# Management of Client Requirements for Design and Build Projects in the Construction Industry of Hong Kong

## Abstract

**Purpose** – This paper aims at investigating the prevailing practice of managing client requirements for design and build (D&B) construction projects in Hong Kong. It attempts to evaluate the limitations and addresses the need for a practical framework for facilitating the implementation of client requirements management within the industry.

**Design/methodology/approach** – Two research instruments were used in this paper: semi-structured interviews and case studies.

**Findings** – The study revealed that the limitations of the current practice included the lack of a comprehensive client's project brief, inadequate involvement of client in the briefing process, the lack of impartial agents, the controversy caused by the uncertain legal status of end-users and the improper timing of raising requirements by key project stakeholders. Recommendations are given that an inclusive project brief is necessary in clarifying the goals and covering all-rounded perspectives. A practical framework is needed to improve the client requirements management practice within the construction industry.

**Research limitation/implications** – The D&B procurement system adopted in Hong Kong actually exists in various forms within the construction industry, which differ from

the prototype that has long been recognized. Therefore, a more detailed study into D & B projects covering a broader area is necessary in the future.

**Originality/value** – Little research work has been undertaken on the study of client requirements management especially for D&B construction projects. This paper has improved the comprehension of the nature of client requirements and has provided valuable insights into the prevailing problems associated with the management of client requirements.

**Keywords:** Client Requirements Management, Design and Build, Hong Kong, Case Study, Construction Industry

**Paper type:** Case study

## Introduction

The design and build (D&B) procurement system has been regarded as an alternative integrated project procurement method in the construction industry of Hong Kong over the past decade. Contractors are responsible for both design and construction of the facility based on a set of requirements laid down by the client. This procurement system allows early introduction of contractors and suppliers, and helps integrate their knowledge and expertise during the design stage (Tam, 2000). This approach shortens the overall project time span and at the same time, is directly beneficial to the cost efficiency (Akintoye, 1994).

Previous researches suggested that briefing is the crucial factor which leads to improvement of D&B projects (Lam et al., 2008). However, clients of the construction industry are dichotomous in attitude towards the preparation of project briefs. Comprehensiveness of the project brief largely depends on the experience of clients – experienced clients tend to develop a detailed, sometimes meticulous brief; while "green" clients have a propensity to ignore the brief completely (Murray, 1995). Problems further accumulate at a later stage during the development of client requirements leading to intractable conflicts and disputes among project stakeholders.

It is of fundamental importance to pinpoint the existing problems with managing client requirements in D&B projects for furnishing potential solutions specific to current practice within the construction industry. An empirical research study using semi-structural interviews and case studies was conducted to investigate the prevalent practice and its associated difficulties in managing client requirements in construction projects. The paper aims to present a summary review of the general situation and associated problems of the client requirements management (RsM) for D&B construction projects.

## Literature Review

### Client Requirements Management

Considering the complex nature of a building, massive information in different forms at various levels and perspectives of needs and desires co-exist. It is essential to identify the key clients and the decision-makers (Miron and Formoso, 2003). In a broad sense, client refers to particular entity including all the stakeholders who have the right in imposing requirements to the end product or facility (Bahill and Dean, 1999). Kamara et al. (2002)

defined a client as the entity that is responsible for incorporating and representing correlated interested groups of a proposed facility.

Client requirements are the initial connection to the industry (Kamara and Anumba, 2000). They reflect the targets, desires, expectations or constraints imposed by the client on the project functionality and quality (Gilb, 2005; Zielczynski 2008; Robertson and Robertson, 2005). However, design professionals' inducement usually varies from client's intent to the proposed facility (Friedlander, 1998). In order to achieve a satisfactory result of the project, full acquisition of knowledge on client's aspirations in both tangible and intangible form would be a critical step in construction projects (Chan et al., 2002).

Requirements management thus refers to the systematic approach that manipulates all project requirements (Leite et al., 2005). The overall processes include defining, eliciting, analyzing, translating, organizing and documenting requirements, and incorporating into the project (Kamara and Anumba, 2000; Oberg et al., 2003). In order to communicate with the design team, the client initiates the briefing process by articulating a formal document which encloses the desired outcomes, constraints, functional and technical requirements, commonly known as a client brief, or termed as the Employer's Requirements (ER) in D&B projects (Yu et al., 2005; Kamara and Anumba, 2001; Murry, 1995).

The brief ranges in form from a statement, through a project brief to a comprehensive performance specification covering various aspects from overall direction to minuscule detailed materials requirements (Shen and Chung, 2006). It serves as the base of the

planning, design and technical work of the facility at various stages (Ryd, 2004). Repetitive refinement of requirements during the development process "purifies" the requirements and adds value to the project (Leite et al., 2005).

**Potential problems with RsM**

Several research studies have identified numerous limitations regarding the current Requirements Management (RsM) practice. The project brief is thus seen as a significant point depositing divaricates on the development of client requirements (Shen et al., 2004). Many have pointed to the errors generated from the initial brief, as follows (Arayici et al., 2006; Kamara and Anumba, 2001; Yu et al., 2005; Shen and Chung, 2006):

1. Incomplete and inconsistent requirements and specifications – The brief covers only limited perspectives of the proposed facility, and stakeholders overlook some vital parts of the building. Client and professionals seldom perceive the project as a whole at the inception stage (Leite et al., 2005) and they often underestimate the critical requirements that appear to be negligible at first glance. Future change of brief contents is made necessary.

2. Misunderstanding and misinterpretation of requirements – The language used (Zielczynski, 2008) and the clarity of client requirements in a brief always frustrate stakeholders. A client either believes in a clear brief indicating a greater potential of disputes (Barrett and Stanley, 1999); or pays little attention to brief writing.

3. Inadequate time allocated to briefing – Many clients consider briefing as an event which does not generate any value to the project, and refuse to put resources to the briefing process (Othman et al., 2005). They tend to save time in briefing for early commencement of design work. Requirements are not properly identified which in turn impairs the satisfaction level of clients.

4. Lack of user involvement – Only a limited number of stakeholders in a project is allowed to be involved in the brief preparation. For efficient use of time on brief writing, clients and other key stakeholders may prefer having a small group who share similar interests, objectives and agenda involved.

The ideal development of brief is best described with an on-going project which gradually evolves to be more specific and focused when design is progressing (Kamara and Anumba, 2001). Nevertheless, in practice, brief development is largely influenced by clients and professionals. During the development of the brief, there are several drawbacks that hinder the RsM (Arayici et al., 2006; Kamara and Anumba, 2001; Shen and Chung, 2006):

1. Failure to manage end-user expectations – There is no existing framework for the induction of end-users into a construction project. User participation seems impossible in managing market-driven requirements. Late involvement of end-users leaves little room for alterations, and the user requirements are sometimes contradictory to client needs (Kujala et al., 2005).

2. Lack of frozen requirements – Alterations of brief can be caused by changing project requirements from stakeholders, inaccurate documents, late exposition of requirements, overlooking environmental requirements or unanticipated conditions (Othman et al., 2005). Apart from creating unforeseeable impacts, changes often follow the will of client and professionals, who occasionally overlook the initial intention of the project. Changes violating the original goals often bring about negative impact to the facility due to mismatch of the master plan and details.

**Application of design and build procurement in Hong Kong**

According to CIOB (1988), design and build procurement system (D&B) refers to a situation when only one organization would be responsible for both design and construction and the client could appoint a checker for supervising the project delivery process. The contractual link would be only between the client and the contractor. There are 3 variants of D&B contracts: traditional D&B, enhanced D&B and novated D&B (Yu, 1998). The differences occur at the design stage and the contractual relationships of contracting parties involved. Many research studies suggested that there are numerous advantages of D&B over traditional procurement which has long been used (Akintoye, 1994; Tam, 2000; Chan, 2002) as follows:

- time and cost savings
- single point of contact and responsibility
- improved buildability (early introduction of contractor's expertise in construction techniques)
- increased client involvement

- reduced variations (since design development changes are excluded)

In light of such advantages mentioned above, D&B gains its popularity in recent years (Haque et al., 2001) and appears to be the most accepted alternative to traditional procurement (Akintoye, 1994), but it happened to be only in large-complex projects (Tam, 2000) or in public sector projects (Lam et al., 2003; Lam et al., 2004; Chan et al., 2002). Insufficient knowledge and experience on D&B projects and its dubious risks which perplex stakeholders could be the main causes that lead to the neglect of this procurement by the private sector in the construction industry (Konchar et al., 1997).

A factor critical to the success of D&B projects is the development and management of terse and vigorous Employer's Requirements during the project development process (Dorgant et al., 2002). Understanding the requirements of the facility in both functional and performance terms is the first and foremost step in developing the scope of project (Lam et al., 2008). The development of ER is a dynamic interaction among stakeholders (Barrett and Stanley, 1999). Owing to the complexity of requirements identification to be considered at the initial stage of D&B contracts, project briefs are often insufficient and implicit, and hence may not truly reflect client requirements (Barrett and Stanley, 1999; Kamara and Anumba, 2001).

## Research Methodology

Since there are limited D&B projects in Hong Kong, the research methodology adopted in appraising the client requirements management involved "qualitative" research methods. Case studies of the requirements management adopted by four construction projects were conducted using semi-structured interviews. These in-depth interviews

provided useful insights into how the requirements management process is organized in specific organisations and projects. The following approach was adopted in this study:

- initial contact with target interviewees
- in-depth face-to-face interviews, which were audio-recorded with recorder pen
- review of relevant project documents supplied by interviewees
- further discussions over the phone to clarify any ambiguities or difficulties
- writing of draft report, solicitation of comments and feedback from interviewees, amendments and confirmation of interview report

Yin (1981) defined a "case study" as an empirical inquiry that (1) examines a contemporary phenomenon and context which are not clearly evident; and (2) incorporates several sources of evidences. Case studies are appropriate to projects that are significant and representative (Yin, 2009). Qualitative information was obtained from relevant documentation and interviews, which were regarded as typical and effective data collection tools for the case study approach (Eisenhardt, 1989). A series of face-to face interviews with different key project stakeholders were undertaken in March of 2009 for the case studies. Senior representatives from various major participating organizations (i.e. client, consultant and main contractor) in the four selected case projects were invited for interview. Each interview took 1-2 hours and was conducted at the interviewee's office. It was assured with the interviewees that all the project information and opinions acquired will be solely used for research purposes only and their names will not be disclosed to any third parties due to personal privacy and ethical reasons.

## Presentation of research findings

Due to length limitation, four case studies in Hong Kong and PRC were selected to highlight in detail for depicting the differences in briefing process and problems between the public and private sectors. The details of the projects involved in the case studies are listed in Table 1.1, which shows the sector of client, type of project and type of contract used. Table 1.1 also presents a summary of the findings on requirements management processes based on these projects and outlines the general procedures adopted, those involved in the RsM processes, the information collection process and some notable observations about the requirements management for each project. It should be noted that these studies were not intended to be representative of requirements management practices generally, but rather served to provide some indicative insights into the requirements management process within a particular project.

Information collected from the research interviews reflected the evolving development of the D&B procurement system and associated RsM practices within the construction industry. A noticeable difference is discerned in the experience of clients of the construction projects, two cases of which from the public and private sectors were selected respectively in this paper for a more detailed investigation and meaningful cross-comparison.

**Case study 1**

The first case study was an institutional facility of which the client was a government works department. Unlike its role in traditional procurement, the Architectural Services Department (ArchSD) was responsible for only the initial design development. After contract award, ArchSD supervised the project progress and coordinated between client

department and contractor. ArchSD played a dual role as the client representative and project manager in D&B projects. Professional advice was given on the project-related issues throughout the whole project delivery process.

*RsM Process and Practice*

Both the client department and ArchSD worked together on the preparation of Employer's Requirements. Client department was responsible for providing functional brief, room data sheet and technical requirements to ArchSD. Meetings between top management of ArchSD and client department were held for further clarifications and elicitation of necessary client requirements before tender invitation.

During the pre-qualification period, prospective tenderers were provided with a pre-qualification document, which contained some factual information of the project as articulated by ArchSD. Qualified tenderers were shortlisted and given further information - ER, Form of Tender, Conditions of Tender and D&B General Conditions of Contract. ER included a design brief, ArchSD preliminary design of the proposed facility in A4-sized presentations as reference, room data sheet, specifications, etc. ER was bound in 10 volumes, focusing on the factual information and technical prerequisites of the client.

Before tender submission, any uncertainties raised by tenderers were replied by ArchSD to clarify any discrepancies or questions. Tenderers were allowed to propose options or alternatives for further improvement. When the proposal was accepted, it would be recognized by the Letter of Intent, and the changes would be incorporated into the contract. Under the two-envelope tendering approach, tenders were divided into two parts

– technical submission and tender price document. Internal assessment mechanism helped fine tune the weightings on the two received envelopes.

Submission procedures at the post-contract award period included the Approval-in-Principle (AIP) and Detailed Design Approval (DDA). AIP consisted of conceptual and schematic designs of the facility, while contractor had to submit detailed design drawings and calculations in DDA. Feedbacks and verifications from ArchSD and the client department were made during these two submissions. All the procedures were specified in ER which was bound in the contract. During the post-contract award period, ArchSD and the client department seldom made alterations to the ER, as only minor changes would be accommodated since public sector projects need not follow market development trends (Lam et al., 2004).

In order to achieve a better understanding among key project stakeholders, regular value management or partnering workshops were included in the schedule. In case of any unclear requirements concerning the operational requirements of specific departments, ArchSD and the client department organized visits to existing facilities for the contractor and their consultants. In this project, there was an Administrative Officer who was responsible for collecting opinions from within the client department, contacting with and passing related information to ArchSD and documenting daily information flow in-between. On the other hand, at regular meetings among all stakeholders, representatives from the Planning and Development Branch of the client department were invited to join for discussion. For any queries about the technical requirements, the related parties contacted the contractor directly.

*Associated problems with RsM*

Problems first arose from the comprehensiveness of ER. Most of the interviewees who had been involved in the ArchSD D&B projects agreed that ER developed under the Administrative Procedure were very comprehensive. Requirements ranged from the goals of the project down to every detail of the facility. In this case study, one consultant added that this leaves only little room for the project team members to alter the design. Stakeholders claimed that the contractor could start construction without too much design development.

The language used in ER is also another contentious issue which bewildered contractors and consultants. Improper use of phrasings and wordings can mislead contractors and in the worst case, commit errors during requirements development (Hooks and Farry, 2001). What the contractor and consultant considered to be vague and ambiguous was seen to be allowing flexibility in the client's view. For example, material specifications were often prescribed with the permission of "similar or equivalent" which implies that there could be more options or preferences of the client which were not precisely indicated in the contract. Meetings and sample boards were always indispensable in capturing further client requirements. Thus, the black and white document may not necessarily reflect completely and accurately the desire of client. Due to the public sector probity, ArchSD or the client department could hardly be specific, such as stating the brands and origins of materials; while actually they had individual preferences, causing ambiguities to contractor.

In addition, the functional brief and room data sheets prepared by end-users before tender invitation could not truly reflect the end-user's requirements as raised by them at the design and construction stages. Client's expectations and technical solutions mismatched (Huovila and Seren, 1998) which led to late introduction of new requirements after the original requirements are deemed to be frozen (Robertson and Robertson, 2005). It is very common that client with less experience in construction projects would have difficulties in expressing themselves without visualizing any products. Abstract performance specifications could be problematic to client (Lawson, 1990; Ferreira et al., 2007) and occasionally some necessary requirements were overlooked which finally misled all the stakeholders including the client. Repetitive refinement of requirements was needed if this would be beneficial to the project (Leite et al., 2005). However, it would then be contradictory to D&B procurement principles, with the aim of minimizing changes of design from clients (Murray, 1995).

End-users, who often lack legal status, play a pivotal role in construction projects (Kujala et al., 2005). The client department was not an authorized entity in contract but they had the right to make any final decisions on the facility. Not fully acquainted with RsM, end-users' slow response posed difficulties to consultants and contractors on reflecting end-users' needs promptly, and on tightening the project schedule (Odeh and Battaineh, 2002). Decision making by end-users, in other words, could be time consuming. However, as their obligations are not bound by contract, the facility shall still "fulfill users' operational needs" and the risk was then shifted to the contractor.

**Case study 2**

The second case study was an industrial building of which the owner was rooted in the PRC region. It was the first factory erected by the company, and before the project, the company had never been involved in any construction projects in Hong Kong before. The contractor in this project was experienced in construction projects in Hong Kong, whilst the consultant was a global firm which had been involved in numerous projects worldwide.

*RsM process and practice*

The client approached the contractor directly and started the project with a simple brief. The initial brief was only in 4 pages of Chinese writing, including some basic information about the physical parameters of the site, requirements on guaranteed maximum price (GMP) and the descriptions of overall production line including standards. It was an immature ER as described by the interviewee. The contractor had to sort out other related requirements, which indicated that they were involved in the development of ER. However, it was not the client's intention to get the contractor involved in ER preparation. As distinct from the Hong Kong practice, Employer's Requirements of PRC projects are relatively simple: client only prepares a small volume of written documents bound in a contract, in view of the fact that on top of the contract, there are well prescribed regulations and practice guideline issued by the PRC Government.

Based on the information given, the contractor developed a schematic design before contract award. Room data sheets were also prepared using previous template from other D&B projects, together with some historical data provided by the client and through

contract communication meetings; while the consultants used their own in-house technical specifications as the base, worked out the general specifications with end-user representatives and the contractor. The final documents were bound in the contract (in JCT form). The client and contractor agreed on cost by negotiation – using schematic design for price breakdown and for other detail parts and, using norm indicators for cost estimation. To avoid any mis-communication among stakeholders, the client invited the contractor and their consultants to visit the existing factory in the PRC before contract award, which functioned as a reference to project design development. In order to prevent any possible disputes among stakeholders on the briefing documents, the contractor studied preceding legal cases on previous disputes on briefing in order to assist the client in developing ER.

According to the interviewee, the contractor would like to be involved in the preparation and development of ER, for building up mutual trust between the stakeholders and client, and help adding value to the project. Early participation of the contractor and consultants enabled them to contribute their knowledge and expertise to the project and allow a holistic view (Leite et al., 2005). However, as ER is a document reflecting on client's needs, it should be initiated by the client. Contractor's involvement, on the other hand, may not be appropriate since he or she possessed little or no knowledge of the client's needs, indicating that he or she may not be a good brief writer (Kamara and Anumba, 2001).

*Associated problems with RsM*

As ER was a joint product of the client, contractor and consultants, few problems arose from the documents. However, the client possessed too little knowledge on D&B and they were unwilling to devote time and resources on the development of ER. Unlike those clients intending to avoid detailed descriptions and preventing legal claims arising from modifications (Shen and Chung, 2006), they were unaware of their liabilities (Murray, 1995), whilst being accustomed to PRC practice. Comprehensive national codes and regulations were issued by the PRC Government, and typical contracts were signed with reference to those official documents. In contrast, there were little regulations concerning ER and price setting in Hong Kong. The responsibility of brief development thus shifted to the shoulders of the contractor and their own consultants.

Inexperience of client in construction project delivery process also resulted in improper timing of bringing up requirements. Being unfamiliar with construction projects and D&B procurement method, the client failed to voice out their opinions at an early stage. And similar to the end-users as described in Case Study 1, they might not be able to express themselves accurately and precisely unless they could visualize the final products (Lawson, 1990; Ferreira et al., 2007). The client could have overlooked parts of their requirements until the design became progressively fixed. When there were a number of options available, the client lost track of time once (Murray, 1995; Odeh and Battaineh, 2002). All the above would lengthen the construction duration or even cause abortive works. The interviewee believed that without a benchmark standard in monitoring the schedule, it would be difficult for stakeholders to cope with time, especially for medium scale projects.

Impartiality could be another critical success factor to RsM in D&B projects. Since there was not well-developed framework for the private sector using D&B procurement form, all the agreements and decisions made are on a compromised basis. The private sector is still in search of the direction of D&B development. Although there are many criticisms on practical briefing and suggested guidance in academic publications, no focus on the D&B procurement was considered to be appropriately set (Ferreira et al., 2007). Without a governing framework, the role of an impartial party is thus significant. Minor conflicts are unfavourable to any party who appears to be less dominant in the project, and usually it is the contractor. In contrast with D&B projects for ArchSD, there is no design checker who is responsible for tracking any changes to the project. Hierarchical difference was usually the decisive factor to resolve conflicts (Fernie et al, 2003), and yet, it did not appear to be the most suitable key to all conflict resolutions.

## Recommendations for effective client requirements management

According to Young (2004), there are several decisive factors which generate difficulties in the implementation of RsM. With regard to the case studies, the following measures could provide us with effective answers to the problems:-

*Comprehensive preliminary project statements*

The above case studies revealed that the initial brief is the common source of problem to both experienced and inexperienced clients. Experienced clients tend to develop their ERs to include sophisticated details, leaving little room for contractors and consultants to offer alternatives. In contrast, inexperienced clients pay little attention to the brief and

totally rely on the professionals. In either case, implicit requirements for the project are the major cause of problems to the resulting brief (Young, 2004). According to the interviewees, a comprehensive preliminary project statement is critical to the success of D&B projects by allowing contractors and consultants to understand thoroughly the client requirements (Akintoye, 2004). Murray (1995) stressed that the preliminary project statement is essential in: (a) clarifying and making clear of the client's organisation; (b) illuminating goals of the projects; and (c) outlining requirements. Although there is controversy over the issue of comprehensiveness of the brief, stakeholders would prefer to have detailed written requirements (Murray, 1995). Many interviewees agreed that a well written ER should be in detail form (Lam et al., 2008), in a way that it should also reserve some rooms for subsequent design development by the contractors. In other words, ER shall be broad in the scope of coverage and precise, but avoiding meticulous details.

*Well defined project goals at inception stage*

Many interviewees also pointed to the significance of well defined project goals, indicating another important issue to the success of RsM in D&B projects. Several research studies concluded that, an objective-oriented approach is a good tool to capture the requirements, improve traceability and effectively prioritize requirements (Songer and Molenaar, 1997; Arayici et al., 2006; Kamara and Anumba, 2001). Project goals shall be clearly defined at the inception stage such that all major stakeholders could have a mutual direction (Chan et al., 2001). Conflicts could be resolved quickly especially when disagreement arises from personal preferences and project goals. As per the case studies,

there is no mechanism to reach any agreement on the definition of the requirements (Young, 2004). Thus, a common and well defined goal is momentous antidote to any conflicts arisen. A regular review of project goals also helps keep the project on the right track, eliminate any non-value adding requirements entering into the contract, as well as enhance schedule compliance and resource allocation.

*Formal procedures in gathering requirements*

Slow response and improper timing of requirements are all related to the procedures in gathering requirements. Requirement creeping refers to additional requirements that enter into the project after the due requirement process is finished, or requirements are developed beyond the project goals (Robertson and Robertson, 2005). Some interviewees referred to the need for a design freezing stage for the sake of creep control. However, RsM should be a continuous evolvement and refinement exercise of requirements (Ferreira et al., 2007; Kamara and Anumba, 2001). Hence, some mechanisms are vital in maintaining regular communications between stakeholders in a project (Young, 2004). Preset milestones and schedule for gathering feedbacks from stakeholders govern the requirements entering into a project at suitable intervals, especially for tight schedule projects. Formalizing procedures in gathering requirements and corresponding feedback mechanisms help check and trace alterations in requirements, hence improving mutual communications between various stakeholders.

*Specific roles and responsibilities of each contracting party*

With reference to Young (2004), the inactive involvement of client as partner in a project poses difficulties to RsM. Similar to the situation in traditional procurement, client and other stakeholders may have little incentives in the overall involvement of the project – the client's role is elevated while other stakeholders concentrate on their own job duties without viewing the project as a whole (Leite et al., 2005). Previous research studies have proved that stakeholders' commitment indisputably yield positive results to D&B projects (Chan et al., 2001; Arayici et al., 2006). To encourage the active participation of stakeholders, both the roles and responsibilities of each contracting party need to be clearly defined, especially in capturing, approving and managing client requirements. A well-organized project team with specific jobs on RsM facilitates the efficient management of contractor for a faster response to cope with any alterations of requirements (Lam et al., 2004).

## Conclusions

This paper has depicted the general practice and limitations of RsM in D&B construction projects in Hong Kong and the PRC. It has provided valuable insights into the potential difficulties that industrial practitioners have encountered in both public and private sectors. Potential constraints that the private sector may face include: (1) a lack of comprehensive client's project brief; (2) a lack of active involvement of client in the briefing process, and (3) a lack of impartial parties.

While the public sector is experienced in D&B projects, the industry is confronted with the legislative aspect – the legal status of end-users and the over-detailed project brief.

On top of those constraints, both industry sectors face the common limitation of improper timing of raising requirements by various key stakeholders.

To alleviate the above problems, an inclusive project brief is necessary in clarifying the goals and covering all-rounded perspectives. A proper framework is inevitably needed to improve the prevailing practice within the industry. Several recommendations have been made to align with D&B projects including: (1) comprehensive preliminary project statements; (2) well defined project goals at inception stage; (3) formal procedures in gathering requirements; and (4) specific roles and responsibilities of each contracting party.

This paper has highlighted that the D&B procurement method in Hong Kong and PRC has evolved in various forms within the construction industry, and they differ from the prototype that has long been recognised. Leading property developers tend to employ their preferred consultants and contractors with a long-term partnering relationship, or even possess their in-house project design teams which develop the design of their properties. Under such situation, the project still maintains a single point of contact as D&B does, although it is more akin to be the traditional procurement. In this connection, the Hong Kong Housing Authority has recently developed a new type of hybrid procurement method (integrated contract) which amalgamates the use of traditional approach and partial D&B method. Such a new system has been applied to the Kai Tak Development project for the first time, details of which are still pending at the time of writing this article. To keep track of the latest development trend of D&B procurement options, more detailed researches and case studies are envisaged in the near future.

## Acknowledgements

This paper is supported by a research grant provided by the Department of Building and Real Estate of The Hong Kong Polytechnic University (Project Account Code: BRE-1-ZV55). The authors would also like to acknowledge the organisations and interviewees who participated in the semi-structured interviews for providing their opinions and necessary project information as case studies to facilitate this research study.

## References

Akintoye, A (1994), "Design and build: a survey of construction contractors' views", *Construction Management and Economics*, Vol. 12, No. 2, pp. 155-163.

Arayici, Y., Ahmed, V and Aouad, G (2006), "A Requirements Engineering Framework for Integrated Systems Development for the Construction Industry", *IT in Construction (ITcon)*, Vol. 11, pp. 35-55.

Bahill, A.T, and Dean, F.F (1999), "Discovering System Requirements". Sage, A.P., *Handbook of System Engineering and Management*, Wiley-Interscience Publication, USA, pp. 175-219.

Barrett, P.S., and Stanley, C. (1999) *Better Construction Briefing*, Blackwell Science, Oxford.

Chan, A.P.C. (2002), "Evaluation of enhanced design and build system: a case study of a hospital project", *Construction Management and Economics*, Vol. 18, No.8, pp. 863-871.

Chan, A.P.C., Ho, D.C.K and Tam C.M. (2001), "Design and Build Project Success Factors: Multivariate Analysis", *Journal of Construction Engineering and Management*, ASCE, March/April, Vol.127, No.2, pp. 93-100.

Chan, A.P.C., Scott, D. and Lam, E.W.M. (2002), "Framework of Success Criteria for Design and Build Projects", *Journal of Management in Engineering*, ASCE, July, Vol.18, No.3, pp. 120-128.

Dorgant, C., Dorgant, C.E. and Grindle C.S. (2002), "Developing Owner's Project Requirements During Pre-design", *ASHRAE Transactions*, Vol. 108, Part 2, pp. 1193-1199.

Eisenhardt, K.M. (1989), "Building Theories from Case study Research", *The Academy of Management Review*, Vol.14, No.2, pp.532-550.

Fernie, S., Green, S.D. and Weller S.F. (2003), "Dilettantes, Disciplines and Discourse: Requirements Management for Construction", *Engineering, Construction and Architectural Management*, Vol. 10, No. 5, pp. 354-367.

Ferreira, F.P., Lima, L.P., Formoso, C.T. and Leite F.L. (2007), "Opportunities for Clients' Requirements Management in a New Form of Housing Provision in Brazil", *CIB World Building Congress, Cape Town, South Africa*, pp. 2055-2066.

Friedlander, M.C. (1998), "Design/Build Solutions", *Journal of Management in Engineering*, ASCE, November/December, Vol.14, No.6, pp. 59-64.

Gilb, T. (2005), *Competitive Engineering*, Elsevier, Great Britain.

Haque, M.E., Alkaabi, N. and Arosha, D.S. (2001), "Selection of a right project delivery system: a tabular knowledge base approach", *Proceedings of the Third International Conference on Construction Project Management*, 29-30 March 2001, Singapore, pp. 471-480.

Hook, I.F. and Farry, K.A. (2001), *Customer-Centered Products: Creating Successful Products through Smart Requirements Management*, AMACOM, USA.

Huovila, P. and Seren, K.J. (1998), "Customer-oriented Design Methods for Construction Projects", *Journal of Engineering Design*, Vol. 9, No. 3, pp. 225-238.

Kamara, J.M. and Anumba, C.J. (2000), "Client Requirements Processing for Concurrent Life-Cycle Design and Construction", *Concurrent Engineering*, Vol. 8, No. 2, pp. 74-88.

Kamara, J.M. and Anumba C.J. (2001), "A Critical Appraisal of the Briefing Process in Construction", *Journal of Construction Research*, Vol. 2, No.1, pp. 13-24.

Kamara, J.M., Anumba, C.J. and Evbuomwan, N.F.O. (2002), *Capturing Client Requirements in Construction Projects*, Thomas Telford, London.

Konchar, M.D., Sanvido, V.E., and Moore, S.D. (1997), "The benefits of design/build contracting in the United States", *Proceedings of the International Conference on Construction Process Re-engineering*, Australia, 14-15 July 1997, pp. 191-201.

Kujala, S., Kauppinen, M., Lehtola, L. and Kojo, T (2005), "The Role of User Involvement in Requirements Quality and Project Success", *Proceedings of the 13th IEEE International Requirements Engineering Conference*, 29th August – 2nd September 2005, Paris, France.

Lam, E.W.M., Chan, A.P.C. and Chan, D.W.M. (2003), "Why is design-build commonly used in the public sector - an illustration from Hong Kong", *The Australian Journal of Construction Economics and Building*, Vol.3, No.1, pp. 53-62.

Lam, E.W.M., Chan, A.P.C. and Chan, D.W.M. (2004), "Development of the design-build procurement system in Hong Kong", *Architectural Science Review*, Vol.47, No.4, pp. 387-397.

Lam, E.W.M., Chan, A.P.C. and Chan D.W.M. (2008), "Determinants of successful design-build projects", *Journal of Construction Engineering and Management*, ASCE, Vol. 134, No. 5, pp. 333-341.

Lawson, B. (1990), *How Designers Think*, 3rd edition, The Architectural Press, London.

Leite, F.L., Miron, L.I.G. and Formoso C.T. (2005), "Opportunities for Client Requirements Management in Low-Income House Building Projects in Brazil", *Proceedings of the IGLC-13*, July, Sydney, Australia, pp. 333-341.

Miron, L.I.G. and Formoso, C.T. (2003), "Client Requirement Management in Building Projects", *Proceedings of the 11th International Group on Lean Construction Conference, July, Blacksburg, Virginia,* IGLC.

Murray, J.P. (1995), "Effective briefing: the key to project success", *Proceedings of the International Congress on Construction, Design, Build Projects – International Experiences in Singapore*.

Oberg, R., Probasco, L. and Ericsson, M. (2003), *Applying Requirements Management with Use Cases,* Rational Software Corporation., USA, available at: http://www.compgraf.ufu.br/alexandre/esof/use_cases.pdf [accessed on 10 July 2008]

Odeh, A.M. and Battaineh, A.T. (2002), "Causes of Construction Delay: Traditional Contracts", *International Journal of Project Management*, Vol.20, No.1, pp. 67-73.

Othman, A.E, Hassan, T.M and Pasquire, C.L. (2005), "Analysis of Factors that Drive Brief Development in Construction", *Engineering, Construction and Architectural Management*, Vol. 12, No.1, pp. 69-87.

Robertson, S. and Robertson, J. (2005), *Requirements-Led Project Management: Discovering David's Slingshot*, Addison-Wesley, Boston.

Ryd, N. (2004), "The Design Brief as Carrier of Client Information during the Construction Process", *Design Studies*, Vol.25, No.3, pp. 231-249.

Songer, A.D. and Molenaar, K.R. (1997), "Project Characteristics for Successful Public-Sector Design-Build", *Journal of Construction Engineering and Management*, ASCE, March, Vol. 123, No. 1, pp. 34-40.

Shen, G.Q.P. and Chung, J.K.H. (2006), "A Critical Investigation of the Briefing Process in Hong Kong's Construction Industry", Facilities, Vol. 24, No. 13/14, pp. 510-522.

Shen, Q., Li, H., Chung, J. and Hui, P.Y. (2004), "A Framework for Identification and Representation of Client Requirements in the Briefing Process", *Construction Management and Economics*, Vol. 22, No.2, pp. 213-221.

Tam, C.M. (2000), "Design and Build on a Complicated Redevelopment Project in Hong Kong: the Happy Valley Racecourse Redevelopment", *International Journal of Project Management*, Vol. 18, No. 2, pp. 125-129.

The Chartered Institute of Building (1988), *Design and Build Code of Estimating Practice Supplement*, No. 2, UK.

Yin, R.R. (1981), "The case study as a serious research strategy", *Knowledge: Creation, Diffusion, Utilization*, Vol.3, pp. 97-114.

Yin, R.R. (2009) *Case Study Research – Design and Methods,* 4th Edition, Sage Publications, Thousand Oaks, California, USA.

Young, R.R. (2004), *The Requirements Engineering Handbook,* Artech House Publisher, London.

Yu, T.W.A. (1998), *Evaluation of Integrated Procurement Systems in Hong Kong*, unpublished MSc thesis, City University of Hong Kong, December.

Yu, T.W.A., Shen, Q., Kelly, J. and Hunter, K (2005), "Application of Value Management in Project Briefing", *Facilities,* Vol. 23, No. 7/8, pp. 330-342.

Zielczynski, P. (2008), *Requirement Management Using IBM Rational Requisite Pro,* IBM Press, New Jersy.