that DB has been used for many years, initially there was no standard contract available intended for DB projects (Saito, 1999). Only later in 2001 did the Building Contractors Society (BCS) of Japan introduce the Design and Construction Service Agreement in an attempt to develop a standard contract form meant for DB projects. The BCS contract was developed based on a Japanese standard contract form for traditional contract, namely, the Standard Stipulations for Construction Works Contract of Japan Federation of Four Construction Associations (JFFCA or Shikai Rengo). It is worthwhile to study how the contents of the BCS contract represent the actual Japanese DB and resemble a global DB standard contract form. Allocation of responsibility and risk between Owner and Design-Builder is one of the central aspects in evaluating the Japanese DB. Considering that the Japanese DB system is unique and is not a typical DB, it is therefore necessary to compare it with project delivery systems and standard contract forms used in the US and UK. Whether or not the BCS contract meets the global DB standard contract, this can be ascertained through such a comparison, the apportionment of responsibility and risk, and other essential features that are significant as a standard contract which can be identified for consideration toward inclusion in the Japanese contract.

(c) Performance and appropriateness of the Japanese DB

A research by Xiao and Proverbs (2002) reveals that Japanese contractors achieve shorter construction times, higher levels of time certainty, and higher levels of client satisfaction than their UK and US counterparts. Long-term relationships with clients, effective schedule planning and monitoring techniques, working more closely with subcontractors, and preference for negotiation are among the key factors influencing performance. They generally reflect some of the parameters of good performance among Japanese contractors in completing projects for their clients. In the context of the Japanese DB, a higher project performance can sensibly be offered to the Owner by the GCs through their full design and construction services anchored with R&D capability. To date, there is no study that has focused on the performance of DB in Japan. Therefore, it is worthwhile developing a framework in order to measure or evaluate the performance of DB projects. Performance of projects employing the Japanese DB in comparison to the Traditional method based on various parameters evaluated by different stakeholders will provide additional insights into the Japanese DB. The characteristics and types of project appropriate for the Japanese DB ought to be identified in exploring the room for survival and sustainability of the Japanese DB in the changing market of Japanese and global construction industries.

1.2 Framework and scope of the research study

Three unique characteristics of the Japanese DB provide the basis for two scopes of this research study, as depicted in Figure 1.2. The main scope revolves around the examination and analysis of construction contract so as to ascertain the project characteristics and allocation of risk between owner and DBr. Standard contract forms are limited to those used for architectural works (building projects). Standard contract forms of the American Institute of Architects (AIA) and the British Joint Contracts Tribunal (JCT) (typical of western contracts) were chosen to be compared with the Japanese contracts.

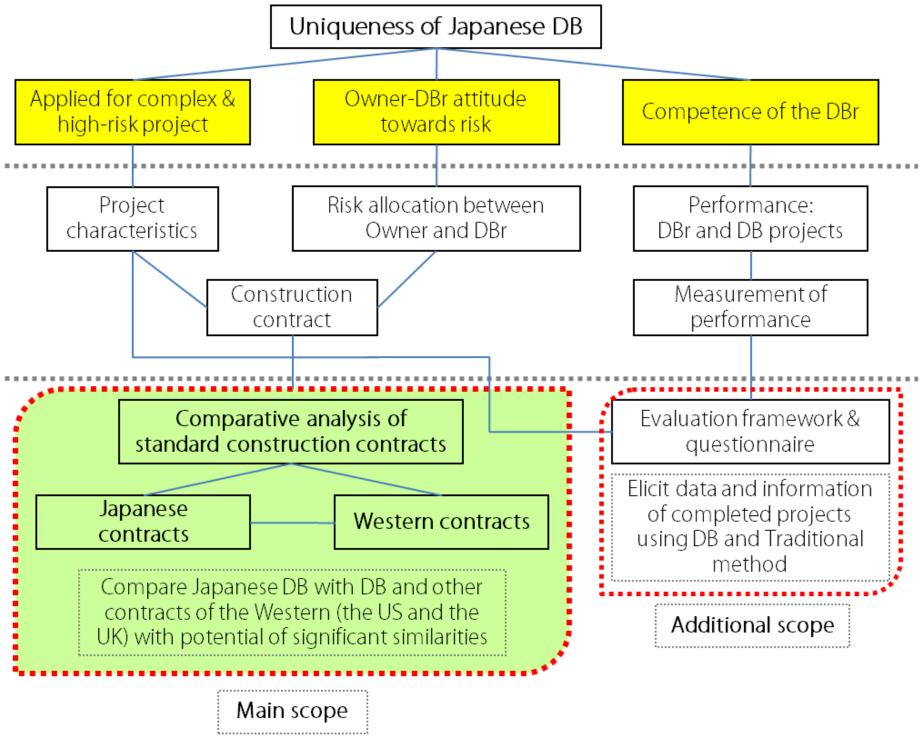

Figure 1.2: Research framework and scope

The competence of the DBr comprises its own performance as reflected in the performance of the projects. In response to this issue, the second scope, which is treated as an additional scope, revolves around evaluation framework in measuring project performance. Due to some constraints, this research study will only focus on the development of a questionnaire to acquire data and information related to the overall project performance, nature, type, and characteristics.

1.3 Objectives

The purpose of the first part (main scope) of this research study is to analyse the uniqueness of the Japanese DB based on allocation of responsibility and risk in the standard construction contracts. By acquiring an understanding of how each contract approaches the contractual issues and allocates the responsibilities and risks among the principal contracting parties (mainly between Owner and Contractor), this research outlines the following objectives:

- To ascertain the similarities and differences between the Japanese DB (BCS-DB) and the Japanese Traditional (JFFCA) contracts.
- To ascertain the similarities and differences between Japanese and Western contracts.
- To highlight the contractual issues and allocation of responsibility and risk (substantial for a standard contract) for inclusion in the Japanese DB contract.

The purpose of the second part (additional scope) of this research study is to develop a questionnaire for collecting the information and data necessary for measuring the Japanese DB performance and identifying the nature, characteristics and types of DB projects in Japan. The questionnaire is developed to achieve the following objectives:

- To ascertain the nature and characteristic of construction projects that employ the DB method
- To ascertain the types of construction projects appropriate for the Japanese DB
- To measure the total product quality performance of completed DB projects.

1.4 Hypotheses

The first part of this research study is carried out based on the following hypotheses:

- The Japanese DB is not typical. It has distinct characteristics compared to a western DB. Consequently, the projects that suit the Japanese DB are of a different nature and characteristic from the projects employing a western DB. In summary, the Japanese DB is unique and distinct from the DB implemented in the US or UK.
- BCS-DB contract is nothing like the DB and other global DB standard contracts. BCS-DB does not properly represent the actual Japanese DB; instead, it indicates that the Japanese DB is closer to the Japanese Traditional method.
- In some sense, the Japanese DB is closer to the Construction Manager as Constructor of the AIA[*1] (AIA-CMC) and Management Building Contract of the JCT[*2] (JCT-MC) rather than the DB of either one. It may also have substantial similarities with the AIA-CMC and JCT-MC.

*1 American Institute of Architects, US *2 Joint Contracts Tribunal, UK

1.5 Organisation of thesis

Chapter 1 (Introduction) provides an overview of this research study. The background and motivation for the research study, the hypotheses and scope of the research, as well as the structure, aims and objectives of the thesis are outlined.

Chapter 2 (Formation and Characteristics of the Japanese DB) elaborates on the formation and characteristics of the Japanese DB as highlighted in Chapter 1.

Chapter 3 (Project delivery method, construction contracts and risks) looks into project delivery systems in Japan, the US and UK as well as construction contracts, and concept of risk allocation.

Chapter 4 (Research methodology for comparison of contract forms) explains the structure of comparison and approaches employed in breaking down the contract clauses, clustering the contract clauses into 10 headings, and preparing a database of responsibility statements.

Chapter 5 (Comparative analysis of standard contract forms) presents and discusses the analysis which is structured into six (6) combinations of comparison.

Chapter 6 (Measurement of project performance) briefly introduces performance measurement within the context of the construction industry and established benchmarking. This chapter explains the development of a questionnaire based on established benchmarking to measure performance and to identify the nature and characteristics of DB projects, particularly in comparison with Traditional projects from selected construction projects in Japan.

Chapter 7 (Discussion and conclusion) concludes this research by reflecting on the limitation of the research and suggesting areas for further research.

1.6 Chapter summary

The three unique characteristics of the Japanese DB provide the motivation for this research in terms of investigating how they are represented in the Japanese DB standard contract form and how they make the Japanese DB distinct from its counterpart in the West as reflected in global standard contract forms. These key characteristics also conjure up the necessity of developing an evaluation framework for measuring the performance and identifying the appropriateness of the Japanese DB. The chapters of this thesis are also summarised.

Chapter 2

Formation and characteristics of the Japanese DB

This chapter explains how certain customs and institutions in the Japanese construction industry have been formed in response to the economic conditions of the 20th century. The theory on the formation of the Japanese DB, based on the concept of risk and relational rent by Ando (2011), is the basis of discussion on this matter. This chapter begins with a look at the concept of risk and rent, and then discusses the customs and institutions in terms of contractor, owner, and designer.

2.1 Risk and relational rent

To begin with, it is important to first understand that the basic schema of risk allotment between seller and buyer is influenced by the economic and market conditions. In the context of this discussion, commodity or good being demanded and supplied is ‘service’. Typically, in the construction industry, the buyer is the owner who demands that necessary services such as design and construction be provided by the seller (i.e. contractor) in order to realize a project that creates a unique product (a building or facility for example).

Typically, during boom time (growth period), there are many projects available that need the service of contractors. This creates a problem for contractors to satisfy the demand for services arising from the vast number of projects in the market, meaning that demand exceeds supply. Therefore, ideally, during the growth period, the market is governed by the seller (supply side). Under this ‘seller’s market’, when a transaction (please refer to 2.1.1 for elaboration) takes place between the owner and the contractor, the owner will always have to contend with risk as illustrated in Figure 2.1 (period of growth). It is hard to invite good contractors, as they are busy with many other projects on hand. In agreeing with this, Ashworth (1996) highlights the fact that where the risk involved is high, it will be even more difficult to persuade contractors to tender for the work. Due to this scarcity of service, the contractor is likely to offer a higher price with no guarantee it can deliver the project on time. Otherwise, the owners may need to delay their projects at such a time, waiting for a more favourable economic environment to launch the project. If not, quality, cost, and time risks will be on the owner.

Conversely, during recession time (shrinking period), there are very limited projects available in the market for a huge number of contractors looking for projects. The services of contractors are kind of idle due to the lack of work available or even worse no work at all. This creates a situation in which supply of services exceeds the demand, meaning that a 'buyer's market' is created where buyers have an advantage over sellers in price negotiations. Owners may request contractors to provide good quality services at a lower price. Ashworth (1996) points out that in such situations, contractors are sometimes prepared to do the work at very low cost. In this case, the owners face no risks but contractors are always at risk, either from not getting any projects from the owners or securing projects at a low price. The risk allocation is illustrated in Figure 2.1 (shrinking period).

Interestingly, in Japan, what actually happened during boom time was that contractors always faced the risks. The initial profile of transaction risk is similar to the one for the shrinking period, as illustrated in Figure 2.1. All the risks (quality, cost, and time associated risks) are actually transferred from owner to contractor based on the willingness (according to the will) of the contractor to take those risks without any pressure from the owner. On what sort of ground could this situation happen?

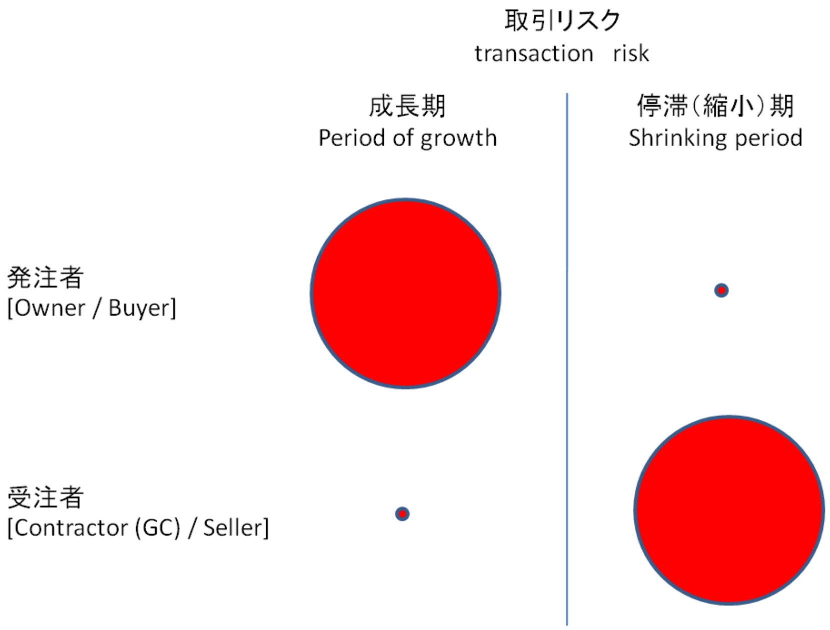

Figure 2.1: Transaction risk during growth and shrinking period (Ando, 2011)

As a basis for the subsequent explanation on the situation in question, understanding the concept of ‘relational rent’ is a prerequisite. The relational rent concept is based on a study of the Japanese automobile industry’s competency. ‘Rent’ in this context means the expected unknown future profit yielded through additional investment which is earned by the contractor in addition to normal profit. Normal profit is something contractual, stated at the time of making and signing a contract, whereas a long-term relational specific rent can only be acquired through a good long-term and strong relationship between ‘specific owner’ and ‘specific contractor’.

In the case of the automobile industry, the owner is the assembling company (automobile maker, manufacturer or assembler), Toyota or Honda for instance, and contractor is the supplier of parts. A car design normally lasts 3 to 4 years until the next model change is required. Hence, one contract between the assembler and supplier lasts from 3 to 4 years, with a fixed price and more or less fixed design (currently, it is reported that the contract is for 2 to 3 years). Any major change takes place at the time the model changes. At this time, the assembler requests the supplier to give better quality products and better quality parts than the one for the previous model at lower prices. In the attempt to satisfy the assembler’s requirement, the supplier puts in an additional investment to produce and manufacture better quality products and parts at lower prices. If the supplier is capable enough, it succeeds in supplying better products and parts at even lower prices, the difference in the profit it acquires is the rent. The rent means that the extra profit throughout the 3 to 4-year contract is gained through the additional investment. The rent can be shared by the assembler and the supplier. But mostly, since the assembler does not know what investment the supplier will actually put in, the amount of investment is unknown, so that the rent is unknown as well. Normally, the entire rent is received by the supplier, and nothing goes to the assembler. Eventually, the supplier acquires the extra profit and the capability to design better products.

This is the mechanism that encourages the supplier to take the risk, provided that the rent is foreseen by the supplier. During a period of growth, the rent looks bigger from the supplier’s perspective, as depicted in Figure 2.2. The rent is not apparent and can only be seen by the supplier. The supplier sees that the rent (probable profit) is bigger than the risk (probable loss). Likewise, in the context of the Japanese construction industry, this explains why the contractor ended up with the risk which was originally intended for the owner to carry during the period of growth. The contractor opted for a risk-taking attitude by putting in additional investment to acquire a foreseeable, bigger probable rent than probable loss.

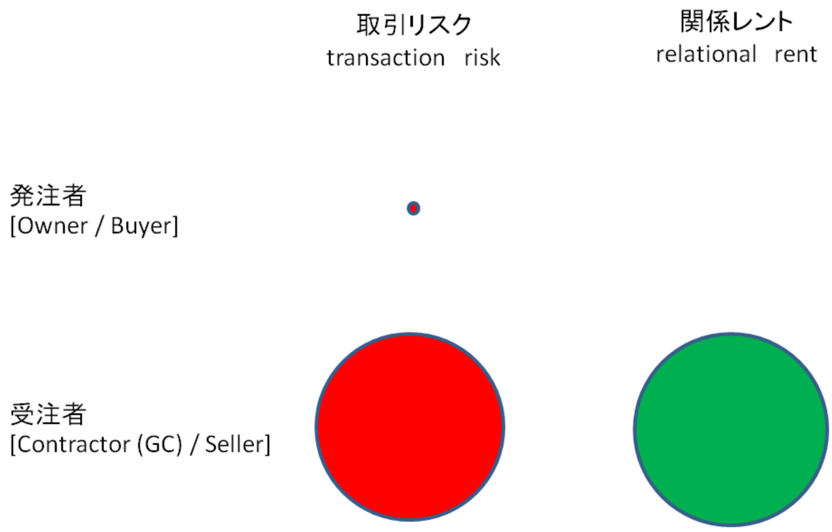

Figure 2.2: Transaction risk and relational rent during period of growth (Ando, 2011)

If there is continuous growth, the contractor will secure project after project from the same owner based on the trust and good relationship established between them. And this is what actually happened during the boom time. Hasegawa (1988) reported that during the high-growth economic period, contractors were able to obtain orders, especially private orders, almost effortlessly. Large general contractors got 80 percent of orders without having to compare with rival bids because long-standing business connections with clients were respected. There is certainty in having the next project with the owner, thereby avoiding a vicious cycle in securing projects. Even if the contractor fails to make a profit from a project because of taking risks and putting in more investment, the losses would be partially and eventually completely repaid in the next or other future projects with the owner. The transaction risks inherent in each specific transaction between owner and contractor is now more appropriately termed as structural risks to represent the overall risks contained in the repetitive transactions between them. The risks faced by the contractor are minimised, and the contractor always gains a big and preferable circle of rent albeit a win-win transaction for both owner and contractor. The more successive projects there are with the owner, the more rent that can be accumulated from each transaction, and eventually there will be no structural risk in the market. To further clarify, such profiles of structural risk and relational rent under this condition are illustrated in Figure 2.3.

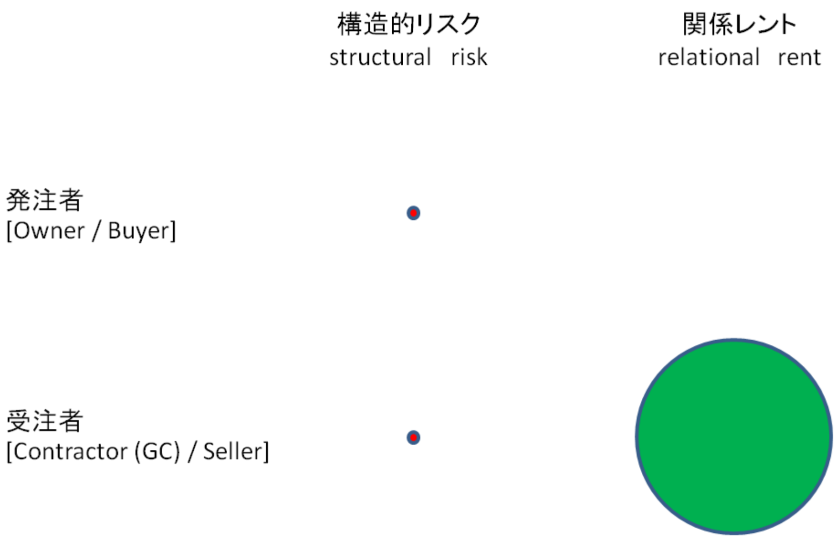

Figure 2.3: Structural risk and relational rent during period of growth (Ando, 2011)

The prosperous period finally came to an end and transitioned into a shrinking market condition (which is now). It is observed that the risks allotment goes in the opposite direction. The market is governed by the buyer (demand side) where there are big transactional risks to the contractor with very little rent (see Figure 2.4). It is difficult for contractors to secure projects from owners and they have to work much harder to secure them, thereby elevating transaction risks to a far greater extent than the previous prosperous period.

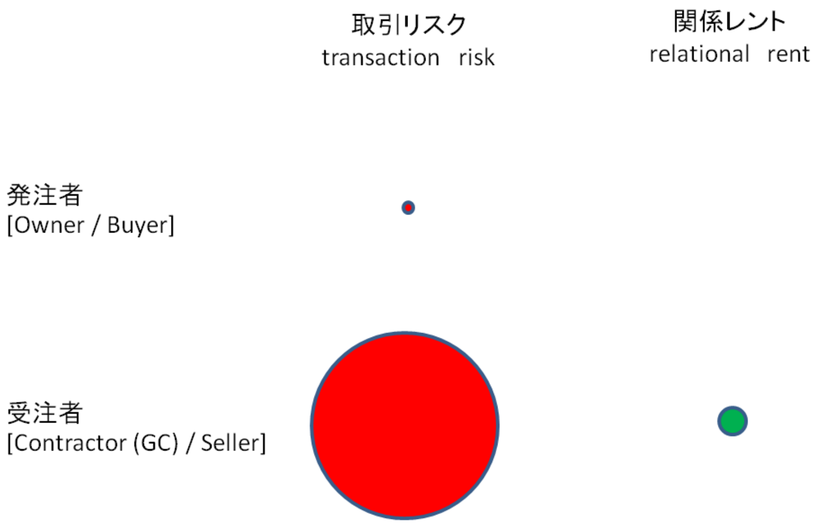

Figure 2.4: Big transaction risk and little relational rent during shrinking period (Ando, 2011)

2.1.1 Transaction and risk

Previously, it has been mentioned that risks are inherent in transactions between the owner and contractor. The costs of conducting market research, exploring financial opportunities, conducting a feasibility study, organizing a bidding or negotiation, managing design during pre-contract phase, administering the contract, administering the change orders and claims, resolving disputes and managing incentives incurred in the post-contract phase (Li et al. 2012) are typical examples of transaction costs that entail risks especially for the owner. The research conducted by Li et al. (2012) found that the uncertainty in the transaction environment impacts on transaction costs. The more uncertainty in the transaction environment, the higher the transaction costs. Certainty in the transaction environment means that plans and specifications are clear and complete, the relationships between the parties are smooth, and risks are allocated to the satisfaction of all parties. The relationship between the owner and the DBr in the Japanese DB has proven that the last two features are contributing to the certainty in the transaction environment which in the long term minimized the structural risks between them.

2.2 Custom and institution formed during the period of growth

Significant customs and institutions in the Japanese construction industry were formed during the period of growth. Specifically, certain features of the market and transactional customs were formed.

2.2.1 Custom and institution in terms of contractor

On the part of contractors or specifically general contractors (GCs), the customs fundamentally emerged out of their efforts to minimise risks and maximize rents; and their strategies for furtherance of their services offered to the owner, their reputation and competence as general contractor.

(a) Securing relational rent

In order to secure relational rent, in their first (few) project(s) with the owner, the GCs chose to be satisfied with sticking to the original contract and playing it safe to avoid any industrial dispute. They just do first what is promised to the owner. A successful completion of the project(s) with good performance in satisfying the owner's requirement is for GCs the key to gaining the owner's trust and long-term relationship. Once they succeed in gaining the owner's trust and long-term relationship, a larger long-term relational rent can be secured.

(b) Investment in R&D

As mentioned earlier, additional investment is required to minimise risks and maximise rent. To this end, the GCs have invested heavily in R&D. All the big GCs have their own huge research institute. Initially, the main reason for having such a research institute was to reduce defects in their products. They have to be knowledgeable so as to be capable of reducing the defects. Being capable of reducing such defects means that their products are in even better quality and worth more satisfaction for their owners. They continued expanding their R&D activities before investing in long-term innovative research. Among client-related objectives of this R&D, as reported by Levy (1993), they are to provide a contractor with a unique product, system, design, or technology that acts as marketing tool for retaining existing clients while attracting new ones, as well as the assurance that the contractor is providing the best possible product to his valued, long-term clients.

(c) Employment of in-house specialists including architects

The GCs are also keen to employ architects and all sorts of specialists such as scientists (physicists, chemists) within their own companies (Ando, 2011). Fraser (2001) also reports that research professionals from a broad range of disciplines (such as pure sciences, even humanities) are being employed by research institutes of the major construction firms (GCs). The reason why they employ specialists from a broad range of disciplines is to cope with all sorts of problems and to be in a position to curb the potential risks (Ando, 2011). Research conducted by professionals at the research institute will be followed up on-site through the development phase of each project Fraser (2001). Research expertise and facilities are used in a direct support role to deal with construction problems (Construction Industry Institute, 1988).

With architects in particular, the main motives of employing them are to increase the GCs design capability and to limit their exposure to risk. If a GC is not allowed to develop design on his/her own, risks can be huge because the GC has to keep to what is specified in the design documents. If they are to deal with the risks, the GCs can convincingly request the owner to allow them to specify a part of the project through their own architects so that they can avoid or minimize the risks along with a pledge to make more profit for the owner.

(d) Formation of the Japanese DB system

All the customs and institutions mentioned earlier trigger the demand for DB custom within the Japanese GCs. For the GC, it is a pre-requisite to be able to design and specify the project. These were done without reducing the quality and raising the price to maintain the owner's trust and long-term relationship, just like the rent concept in the automobile industry. They were given the opportunity and trust to design and were eventually faithful to the owner.

2.2.2 Custom and institution in terms of owner and architect

(a) Incomplete market

Eventually, an incomplete market is formed which is biased towards the supply side (supply-pushed imperfect market), with no demand side (or very weak demand side). GC always takes the lead at this level.

(b) Silent owners

Owners say nothing and GC does everything. Owners are accustomed to having the GC does everything.

(c) Insufficient or uncertain owner's brief

Uncertain brief (or no brief) given by the owners. This is sensible in Japan where good faith is the core of construction contracts but not in a contract-oriented society like the UK and US, where providing a detailed project brief is the owner's obligation. This is in line with Levy (1990) who echoed a statement by one of the big six GCs that generally owners simply tell the GCs what they want, and leave the details and how the project is to be accomplished to the GCs. The Owners purposely leave the details vague so that they can be filled in as construction progresses while previous understandings between the parties are further developed and exhibited in the new projects. A new project concept and budget can be prepared with minimal additional Owner input as the GC is very familiar with the Owner's requirements, quality levels, materials and equipment preference based on a number of previous projects with the Owner.

(d) Owners less motivated to employ specialist consultant

The fact that Owners are not willing to employ a specialist consultant has to do with a Contractor who can do everything for free. In reality though, it is not free, but from the Owner's perspective it looks as if it is done for free because Contractors never specify the costs for management, and the necessary fee is a sort of hidden cost. As a result, Owners are not very eager to hire management consultants for a service which they have gotten for free (Sjoholt, 1999). This explains well why the construction management (CM) is having difficulties gaining popularity for implementation in the construction industry in Japan. In particular, the owners and contractors have the mentality that owners never take risks while contractors ought to take risk because risk is everywhere. In other words, it is the contractor who has to face the risk. As to the owners, they are not used to thinking things differently.

(e) Incomplete and uncertain design specification

As a result of GCs being given the trust to design and since they have such capability, the design and specification provided by the owner's architect tend to be incomplete and uncertain. Even in the case of a separated design and construction, the design and specification provided by the architect tend to be incomplete. Even if the design is complete, as the owner and his architect always avoid taking risks, they rarely assert or insist that the design should be their job. Owners employ architects to provide them with an intentionally incomplete design. The design is then given to the contractor to complete with all the risks thereof. Owners are complacent enough to continue with this practice. They employ architects to provide them with designs in this manner. This is quite convenient and an acceptable offer to contractors as they can actually make the design. As they carry out the design by themselves, they can reduce the risks and increase the rent. In DB project, a harm-free design is given to the owner. In the case of a separated design and construction, normally about 30 to 50 percent of design and specification are transferred to and done by the contractor. The risk is preferable to Japanese contractors, provided that they are allowed to design by themselves. Japanese contractors are keen to grow themselves with additional investment. This explains the critical and crucial difference between these two DB systems. The Japanese DB is applied to a risky project as well, whereas DB in the US and Europe is simply applied to the simplest projects with very low risks.

2.2.3 Chapter summary

This chapter has provided an elaboration on the formation and characteristics of the Japanese DB, based mainly on attitudes towards risks and relational rent between owner and contractor. From the contractors' perspective, providing services to the owner using the DB method was about taking sensible and profitable risk. In exchange, they secured a long-term relationship with the owner and high profitability during the growth period. At the same time, the contractors acquired a high level of competence in terms of design and R&D capability. Overall, the response and attitude towards risks by the main construction players (especially owner, designer and GC) against the background of such economic conditions in turn formed a unique DB system in Japan.

Chapter 3

Project delivery method, construction contract and risk

Generally there are three major categories of project delivery methods: design-bid-build (traditional method), design-build and construction management. This section provides an overview of the emergence, basic characteristics and variants of the main delivery methods implemented in Japan, the US and the UK. It then highlights the important concepts related to construction contract and risk allocation.

3.1 Project delivery method

Some comprehensive definitions of project delivery method are highlighted here, whereas there are many more of them can be found. Project delivery (or procurement) is literally referred to as method, option, path or system. In reference to construction project, project delivery method is a comprehensive process by which designers, constructors, and various consultants provide services for design and construction to deliver a complete project to the owner (Molenaar et al., 2009). From the perspective of the project participants, it is how the various individuals or professionals organise their participation and responsibilities to complete a building project (AIA California Council, 1996). This is close to a definition by Murdoch and Hughes (2000) who point out that the characteristic patterns of participants' involvement, and the disposition of risk among them, constitute the procurement method, or procurement systems for a project. Project delivery method involves formulation of a project strategy, which requires careful consideration on the benefits, risks and financial constraints which surround the project. The choice of contractual arrangement is finally determined after such a deliberation of wide-ranging aspects of the project (Joint Contracts Tribunal, 2011a). Overall, project delivery method or system is a comprehensive approach to realise a project for an owner through involvement of various parties with certain relationship arrangement and risk apportionment in fulfilling the owner's requirements within certain project constraints.

3.1.1 Design-bid-build (DBB) or Traditional

DBB or Traditional method is a project delivery system in which an owner retains a designer to furnish complete design services and then advertises and awards the separate construction contract based on the designer's completed construction documents. The owner is responsible for the details of design and warrants the quality of the construction design documents to the constructor. The process offers checks and balances through the separation of design and construction contract, but the separation yields a linear process that is the most lengthy of the three methods (Molenaar, et al., 2009; Konchar, 1997; Murdoch and Hughes, 2000). Typical contractual relationships in DBB are shown in Figure 3.1.

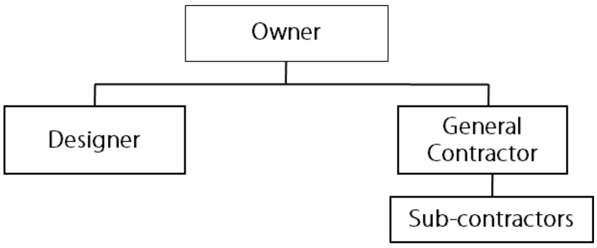

Figure 3.1: Typical contractual relationships in Design-Bid-Build (DBB)

(a) DBB in the US

Industrial Revolution (1850s – 1980s) triggered the changes in technology in facilities. This required specialisation of design and construction services, a dramatic moved from the master builder systems where a master builder design and construct a whole facility. The birth of the traditional DBB in the US was led through the Miller Act, Separation of Design and Construction Services which was passed in 1935 and then mandated for all Federal, State and municipal Government project (Unger, 2011 as cited by Barghava, 2012).

The practice of the DBB in the US is owner contract with an architectural engineering (A/E) firm for full completed design and specification. Then, based on the completed design and specification, he advertises for a firm fixed price from a GC to construct the facility. The prime A/E firm may subcontract part of its design scope to several specialty design consultants. Likewise, the GC in most situations subcontracts part or all of its scope to specialty contractor (Barghava, 2012).

(b) DBB in the UK

In the UK, the emergence of DBB which separate design from construction was influenced by numerous factors. Two factors are pointed here. Like in the US, the first factor revolves around the Industrial Revolution. During that era, increasing sophistication of construction technology caused techniques and materials proliferated. This led to more complex coordination problems on building sites. Such problems may also contribute to the second factor which is the desire of architects to focus more on design and client-related issues and less on the day-to-day business of construction. These factors point towards the separation of design from construction in the UK (Murdoch and Hughes, 2000).

In the DBB or general contracting, apart from contracting with general contractor and professionals including architect and engineers, an employer also contracts with a quantity surveyor (see Figure 3.2). Murdoch and Hughes (2000) further explain the typical process in this project delivery method. The designers act on behalf of the employer in converting the employer's requirements first into brief and subsequently into a workable design. Based on the design, a complete set of documents (including the design itself) that described the proposed building fully is prepared and contractor(s) is invited to price the set of documents. Such documentation demands that the architect (or lead designer) coordinates design advice from a wide variety of specialists. Therefore, the contractor has no responsibility for design. The price offered by the contractor is based on a bill of quantities (BQ) prepared by the quantity surveyor. A BQ is a pricing document that itemizes and quantifies, as far as possible, every aspect of the work based on complete design. The comprehensiveness of the BQ forms an important mechanism for controlling costs as the project progresses. All the foregoing documents form the basis not only for examining the means by which the contractor is instructed what to build but more importantly for self-evident in ensuring that the work is produced in accordance with the design. The standard-form contracts tend to oblige the contractor to produce what is in the documents for this reason. In general contracting the contractor agrees to produce what has been specified in the documents. Table 3.1 summarises the characteristics of general contracting implemented in the UK.

There are two types of procurement by tendering process implemented in the UK i.e. single-stage tendering and two-stage tendering applied for traditional method:

- Single-stage tendering: the contractor is selected through competitive bidding based on full scope of work, i.e. complete drawings
- Two-stage tendering: the contractor is selected through competitive bidding based on schematic drawings. The selected or preferred contractor will then develop and complete the design before commencing the construction work (Rawlinson, 2006; Rawlinson, 2008; Saito and Hughes, 2012).

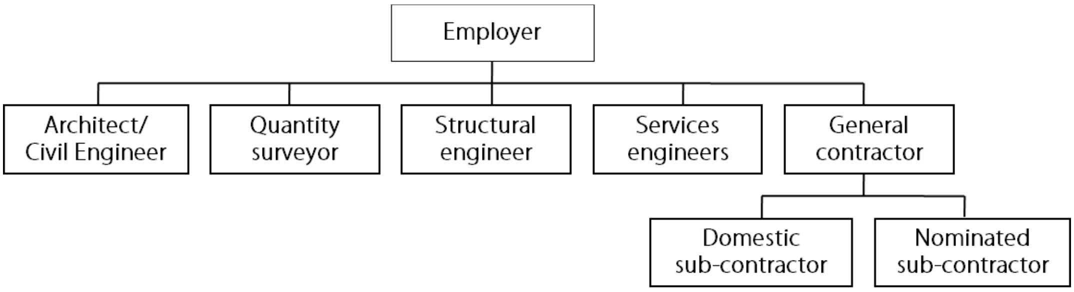

Figure 3.2: Contractual relationships in general contracting in the UK
(Murdoch and Hughes, 2000)

Table 3.1: DBB or general contracting in the UK
(Summarised from Murdoch and Hughes, 2000)

Typical circumstances of using the DBB contract:	
Design responsibility	Employer commissions design. The employer has caused the design to be prepared and for the purposes of the building contract takes responsibility for it.
Experience of the lead designer	The employer's designer is sufficiently experienced to coordinate and lead the design team and to manage the interface between design and production.
Complete design	The design is substantially complete when the contractor is selected. It is customary to choose a contractor by opting for the one with the lowest price.
Involvement of quantity surveyor	An independent quantity surveyor will be used to plan and control the financial aspects of the project.
Price	Price as the basis of selection. The contractor is selected on the basis of the contractor's estimate and carries the risk that the estimate may be wrong. The contractor offers to do the work for a price, not for reimbursement of cost.
Employer-selected sub-contractors	The employer reserves the right to select sub-contractors for certain parts of the work.
Proportion of prime cost sums	Prime cost sums, including employer-selected sub-contracts, do not form the major proportion of the contract sum.
Basic characteristics:	
Design and workmanship	Employer is liable for design, Contractor is liable for workmanship.
Contractor's obligation	Entire contract would carry with it a fitness for purpose warranty and an obligation to complete the whole of the building in its entirety.
Sub-contracting	Nominated sub-contracting – an excellent mechanism for ensuring that the Contractor employs sub-contractors of adequate standing.
Variations	Contract administrator has the power to change the specification (the work required of the Contractor).

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