OPPORTUNITIES AND BARRIERS
OF ARCHITECT LED DESIGN-BUILD PROJECTS

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ABSTRACT

OPPORTUNITIES AND BARRIERS
OF ARCHITECT LED DESIGN-BUILD PROJECTS

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From past to today, technological developments have resulted in new systems in parallel with digital age. Innovations have been started to be replaced with the traditional solutions. Standardizations have also started to be renewed in accordance with the high technology and complexity of the projects. Under these circumstances, design and construction activities have been separated in the construction industry. As a result, alternative project delivery systems have been developed and selecting the right delivery system has gained importance depending upon the complexity of the projects

The main objective of this study was to propose a model that supports architect's leadership in design-build systems throughout an international airport project as a case study. Thus, construction industry will gain awareness for the organization structures in which architectural groups lead the other disciplines to achieve success in design-build systems considering time cost quality triangle.

In this study, organization charts including project construction process and factors affecting design and construction activities were investigated. The matrix relationship in production level of the organization charts among the project disciplines has been analyzed. According to the evaluation of models reflecting the existing status, alternative models supporting architect's leadership are proposed.

Key words: Project delivery systems, design build projects, architect led design-build

ÖZ

MİMAR ÖNDERLİĞİNDEKİ YAPIM -TASARIM SİSTEMLERİNİN İMKANLARI VE ENGELLERİ

Deniz, Ayça
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Dünden bugüne, teknolojik gelişmeler dijital çağa paralel olarak yeni sistemlerie sonuçlandırıldılar. Inovasyonlar geleneksel çözümlerin yerini almaya başladılar. Standardizasyonlar da son teknolojiye ve projelerin karmaşıklığına göre yenilenmeye başladılar. Bu şartlar altında inşaat endüstrisinde yapım ve tasarım aktiviteleri birbirlerinden ayrıştırıldılar. Bunun sonucu olarak alternatif proje teslim sistemleri geliştirildi ve projelerin karmaşıklığına bağlı olarak doğru sistemi seçmek önem kazandı.

Bu çalışmanın temel amacı, uluslararası bir havaalanı projesi örneğinden mimar önderliğinde yapım-tasarım sistemlerini destekleyen model geliştirmek oldu. Böylece inşaat endüstrisi, yapım-tasarım sistemlerinin zaman, bütçe, kalite üçgeni içinde başarıyla sonuçlanabilmesi için mimari grupların diğer disiplinlerine liderlik ettikleri organizasyon yapılandırmaları için farkındalık kazanacaklardır.

Bu çalışmada, projenin yapım sürecinin de dahil olduğu organizasyon şemaları ve yapım-tasarım aktivitelerini etkileyen faktörler incelenmiştir.

Proje disiplinlerinin organizasyon şemalarındaki üretim düzeyinde matriks ibağlantıları analiz edilmiştir. Mevcut durumu yansıtan modellerin değerlendirmesine göre, mimarın liderliğini destekleyen alternatif modeller önerilmiştir.

Anahtar kelimeler: Proje teslim sistemleri, yapım-tasarım projeleri, mimar önderliğinde yapım tasarım

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Firstly, I am deeply grateful to my thesis advisor Assoc. Prof. Dr. Soofia Tahira Elias Ozkan. Working with you has been a real pleasure and honor to me. With your steady influence and your support throughout this thesis, the hardest parts have always been clarified; you have always been encouraging in times of new ideas and difficulties; you have oriented and supported me with high motivation and care. I admire your ability to balance various research interests; your high scientific standards and your guidance set an example.

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To My Parents & My Grandmother

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LIST OF ABBREVIATIONS

AIA	**:** American Institute of Architects
ASCE	**:** American Society of Civil Engineers
BIM	**:** Building Information Modelling
CII	**:** Construction Industry Insitute
D-B	**:** Design Build
DBIA	**:** Design Build Institute of America
DCC	**:** Document Control Center
HVAC	**:** Heating Ventilating and Air Conditioning
ICT	**:** Information Communication Technologies
IFC	**:** Issued for Construction
IRR	**:** Interface Requirement Review
ITT	**:** Invitation to Tender
MEP	**:** Mechanical, Electrical and Plumbing
OSHA	**:** Occupational Safety and Health Administration
PMI	**:** Project Management Institute
RFI	**:** Request for Information

CHAPTER 1

INTRODUCTION

Through industrialization, the built environment has been recognized with its significance in both the private and the public sectors. The design, construction disciplines have been separated in the construction industry and the productivity has become strongly related to various issues including project delivery systems.

As stated by Friedlander (1998), historically, the architect as master builder had overall responsibility for a given project, both the design and construction; and as the legal climate became more adversarial, architects retreated from responsibility for construction, carving out the ever-narrowing niche that they now occupy.

After the separation of design and construction functions, alternative systems have been evaluated to carry out design and production as a single process. The design build concept began to develop as a continuation of the master builder concept in order to increase productivity due to the needs of the industry. Furthermore, the effect of organizational structure on productivity and quality, has a significant importance. The conditions it creates and the incentives it gives, can contribute to the successful realizations of operational project models in the overall picture.

As mentioned by Hillebrant (2000), the main reason for the growing importance of an organizational culture can be explained by the fragmented nature of the construction industry. This nature can lead to insufficient innovation, productivity and inadequate quality. The ‘‘design build’’ concept can help to reduce these problems through collaboration and control. There is, however, a gap of design quality and it is a big concern. At this point, the investigator’s question is whether this gap can be filled by a competitive strategy through a form of design build or not.

1.1. Argument

The fragmented nature of construction industry leads to the developments of new concepts, especially in design build systems due to the problems arising. But there still exists problems in achieving the expected design quality in design build projects. Friedlander (2008) indicates that a comprehensive study by the University of Reading has corroborated a commonly held opinion of design-build recently: that it receives high marks for shortening project delivery time and providing single-point responsibility, but the quality of design suffers.

The forms of cooperation in design build differ due to the command center of the organization. Architect led design build focuses on architecture profession throughout the integrated approach to design and quality. Besides, the architect accounts for the design and implementation risks, in architect led design build. Uncertainty exists about the significant factors that compose sustainable competitive approach in design build throughout architecture profession. However, architect-led design-build seems to be attractive for increasing the level of design quality and providing competitive strategy.

The factors that supply architectural competitive approach within design build and the barriers that avoid the evaluation of architect led design build are unclear. Through the identification of these factors, the architects can undertake a competitive strategy in design build market. And the resources available that form a basis for architect led design build can lead to competitive strategy.

On the other hand, developments in the construction industry such as Information Communication Technologies (ICT) technology support collaborative concepts. The collaborative strategy in organizations can increase the productivity of technological aspects as well. There is no single solution that can reduce the unexpected situations till the execution effectively. And today a well-structured design build system supported by ICT technology can have the potentials to fill the gap between the design process and production process. The research study aims to enhance a competitive strategy for design build system through architect's leadership.

1.2. Objectives

In literature, generally design build is described in terms of construction. Currently, there are limited publications from the perspective of architecture profession. Therefore, this diagnostic survey focuses on the background, causes and relations of the arising problems. The results may serve as input for further research.

The points set forth below summarize the objectives intended to be reached at the conclusion of this research;

- To carry a literature survey on design-build systems and architect's role in the organizational chart in order to identify the advantages of architect-led design build.

- To explore the problems in the organizational level of design build systems that cause design-based omissions.
- To identify the design-based problems in the production process in order to develop competitive strategy in the architecture profession.
- To identify the factors to create competitive approach in architecture profession by figuring out the perceptions of the architectural community against the implementation issues for a design build organization.
- To identify the barriers in establishing architect's leadership.
- To develop strategies to enhance collaboration through a well-structured organization system.
- To introduce the technological developments that strengthen collaborative approach supporting architect-led design build from design development to project completion.

1.3. Procedure

The investigation progresses through several stages can be followed in Figure 1.1.

1.4. Disposition

In Chapter 1, the argument for, the objectives of and the procedure followed for this study are presented in brief.

Chapter 2 presents a concise review of the literature sources related to project delivery systems, the advantages and disadvantages of design-build project delivery systems and models of architect led design-build systems.

Chapter 3 is related to the material used in the study, a case study of an international airport project, and the method followed for evaluating the organization charts, approval process and information flows.

Chapter 4 presents a discussion on the results obtained from the existing organization charts , the evaluation of the actual status of the organization structures and the proposed models highlighting architect's leadership.

Chapter 5 concludes this study with an overview of the pros and cons of using architect led design build models.

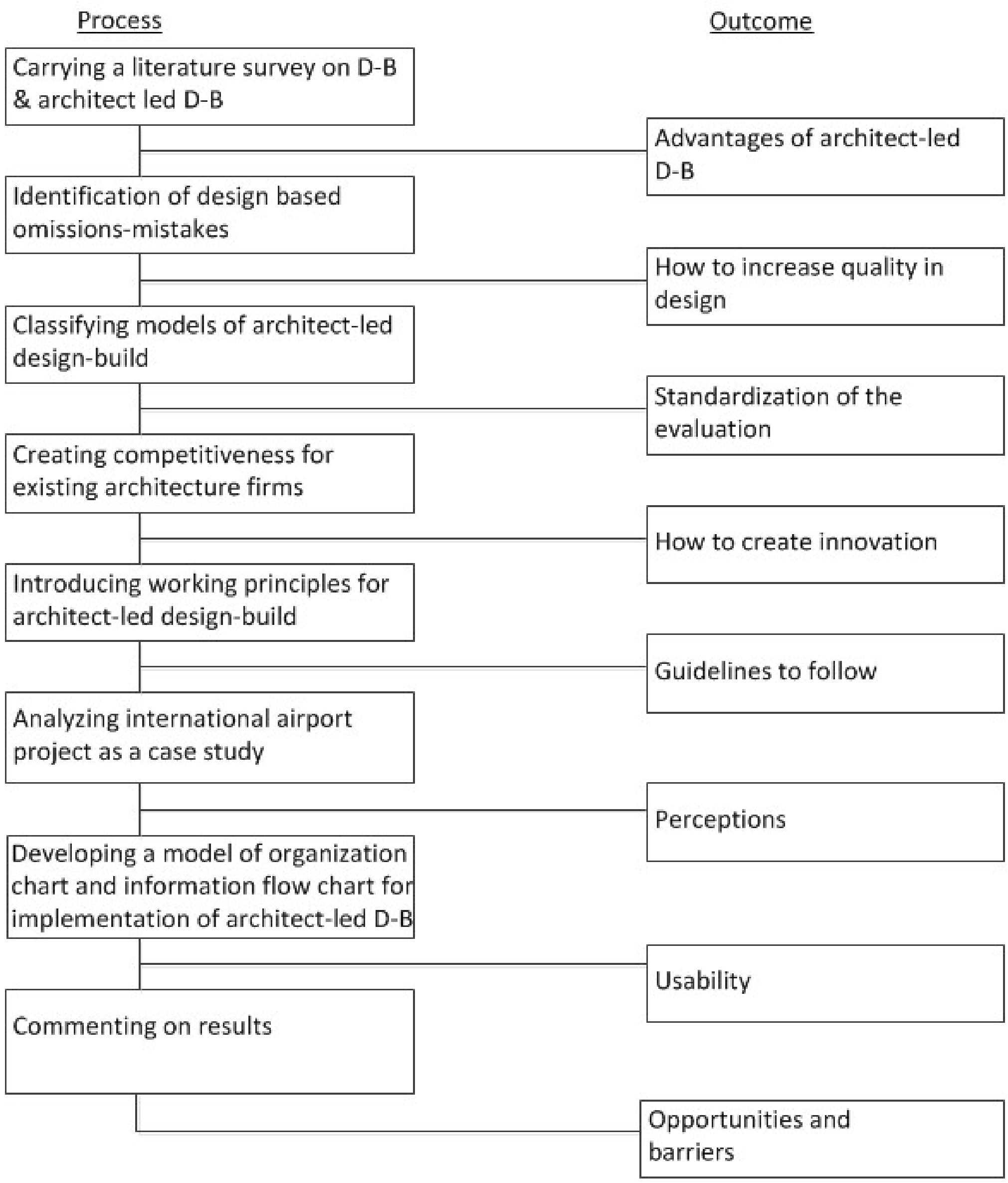

Figure 1.1 The Stages of the Study

CHAPTER 2

LITERATURE SURVEY

This literature survey is based on evolvement of architect-led design-build in historical process. Firstly, design-build systems are introduced, the advantages and disadvantages of design-build are discussed. Then the models of design-build systems are defined, the comparisons are presented and the role of architecture profession is discussed through architect-led design build.

Researcher Robert K. Yin (1984) defines the case study research method as an empirical inquiry that investigates a contemporary phenomenon within its real-life context; when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used. Literature survey is aimed to be supportive for the case study of an international airport project as an indicator of real-life situations.

2.1. Change in Industry

According to Egbu (1999) and Carrillo (2000), the fragmented nature in which the industry is organized means that efficiency in project delivery is less than expected, resulting in dissatisfied clients, and low profitability for construction firms.

Besides, Aouad (1994) indicates that the procurement of any single construction project is complex in the separation of functions into discrete sub-processes, in its structures and procedures, in its proliferation of acto and activities, in the diversity of the resources employed their sources and their mobilization.

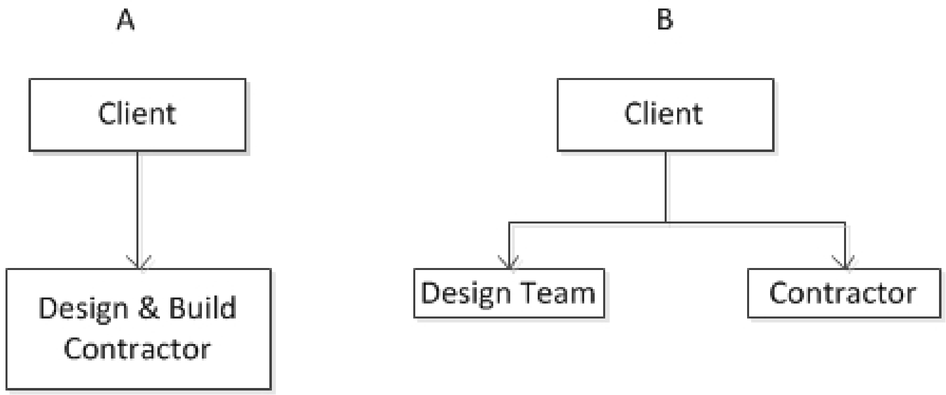

Figure 2.1 (A) Single point responsibility – D-B contract (B) Fragmented responsibility – Traditional contract (Bennett and Grice, 1992)

Responsibilities in D-B contract and traditional contract are classified as single point responsibility and fragmented responsibility by Bennett and Grice (1992) as can be seen in Figure 1.

Due to the effects of the industrial revolution, the district separation of the disciplines has led to the complexity in design and construction process. Fragmentation can be seen as the primary reason why the structure of the industry has started to seek different systems in order to increase productivity and performance.

As noted by Masterman (1994), the adoption of various forms of procurement is arguably the most significant attempt that the construction industry has made to improve its services.

In an attempt to improve these services mentioned by Masterman (1994), the manufacturing industry can be taken into account by practitioners and researchers as a point of reference and a source of innovation.

2.2. Procurement Systems

Earl, Love and Skitmore (1997) state that a procurement system is an organizational system that assigns specific responsibilities and authorities to people and organizations and it defines the relationships of the various elements in the construction of a project.

Procurement systems are generally classified as traditional systems, design and build and construction management. Mastermann (1994) classifies project procurement systems into several categories based on the relationship and critical interaction between design and construction responsibilities.

According to Masterman (2002) procurement as the whole process of creation, communication, response and integration in the context of the project, is an expensive process due to its potential for waste and high level of error.

The dynamics of procurement systems increase their flexibility. They can be adapted due to the individual circumstances and requirements of a project through the subsystems. It is important to seek solution to match the individual necessities of the project. For some projects, certain requirements can be more important than others. For this reason, the sub classifications of the procurement systems mentioned by Perry (1985) in Figure 2.2, have a considerable importance.

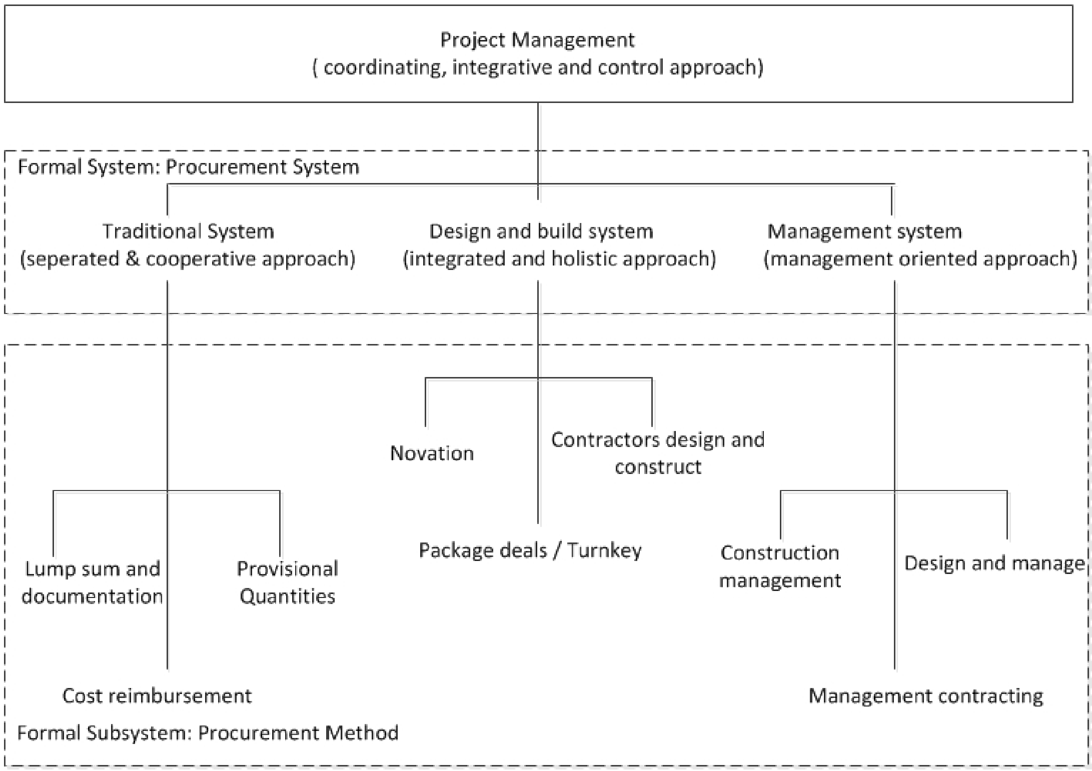

Figure 2.2 Categorization of building procurement systems (Perry, 1985).

As mentioned in Figure 2.2, the main procurement systems are traditional, design build and construction management systems. Each of them provides different procurement strategies by using different methods of risk allocation.

According to Mincks and Johnston (2010) three primary delivery systems – the traditional system (also known as design-bid-build), the CM system, and the design-build system are used in the construction of building and industrial facilities today, each of these systems has different roles for the contractor, architect, and owner, and each has a different communication network between the parties in the system. Mincks and Johnston (2010) also mention that although the traditional system is the most common delivery system currently used, the alternative systems of CM and design-build offer opportunities to provide more management in the process, controlling cost, time, and quality.

In traditional system, firstly design stage is completed. After design stage, contractual arrangements are made and construction starts. In construction management system, design and construction stages overlap. The construction manager controls the work packages. And contractual arrangements are made between the client and the contractors.

In design and build system, design and construction stages are assumed under the control of a single contract. After the schematic design is completed, the contractor and the client start to collaborate in order to evaluate the schematic design and set the rules of the contract through taking into account the detailed design and construction. These systems are evaluated and sub classified to find better ways as the complexity of the projects increases. For this reason, the number of choices for different procurement strategies has increased as well.

Mincks and Johnston (2010) state that each project situation has unique parameters that need to be examined to determine the most desirable delivery system for the owner.

According to Shockley and Zalaback (1991), communication has been linked to team effectiveness, the integration of work units across organizational levels, characteristics of effective supervision, job satisfaction, and overall organizational effectiveness.

After setting a systematic principle analysis, what needs to be done is to establish an effective communication within the organization to select the appropriate project structure and make contractual arrangements. The success of the project is not only related to the selection of the appropriate systems. The adaptation of these systems to the organizational structure has also a considerable influence on the success of the project.

2.3 Design Build

As stated by Molenaar, Songer and Barash (1999) design build system is one of the new procurement systems introduced to address the problems associated with the traditional system and innovative practices of the D-B system have been developed to cope with the growth in both the private and the public sectors.

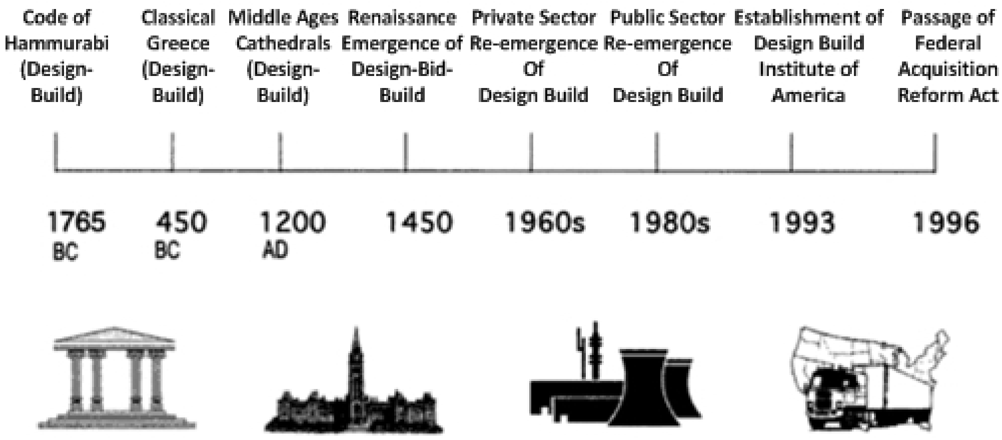

Figure 2.3 History of Design Build (Levy, 2006).

According to Gwen (1998), design and build acclaimed to be beneficial to all parties such as clients, architect, engineers and contractors. Furthermore, P.Chan (1997) states that unlike traditional approach which only appoint a single unit of design team to come out with the design ideas, D-B will produce much more different design ideas from the design builder who enter the tender.

The disadvantages of contractual arrangements in traditional systems, lead to the need of improvements in procurement systems as well as the constraints of time, cost and quality. Under the control of a single contract, these improvements can be achieved with a direct responsibility to the client.

On the other hand, technological improvements can be more beneficial through the selection of the appropriate procurement system that makes an improved deal with the client.

Hibberd and Basden (1996) suggest that a contractual arrangement initially should be selected to take into consideration how risk will be transferred between parties, therefore determining the nature of the procurement method so as to meet the client's objectives.

The procurement strategy of a particular procurement system has a considerable importance for the success of the project. The establishment of the most appropriate system is one of the main issues that the client has to take into consideration. The strategy is set during the early phases as a result of a series of decisions. It has strong influences on the risk allocation and design strategy. It also has a considerable strategy on the roles of the consultants and contractors. Risks generally relate to objectives, time-cost certainties and operation phase. Accordingly, risk allocation has a significant importance through the procurement system, organization culture and organizational structure.

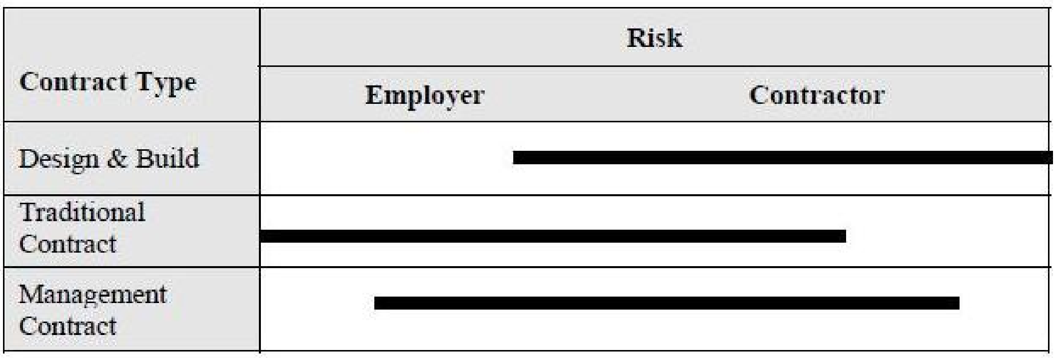

Figure 2.4 Allocation of risk for each type of procurement contract (Hoggs and Morledge, 1995).

Levy (2006) states that risk sharing is an integral part of the design-build process and invites discussions involving insurance, what limits are required, and who is to furnish the necessary policies.

The identification of advantages and disadvantages for the selection process of the procurement system are evaluated due to the risks. So the risk analysis and risk allocation have to be considered in a proper and disciplined way in order to set the procurement strategy and get the desired result.

As shown in Figure 2.4 (Hoggs and Morledge, 1995) in design-build systems risk allocation is contractor-oriented whereas in traditional systems it is employer-oriented. And in management contract systems, there is a balance of power between employer and the contractor due to the consistent risk allocation.

2.3.1. Advantages and Disadvantages of Design Build

The main advantage of the design and build procurement system is its single point responsibility through the overall management of the project. It provides the required integrated approach of each different discipline. The relationship between the designer and contractor starts to be evaluated at an early phase of the project. For this reason,the responsibility is defined under the control of one organization for design and construction activities.

Table 2.1 Construction delivery processes: pros and cons (Levy, 2006).

Advantages and Disadvantages of Design-Bid-Build &Design-Build	
Design-Build	
Advantages	**Disadvantages**
• Price certainty	• Limited assurance of quality control.
• Agency may avoid conflicts and disputes.	• Subjective contract award,
• Builder involved in design process.	• Limited access for small contractors.
• Faster project delivery.	
• Agency needs less technical staff.	
Design-Bid-Build	
Advantages	**Disadvantages**
• Building is fully defined.	• Agency gets involved in conflicts and disputes.
• Competitive bidding results in lowest cost	• Builder not involved in design process
• Relative ease of assuring quality control.	• May be slower.

• Objective contract award.	• Price not certain until construction bid is received.
• Good access for small contractors.	• Agency may need more technical staff.

As mentioned by Sanvido and Kochnar (1997) a study by CII, examining the 155 design-build projects available, identify the major advantages of design-build as summarized below;

- Design and construction issues are well integrated and the constructability of the project is well developed as a result of the early involvement of the contractor.
- With a consolidated design and construction team, the implementation of fast-track construction is straightforward. Overlapping of different phases in the project process saves time.
- There is a single point of contact and contract responsibility during the whole project performance rather than the separation in the activities of design professional and contractor.
- As a result of single point of responsibility, there is efficient communication flow between design and construction team members.
- Transfer of monitoring activities and risks to the company can reduce construction-engineering costs.
- Monitoring the project activities is well controlled in this system as a result of design team's active position from inception to execution.
- Innovations can be provided in the project throughout the project objectives and contractor's achievement.
- Before the construction phase, identification of design errors throughout the completed data reduces the changes in the project process.

According to Sanvido and Kochnar (1997), the CII study also identifies the disadvantages of design-build are summarized as below;

- If the client wishes to make changes in the design issues, after the building contract is determined and signed, he/she has to pay more fees. For changes in design, client has to give instructions to the contractor. This situation leads to claim management.

- This system can cause delay of construction to complete the design phase. Design phase continues during the project process.
- Pricing cannot be done at the early phase.
- In design-build, the contractor or the design professional takes the overall project leadership. Most commonly, the contractor is selected as the leader.
- Therefore, the design professional has no direct contractual relationship with the client. Furthermore, the indirect relationship of the design team can limit the control activities of the client on the design issues. And if the design quality is one of the main priorities, contractor-led design-build system can be unsatisfactory.

Table 2.2 Advantages and Disadvantages of Design-Build Projects
(adapted from Sanvido and Kochnar, 1997).

DESIGN-BUILD PROJECTS	
ADVANTAGES	**DISADVANTAGES**
Constructability: Design and construction activities are well integrated and the constructability of the project is well developed	**Claim Management:** If the client wishes to make changes in the design issues, after the building contract is determined and signed, he/she has to pay more fees. This situation leads to claim management.
Shorten Duration: With a consolidated design and construction team, the implementation of fast-track construction is straightforward. Overlapping of different phases in the project process saves time.	**Ongoing Design Activities:** This system can cause delay of construction to complete the design phase. Design phase continues during the project process.
Single Point Responsibility: There is a single point of contact and contract responsibility during the whole project performance rather than the separation in the activities of design professional and contractor.	**Leadership:** In design-build, the contractor or the design professional takes the overall project leadership. Most commonly, the contractor is selected as the leader. Therefore, the design professional has no direct contractual relationship with the client.
Efficient Communication: As a result of single point of responsibility, there is efficient communication flow between design and construction team members.	**Design Quality:** The indirect relationship of the design team can limit the control activities of the client on the design issues.
Reduce Cost: Transfer of monitoring activities and risks to the company can reduce construction engineering costs	**Forecast Budget:** Pricing can’t be done at the early phase.
Reduce Claims: Monitoring the project activities is well-controlled in this system as a result of design team’s active position from	

inception to execution.	
Innovation: Innovations can be provided in the project throughout the project objectives and contractor's achievement.	
Change Management: Before the construction phase, identification of design errors throughout the completed data, reduces the changes in the project process.	

Table 2.3 Design Build Selection Factors and Definitions
(Songer and Molenaar, 1996).

Selection Factor	**Definition**
Establish Cost	Secure a project cost before the start of detailed design.
Reduce Cost	Decrease the overall project cost as compared to other procurement methods (design-bid-build, construction management at risk, etc.).
Establish Schedule	Secure a project schedule before the start of detailed design.
Shorten Duration	Decrease the overall project completion time as compared to other procurement methods (design-bid-build, construction management at risk, etc.).
Reduce Claims	Decrease litigation due to separate design and construction entities.
Large Project Size/Complexity	The project's sheet magnitude is too complex to be managed through multiple contracts
Constructability / Innovation	Introduce construction knowledge into design early in the process.

Design Build Institute of America (1994) mention that performance aspects of cost, schedule, and quality and responsibility of risk are more appropriately balanced. According to DBIA (1994), individual risks are managed by the party in the best position to manage those risks and change orders due to omissions and errors are reduced because the design-builder has the single source responsibility of designing and producing a functional facility.

Moreover, as Wilking (2004) states, in spite of increased financial risk, mostly due to the single point responsibility for cost, quality and schedule, most A/E firms agree that design-build can be more profitable to a firm than traditional approach.

2.3.2. Design Management for Design-Build Projects

Different design options gain importance for a successful decision making process in design stage. In order to generate considerable design ideas, the right allocation of design responsibility forms a basis in design management.

As noted by Gray and Will (2001) and Dulamimi (1995) design management is to ensure that all the information is managed and distributed sensibly and responsibly at the right time.

Design management is a continuous process. Schematic design and design development phases are followed by detailed and as-built drawings. According to Hegazy, Grierson and Hampton (2001) the major difficulty in design management is the need to collaborating multidisciplinary personnel and issues and the process also involves the allocation of design responsibilities among all the project participants and appreciation of contractual implication in the process.

As noted by Beard, Loulakis and Wundram (2001) due to the complexity in the collaborative process, the project manager must understand the requirements of design management as well as construction management, leading the design and construction team in meeting the project objectives of quality, cost, schedule, and performance.

General skill areas recognized by the Project Management Institute (PMI) include integration, scope, time, quality, cost, risk, procurement, communications, human resources. In design & build system, there is a strong interaction between its collaborative contracting method and the continuous design management till the completion of the project. The single point responsibility strengthens the common objectives of the client, contractor and the designer. A strong collaboration between the sides can result in successful project process. Without doubt, such a system needs an effective design management and information flow between the sides for a successful change management as well.

Changes during project process are mostly related to the design-based omissions and mistakes. And as mentioned by Ouatman and Dhar (2003) the designer-builder is also responsible for design problems that affect the ability to achieve performance requirements. For this reason, the leadership in design-build systems gains importance from architect's perspective.

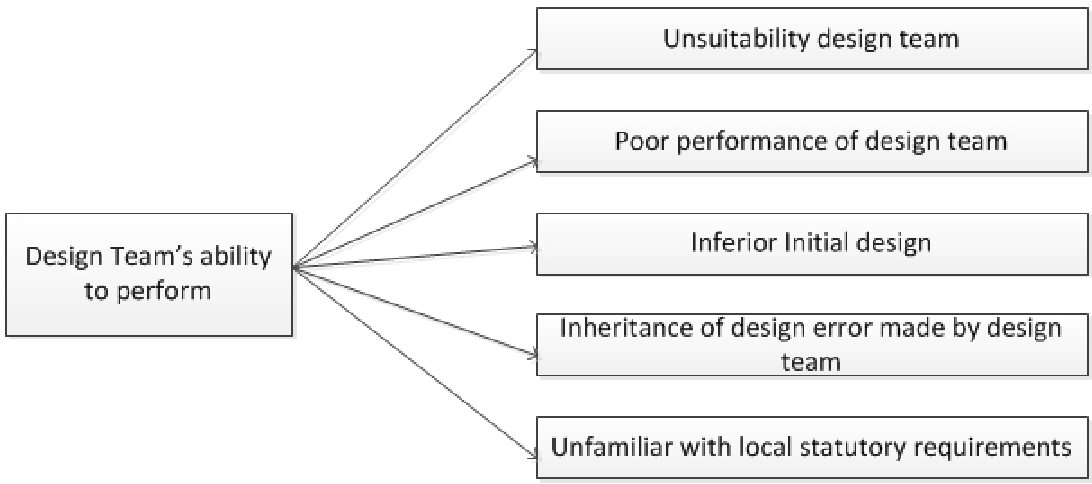

Figure 2.5 Risk elements pertinent to design team's ability to perform (Thomas and Skitmore, 2001).

As mentioned by Riley, Diller and Kerr (2005), field generated change orders are typically due to design errors or poor project coordination and can usually be avoided.

According to Fredrickson (1998), areas where design work effort is often unnecessary or duplicated include:

- Design effort is often duplicated in specialty subcontracting and supply outside the designer's area of expertise.
- Routing of piping, conduits, and HVAC is often designed twice —once by the designer outlining his or her understanding of the best routing and once by the detailers responsible for preparing the fabrication and material ordering documentation needed to complete the work.
- Technical specifications are often quite detailed because of the need for protective language and to completely describe material and equipment desires in lieu of performance requirements. Protective language can generally be eliminated in the design-build process. Material and equipment requirements can usually be reduced to lists of specific equipment and material used to prepare the bid.
- Redesign often results from changes to selected equipment or details provided during the shop drawing process.

Ouatman and Dhar (2003) also indicate that a project manager/estimator can not easily be turned into an architect, but an architect, with some training, can be turned into a project manager/estimator due to their professional experience in the industry. As mentioned by Beard, Loulakis and Wundram (2001) the design-builder must provide leadership that encourages creative suggestions from all members of the design and construction team, regardless of the source and successful design-build programs are those that integrate, at the conceptual design stage, the entire industry from design architect through design-build subcontractors, trade subcontractors, suppliers, vendors, building systems manufacturers, and craftspeople. Besides, a design-build project can be managed in different ways depending on the structural variations. According to these variations, the allocation of risk and responsibility differs as well.

2.4. Design Build Process Variations

As mentioned by Beard, Loulakis and Wundram (2001), whenever an owner decides to employ the design-build project delivery method, an important next step is to determine which variation of design-build is most appropriate for meeting the owners and the project needs. As an architect and design professional criteria, Wundram (2001) states that design-build is an entire range of possibilities. Variations of design-build can be divided into two basic types, operational variations and structural variations.

2.4.1 Operational Variations of Design Build

Beard, Loulakis and Wundram (2001) state that while structural variations are important, another way to analyze and categorize design-build is to consider the operational variations of design build. They classify operational variations including direct design-build, design criteria design-build, and preliminary design-build.

According to Beard, Loulakis and Wundram (2001), operational variations of design-build can be listed as below;

- Direct Design-Build – In this variation of design-build, the contractual arrangements are considered with the owner at the earliest stages of the project including scope of project, feasibility studies and conceptual design options.
- Design Criteria Design-Build – In this variation of design-build, the owner defines the design parameters and the required performance criteria. The owner prepares a Request for Proposal (RFP) in order to increase competitiveness in the selection process and identify the appropriate solution. The clarity of the owner’s objectives and

requirements composes the selection criteria and the level of design details. Design builders develop design options by taking into account RFP.

- Preliminary Design-Build – In this variation of design-build, the content of the initial design is carried out by the design consultant of the owner .The Design-Builder is contracted to complete the project on the basis of this preliminary design solution.
- Bridging Design-Build – This variation of design-build attempts to position itself between design-build delivery and traditional design-bid-build. Under this approach, the owner contracts with a design professional to prepare partial design documents. The owner issues the partially complete design documentation (30% to 80%) to the marketplace and requests proposals.

Timing of contractual arrangements compose the main difference among these variations through design life cycle. In Figure 2.6, the basic steps of design-build's operational variations are mentioned. In structural variations, the roles of the parties within the design-build entity differ. Whereas, in operational variations, the prescriptive specifications, that are strongly related to design phase, differ.

The diversity in structural and operational aspects composes numerous alternatives for design-build methodology. Thereby, the design-build entity can be managed through a hybrid approach of these variations due to the project's objectives. The level of design detail and the leadership of the entity are significant determinants in order to provide performance based requirements and the prescriptive specifications of the project.

2.4.2. Structural Variations of Design Build

According to Beard, Loulakis and Wundram (2001), structural variations are characterized by the roles of the parties within the design-build entity, including joint-venture arrangements, architect-led, contractor-led, integrated firm, and developer-led.

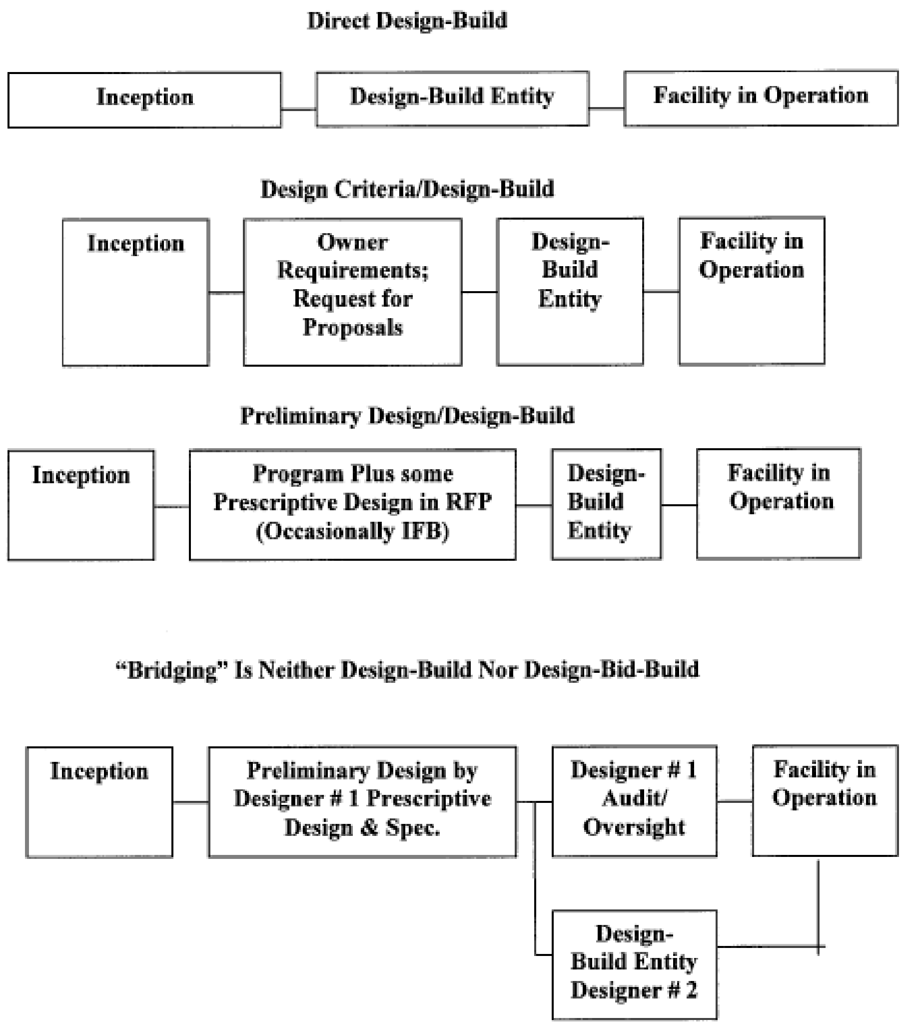

Figure 2.6 Operational variations of design-build (Beard, 2001).

Oregon Public Contracting Coalition (2002) makes the definitions of these five variations as can be seen below;

- Joint Venture Design-Build: The design builder can assume the organizational structure throughout a joint-venture which is a contractual collaboration between design professional and constructor.
- Integrated Design-Build: The agency utilizes an integrated design-builder that engages subcontractors, consulting engineers, suppliers.
- Contractor-Led Design-Build: The agency contracts with a general contractor that acts as the Design- Builder and that engages the design professionals, trade subcontractors and suppliers.
- Architect-Led Design-Build: The agency contracts with a design professional that acts as the Design- Builder and that retains additional design professionals, consultants and a general contractor that then engages trade subcontractors and suppliers.
- Developer Led Design-Build: The agency engages a developer and the developer engages a design professional and a general contractor that retains trade subcontractors and suppliers.

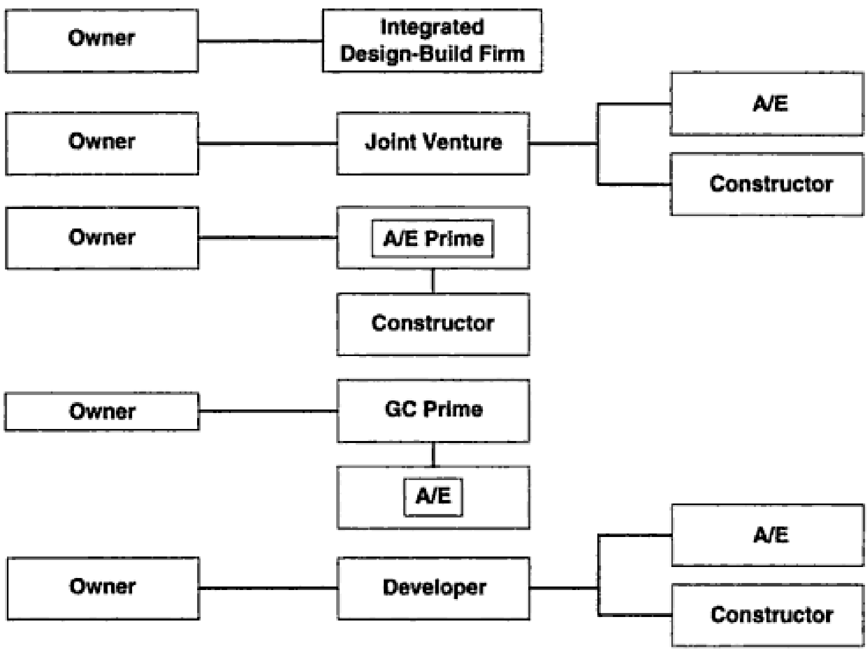

Figure 2.7 Structural Variations of Design Build (Beard, Loulakis, Wundram, 2001).

2.5. Architect Led Design-Build

The roots of design build method come from the early history of construction industry. It is a process that stems from the predominant approach of the master builders until the 19th century. As indicated by Macneil (1993), architect led D-B is a system whereby the architect takes the reins as a way of allowing the client direct access to the design team throughout the construction process, while retaining the fixed price and contractual simplicity of D-B.

The AIA (2005) maintains that projects can be effectively designed and constructed by a variety of delivery methods, including but not limited to design-bid-build, design-build, and negotiated select team. The AIA (2005) also believes an architect is the most qualified to lead alternative project delivery teams, and advocates that architects should be retained in that role regardless of which delivery method is used.

According to the survey of 40 architects carried out by Akintoye and Fitzgerald (1995), 20% of architects' private sector workload (and 8% of public sector) is derived from D-B, they perceive this procurement type to involve sacrificing product quality and design innovation. As mentioned by Chevin (1993) D-B has been held to encompass a variety of names, including design and construct, develop and construct, and design and manage. D-B has been described mostly like as the contractor is responsible for both design and construction and leads the design build process.

Friedlander (1996) states that architects have feared that design-build diminishes the role of design professional and the importance of design to the project as a result of their subservient role to the contractor in design-build projects.

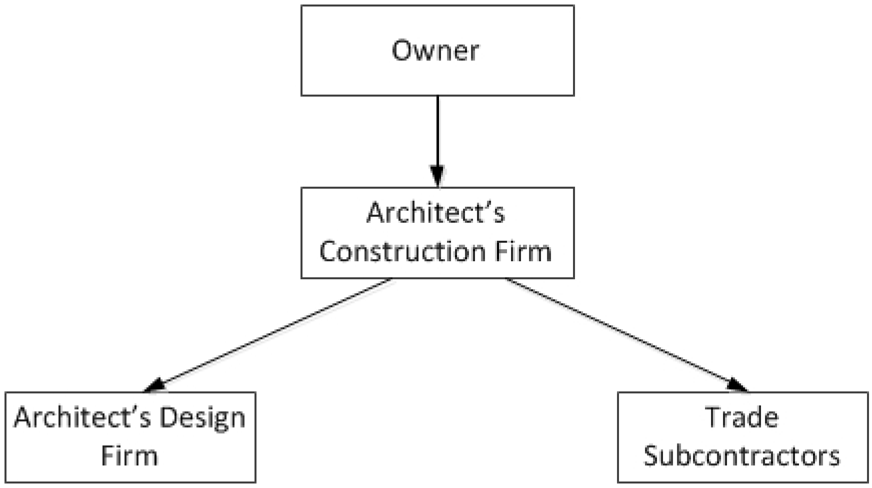

Figure 2.8 Architect Led Design Build (Quatman and Dhar, 2003).

Whereas, mostly architects question the implication on the prevalence of contractor led design build. As noted by Mortimer (1993) in recent times, the term 'architect-led design and build' has appeared and has sometimes been referred to as 'total procurement' to distinguish it from 'design and build' which typically implied contractor-led procurement.

The architect-led D-B is claimed to provide safeguard quality. According to Gallagher (1993), this may have strong appeal to the majority of clients, those who believe that contractor-led D-B leads to lower design standards. In contractor-led design build, the contractor has the full responsibility of coordinating the disciplines that take place in the contract. The contractor's controll overall, the project has resulted in the necessity of innovation for high-qualified design standards from the client's perspective.

Especially Quatman (2004) and Elvin (2007) are pioneers of design build from the perspective of architecture discipline. As indicated by Quatman (2006) design build is a supply method in which the design and realization are combined in one contract. Furthermore, Quatman and Dhar (2003) mention that the architect offering construction services gains control of all aspects of a project, including design, workmanship, budget, and Schedule and this much control can be attractive when compared to the lack of control the architect has in other project delivery methods.

2.5.1. Advantages of Architect Led Design Build

Quatman and Dhar (2003) state that in an architect-led design-build scenario, an architect should head both of the architectural, engineering and construction entities in order to assure the owner that a design professional will lead the entire design-build project all the way through post occupancy services, thereby keeping design and quality at the forefront of the project.

As Akintoye and Fitzgerald (1995) mention, architects therefore progress beyond the sterile terms of the current debate on design and build, adapt to their new role in project procurement and develop a meaningful collaboration with contractors to satisfy the building clients' requirements for efficient procedures, value for money and optimum project performance.

On the other hand Levy (2006) points out that initially setting aside issues of contractor licensing, bonding, and insurance, which can be overcome by the creation of the legal design-build entity, developing a design-build capability within the architect's firm can be explored with a contractor with whom the firm has had prior positive dealings.

Levy (2006) also indicates that an architect's share of profit maybe considerably higher if they assume the role of prime contractor rather than the role of subcontractor to a builder. According to Gransberg, Koch and Molenaar (2006), an architect-led design build team with the builder as a subcontractor ensures that the project will be completed by an entity that is capable of complex design and has a constructability crosscheck available on demand.

As stated by Friedlander (1996), there are four significant advantages of architect -led design -build to the architect as can be seen below;

- Firstly, it enables the architect to participate in construction profits which dwarf the profits from the design phase.
- The second major advantage is in marketing. The architect will be able to offer owners a design-build option, which the owner may elect, or not at his choice, any time during the design phase.
- The third advantage is control of design. An architect who is prime can control the quality of design and can ensure that the construction implements the design.
- The fourth advantage is minimized problems during the construction phase. The contractor would not be entitled to change orders for errors or omissions in the construction documents

Besides, another considerable advantage mentioned by Quatman and Dhar (2003) is streamlined communications. Quatman and Dhar (2003) state that when the architect is the contractor, communication with the client is direct, without the intervention of a third party and communication with consultants, subcontractors, suppliers is also direct between the designer-builder and the parties.

Furthermore Levy (2006) states that the architect will have the most direct contact with the owner and must be able to deal with contractual issues and financial concerns that may be far removed from their regular field of architecture, whereas the contractor may be more familiar with these events which are a day-to-day occurrence in the construction industry.

2.5.2 Risks of Architect Led Design-Build

Gransberg, Koch and Molenaar (2006) point out that the major disadvantage with architect led D-B teams is that most design firms are not staffed to manage full-blown construction sub-contracts and would probably have to add additional resources to do so.

Quatman (2000) states that one of the disadvantages of architect led design build, however, is the inability of the design firm to make a claim against its own insurance policy for design errors made by the design firm. Quatman (2000) also indicates that though there is coverage for claims made by the owner or third parties, the added construction costs caused by project delays, design errors or omissions by the staff are not covered by the firm's policy and, therefore, must be self-absorbed by the prime contractor.

Furthermore, Friedlander (1996) underlines that the major risk in architect led design build is liability to the owner for construction defects and related problems. But as explained by Friedlander (1996) due to the theory of general contracting, if the architect is liable to the owner, the contractor is similarly liable to the architect and as long as the contractor is financially sound or bonded, the architect's ultimate financial risk is minimal.

Moreover, Quatman and Dhar (2003) declare that as a result of traditional architectural education programs that emphasize design skills at the expense of the construction-related skills, architects often lack some of the training needed to take on the role of contractor. But according to them, this training can be obtained by completing a formal, postgraduate education, hiring staff with the needed training, or engaging in the school-of-hard-knocks approach.

Levy (2006) points out some legal matters that architect has to consider as can be seen below;

- Added risks include insurance coverage for faulty or defective work in the architect's new role as builder.
- The architect will be liable for any accidents or Occupational Safety and Health Administration (OSHA) violations/fines during the construction process and will require additional insurance coverage in that respect.
- In case of cost overruns not attributable to justifiable increases in contract cost, the architect may experience a diminution of fee.
- If a subcontractor or vendor defaults on their contract or declares bankruptcy, the architect may have to engage another subcontractor, often at significantly higher costs to the project.

Table 2.4 Advantages and Disadvantages of Architect Led Design-Build Projects (Friedlander, 1996; Levy, 2006).

ARCHITECT LED DESIGN-BUILD PROJECTS	
ADVANTAGES	**DISADVANTAGES**
Profits: Firstly, it enables the architect to participate in construction profits which dwarf the profits from the design phase	**Insurance:** Added risks include insurance coverage for faulty or defective work in the architect's new role as builder.
Marketing: The architect will be able to offer owners a design-build option, which the owner may elect, or not at his choice, any time during the design phase.	**Health and Safety:** The architect will be liable for any accidents or Occupational Safety and Health Administration (OSHA) violations/fines during the construction process and will require additional insurance coverage in that respect.
Design Control: An architect who is prime can control the quality of design and can ensure that the construction implements the design.	**Cost Overruns:** In case of cost overruns not attributable to justifiable increases in contract cost, the architect may experience a diminution of fee.
Minimizing Errors: Problems are minimized during the construction phase. The contractor would not be entitled to change orders for errors or omissions in the construction documents.	**Financial Risks:** If a subcontractor or vendor defaults on their contract or declares bankruptcy, the architect may have to engage another subcontractor, often at significantly higher costs to the project.

2.5.3 Overcoming the Obstacles

Mozur (1999) points out that as more insurance companies become aware of architect led design build projects; there is a growing market for insurance products specifically aimed in the market. According to Solomon (2005), risk in architect led design build is not managed by insurance but by significantly higher profits that can be used to correct any defective work that may occur in the field.

As mentioned by Aritua, Bower and Male (2007) designers must acknowledge that many clients, especially in view of the increased complexity of today's projects, may not prefer the more traditional ways of procuring and delivering projects. According to Aritua, Bower and Masce (2007), they also have to look to their real areas of strength and develop them by improving the areas of their deficiencies and delivering practical solutions that take into consideration better quality of construction, sustainability and whole-life costing.

On the other hand, Friedlander (1996) indicates that architect-led design build works because the architect's construction company hires a general contractor to be 100% subcontractor, rather than hiring multiple prime trades. And Friedlander (1996) summarizes the benefits from hiring a general contractor as can be seen below;

- Construction risks are virtually eliminated if the general contractor is financially sound.
- The general contractor's presence as a team member may assist the architect in obtaining the project.
- To maintain the relationship, the general contractor is likely to refer business to the architect.

- The architect will not be perceived as competing with general contractors.
- The general contractor may be the source of financial security for the owner.
- The general contractor may be an additional source of management expertise.
- The general contractor will likely earn additional profits for the design build team negotiating better deals with subcontractors and suppliers.

2.6 Models of Architect Led Design Build

As noted by Quatman (2001) four common models of architect-led design-build according to the architect's relationship with general contractor

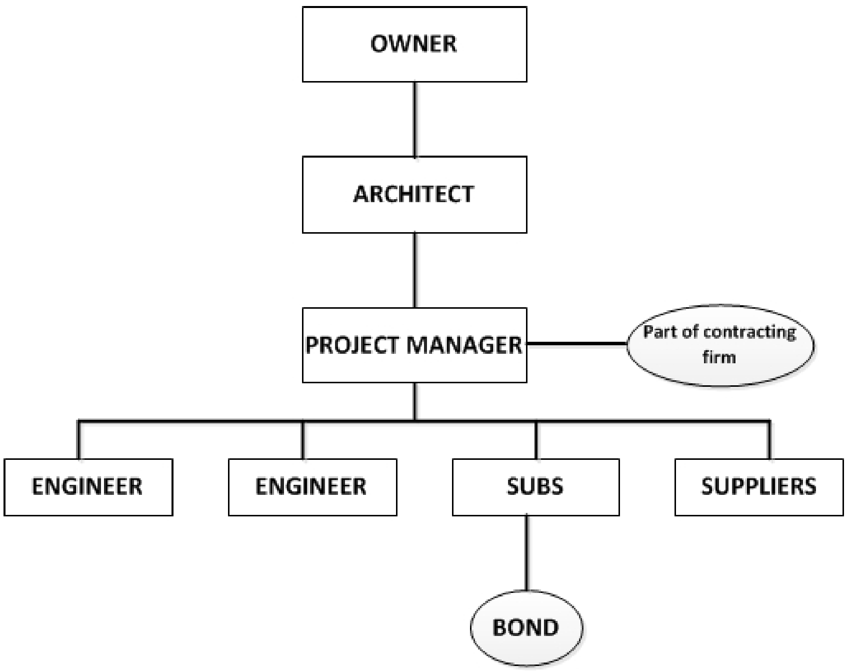

Figure 2.9 Architect led design build where architect acts as general contractor (Quatman, 2001).

Quatman (2001) indicates that if the architect can eliminate the use of a general contractor and act as its own ‘‘general’’, as shown in Figure 2.9, the profits increase. On the other hand, Quatman (2001) also states that the architect, as prime, could not make a claim against its own professional liability policy, but the contractor-as-subcontractor may be able to make claim under the policy carried by the architect for costs it incurs due to design errors or omissions, thereby holding to the guaranteed contract price and covering the loss with insurance.

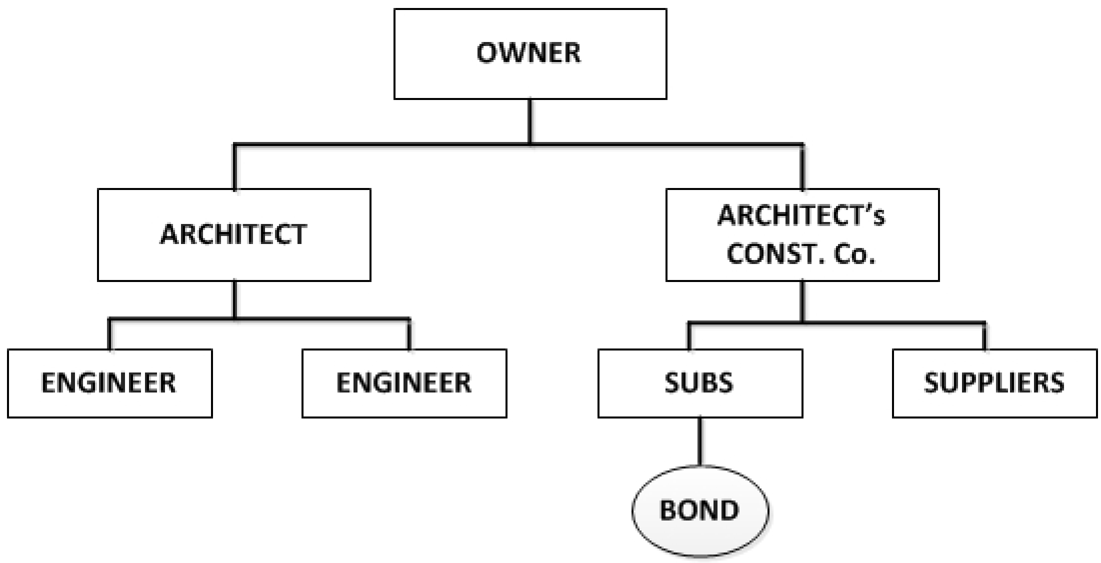

Figure 2.10 Architect-Led Design-Build Where Has Construction Subsidiary (Quatman, 2001).

According to Quatman (2001), design firm can also form a construction subsidiary to hold the construction contract and take on the construction risks as shown in Figure 2.10. As mentioned by Quatman (2001), the benefit of this model is that the subsidiary absorbs the risk of a construction loss, *e.g.,* a cost overrun or an uninsured loss, without putting the design firm at risk for those losses. When the owner wants the services from one entity, this model can satisfy the owner’s requirement. However, this model does not truly offer design-build under a single contract.

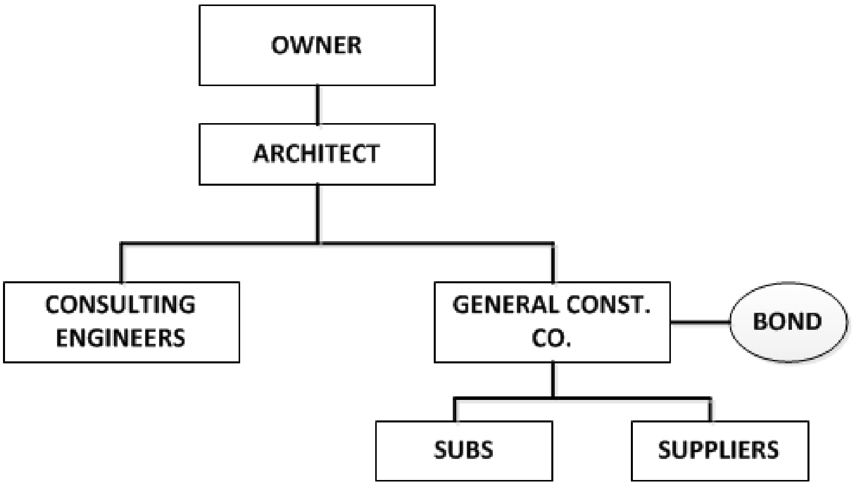

Figure 2.11 Architect-Led Design-Build Where Architect Subcontracts 100 Percent of Construction to a General Contractor (Quatman, 2001).

Friedlander (1997) mentions that by making the owner a third-party beneficiary of the prime subcontract (with the general contractor), bonding the general contractor, and providing the owner with assignment rights to all subcontracts, the owner gets the protection it needs, but the design firm avoids some of the risk.

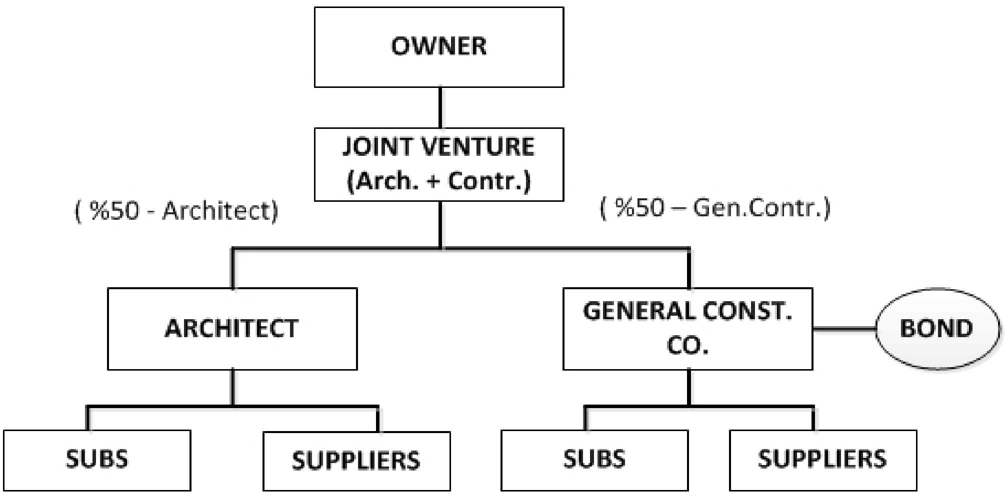

Figure 2.12 Joint venture (or LLC) formed between an architect and a contractor. Shown with 50/50 ownership (Quatman, 2001).

Quatman (2001) also explains that the owner can usually be named as a ‘‘dual obligee’’ with the architect on the contractor’s bond, thereby providing protection to both the owner and the architect.

As indicated by Cushman and Loulakis (2001), most integrated design build firms and general contractors can not cooperate with design firms successfully and for this reason design-builders are required to be organized in the form of joint ventures or led by architects. Cushman and Loulakis (2001) also point out that the designer still has an economic interest in the form of joint ventures and it has a fiduciary duty to its partner, the contractor, which potentially influences its ability to act in the owner’s best interests if the joint venture/LLC would be adversely affected.

Bramble and West (2003) underline the important issues where the architect is the prime contractor with the owner or the dominant force on a joint venture as can be seen below;

- The need to have designer staff on site or otherwise involved during construction to resolve design issues,
- The need to establish a joint process for determining the construction estimates and the amount of any ceiling costs or fixed prices,
- The assignment of key managers of the design firm with experience in both design and construction,
- The need to establish a method for resolving disputes between design-build team members during the course of performance, rather than waiting until the end of the project.
- The identification of these issues has a considerable importance to raise the awareness about the position of the architect in the design build team and the potential conflicts it creates.

Bramble and West (2003) also point out the other issues in order to develop a successful architect led design build. These include;

- Establishing a procedure for ongoing design review by both the contractor and the designer,
- Establishing a process for a concerted value engineering effort by the designer and the contractor before the design is complete,
- Creating a totally open and shared project cost system,
- Including shared-risk provisions in the agreement between the designer and the contractor that include mutual incentives and disincentives to ensure that both design and construction costs are performed within budget,
- Requiring a joint scheduling effort by seasoned staff of both the designer and the construction contractor to address the key milestone and interface dates,
- Establishing a process to address field engineering, unknown site conditions, and environmental challenges that may arise on the project. Matters that are to be addressed in the agreement include the terms of any indemnification for design and construction deficiencies, licensing requirement compliance, the issue of joint and several liabilities for any joint venture agreements, and provisions concerning potential conflicts of interest and confidential business matters.

These issues also have a significant importance for architect-led teams, because traditionally these areas of expertise, management tools, and resources are lacking in many architecture firms.

2.7. Market Development Process of Architect-Led Design-Build

As mentioned by Wilking (2006), owners are putting a priority on value, which will require that teams, rather than individuals, work together to complete designs. In addition, Wilking (2006) states that architects must step up, take charge, and manage the entire design and construction process to maintain design integrity and fulfill their traditional role.

In project life cycle, value can be assessed in terms of better functionalities of the projects such as better healing in hospitals, or better education for students in schools. And during project management process, value can be assessed in terms of efficiency and frequency of the building's use, the cost of operations and the necessity of maintenance over time. Without doubt, the architects and the contractors have different priorities in construction industry. As architects place a priority on quality, the contractors place a priority on efficiency in terms of cost and schedule.

Wilking (2006) also states that architects have the ability to explore options early in a project's schedule and are most familiar with the major decisions needed to ensure long-term success. And as mentioned by Wilking (2006), contractors simply can not provide the expertise that architects can early on in the project.

According to Wilking (2006), drawings are often incorrect, causing delays on the job site or an increase in costs and the owner, who typically is not able to understand the drawings for his or her project, must often make the difficult decisions.

As stated by Downs (2006), the collaborative nature of design-build projects promotes a sense of empowerment and ownership in all team members and when problems do surface, the team works together toward solutions, rather than investing energy, time, and emotions in defending positions and assigning blame to others.

Downs (2006) also mentions that architects are better able to ensure that designs are executed as intended and better positioned to respond directly to a broader array of client needs, from design detailing to correcting a cold lobby to quieting a noisy air-handling unit.

Architectural firms leading single-source projects enhance the ability of architects to detail and develop collaborative design solutions within budgets and schedules.

Downs (2006) also points out the other issues to develop marketing strategy of architect-led design-build. These include;

- To reinforce the identification of design-build company by developing design-build opportunities with parent architecture and engineering firm, using the same marketing staff.
- To develop collaboration between team players through working together toward solutions, rather than investing energy, time and emotions in defending positions and assigning blame to others.
- To make investments for certain priced projects that supply efficiency in teaming arrangement.

2.8. Example of an Architect Led Design-Build Project

Cortes (2006) mentions that renovation of a five-story townhouse in New York is delivered in design-build team including designers, consultants, vendors, subcontractors and laborers; the steps that depict the effort of the team in terms of collaboration include;

- Generation of ideas for millwork by an architect and development of ideas about colour, pattern and texture by an interior designer,
- Suggestions for streamlining assembly by the foreman of the team,
- The expertise of an arborist, an ornamental metalworker,
- Views of subcontractors for project delivery considering time, cost and quality.

CHAPTER 3

MATERIAL AND METHOD

Briefly, this chapter presents the survey materials and the survey methodology of the investigation. In the section of survey materials, the actual organization charts and the flow charts of the case study are highlighted. One of the objectives of this study is to review the factors that are influencing the trend of D-B from the perspective of architect's leadership in construction industry in order to develop competitive approach. In order to meet the objectives of the study, this chapter presents materials and methodology of the case study.

3.1 Materials

Based on the literature review, according to the factors that affect the use of architect-led design-build system, firstly the organization charts regarding architectural project team and site team of an international project was studied considering the issues mentioned in the literature review. The case study is an international airport project that has the capacity of 12 million passengers when the future expansion of the terminal building is complete. There are MEP, Civil and

Architectural project teams and each team has its own production manager. Architectural project team has 120 architects and 30-construction draftsman.

Division of responsibilities are shown in the organization chart of architectural project team. The population of architects and construction draftsman in the project, is also related to the considerable number of documents produced for the project.

In detailed design stage, the project has approximately 2600 sheets of drawings produced by architectural project group. And this number of sheets exceeds 4500 drawings with subcontractors' drawings. The great number of subcontractors' drawings as well as the architectural group's drawings is also the indicator of the considerable coordination-oriented drawings that are needed to be developed through the versatile leadership of architectural project group.

For the selected design-build project, the procedures and approval process of a consortium are used to evaluate the role of the general contractor that includes architectural project group in that consortium. In the case study, as shown in Figure 3.1, an architecture-engineering joint venture firm leads the contractor-based architectural project group responsible for production of interim and detailed design; and IFC (Issued for Construction) drawings. Besides producing the drawings, architectural project group is also responsible for the design development. The project process consists of interim, detailed and IFC stages. After IFC stage is approved, the design-office team at site starts to produce shop drawings needed except the drawing sheets within the responsibility of subcontractors.

Following that, order of importance for production and the progress of architectural project group due to the schedules is strongly related to the progress and hierarchy of the other engineering disciplines. The organization charts of construction management, design management, procurement management and quality management are used to show the hierarchy within the departments in the below mentioned management charts.

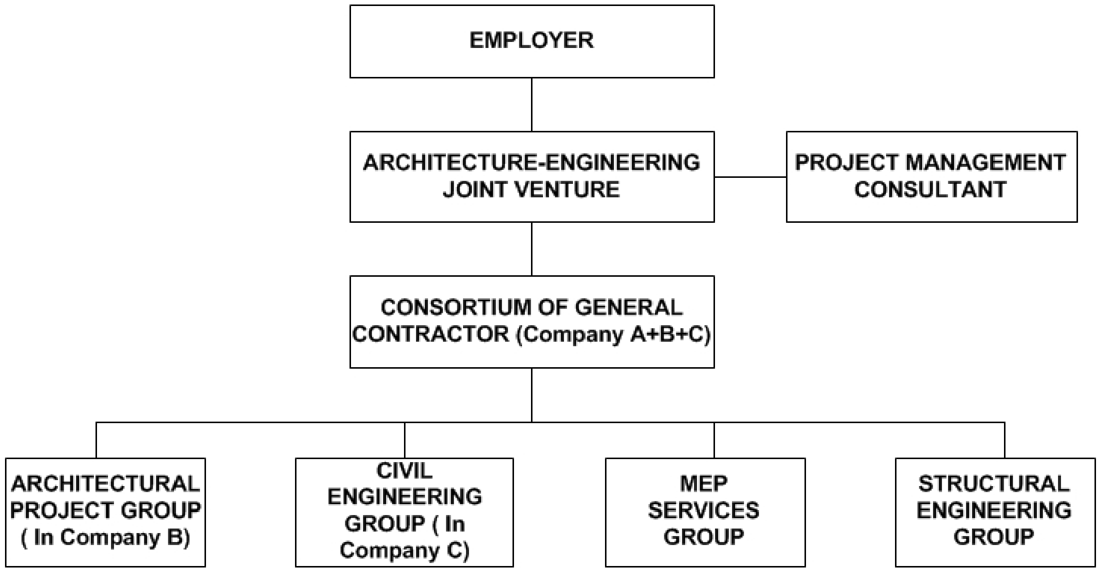

Figure 3.1. General Organization Chart for the case study

In Figure 3.2, the organization chart of architectural project group is shown. The main structure of the chart is based on six major groups as stated below;

- Architectural Design Management
- Architectural Design Coordination & Control Team
- DCC (Document Control Center)
- Planning-Time -Cost Management & Procurement Coordination
- Architectural Details Coordination & Control Team
- BIM (Building Information Modeling) Coordination and 3rd Eye Control

DCC sends notifications for the latest project documents of other disciplines' to specified groups such as design coordination and control team, third eye control, planning-time-cost management, details coordination and control team, architectural design management. There is a direct coordination-based information flow between these groups. Project is divided into specific groups to be coordinated efficiently and each group has a group leader.

Among these groups, there are primary and secondary groups. The primary groups are divided according to the zones of the project. After the submissions of the primary groups regarding general architectural arrangements, the submittals of secondary groups such as ceiling, conveying, floor finish and fire engineering get started. Each group has direct connection with the architectural project group deputy manager. However, there is no direct connection between the groups.

As shown in Figure 3.2, there are three coordination-based groups;

- Architectural Design Coordination & Control Team
- Architectural Details Coordination & Control Team
- BIM (Building Information Modeling) Coordination

There is also no direct connection between these coordination-based groups. Planning-time-cost management and procurement coordination team is responsible for material approval process, bill of quantities, planning of submittals and work packages, material requisition packages. This team provides technical consultancy to design management, construction management and procurement for the overall project.

Planning department is responsible for schedules and follow-up of submittals. This department prepares weekly process reports to monitor the project process. Material approval team evaluates the incoming documents by the vendors in accordance with specifications, latest approved drawings and tender documents. As the engineer confirms the material approvals, the process for material requisition for purchase gets started for the approved material.

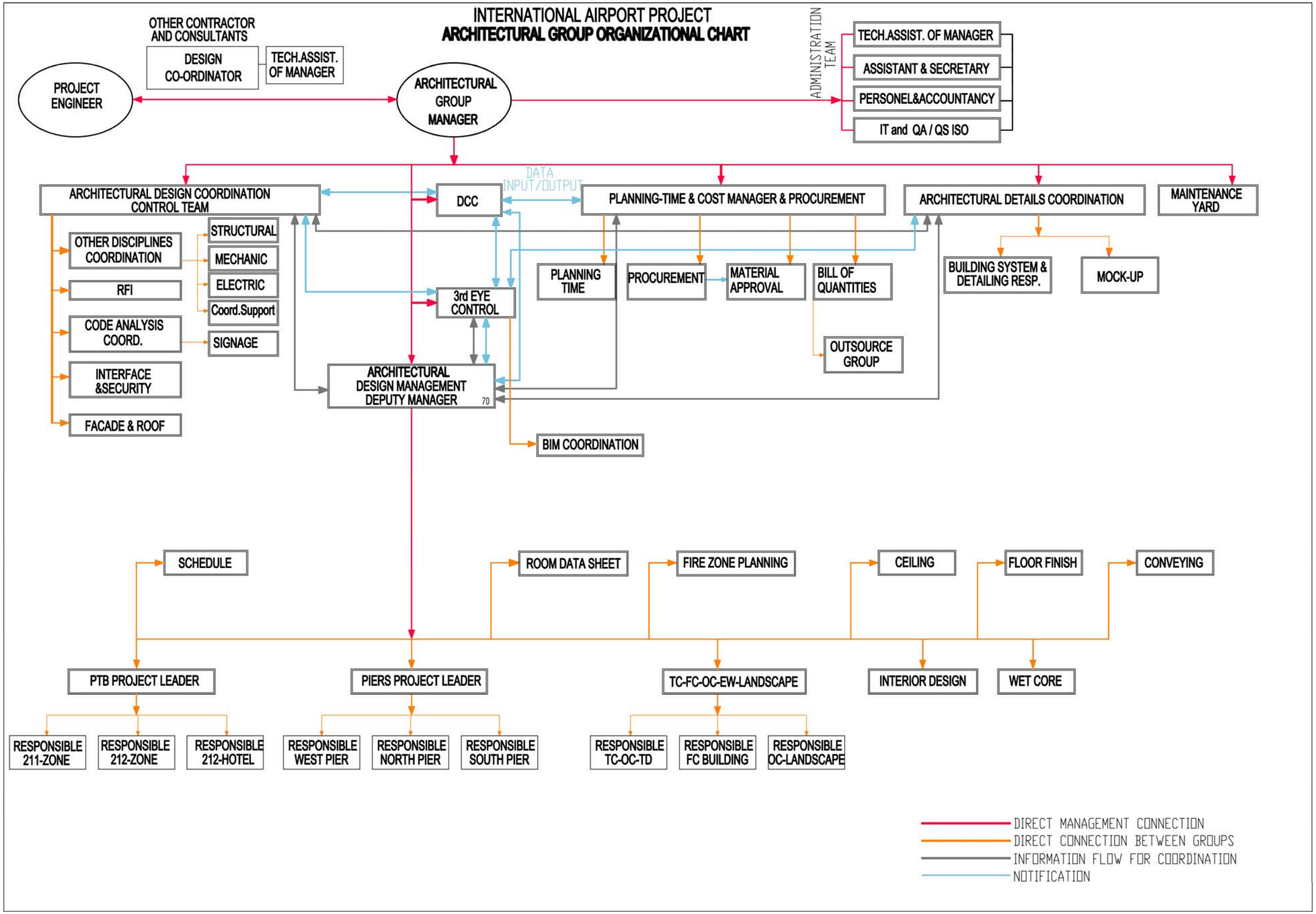

Figure 3.2. International Airport Project / Architectural Project Group Organizational Chart:

In Figure 3.3, as shown in construction management chart, there are six major management teams;

- Design Management
- Major Procurement Team
- Site Procurement Team
- Construction Management
- Business Management
- Government Relations Management

Abovementioned teams are leaded by the project director and deputy project director. Quality management and risk management teams have also direct connection with the project director. Major procurement management is responsible for the purchase of the most appropriate materials regarding time, quality, budget, shipping and storage. Each procurement package manager is in contact with the technical representative of architectural project team for the latest project documents such as related drawings, key plans, specifications, bill of quantities, material approval status and contract requirements.

Therefore, major procurement management defines the scope of supplier and award the most suitable vendor. There is also contracts supervisor responsible for contractual issues regarding claims, contracts of subcontractors and compliance of contracts with the employer’s requirements.

Site procurement team is responsible for the purchase of materials that can be supplied by local vendors such a screed, plaster, blockwall in consideration of time, cost, quality and especially shipping. In Figure 3.3, there is no direct connection between the abovementioned procurement groups.

Prime contracts and risk management team is responsible for the review and approval of deviation letters, RFI (Request for Information) letters and pending items that come from architectural, MEP and civil engineering groups. After the approval of the consortium risk management, these documents are sent to the engineer (architecture firm -engineering consultancy joint-venture) to proceed.

Construction management team is responsible for the site activities and site working packages. Area managers are responsible for the specific building zones and each area manager is responsible for the civil-structural, architectural, mechanical and electrical works.

Government relation management and business management teams are responsible for supporting the organization on general issues such as IT services, visas and residence management, HR (human resources) management, DCC management. For the large-scaled global project, these two groups have various services in order to solve urgent issues.

In Figure 3.4, the organization chart of concourse and external works is shown. In the chart, work packages for the area regarding fabrication, installation, equipment and civil engineering are defined as;

- Civil Engineering Management
- Concrete Fabrication Management
- Rebar Fabrication Management
- Formwork Fabrication Management
- Temp. Facilities Management
- Equipment and Plant Management

For the abovementioned work packages, day-shift and night-shift technical supervisors take action.

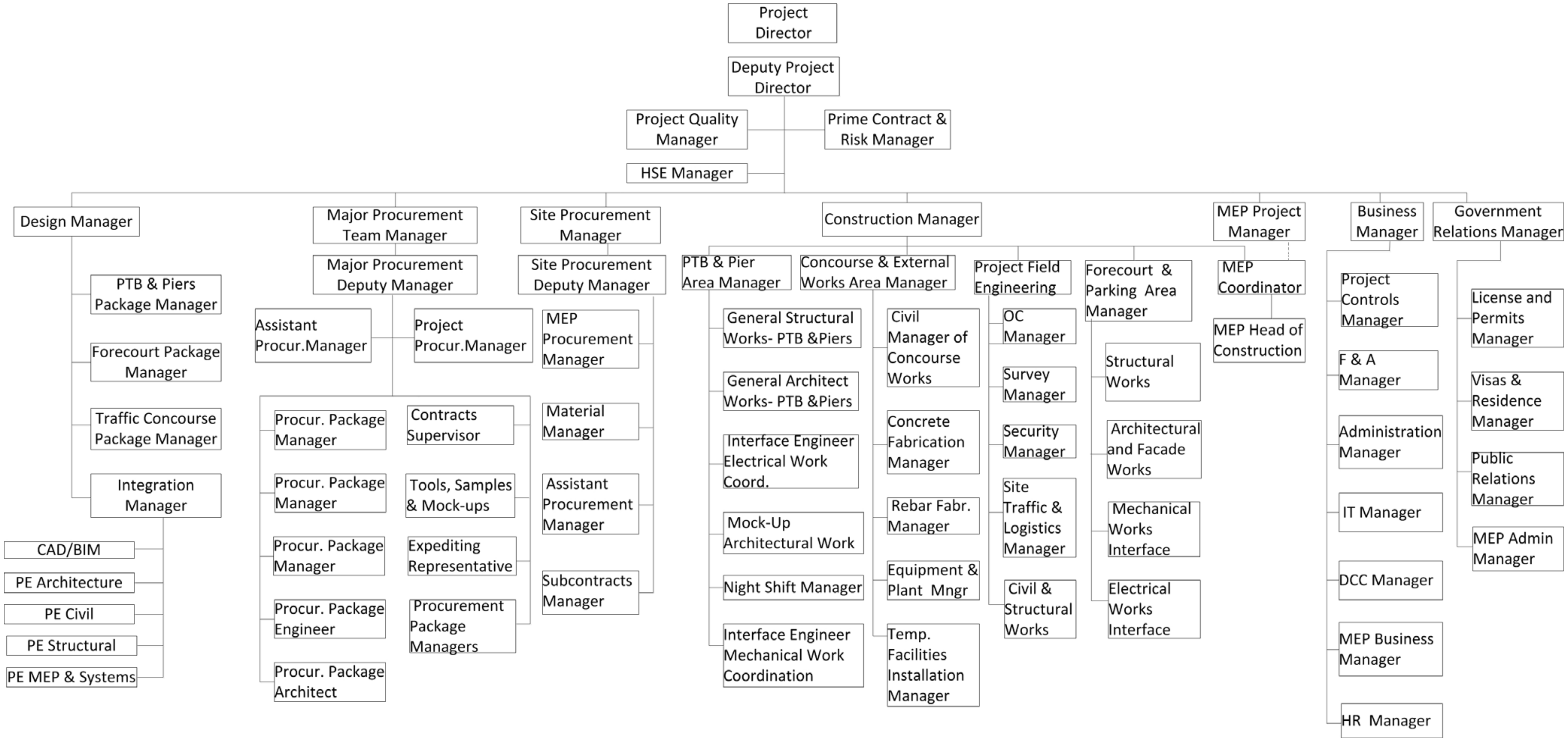

Figure 3.3. International Construction Management Chart

In Figure 3.5, the organization chart for PTB (Passenger Terminal Building) and Piers is shown. Under the control of area manager, the work packages for these groups are divided into architectural, mechanical, electrical, structural and mock-up works. These work packages proceed in parallel for each group. Especially the architectural work packages are divided into groups regarding architectural finishes and architectural elements. The schedules of these packages support and follow each other to proceed in parallel with other groups.

Architectural manager at site for the specified area leads all these activities. During the project process, the architectural project team supports site team and manager for architectural works. As the project process of architectural project group and site activities start to overlap. Hence, the schedules are updated to avoid delays during the project duration. Material requisition packages for purchase are also planned to proceed in accordance with the network of architectural work packages as shown in the chart.

In Figure 3.6, the organization chart for Forecourt and Parking Management is shown. The organization structure is developed in accordance with the abovementioned construction management charts. Especially the work packages of architectural & façade works and civil & structural works are divided into groups.

For this area, construction site activities are separated in accordance with the repetitive levels and zones of the building. This is the main reason for the sequential activities in the chart.

In contradistinction to the abovementioned construction management charts, there is a project controls lead engineer for this area in the chart. For cost-control and planning issues, this area is being specifically evaluated in consideration of sequential work packages due to the repetitive levels

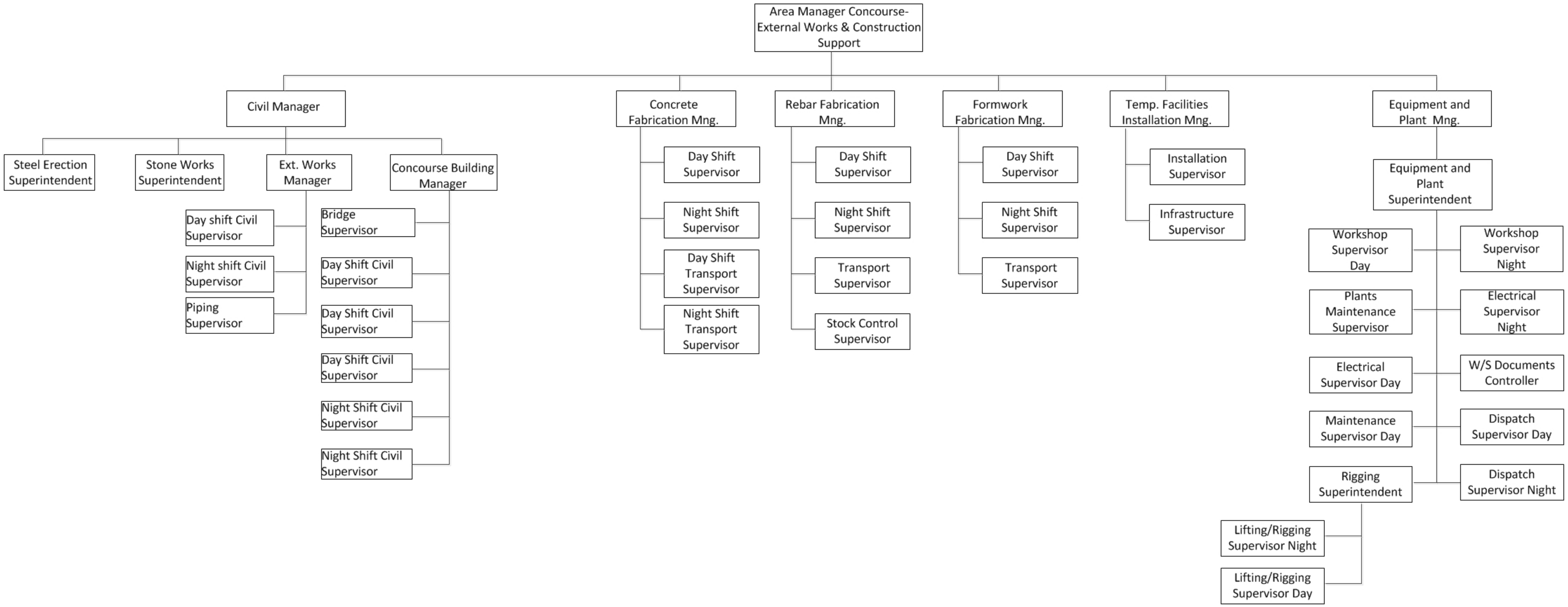

Figure 3.4 Construction Management – Concourse & External Works Organization

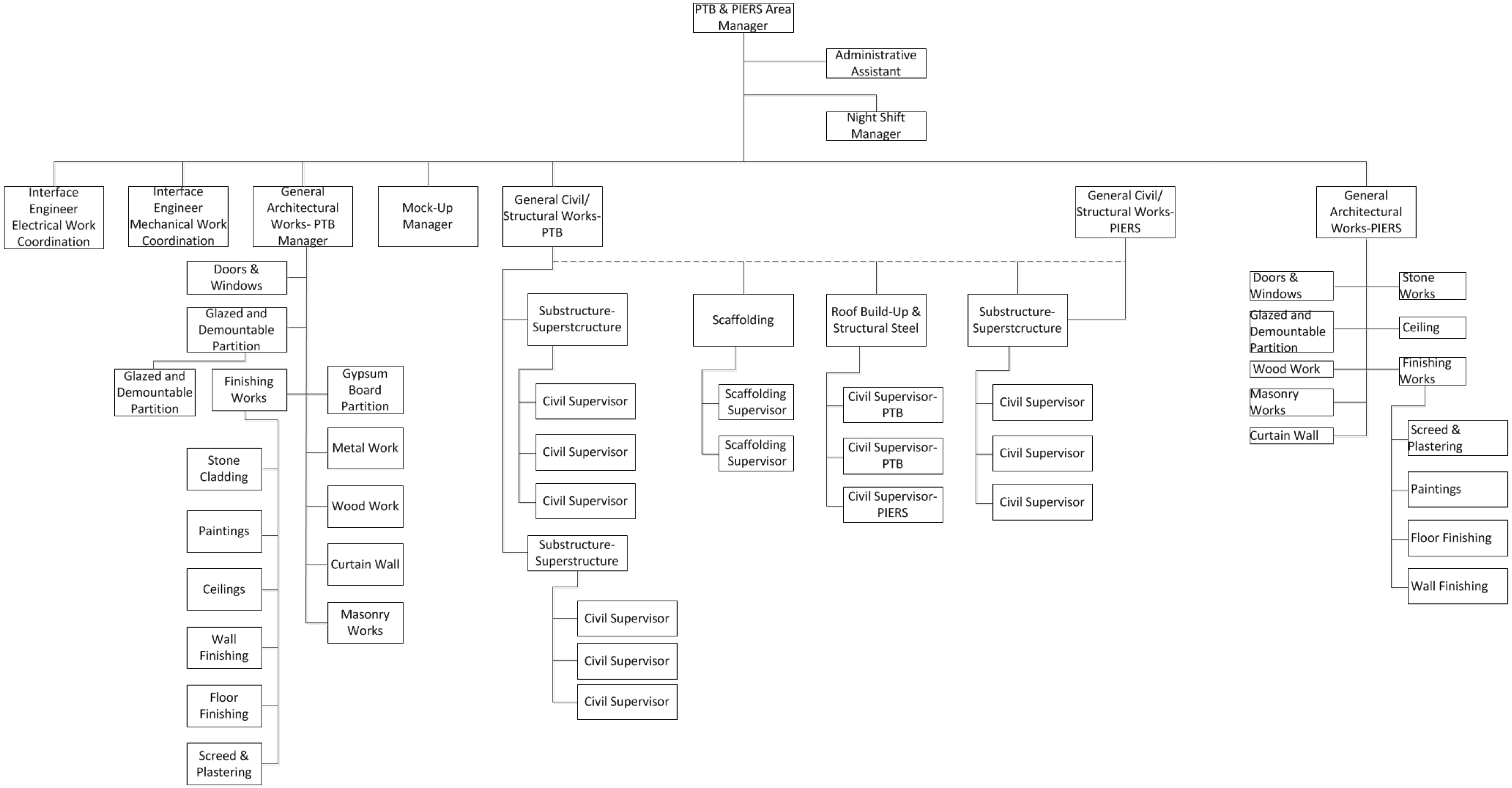

Figure 3.5 Construction Management – PTB & Piers Organization Chart

In Figure 3.7, the organization chart for site procurement management is shown. The major management groups are classified as;

- Material Management
- Procurement Management
- Subcontracts Management
- Procurement Management for local materials and temporary works

Material management is responsible for transportation, shipping, material approval process, material request, material receipt and the organization of warehouse operations. Procurement management is responsible for the material requisition packages that are supplied by local subcontractors. There is also a specific procurement management responsible for the MRP (Material Requisition for Purchase) packages of local bulk materials and temporary works and a subcontractor management responsible for the subcontracts.

In Figure 3.8, design management chart is shown. According to the chart, the building is divided into three major zones and each zone has a package manager responsible for design-based issues, omissions, discrepancies. They follow-up the approval process and responses of official letters sent to the engineer. Integration manager leads the letters regarding change management such as RFI letters, pending items, and deviation letters. All these documents from architectural, structural, civil engineering and MEP groups are sent to the integration manager. Integration manager follows up each group's design-based changes regarding omissions, discrepancies within the ITT (Invitation to tender) documents and instructions sent by the engineer during the project duration.

Design management team as shown in Figure 3.8 leads project engineers of each group. Planning time-cost management within the architectural project group is directly in contact with the EPPR planner for the latest submission schedules and progress reports.

As shown in Figure 3.9, project quality manager leads MEP QA/QC (Quality Assurance / Quality Control) manager, QA lead engineer and training coordinator. Engineering standards such as BS (British Standards), ASTM (American Society for testing and materials) guide the design and engineering disciplines for the project. The procedures of the consortium are based on these standards. Engineering standards and quality management are being integrated through the international standards in compliance within the specifications. QA engineers of architectural, mechanical, electrical and civil engineering groups are led by QA lead engineer. The ITT architectural specifications are being updated by the planning management within the architectural project group. As the architectural drawings are being updated and they are sent to the engineer for approval ITT architectural specifications are also being updated by the architectural project group in accordance with the latest the project drawings.

The items mentioned in architectural project specifications are;

- Related project documents
- International codes and standards regarding the architectural materials, elements and systems
- Warranty documents
- Performance requirements
- Products
- Execution stage including examination, preparation, installation, workmanship, cleaning and protection
- Quality Control including delivery, storage, handling, source limitation, mock-up
- Testing including physical, mechanical properties, acoustic requirements, fire engineering requirements, seismic requirements in compliance with the related international standards.

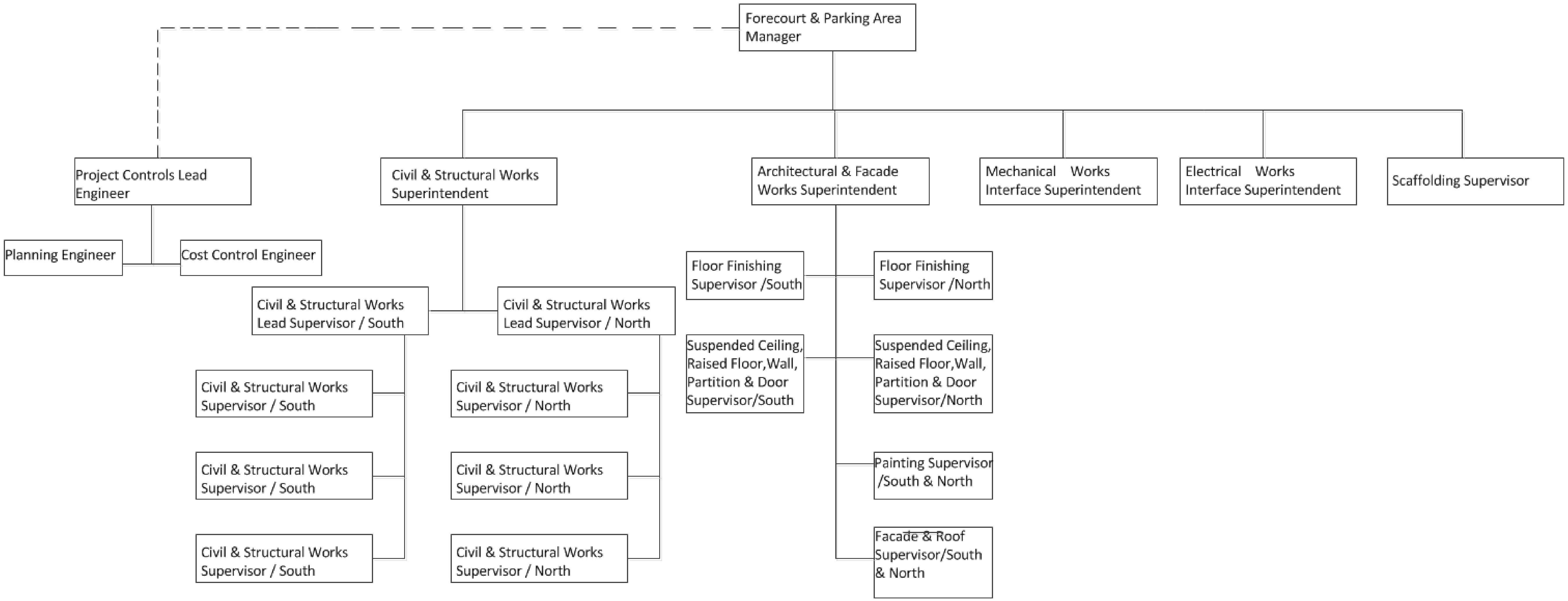

Figure 3.6 Construction Management- Forecourt & Parking Area Management Organization

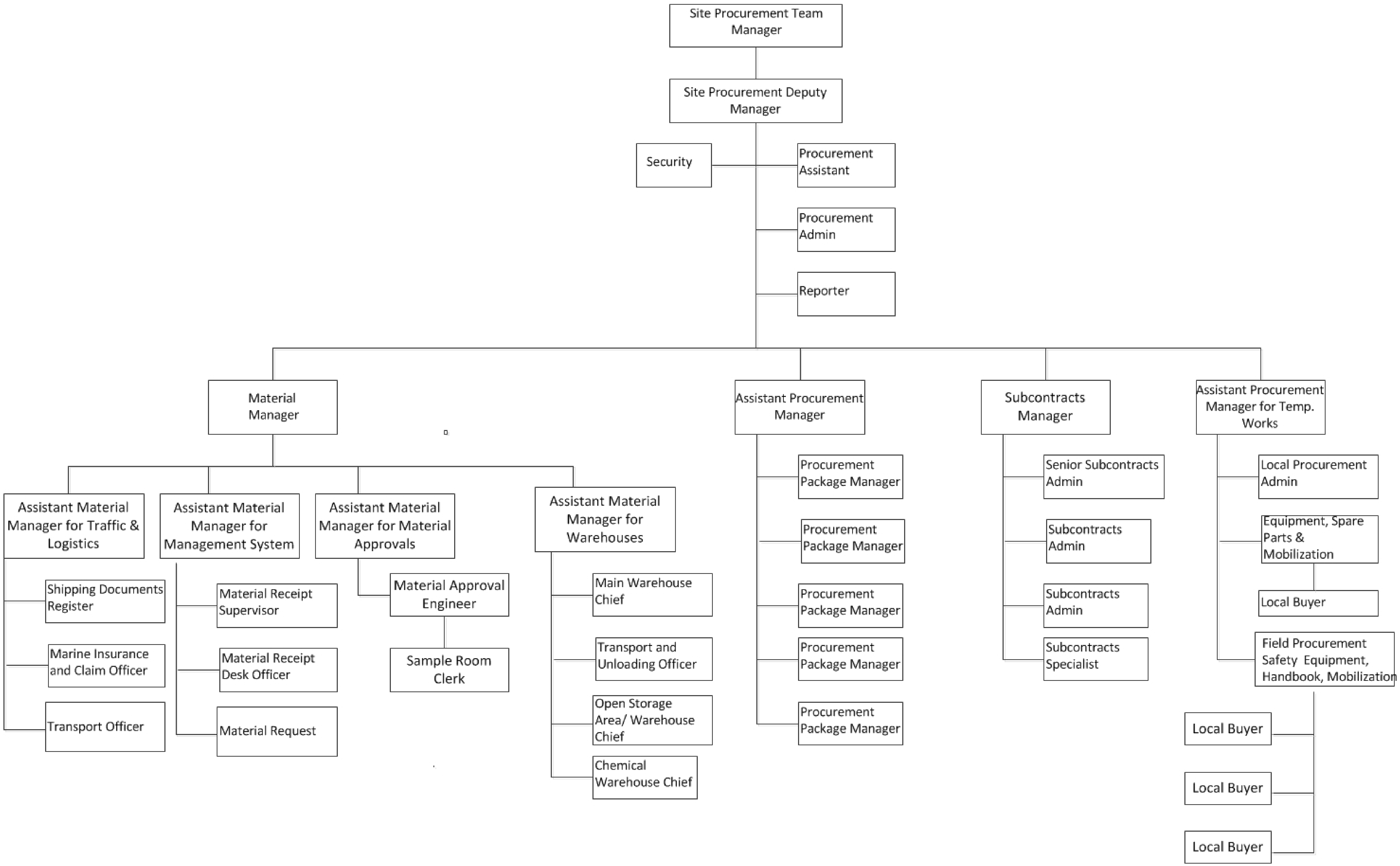

Figure 3.7 Site Procurement Management Organization.

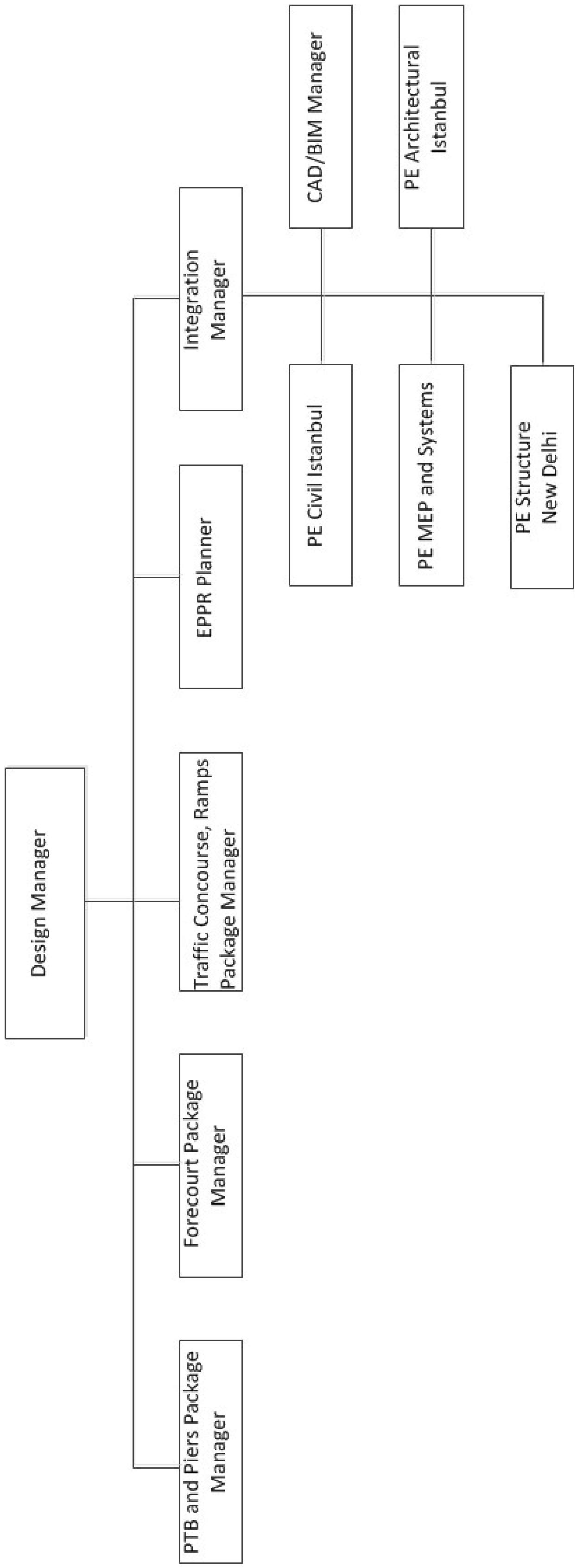

Figure 3.8 Design Management Organization

In Figure 3.9 the approval process and information flow for the project are shown. According to this chart, the internal process for approvals and information flow is a long process including preparation of project deliverables, preparation of transmittals for issuing and 3rd eye control.The information flow between engineer and architectural group is provided through DCC.

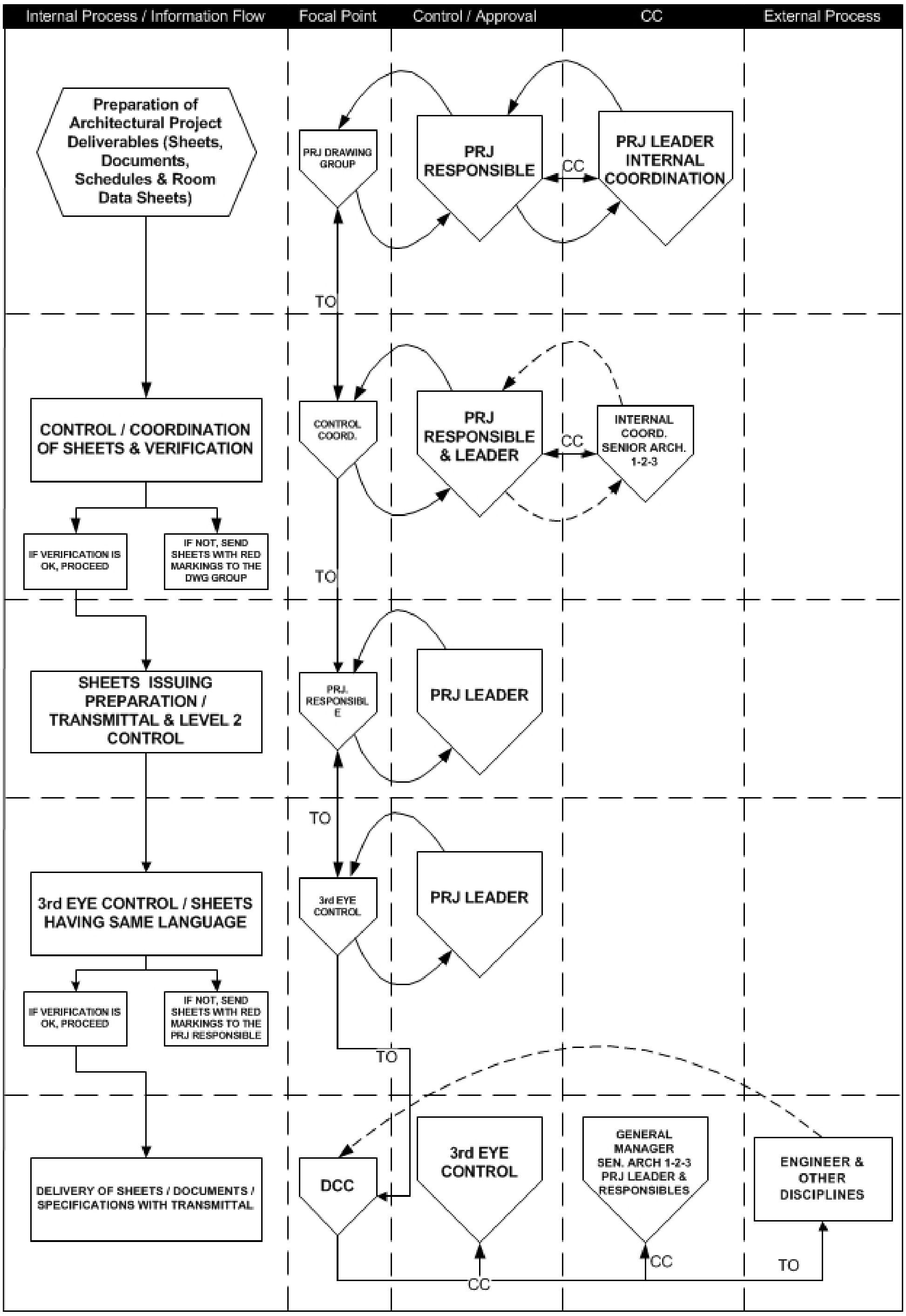

Figure 3.9 Approval Process and Information Flow

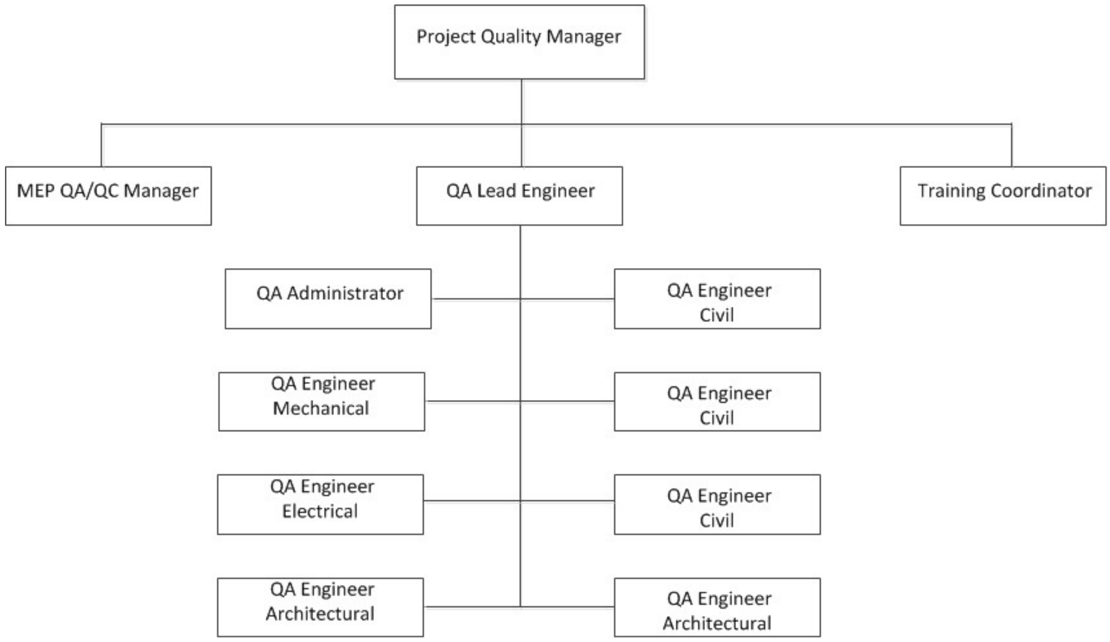

Figure 3.10 Quality Management Organization

Material approvals are prepared and evaluated in compliance with the abovementioned items of architectural specifications. Thus, the architectural project group provides technical support in consideration of quality management through the evaluation of material approvals.

Architectural project group also provides technical support to the Cad manual manager in design management team. Architectural title blocks, graphical blocks, dynamic blocks and user blocks are prepared and sent to the Cad manual manager in compliance with U.S National Cad Standards for confirmation.

Blocks regarding doors, windows, escalators, elevators, travelators , wet core and ceiling are prepared as dynamic blocks by the architectural project group. Dynamic blocks provide flexibility during insertion to the project. After approval process, all of them are inserted to the latest project documents in compliance with the related contract clauses.

The joint-venture’s requirements regarding architectural blocks is also related to the 3rd eye control of abovementioned architectural elements. However, the main reason of Cad manual requirements is that project documents produced by each group shall speak the same language for the future archive of the project. The architectural project group provides technical support for cad manual in consideration of quality management as well.

3.2 Method

The case study includes the analysis of organization charts, information flow charts, and the key factors that influence the success of the project through designer’s leadership in accordance with published sources included in the literature survey. The analysis of organization charts and information flow charts are done in consideration of the parameters regarding coordination, approval process and for information network.

The opportunities of architect-led design build are examined to avoid problems in design development from interim stage to IFC and to investigate the potentials for the organization charts to be converted to architect-led design build.

The working principles, file sharing methods and approval process of the project is described throughout its coordination within engineering department. In other words, the work sharing within the architectural department and with MEP, civil engineering. are analyzed and they are compared with literature findings in order to establish the opportunities and the potentials for architecture-led design-build.

For the selected design-build project, the procedures and approval process are evaluated to examine the role of the architectural project group of one of the contractors in the consortium. The consortium is led by the joint-venture of an architecture firm and engineering consultancy. In the joint venture, architecture firm is responsible for all architectural and master planning.

Engineering consultancy is the main consultant responsible for engineering works. Design is still being developed through the project process. And during this duration, architects have the most updated knowledge as the originators of the project documents. In view of the observations with regards to architecture, a new hierarchy has been proposed to accomplish a successful project management process by strengthening architect's decision-making mechanism.

The existing organization charts are examined and proposal charts are developed based on observations regarding abovementioned factors during the duration of the project. Proposed organization charts are especially developed to decrease the coordination-based design omissions and to decrease the approval procedures that cause loss of time and delays. Proposals are developed to highlight that architects can use initiative as they take actions in various fields of the project.

Furthermore, knowledge delivery systems and project collaboration systems amongst the MEP, civil engineering and architecture groups have been reviewed in order to develop the related information flow in accordance with the proposed organization chart.

These major collaboration tools provide communication and coordination of each group in different cities strengthen the communication between the groups and site. The joint-venture firm replies to the letters using these systems. Hence, the consortium is being notified for rejections and confirmations of the joint-venture through these systems.

Quality management is also responsible for the training activities of these systems. The architectural project group within the consortium experiences the use of these systems and take activities in terms of collaboration. The case study is evaluated to highlight all the activities of the architectural group including design development. Proposals are developed in consideration of the compliance of these activities with architect-led design-build systems as mentioned in literature survey. The case study is based on the observations of the responsibilities of architectural project group. The role of architectural project team within the consortium includes design development in terms of contract requirements. Hence, design development is also taken into consideration in terms of strengthening architectural project group's leadership.

Design development includes;

- Detection of design omissions, discrepancies within the ITT documents, design defects,
- Development of system details in compliance with subcontractors' details,
- Sending notification to the other disciplines in order to proceed in a coordinated manner,
- Project coordination with the consultants regarding acoustics, fire, conveying, landscape, façade,
- Development of interior architecture including colour proposals for the specific materials.

According to the items above, design development continues during the project production phases from interim to execution. During design development activities, architectural project group is also experienced in terms of design management.

Design development activities abovementioned are carried on through the confirmations and rejections of design management in accordance with the procedures. Therefore, ‘’lessons learned’’ are analyzed through the design development activities to find out the reasons why the design-build system is not design-oriented in architecture’s leadership at each level of the organization structure. Although engineering works are also developed during the project duration, they are based on the latest design documents. Furthermore, architectural project group takes activities in various fields as shown in charts above except design development and production process.

CHAPTER 4

DISCUSSION

The case study is planned to discuss the observations of the project process from the view of employers, contractors and architects. The current situation has been observed and the organization charts are evaluated based on certain parameters regarding various fields supported by the architectural project team. Architectural project team provides technical support in various fields such as;

- Design development
- Planning, time and cost management,
- Claim management,
- Material requisition packages,
- Letters regarding change management (RFI, pending item, deviation letters)
- Material approval and evaluation process,
- Cad Manual/ BIM
- Quality management

After evaluating the organizational structure, the compliance between literature and the project process has been presented. Due to the influence of the above-mentioned parameters on the development of architect-led D-B system, new models of organization charts and information flows have been proposed.

The problem of this investigation is the uncertainty about the factors that can result in competitive advantage in the architecture profession for large scale projects. Architect-led design build seems to be attractive but there is only a small proportion of the construction industry participating in this system. The factors that act as a hindrance to the evaluation and operation of architect-led design build are unclear.

The case study is analyzed to prepare a basis for a broad view of integrating the architecture profession into design build phenomenon. It was observed that responsibilities of architectural project group includes;

- Planning to follow the schedule of submissions for a great number of drawings,
- Responsibility of material requisition packages including the related materials, technical specifications, quantity surveys, and defining scope of work of the subcontractor that will be awarded,
- Material approval process including the evaluation of materials according to their compliance with the related technical specifications and project documents,
- Coordination of consultancies regarding acoustics, landscape, conveying equipment, façade and fire engineering and developing design according to the latest updates,
- Interface management including back of house services (BOH), baggage handling systems (BHS) through IRR (Interface Requirements Review) letters in coordination with the other contractors

However, in the general organization chart shown in Figure 3.1 the relationship of architectural group with the engineering departments is horizontal. The delays of the other disciplines' submittal packages strongly influence the submittals of the architectural group. Each delay on the part of one group cause delays in others; this constitutes a risk for the field activities. Revision activities are shown in Table 4.2 for IFC process and delays due to the coordination-based problems for code B drawings (Code B:Approved with comments) are shown in Table 4.1 for Detailed Design Process.

Each group delivers their submittals according to their own schedule to the employer's representative (engineer). Hence, architectural group cannot ask for the engineering documents that are to be issued according to their own submittal schedule. This is the significant reason for the coordination based and design-based problems and omissions. In this project, architectural project group is also responsible for design development; however, the MEP and civil engineering groups are not under the control of the architectural group.

For instance, when there is discrepancy between ITT structural and ITT architectural drawings and the groups recognize this situation during the project process, the structural group does not proceed in accordance with ITT architectural drawings.

Architectural group makes an effort to be in a coordinated manner with the structural group. Such a situation can cause delays for submittals. To avoid such coordination-oriented delays, architectural group can lead the other disciplines and take decisions in consideration of contract documents and project specifications.

Table 4.1 Delays in submission of Detailed Design Code B Drawings due to the coordination-based problems with the other discipline

ARCH. GROUP DD SUBMISSIONS	Engineer Comments Date	Expected IFC Sub.Date	Delay	Planned IFC Date	SHEET PCS	CODE A	CODE B	CODE C	CODE D
VOLUME 06 NP_WALL FINISH	11.06.2012	18.06.2012	56	13.08.2012	8		8		
VOLUME 06 PTB 211_WALL FINISH Rev B	06.06.2012	13.06.2012	75	27.08.2012	4		4		
VOLUME 06 PTB 211_WALL FINISH Rev C	06.06.2012	13.06.2012	75	27.08.2012	1		1		
VOLUME 06 PTB 212_WALL FINISH Rev B	06.06.2012	13.06.2012	75	27.08.2012	3		3		
VOLUME 06 PTB 212_WALL FINISH Rev C	06.06.2012	13.06.2012	75	27.08.2012	2		2		
VOLUME 04 NP 240_SYSTEM DETAILS_Rev B	04.03.2012	11.03.2012	180	11.09.2012	4		4		
VOLUME 04 NP 240_SYSTEM DETAILS_Rev A-B-C	05.06.2012	12.06.2012	87	13.09.2012	15		15		
VOLUME 04 NP 240 SYSTEM DETAILS PART 2	14.07.2012	21.07.2012	48	14.09.2012	6		6		
VOLUME 06 FCS 290_WALL FINISH	11.02.2012	18.02.2012	173	09.08.2012	6		6		
VOLUME 05 SP 250_FLOOR FINISH	26.07.2012	02.08.2012	14	16.08.2012	16		16		
VOLUME 05 FCN 280_FLOOR FINISH	04.06.2012	11.06.2012	60	10.08.2012	31		31		
VOLUME 06 FCN 280_WALL FINISH	27.02.2012	04.03.2012	158	09.08.2012	6		6		
VOLUME 01 PTB 211-212 RCP REV C-B	29.07.2012	05.08.2012	33	07.09.2012	3		3		
VOLUME 02 PTB 211-212 WETCORE 3 TYPE B REVA-B	24.07.2012	31.07.2012	29	29.08.2012	32		32		
VOLUME 03 PTB 211-212 SYSTEM DETAILS	05.05.2012	12.05.2012	118	14.09.2012	6		6		
VOLUME 03 PTB 211-212 SYSTEM DETAILS PART 2	06.06.2012	13.06.2012	86	25.09.2012	17		16		
VOLUME 03 PTB 211-212 SYSTEM DETAILS PART 3	20.06.2012	27.06.2012	72	13.09.2012	8		8		
VOLUME 03 PTB 211-212 SYSTEM DETAILS PART 4	11.07.2012	18.07.2012	51	30.09.2012	13		13		
VOLUME 03 PTB 211-212 SYSTEM DETAILS PART 5	11.07.2012	18.07.2012	51	20.09.2012	10		10		
VOLUME 07 PTB 211-212 GREEN WALL DETAILS	11.06.2012	18.06.2012	81	25.09.2012	6		6		
VOLUME 06 PTB VIP PACKAGE PART 2	14.07.2012	21.07.2012	48	20.09.2012	3		3		
VOLUME 08 PTB LANDSCAPE REV A-B	12.07.2012	19.07.2012	36	09.08.2012	55		49		
VOLUME 02 TC_ROOF PLANS	30.04.2012	07.05.2012	123	28.09.2012	6		6		
VOLUME 05 TC_FLOOR FINISH	24.07.2012	31.07.2012	13	13.08.2012	12		12		
VOLUME 06 TC_WALL FINISH	30.04.2012	07.05.2012	95	10.08.2012	3		3		
VOLUME 01 AL ABBAR PMU PTB TYPE A1 REVB	09.07.2012	16.07.2012	29	14.08.2012	7	2	5		
VOLUME 01 AL ABBAR PMU PTB TYPE A2 REVB	09.07.2012	16.07.2012	29	14.08.2012	7	5	2		
VOLUME 03 Bridge House System Sections	26.07.2012	02.08.2012	4	06.08.2012	26		26		
VOLUME 03 FCS 290_SYSTEM DETAILS PART 2	22.05.2012	27.05.2012	103	25.09.2012	4		4		
VOLUME 03 FCS 290 SYSTEM DETAILS PART 3	23.07.2012	30.07.2012	28	27.08.2012	3		3		
VOLUME 04 FCS 290_INTERIOR	20.05.2012	27.05.2012	92	27.08.2012	13		13		
VOLUME 03 FCN SYSTEM DETAILS PART 2	21.07.2012	28.07.2012	30	27.08.2012	3		3		
VOLUME 04 FCN INTERIOR	22.05.2012	29.05.2012	90	27.08.2012	12		12		
VOLUME 01 MUSHARABIYEH SYSTEM DETAILS	11.07.2012	18.07.2012	27	14.08.2012	18		18		
VOLUME 05 FC PLAZA_FLOOR FINISH REVC	18.07.2012	25.07.2012	13	07.08.2012	16		16		
VOLUME 06 FC PLAZA_WALL FINISH	30.04.2012	07.05.2012	94	09.08.2012	1		1		
VOLUME 05 WP LANDSCAPE	28.07.2012	05.08.2012	3	08.08.2012	6		6		
VOLUME 01 TC SYSTEM DETAILS	19.06.2012	06.07.2012	40	15.08.2012	2		2		
VOLUME 04 TC LANDSCAPE	26.07.2012	03.08.2012	21	24.08.2012	5		5		
VOLUME 02 FC INTERIOR	19.06.2012	26.06.2012	66	31.08.2012	2		2		
VOLUME 02 TD INTERIOR	26.07.2012	03.08.2012	28	31.08.2012	2		2		
VOLUME 03 TD SYSTEM DETAIL	24.07.2012	01.08.2012	37	11.09.2012	1		1		
VOLUME 01 FCS MOVEMENT JOINT DRAWINGS	03.07.2012	10.07.2012	59	30.09.2012	7		7		
VOLUME 02 TRAFFIC CONCOURSE MOVEMENT JOINT	21.07.2012	28.07.2012	41	30.09.2012	5		5		
VOLUME 08 PTB 212 PIER TRANSITION and HOTEL LOBBY ELEVATORS	30.07.2012	06.08.2012	32	-	3		3		
VOLUME 02 FC RAMPS	26.07.2012	03.08.2012	-	02.08.2012	3		3		
VOLUME 01 TD FIRST SUBMISSION PACKAGE	30.07.2012	07.08.2012	-	06.08.2012	8		8		
VOLUME 07 PTB PMU SKYLIGHT TYPE D19	19.07.2012	26.07.2012	43	-	1		1		
VOLUME 02 NP 240 WETCORE TYPE B	24.07.2012	01.08.2012	30	29.08.2012	19		19		
VOLUME 06 NP 240_LANDSCAPE APRON REV C	07.08.2012	15.08.2012	13	24.08.2012	5		5		
VOLUME 02 PTB WETCORE 4 TYPE B REVA-B	04.08.2012	12.08.2012	26	14.09.2012	42		42		
VOLUME 05 SP LANDSCAPE	29.07.2012	06.08.2012	8	14.08.2012	7		7		
VOLUME 01 OC PLAN-SECTION-DETAILS	25.08.2012	03.09.2012	4	22.09.2012	68		68		
VOLUME 05 WP 235 FLOOR FINISH DETAILS	05.09.2012	12.09.2012	-	12.09.2012	5		5		
VOLUME 05 SP 250 FLOOR FINISH DETAILS	05.09.2012	12.09.2012	-	12.09.2012	4		4		
VOLUME 06 SP 250_WALL FINISH	05.09.2012	12.09.2012	-	12.09.2012	1		1		
VOLUME 05 PTB INTERIOR PART 1	05.09.2012	12.09.2012	-	12.09.2012	1		1		
VOLUME 05 PTB FLOOR FINISH DETAILS	05.09.2012	12.09.2012	-	12.09.2012	6		6		
VOLUME 03 FCS SYSTEM DETAILS PART 2 REV B	05.09.2012	12.09.2012	-	12.09.2012	1		1		
VOLUME 03 FCN SYSTEM DETAILS SYSTEM DETAILS REV	04.09.2012	12.09.2012	-	12.09.2012	1		1		
VOLUME 02 FCN-FCS WETCORE TYPE B	05.09.2012	12.09.2012	-	12.09.2012	9		9		
VOLUME 03 WP SYSTEM DETAILS PART 1	02.09.2012	10.09.2012	-	10.09.2012	24		24		
VOLUME 01 TC SYSTEM DETAILS PART 2	04.09.2012	11.09.2012	-	11.09.2012	5		5		
VOLUME 05 PTB INTERIOR PART 2	30.07.2012	07.09.2012	-	07.09.2012	13		13		
VOLUME 05 TC INTERIOR	30.07.2012	07.09.2012	-	04.09.2012	5		5		

	TO BE SUBMITTED IN IFC WITH JUSTIFICATION	193
	TO BE SUBMITTED IN IFC on Planned Dates	110
	ISSUED IN IFC (02.08-31.08.2012)	331
	ISSUED IN IFC (31.08-07.09.2012)	18

Furthermore, it is observed that at the beginning of the process, Company B has used a different IBM program rather than the program used by the employer. And this situation has led to difficulties for company B in providing reports including a great number of drawings with all their revision activities. Reports are developed through excel sheets as shown in Table 4.2 detailed design Code B drawings follow-up list. All the sheet information for submission packages provided by the employer is transmitted manually to the IBM program that company B uses. Hence, margin of error has increased and this situation has resulted in a loss of man-hours for Company B.

Each group is responsible for the planning of their production in compliance with the activity schedule. Hence, each group's planning reports that are submitted to the design management speak different languages. If the employer's software is used, the reports can be more efficient and compliant with employer's data with minimum margin of error. Thus, project process for each discipline can be followed-up efficiently in order to foresee the critical situations. Architectural group can lead this planning by using the same program as employer instead of Excel, thus all reports that are to be submitted to the employer can speak the same language with minimum margin of error.

In consideration of the abovementioned factors, an architect-led design build model is developed and proposed as shown below in Figure 4.1 in lieu of the existing major organization structure.. Architecture profession can take the advantage of architect-led design build by placing a priority on both design quality and efficiency. For this reason, architects need to get sufficient knowledge and experience about design-build delivery method to avoid misunderstandings and prejudgments on this system. as proposed in Figure 4.1.

Table 4.2 Revision activities for IFC process due to the coordination-based problems with the other disciplines

	IFC SUBMISSIONS 1	SHEET PCS	Planned Date	Submission Date	Engineer Sub. Date	Comments Date	A	B	C	D	NOT YET	REMARKS	STATUS
FORECOURT NORTH													
FCN	VOLUME 01 FCN 280_PLAN	31	29.02.2012	10.03.2012	20.03.2012	03.04.2012			31				REV 0
	VOLUME 01 FCN 280_PLAN	31		17.05.2012	19.05.2012	14.06.2012		3	28				REV1
	VOLUME 01 FCN 280_PLAN	28		08.08.2012	14.08.2012	05.09.2012		24	4				REV2
	VOLUME 01 FCN 280_PLAN	5		11.09.2012		NOT YET							REV3
	VOLUME 02 FCN 280_ROOF PLAN	3	25.02.2012	10.03.2012	20.03.2012	04.04.2012			3				REV 0
	VOLUME 03 FCN 280_SECTIONS	10	24.02.2012	10.03.2012	20.03.2012	03.04.2012			10				REV 0
	VOLUME 03 FCN 280_SECTIONS	10		30.05.2012	02.06.2012	18.06.2012		3	7				REV1
	VOLUME 03 FCN 280_SECTIONS	7		07.08.2012	11.08.2012	04.09.2012		6	1				REV 2
	VOLUME 03 FCN 280_SECTIONS	1		11.09.2012		NOT YET							REV 3
	VOLUME 04 FCN 280_ELEVATIONS	10	07.03.2012	10.03.2012	20.03.2012	03.04.2012			10				REV 0
	VOLUME 04 FCN 280_ELEVATIONS	10		12.06.2012	17.06.2012	26.06.2012		8	2				REV1
	VOLUME 04 FCN 280_ELEVATIONS	2		07.08.2012	09.08.2012	04.09.2012		2					REV 2
	VOLUME 05 FCN 280 FLOOR FINISH	31		10.08.2012	14.08.2012	06.09.2012		22	9				REV 0
	VOLUME 06 FCN 280 WALL FINISH	6		09.08.2012	13.08.2012	08.09.2012		6					REV 0
	VOLUME 08 FCN 280 CONVEYING SYSTEM	11		30.07.2012	01.08.2012	NOT YET							REV 0
FORECOURT SOUTH													
FCS	VOLUME 01 FCS 290_PLAN	31	10.02.2012	28.02.2012	10.03.2012	22.03.2012			31				REV 0
	VOLUME 01 FCS 290_PLAN	31	29.03.2012	08.04.2012	12.04.2012	24.04.2012		14	17				REV 1
	VOLUME 01 FCS 290_PLAN	17		08.08.2012	14.08.2012	04.09.2012		12	5				REV 2
	VOLUME 01 FCS 290_PLAN	5		04.09.2012	05.09.2012	NOT YET							REV 3
	VOLUME 02 FCS 290_ROOF PLAN	3	10.02.2012	28.02.2012	08.03.2012	20.03.2012			3				REV 0
	VOLUME 03 FCS 290_SECTIONS	10	10.02.2012	28.02.2012	08.03.2012	22.03.2012			10				REV 0
	VOLUME 03 FCS 290_SECTIONS	10	29.03.2012	07.04.2012	09.04.2012	24.04.2012		3	7				REV 1
	VOLUME 03 FCS 290_SECTIONS	7		07.08.2012	11.08.2012	04.09.2012		6	1				REV 2
	VOLUME 03 FCS 290_SECTIONS	1		11.09.2012		NOT YET							REV 3
	VOLUME 04 FCS 290_ELEVATIONS	10	22.02.2012	28.02.2012	10.03.2012	22.03.2012			10				REV 0
	VOLUME 04 FCS 290_ELEVATIONS	10	29.03.2012	07.04.2012	09.04.2012	24.04.2012		2	8				REV 1
	VOLUME 04 FCS 290_ELEVATIONS	8		07.08.2012	11.08.2012	04.09.2012		8					REV 2
	VOLUME 06 FCS 290 WALL FINISH	6			12.08.2012	08.09.2012		1	5				REV 0
	VOLUME 06 FCS 290 WALL FINISH	5		14.09.2012		NOT YET							REV 1
	VOLUME 08 FCS 290 CONVEYING SYSTEM	10		30.07.2012	01.08.2012	09.09.2012		10					REV 0
	VOLUME 05 FCS 290 FLOOR FINISH	31		26.07.2012	31.07.2012	04.09.2012		26	5				REV 0
NORTH PIER													
N.P	VOLUME 01 NP_PLANS	16	06.01.2012	03.02.2012	15.02.2012	29.02.2012		4	12				REV 0
	VOLUME 01 NP_PLANS	12	07.03.2012	29.03.2012	01.04.2012	18.04.2012		8	4				REV1
	VOLUME 01 NP_PLANS	4		13.06.2012	18.06.2012	04.07.2012		4					REV2
	VOLUME 01 NP_PLANS	4		05.09.2012	06.09.2012	NOT YET							REV3
	VOLUME 01 NP_PLANS	4		15.09.2012									REV4
	VOLUME 02 NP_ROOF PLANS	4	01.01.2012	03.02.2012	16.02.2012	29.02.2012			4				REV 0
	VOLUME 03 NP_SECTIONS	2	01.01.2012	03.02.2012	16.02.2012	01.03.2012			2				REV 0
	VOLUME 03 NP_SECTIONS	2	08.03.2012	29.03.2012	31.03.2012	19.04.2012			2				REV1
	VOLUME 03 NP_SECTIONS	2		13.06.2012	17.06.2012	01.07.2012		2					REV2
	VOLUME 04 NP_ELEVATIONS	5	07.01.2012	03.02.2012	15.02.2012	01.03.2012			5				REV 0
	VOLUME 04 NP_ELEVATIONS	5	08.03.2012	29.03.2012	02.04.2012	19.04.2012		1	4				REV1
	VOLUME 04 NP_ELEVATIONS	5		13.06.2012	17.06.2012	04.07.2012		5					REV2
	VOLUME 05 NP FLOOR FINISH	16		01.06.2012	03.06.2012	20.06.2012		16					REV 0
	VOLUME 05 NP FLOOR FINISH DETAILS	4			02.08.2012	08.09.2012		4					REV 0
	VOLUME 06 NP WALL FINISH	8		13.08.2012	15.08.2012	NOT YET							REV 0
PTB 211-212													
PTB 211-212	VOLUME 01 PTB 211 PLANS	50	09.03.2012	08.02.2012	21.02.2012	08.03.2012		24	26				REV 0
	VOLUME 01 PTB 211 PLANS	36	15.03.2012	22.04.2012	30.04.2012	17.05.2012		36					REV1
	VOLUME 01 PTB 211 PLANS	2		17.07.2012	19.07.2012	NOT YET							REV2
	VOLUME 01 PTB 211 PLANS	7		12.09.2012		NOT YET							REV2
	VOLUME 01 PTB 211 LM2 PLANS	9		30.05.2012	31.05.2012	20.06.2012		9					REV 0
	VOLUME 01 PTB 212 PLANS	59	24.02.2012	08.02.2012	25.02.2012	NO RESPONSE							REV 0
	VOLUME 01 PTB 212 PLANS	59		20.04.2012	02.05.2012	31.05.2012			59				REV 1
	VOLUME 01 PTB 212 PLANS	59		12.06.2012	19.06.2012	09.07.2012		51	8				REV 2
	VOLUME 01 PTB 212 PLANS	8		17.07.2012	19.07.2012	04.08.2012		5	3				REV 3
	VOLUME 01 PTB 212 PLANS	3		27.08.2012	01.09.2012	NOT YET							REV 4
	VOLUME 01 PTB 212 PLANS	16		12.09.2012		NOT YET							REV 3
	VOLUME 02 PTB 211 ROOF PLANS	9	07.01.2012	08.02.2012	29.02.2012	14.03.2012			9				REV 0
	VOLUME 03 PTB 211 SECTIONS	33	08.01.2012	08.02.2012	29.02.2012	13.03.2012			33				REV 0
	VOLUME 03 PTB 211 SECTIONS	33		10.05.2012	15.05.2012	04.06.2012		33					REV 1
	VOLUME 03 PTB 212 SECTIONS	20	24.02.2012	08.02.2012	25.02.2012	11.03.2012			20				REV 0
	VOLUME 03 PTB 212 SECTIONS	20		17.05.2012	23.05.2012	18.06.2012		20					REV 1
	VOLUME 04 PTB 211 ELEVATIONS	6	08.01.2012	08.02.2012	29.02.2012	15.03.2012			6				REV 0
	VOLUME 04 PTB 211 ELEVATIONS	6		03.06.2012	04.06.2012	19.06.2012			6				REV1
	VOLUME 04 PTB 211 ELEVATIONS	6		23.07.2012	25.07.2012	08.08.2012			6				REV2
	VOLUME 04 PTB 211 ELEVATIONS	6		31.08.2012	03.09.2012	NOT YET							REV3
	VOLUME 04 PTB 212 ELEVATIONS	9	16.02.2012	08.02.2012	29.02.2012	15.03.2012		1	8				REV 0
	VOLUME 04 PTB 212 ELEVATIONS	9		01.06.2012	03.06.2012	19.06.2012		1	8				REV1
	VOLUME 04 PTB 212 ELEVATIONS	9		23.07.2012	25.07.2012	08.08.2012			9				REV2
	VOLUME 04 PTB 212 ELEVATIONS	9		31.08.2012	03.09.2012	NOT YET							REV3
	VOLUME 02 PTB 212 ROOF PLANS	8	11.01.2012	08.02.2012	29.02.2012	15.03.2012			8				REV 0
	VOLUME 05 PTB 212_FLOOR FINISH Part1	3	12.04.2012	14.04.2012	15.04.2012	30.04.2012		3					REV 0
	VOLUME 05 PTB 212_FLOOR FINISH Part1	3		08.06.2012	09.05.2012	18.06.2012			3				REV1
	VOLUME 05 PTB 211-212 FLOOR FINISH	109		15.06.2012	20.06.2012	02.07.2012		109					REV 0
	VOLUME 06 PTB 211 WALL FINISH	5		27.08.2012	29.08.2012	NOT YET							REV 0
	VOLUME 06 PTB 212 WALL FINISH	5		27.08.2012	01.09.2012	NOT YET							REV 0
	VOLUME 08 CONVEYING SYSTEM PART 1-STAIRCASE-	16		04.05.2012	07.05.2012	18.06.2012		16					REV 0
	VOLUME 08 CONVEYING SYSTEM PART 2-STAIRCASE-	17			31.05.2012	18.06.2012		13	4				REV 0

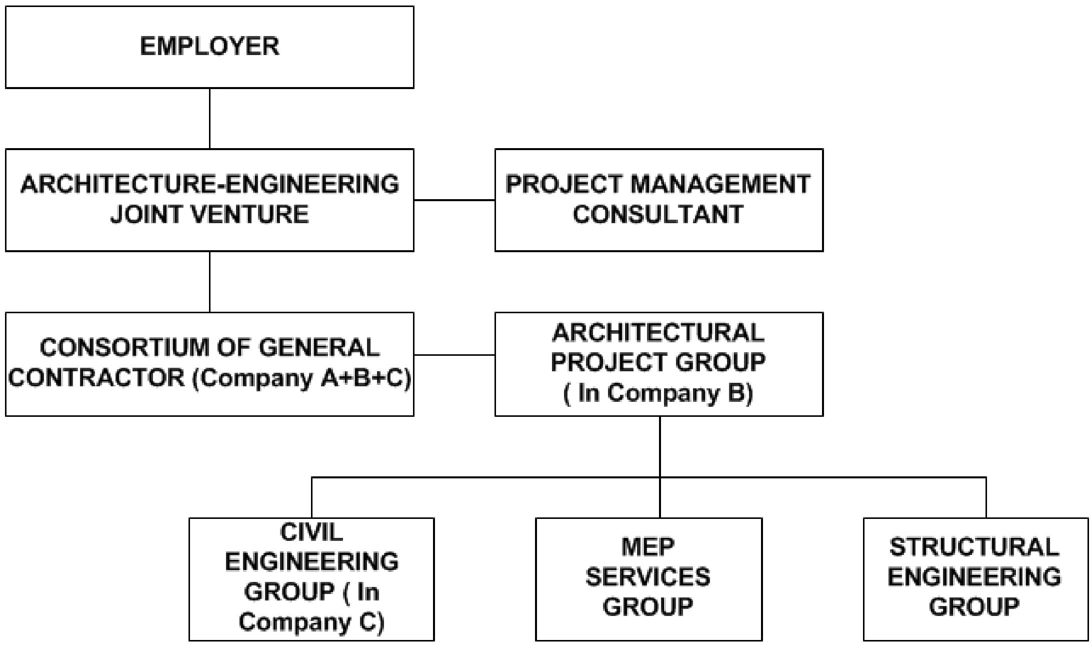

Figure 4.1 Proposal for the General Organization Chart

In the below charts, responsibilities of project management, design management, construction management and procurement management are summarized. As shown in Figure 4.2 the matrix of design management includes CAD/BIM group, four production groups and four package managers. For this reason, the matrix is more comprehensive than the construction management.

In Figure 4.3, the matrix of construction management includes field operations manager, construction support manager and five area managers. The matrix of design management is more comprehensive than the construction management. However, the structure of design management is so similar with the structure of construction management in consideration of the matrix-based network among the groups. This situation causes complexity regarding collaboration in design management

For effective collaboration, the matrix of design management can be simplified through the leadership of architectural project group. Each group is working for the same project, however in design management chart it seems that each group is working for separate projects. Architectural, structural, civil and MEP groups are defined as production groups. In design management chart, architectural project group is led by an integration manager. And design package managers are supported by architectural, structural, civil and MEP production groups. However, the responsibilities of architectural group is not limited to production as mentioned above.

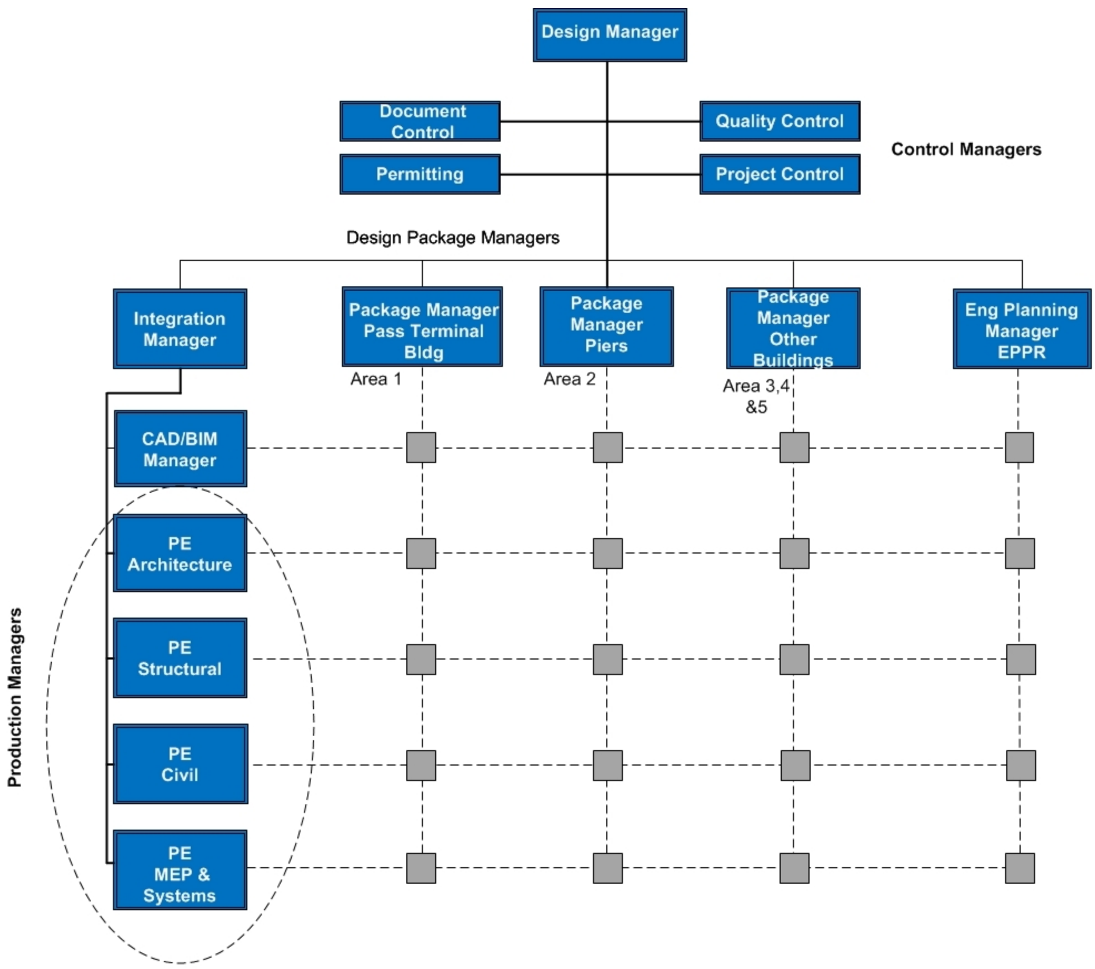

Figure 4.2 Design Management Matrix

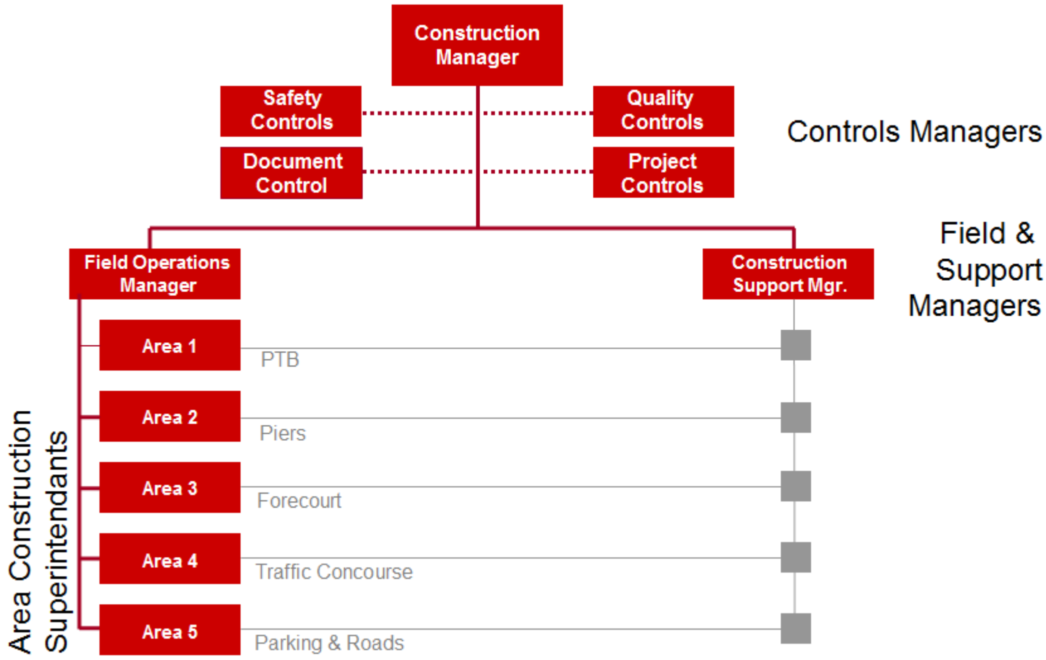

Figure 4.3 Construction Management Matrix

The production level of the organization chart can be established as shown in Figure 4.4 in consideration of these findings. When a production management team is implemented to the architectural project group to lead the other disciplines, the network of production groups and package managers can be more collaborative. As shown in Figure 4.6, the procurement management process involves material approvals, awarding of contracts, purchase of materials, supplier quality management, traffic and logistics management. The main reason why there is no direct connection between the groups is that these processes follow each other sequentially.

Architectural project group provides technical support for;

- Evaluations of material approvals and schedules regarding materials,
- Revisions of specifications in accordance with general contract requirements,
- Technical documents for material requisition packages.

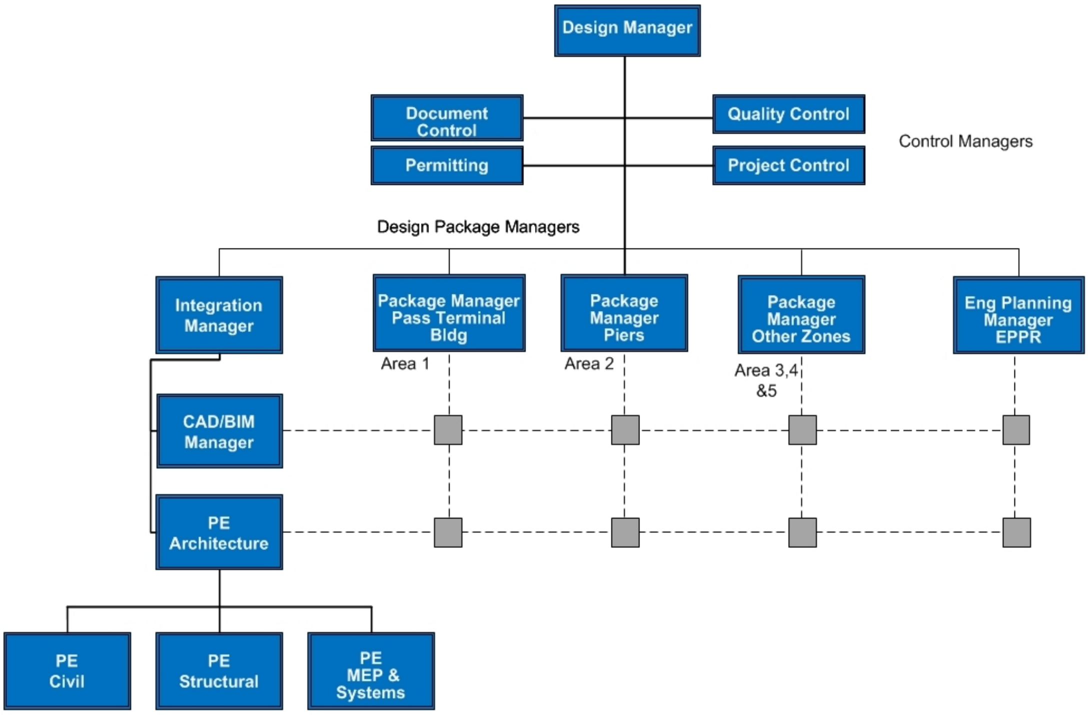

Figure 4.4 Proposal for Design Management Matrix

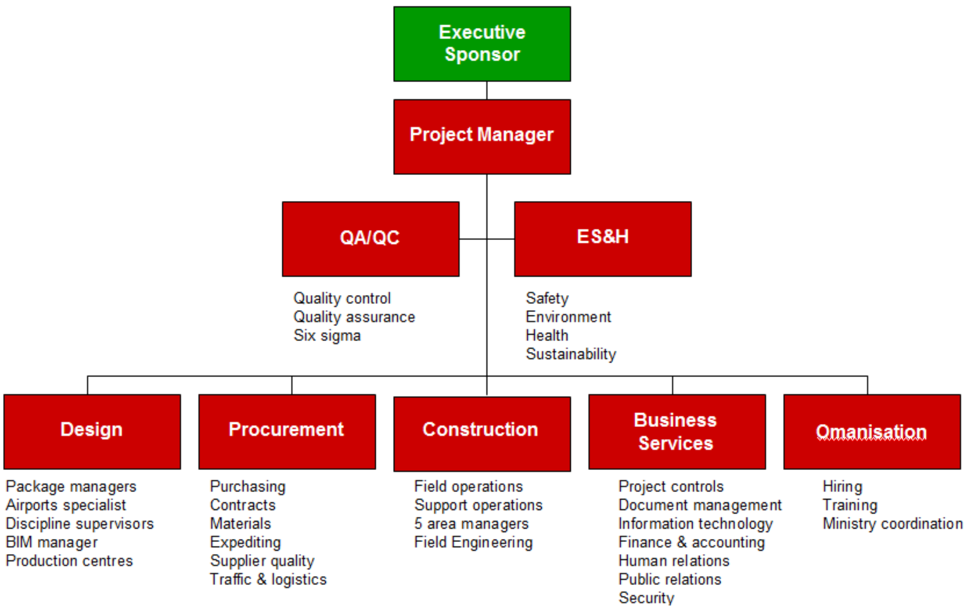

Figure 4.5 General Organization Chart

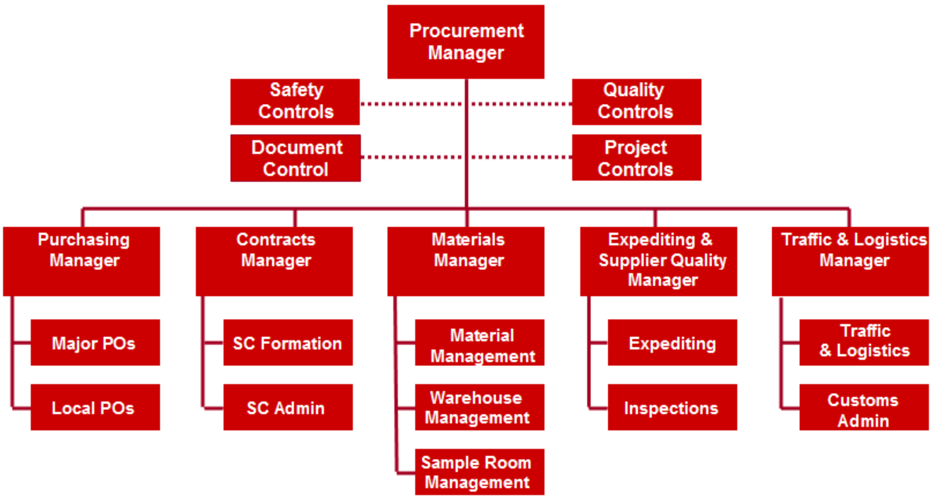

Figure 4.6 Procurement Management Chart

As shown in Figure 4.7, leading team provides development and management for employees, suppliers and subcontractors. This situation is led to continuous improvement within the project team.

Figure 4.7 Continuous Improvement Cycle

CHAPTER 5

CONCLUSION

The main objective of this study was to examine the architect's role in the organizational level. After conducting a literature survey on design-build systems and architect's role in the organizational chart, the advantages and disadvantages of architect led design-build are identified. The design-based problems and architect's responsibilities in the organizational level of design build systems are explored. In this context, an international airport project is examined as a case study. On general organization level, the case study is a joint-venture led design-build system. Different levels of organization charts of the design-build project are analyzed. Through the case study, the problems in the organizational level of design build systems that cause design-based omissions are explored.

The design based problems are identified in the production process in order to develop competitive strategy in the architecture practice. Strategies are developed by proposing organization charts to enhance collaboration through architect's leadership. In production level of organization chart, architect-led design-build in parallel with literature findings supports the organization in consideration of problems detected.

The similarities between the design management and construction management charts are highlighted. Design management chart is established in consideration of the organization structure of construction management. However, it is analyzed that there is no similarity between the site activities and production stage including design development in terms of leadership. Hence, the collaboration-based problems in design management have arisen.

However, spending man-hour for the tasks except design development and production of project documents, delays occur as a result of organizational problems. Sufficient man-hour cannot be spared for co-ordination activities due to project deliverables This situation constitutes a problem in consideration of time management regarding various tasks of architectural team.

The responsibilities of the architectural project team led by the consortium were observed. According to the observations, architectural project group acts as the leader in many fields from design development to planning-time-cost management. However, collaboration-based problems due to the organization structure in a large-scaled project make it difficult to fulfill the responsibilities of architectural team. This problem can be minimized if the architectural team leads the engineering production teams. As well as minimizing collaboration-based problems, the delays can also be avoided. The proposed model is developed regarding these issues.

To avoid the collaboration-based delays, architectural group should be given the initiative and involved in decision-making process for the production management of other teams. This can be achieved if architect led design-build is adapted at the production level of the organizational setup. This fact also corroborated by the findings of other researchers, whose work has been presented in the literature review section.

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