Impact of Organisational Structure on Building Design Execution Periods

By

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ABSTRACT

This research examines the impacts of organisational structure on design execution period, in the context of public sector building design organisations in Thailand, in order to improve design productivity of the organisations. During the course of the study, a review of existing literatures analyses a number of factors influencing the design execution time, including the organisational structure. Three aspects of organisational structure were found to have impacts on the design period, these are departmentalisation, centralisation (or decentralisation), and formalisation. Primary research was employed to obtain the informative data from two representative organisations through collecting secondary data from the organisation records as well as conducting questionnaires and interviews with design-related staffs. It was found that such aspects of organisational structure can have both positive and negative effects on the design execution period and applying matrix structure to the project teams improves the execution time.

Key words: Organisational structure, design execution period, design process, building design organisation

Word count: 11,396

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CHAPTER 1:
INTRODUCTION

1.1 Problem context

There is a perception that building design services – architectural and engineering design – in the public sector of Thailand takes longer period than it should, comparing with those in private sector. This brings about negative and unprofessional image to the public sector design divisions including their staffs in the aspect that they are unskilled and inefficient. Furthermore, inefficiency of the design process can result in not only unproductive design but also unsuccessful construction project as a whole (Manavazhi and Xunzhi, 2001). According to the author's experience in public sector design divisions, a number of projects were never constructed according to design delay. Negligence on this problem may result in deficiency in the reliability of the whole Department. It is therefore important to study this problem in order to explore the real causes and to suggest the improvement channel to the problem.

1.2 Research objective

The research intent is to investigate the factors which influence the design execution period in Thailand public sector design divisions, and to examine how each factor affects such period. Although there are many factors that have impacts on the design period (as will be elaborated further in the next Chapter), organisational structure in public sector context is seen as one of the important factors. The research therefore focuses on the factors influencing design execution period in general and the impacts of organisational structure on such period in particular.

1.3 Scope of research

This research focuses on achieving its objective within the context of public sector building design organisations in Thailand. Although there are a number of organisations involved in such context, it would be difficult to examine all of them because of time limitation. Hence, two representative organisations were selected.

The reason for selecting these organisations is that they are two of the biggest public sector building design divisions in Thailand involved in various types of building for example office buildings, city halls, educational buildings, and cultural buildings in the historical site. The volume of work done annually by them is large, comparing with other public sector building design divisions. Therefore, the research findings based on data from these two organisations can be fairly representative of the building sector.

1.4 Characteristics of public sector organisations in Thailand

According to Esman (1991), all government organisations employ bureaucratic structure, claiming that it is the most effective and reliable structure which assists them the most in dealing with various publics they serve. The characteristics of such structure make the government, or public sector, organisations the mechanistic organisations which apply hierarchical structures of authority with rigid divisions of labour, high specialisation, and rely heavily on explicit rules determining the flow of works (Robbins and Coulter, 2007). Most of public sector organisations in Thailand, similarly, employ such structure (Hofstede, 1983).

Bennis (1966) states that the time of bureaucracy has past since, as the size of bureaucratic organisations is usually huge, they cannot adapt themselves to the fast-changing environment. In addition, high specialised staffs would be no longer required as modern organisations need multi-skilling staffs. On the other hand, Robbins (1990) argues that bureaucratic organisations have been adapted to the environment effectively by developing themselves from machine bureaucracy to professional bureaucracy. Moreover, the larger size of organisation brings them the advantage of organisation resources.

Nevertheless, Esman (1991) mentions that, according to the endemic factors, application of bureaucratic structure in most less developed countries is less efficient. Furthermore, there are a number of criticisms of bureaucratic structure. For instance, Welch and Welch (2007) state that its rigid-control management style destroys staffs' competitiveness. In addition, Grayson (2002) and Lorsuwannarat (2006) point that having too many hierarchical levels as well as formal procedures results in delay in execution. These issues will be examined in the following Chapters.

1.5 Building design process in public sector design divisions in Thailand

Design process comprises a large number of complex and interdependent tasks (McGeorge, 1988 cited in Manavazhi and Xunzhi, 2001). There are many publications that break down the building design process into different stages (for example Shoshkes, 1989; Gray and Hughes, 2001; and Tunstall, 2006). However, to place this research in perspective, a brief description of the building design process in the context of public sector design divisions in Thailand is presented in the following paragraphs.

The design process can be divided into four main stages, namely development of the brief, conceptual and scheme design, detailed design, and cost estimation stages. The process can be simplified in Figure 1. The design process starts when the design division receives the official letter from the client, who is the representative of a government sector, stating the need for a building(s). Then, the division assigns the project to an architect, who is usually the design-team coordinator.

During the development of the brief stage the client briefs the project requirements and indicates a cost ceiling to the architect. In many cases, such specifications are tentative. The architect, therefore, assists the client to assess as well as to develop the requirements into functional brief documents, providing adequate information for developing the concept design.

In the conceptual and scheme design stage the designers develop the concept design based on the functional brief. Once the client approves the concept design, the designers then work up the scheme design, showing basic planning arrangement, appearance, internal space, and comprehensive specification. Roughly cost estimation is also provided for approval by the client. At this stage, engineering works related to the project are roughly discussed so as to determine the design solutions. The work process of this stage can be, and usually is, iterative until the client approves the scheme design.

Once the client approves the scheme design, the design is fixed and ready to be developed in more details. In the detailed design stage, architectural, and structural and services engineering designs are fully developed. All drawings and specifications are produced and then passed to the cost estimators so as to estimate the overall cost of the project as well as

to produce bills of quantities. Once the bills of quantities are finished, the architect hands all information over to the client for the preparation of a competitive tender. That is the end of the design process.

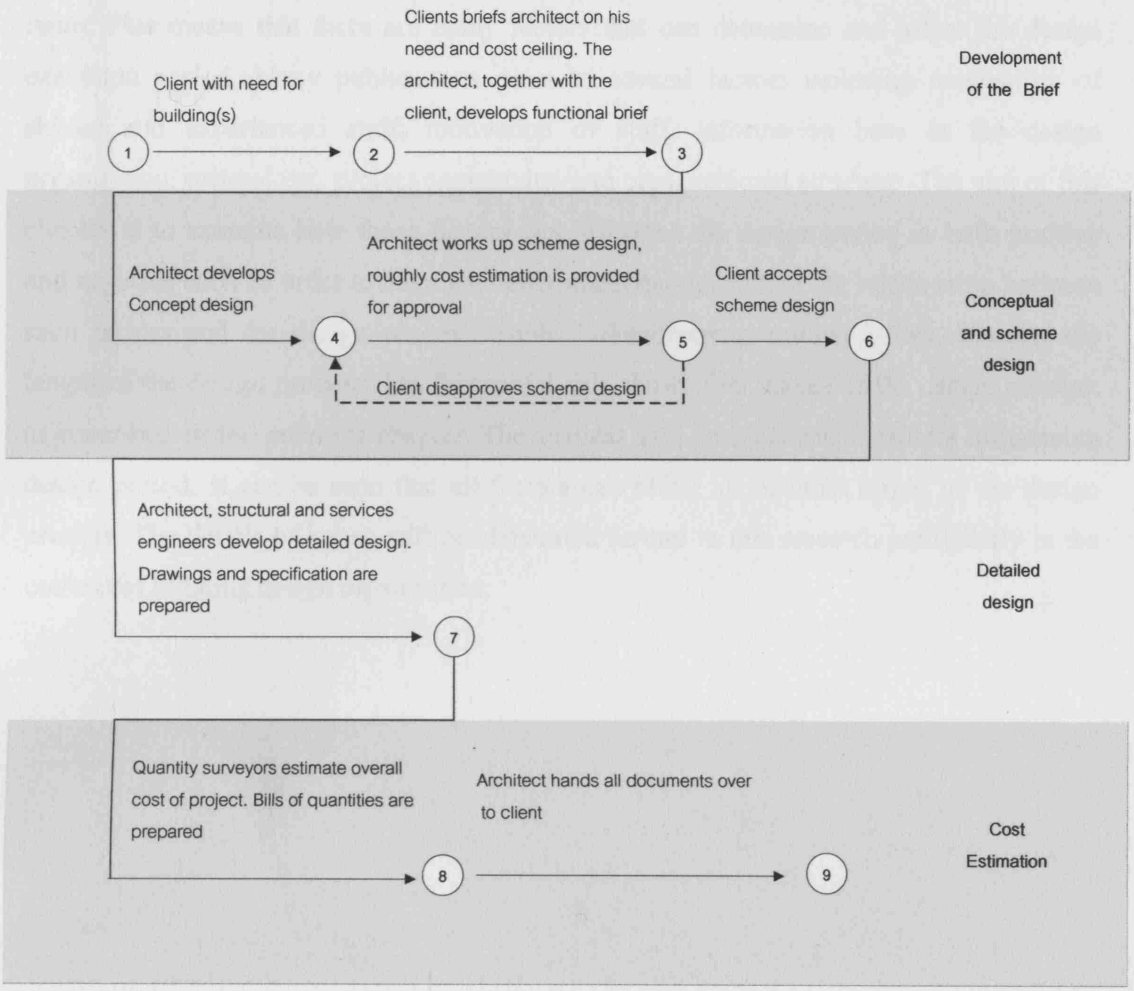

Figure 1: Design process in public sector design divisions in Thailand (adapted from Franks, 1999: p.12)

Normally, when the architect is assigned for a project, he has to inform the client about the design execution period of the project, using the standard time frame of the organisation. The time frame, determined by the organisational committee based on designers' past experience, are catagorised by the scale of the project. In the context of this research, the term 'delay' in design time refers to the additional time taken to complete the design over the initially assigned period.

CHAPTER 2:
FACTORS INFLUENCING DESIGN EXECUTION PERIOD

Manavazhi and Xunzhi (2001) state that design productivity is a complex and multifaceted issue. This means that there are many factors that can determine and affect the design execution period. Many publications point to several factors including availability of skilled and experienced staff, motivation of staff, information base in the design organisation, technology, project complexity, and organisational structure. The aim of this chapter is to examine how those factors can influence the design period in both positive and negative way. In order to have the better understanding about the relationship between such factors and the design process, Table 1 demonstrates critical issues affecting the length of the design process. The horizontal axis shows four stages of the design process, as described in the previous chapter. The vertical axis presents major factors influencing design period. It can be seen that all factors can affect all or most stages of the design process. The details of issues will be elaborated further in this research particularly in the context of building design organisation.

Table 1: Factors and critical issues affecting the length of the design process

Major factors influencing design period	Critical issues affecting the length of building design process in developing countries			
	Stage 1	Stage 2	Stage 3	Stage 4
	- Project planning - Functional brief	- Concept design - Scheme design	- Detailed design - architectural, - structural and services engineering	- Cost estimation - Bill of quantity
General factors				
Availability of skilled and experienced staff	- Skilled staff have better ability to capture project's needs	- Experienced staff can match requirements with solutions more quickly and easily	- Unskilled or inexperienced staff usually make mistakes or omissions	
Motivation	Low motivation can result in low productivity in all stages			
Information(Data) base	- Adequate client's requirements	- Code of practice, building regulations, and method of ensuring compliance with the Town Planning Acts - Fundamental requirements of each building type - Books and magazines, material samples	- Standard designs and drawings - Design parameters of loading and the design for all services - Feed-back information of past projects - Standard information for preparing specifications	- Update material-price lists
Technology	- N.A.	- 3D CAD modelling allow designers to explore a wide range of design options in short period of time - 3D CAD modelling helps in improving the client's understanding of the design, risk of design change in later stages can be mitigated	- CAD allows design, including drawings, to be transferred between designers - CAD allows designers to change, copy, or edit design in drawings more quickly - Risk of redesign caused by conflicts between different sub-system designs can be reduced	- Some programmes can break down quantity of each element from drawings
Project complexity	- Clients cannot always communicate their requirements completely at the early stage - Client's requirements clash with budget or needs of local authority	- Site characteristics, site's environmental conditions, and cultural context of the site	- Building types which have a lot of details or large-scale buildings need more time	
Aspects of organisational structure (in context of public sector building design organisations)				
Departmentalisation Coordination within a functional area Communication across functional areas Collaboration between project designers				
- ***Functional and product departmentalisation***	- N.A.	- Functional and product departmentalisation encourages coordination within functional area - Coordination between designers across functional areas about basic concept of the project may not be convenient	- Functional and product departmentalisation result in poor communication across functional areas	- Functional departmentalisation result in poor communication between designers and cost estimator which can cause errors and rework
- ***Metric departmentalisation***	- Metric departmentalisation allows all related designers work together at the beginning of project	- Design solutions can be produced more quickly as a result of collaborating design	- Communication between project designers across functional areas can be enhanced - Project leader can make decisions regarding every aspect of the project promptly - Rework as a result of misunderstanding and lack of communication between designers can be reduced	- Rework as a result of misunderstanding and lack of communication between designers and cost estimators can be reduced
Centralisation Decision-making authority	- N.A.	Bureaucratic approval procedure limits agility of design process		
Formalisation Ease of execution of tasks	Formal procedure limits agility of design process and results in lengthy period of circulation of information between designers			

2.1 Availability of skilled and experienced staff

As a building design organisation normally comprises staffs who are professionals, it can be considered as a professional organisation. Mintzberg *et al.* (2003) state that professional organisations rely largely on skills and knowledge of staff. Therefore, this is also the case in building design organisations.

Gray and Hughes (2001) point that a successful design often results from the choice of starting point in relation to the definition of the client's problem. According to Harpum (2004), Jones (1984) and Harwood (1996), skilled and experienced designers have better ability to capture business requirements which can significantly improve the understanding of the needs of the project. This means that they can provide the design that fit the client needs in a shorter period of time. In addition, they can apply knowledge which they have learned or used in the past projects to the current projects. This makes them match the requirements with solutions more quickly and easily in later design stages. On the other hand, unskilled or inexperienced staff can extend the design process since, beside limited capability they have, they usually make mistakes or omissions of design elements which result in rework (Love and Li, 2000). Manavazhi and Xunzhi (2001) corroborate this view by noting that inexperienced designers usually provide inconsistent details, inadequate details, and impractical designs. Skill issue is particularly the case in less developed countries where limited capability of staff impedes public sector organisations from carrying their tasks efficiently (Esman, 1991).

2.2 Motivation

Design of a building project is a combination of motivation and expression of many individuals (Gray and Hughes, 2001). Hence, designers' motivation can be seen as a factor that influences their performance and their productivity.

Individuals have different sets of expectation of themselves, their jobs, and their organisations (Handy, 1999). As a result, an individual tends to put his effort and energy in something that motivates him, in other words, leads him to his expectation. In the context of professional organisations, according to Robbins and Coulter (2007), professionals tend to be motivated by job challenge and value support, that is they want to work on important tasks. In addition, they prefer to control their own works (Mintzberg *et al.*, 2003).

Therefore, if the organisation can provide such needs to the designers, they should perform well and the design period could be shortened (although it should be noted that design period also depends on other factors as shown in Table 1).

Nevertheless, individual motivation can create constraints in the design process as each designer develops a particular approach, which he prefers, to the design problem. This can consequently limit the range of solutions. Furthermore, the design process can be lengthy if the designer follows his motivation too much as the solution that satisfies him can be difficult to achieve (Gray and Hughes, 2001).

Robbins and Coulter (2007) also point that money and promotion are low priority for professionals. However, it should be noted that they recognise that professionals tend to be well paid and enjoy what they do. This might not be the case in public sector organisations, especially in less developed countries, where professionals' salaries tend to be much lower than in private sector. Moreover, Esman (1991) points that, in public sector organisations, there likely to be political penetrations of administrative structure as well as perverse promotions, based on patronage or seniority. In the context of professional organisations, this means that they might not be able to fully control their works. Therefore, it can be considered that public sector building design organisations in Thailand might not be able to motivate their staffs. This can lead to low performance as well as low productivity, which result in lengthy design period.

2.3 Information base

Information base in the organisation is another factor that can affect design period. According to Manavazhi and Xunzhi (2001), inaccurate, incomplete, or untimely information can result in an inefficient design process. The information (or data) base of a building design office that is usually used during the course of the project can be listed as follows (based on Bennett, 1981):

- Code of practice, building regulations, and method of ensuring compliance with the Town Planning Acts. This information is necessary for the designers to refer to at the first stage of the design process in order to see the feasibility as well as the appropriate approach for the project.

- The design standards for the building type for example housing, education, or hospital. This is particularly the case for public sector design offices whose works normally involve with some certain types of building. The information such as fundamental requirements or special issues of such buildings can definitely help the designers to develop the design more quickly in the concept design stage.
- The design parameters of loading and the design for all services. For example, soil condition in different region of the country. This type of data affects the design speed in the structural and services design stage.
- Standard information for preparing specifications. Having the standard information of materials or methods used in the project would facilitate staffs in producing information necessary for the quantity surveyors in order to produce the bills of quantity as well as cost estimation.
- The feed-back information that is available on construction methods. This refers to the success of the techniques used in the past projects which can help the designers in making decisions during the detail design stage.

In addition, Simpson and Viller (2004) point that architectural or engineering books and magazines, including material samples, are regularly used as tools for design and discussion with colleagues and clients throughout the design process.

Apart from the stated information, standardised designs, including drawings, are considerable for shortening the design period. Furthermore, update material-price lists can be seen as one of the important information since they are used in the final stage of the design process for estimating accurate cost of the project. Another type of information which is not included in the building design organisation but can significantly affect the design period is the client's requirements. Without receiving sufficient requirements, the design process cannot proceed (Sawczuk, 1992).

It can be seen that information base is important in every stage of the design process. Consequently, it can be argued that good, and readily available, information base in the organisation allows designers to work more fluently and therefore quickly. On the other hand, poor information base can delay the design execution as the designers would have to waste their time in waiting for such necessary information.

2.4 Technology

At present, computer-aided design (CAD) has an important role in reducing design period. Adopting 3D CAD modelling from an early stage of the design process helps designers to develop their ideas and allows them to utilise its functions to support and reflect design thinking as well as develop a greater awareness of architectural space and form (Szalapaj, 2001). This benefit can shorten the design period for two reasons.

Firstly, the designers can produce the design more quickly with CAD. Some CAD tools, for example parametric modelling, allow the design team to explore a wide range of design options in a very short period of time (Freiberger, 2007). CAD also allows the design, including drawings, to be transferred between designers. Hence, structural and services engineers can develop the design from the drawings which have already created by the architect. Using the same drawings can also reduce the error or omission of design element which can cause rework (Tunstall, 2006). In addition, CAD allows designers to change, copy, or edit the design in the drawing more quickly. Moreover, the risk of redesign caused by conflicts between different sub-system designs can be reduced if building information modelling (BIM) is applied (Zeiss, 2008). Some programmes can break down the quantity of each element from the drawings. This helps the quantity surveyor to prepare bills of quantity more quickly.

Secondly, 3D modelling can be used for improving the client's understanding of the design. This allows better communication between the designers and the client and therefore mitigates the risk of design change in later stages of the project which can cause delay.

However, it should be noted that the potential of technology can shorten the design period only if all necessary equipment and skills of staff to utilise its functions are available in the organisation.

2.5 Project complexity

The scale of complexity of a project depends on three elements – the client, the building type, and the site (Tunstall, 2006). All of these can affect the length of the design process for the following reasons.

Clients cannot always communicate their requirements completely at the early stage of the project as, in many cases, the problem is owned by many parties (Gray and Hughes, 2001). As a result, design are usually changed in the later stage which cause rework and therefore delay (Love and Li, 2000; Manavazhi and Xunzhi, 2001). According to Manavazhi and Xunzhi (2001), changes caused by the client include change in the functional characteristics of the facility, the scale or standard of the building, and change due to custom requirements of end-users. Furthermore, the client's requirement may clash with the budget or the needs of local authority. In such case judgment must be made about the importance of each element which can take short or long time depending on the degree of complexity (Tunstall, 2006).

Building type is one of the factors that can be used to determine the design period. It can be argued that some building types are more complex than others. A hospital, for example, can be considered as more complex than an elementary school within equal floor area and, regardless of other factors, would therefore take more time to design. Another example is the traditional building which is composed of a number of architectural details.

Site characteristic is another factor that can affect the design execution period. The difficulty of design can arise from the physical features of the site such as topography, accessibility, or soil condition. It can also result from the site's environmental conditions (Gray and Hughes, 2001). For example, designing an extending of an operating hospital would need special provision to deal with such issues. Another site characteristic which may influence the design period is the cultural context of the site. The site which has historical context, for example, need more time to research and survey in order to ensure that the design will be in harmony with such context. For instance, 30 St Mary Axe tower, which its site was the site of the Baltic Exchange – one of British historic building, took about two years in developing the design with corporation of London and English Heritage before the planning permission was granted (Powell, 2006).

Another element which is not mentioned by Tunstall (2006) is the scale of the project. Many of complex projects are considered large-scale, for instance a tall building or a university, and usually take more time to design than small projects do. Hence, the scale of the project can be seen as another factor that influences the design period.

2.6 Organisational structure

Organisational structure refers to "the formal configuration between individuals and groups with respect to the allocation of tasks, responsibilities, and authorities within organisations" (Greenberg and Baron, 2003). It is the fundamental context for organisational behaviour – that is how people act or perform at work (Buelens *et al.*, 2006). This implies that same person may present different productivity in different organisation. Therefore, it can be considered that individual issues may be less important regarding work efficiency, which directly relates to time spent on work process. Rather, organisational structure may be more significant.

Different organisations need different structures. According to Robbins and Coulter (2007), effective organisational structure would well support and facilitate job delivery of the organisation's staffs. Hence, it can be seen that effective organisational structure can shorten the job execution period or, in the context of building design organisations, the design period. On the contrary, poor, or inappropriate, structure can delay the job delivering process as will be elaborated further in this research.

Organisational structure involves three main elements – division of labour, hierarchy of authority, and co-ordination of effort (Buelens *et al.*, 2006). In more depth, these elements can be broken down into five issues, namely work specialisation, departmentalisation, span of control, centralisation (or decentralisation), and formalisation. Table 2 demonstrates the relationship between the main elements and the issues within them.

Table 2: Elements of organisational structure

Main elements	Issues
Division of labour	Work specialisation Departmentalisation
Hierarchy of authority	Span of control Centralisation (or Decentralisation)
Co-ordination of effort	Formalisation

Although every issue is an important mechanism of the organisational structure, not all of them directly influence the design period to the same degree. The effects of each issue on the design period are briefly analysed as follows.

Regarding division of labour, work specialisation is "dividing work activities into separate job tasks" (Robbins and Coulter, 2007) whereas departmentalisation refers to the basis of combining tasks and specialists together (Buelens *et al.*, 2006). According to Harwood (1996), building design is multidisciplinary and needs designers who specialise in different fields working together as a project team. Intercommunication is, therefore, very important. Thus, it can be argued that work specialisation *per se* does not directly affect the length of the design process. Rather, the influence of departmentalisation may be more considerable.

Span of control refers to the number of people that a manager is responsible for (Greenberg and Baron, 2003) whilst centralisation refers to the degree of staff empowerment, giving them the authority to make decisions about their tasks, in an organisation (Robbins and Coulter, 2007). According to Robbins and Coulter (2007), the concept of span of control is used for determining the number of levels and managers an organisation should have. However, it is the decision-making authority issue that can affect the design period. Consequently, regarding the hierarchy of authority, this research will focus only on the issue of centralisation.

Formalisation describes the degree of rigidity of rules and procedures that can influence the coordination of staff (Buelens *et al.*, 2006). As previously stated that a building design project needs coordination of multidisciplinary designers, it can, therefore, be considered that formalisation can also influence the design period.

In summary, this research will investigate, in more depth, the effect of departmentalisation, centralisation, and formalisation on the design execution period.

2.6.1 Departmentalisation

Departmentalisation is the process of breaking up organisations into well-organised divisions (Greenberg and Baron, 2003), grouping common tasks together (Robbins and Coulter, 2007), and grouping people based on related expertise (Buelens *et al.*, 2006). According to its definition, it can be argued that departmentalisation can affect three factors which can, therefore, influence the design period – coordination between designers within a functional area, communication across functional areas, and collaboration between project designers. This research will now examine how each type of departmentalisation can cause or prevent delays in design.

There are many forms of departmentalisation. The criteria used to form departments or divisions are grouping by similar functions or expertise, by similar products, services, customers or geographical regions, and by process of workflow (Robbins and Coulter, 2007). However, there are three major forms of departmentalisation, namely functional departmentalisation, product departmentalisation, and matrix departmentalisation (Greenberg and Baron, 2003).

Functional departmentalisation

Functional departmentalisation groups people and jobs by functions or activities performed. For example, a building design organisation might be composed of architecture, interior design, landscape design, structural and services engineering, draftsman, cost estimation, administration, and accounting divisions (see Figure 2).

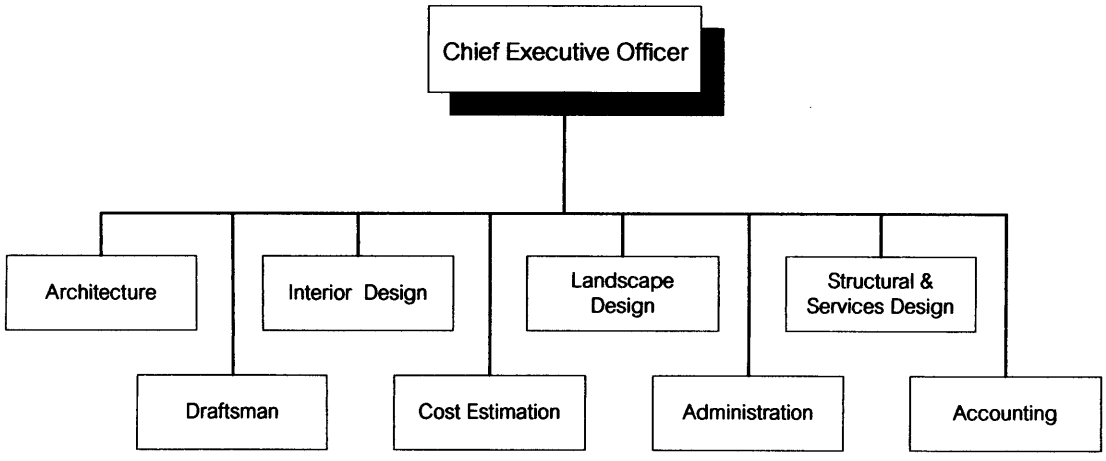

Figure 2: Functional departmentalisation (Source: adapted from Buelens *et al.*, 2006)

The advantages of this form of organisational structure are efficiencies from grouping people with the same expertise together as well as allow them to specialise in their jobs by continual performing the tasks they are skilled. In addition, functional departmentalisation encourages coordination within functional area (Robbins and Coulter, 2007). Proximity to colleagues provides an atmosphere which develops collaboration and discussion (Simpson and Viller, 2004). It can be seen that such benefits can result in faster job delivery in case that the job can be commenced and finished within one division.

However, functional departmentalisation has several drawbacks. This type of departmentalisation allows each division to develop its own interest and therefore limit view of organisational goals (Greenberg and Baron, 2003). This results in poor communication across functional areas (Robbins and Coulter, 2007). Remoteness also makes little questions between co-designers difficult to be supported (Simpson and Viller, 2004). This may be the case in professional organisations as they rely on coordination among operating professionals (Mintzberg *et al.*, 2003). Design works are usually complex and the members of the design team consisted of multidisciplinary professionals therefore need to share their knowledge and skills during the course of the project (Gray and Hughes, 2001). Hence, it can be argued that, although functional departmentalisation encourages in-depth specialisation, such limitation can result in lengthy design period.

Product departmentalisation

Product departmentalisation groups people and jobs by types of product or service (Buelens *et al.*, 2006). It breaks up an organisation into a number of autonomous divisions, each contains sub-divisions necessary for delivering its products or services (Greenberg and Baron, 2003). An example of a building design organisation departmentalised by services is shown in Figure 3.

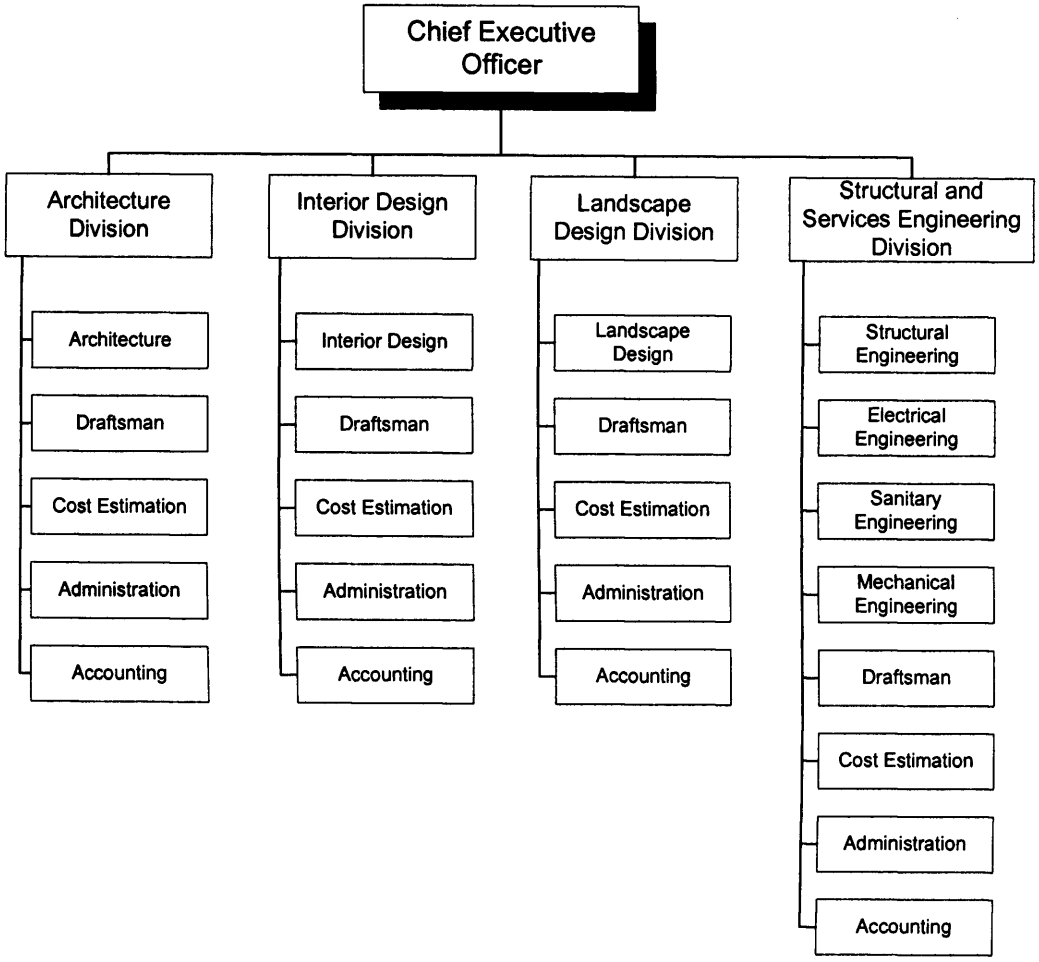

Figure 3: Product departmentalisation (Source: adapted from Buelens *et al.*, 2006)

Product departmentalisation can also establish different divisions on the basis of customer needs or geographical regions (Greenberg and Baron, 2003). For example, a building design organisation might develop the commercial building and the residential building divisions in order to serve particular needs of clients. Likewise, it might develop Northern region and Southern region divisions, enabling the organisation to operate its service close to its customers. These can be seen as the advantages of this form of organisational structure.

Nevertheless, this type of departmentalisation presents duplication of functions (Robbins and Coulter, 2007). As shown in Figure 3, the cost of running draftsman, cost estimation, administration, and accounting functions would highly increase comparing with functional departmentalisation. In addition, similar to functional departmentalisation, product departmentalisation may result in problems of collaboration between project designers

across functional areas as each division operates independently, enabling it to create its own goals (Greenberg and Baron, 2003). Therefore, with the same reason, it can be argued that this form of organisational structure can also cause delays in design.

Matrix departmentalisation

Matrix departmentalisation combines functional and product departmentalisations. In this form of organisational structure, specialists from different divisions are brought together to work on project-based tasks and a project leader is appointed for each project (Robbins and Coulter, 2007). As a result, employees in a matrix organisation have, and have to balance the demands of, two bosses –the functional division managers and the project managers (Greenberg and Baron, 2003). Figure 4 shows an example of the matrix structure in a building design organisation.

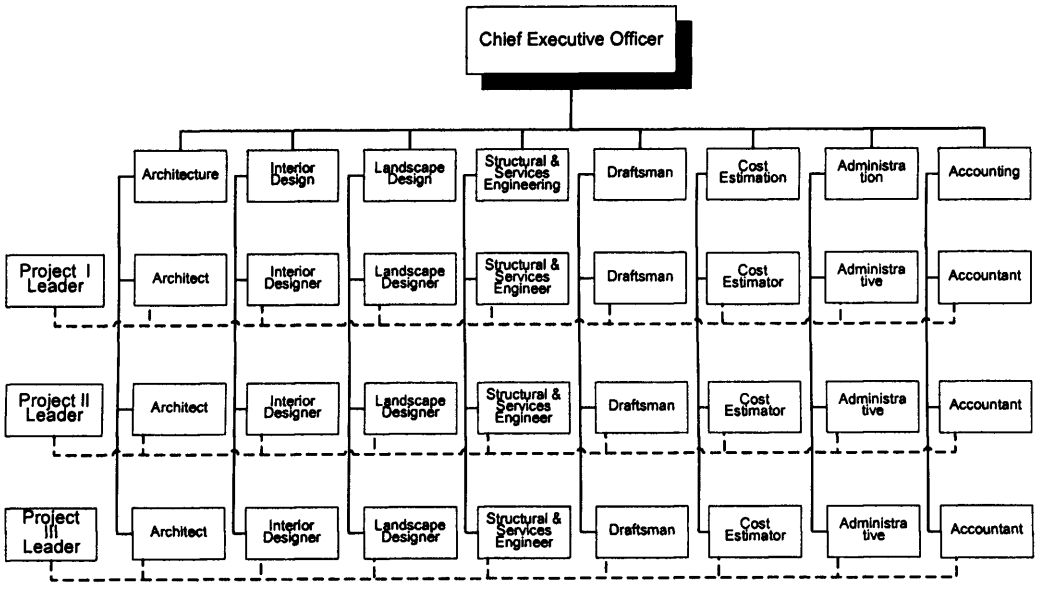

Figure 4: Matrix departmentalisation (Source: adapted from Greenberg and Baron, 2003)

An obvious disadvantage of this type of departmentalisation is having two lines of authority. There is a high probability that one of the two will predominate and hence results in conflict between authority lines (Buelens *et al.*, 2006). In such case, it can delay the process of the tasks as the two managers may be more concerned about the political games than with the tasks to be done.

However, as demonstrated in Figure 4, top management who has authority over both lines is responsible for maintaining a proper balance between functional and project leaders; and enhancing coordination between them (Greenberg and Baron, 2003). In addition, it can be seen that this organisational structure enhance communication between project designers across functional areas as well as allows the project leader to make decisions regarding every aspect of the project promptly, flatten vertical hierarchy in the organisation. According to these advantages, it can be argued, especially in the context of building design organisations where their tasks are multidisciplinary and project-based, that the matrix form of departmentalisation has strong potential to prevent the design delays.

2.6.2 Centralisation

Centralisation describes the extent to which authority and decision making are reserved for the upper levels of the organisation (Greenberg and Baron, 2003). It is the opposite of decentralisation, which allows lower-level staff to make decisions about their jobs (Buelens *et al.*, 2006). Robbins and Coulter (2007) point out that large organisation which has stable environment tends to be more centralised. In addition, Hofstede (1983) found that the structure of organisations in Thailand, in majority, contain a number of organisational levels (large power distance) as well as rules which determine that staffs should report their works to the next higher authority level. Therefore, it can be considered that public sector design divisions in Thailand should be relatively centralised.

Centralisation can have a positive effect on execution period if the jobs are routine and the staffs who perform such jobs are not interested in, or not capable of, taking responsibility for decisions (Greenberg and Baron, 2003). However, in a building design organisation, staffs are professionals who normally work closely with the clients they serve. According to Mintzberg *et al.* (2003: Professional organisations), although the professional judgment is usually framed by clients, professional training and standard, and individual affiliation, it is the professionals who can make the proper decisions about the basic mission, for example what should be design and how, as they are closer to the problem and have more detailed knowledge about such problem. Hence, it can be argued that building design organisations are more suitable with decentralisation. Moreover, the need of supported opinion from higher levels in every step can directly delay the design execution.

Nevertheless, absolute decentralisation is not the best answer for a building design organisation because not all staffs have enough skills and experiences necessary to deal with every problem. Bennett (1981) states that, in a building design office, senior staff has to delegate the tasks to juniors without losing control, which means the juniors will have responsibility to take action while recognising that they should report decisions they have made and work progress to the seniors. This shows that, although a building design office should be more decentralised, some degree of centralisation is necessary as Buelens *et al.* (2006) point that the concept of centralisation and decentralisation is a balancing act.

2.6.3 Formalisation

Formalisation refers to "the extent to which rights and duties of organisational members are determined" (Buelens *et al.*, 2006). It also refers to the strictness of rules and procedures of work processes which indicate the level of job standardisation in the organisation (Robbins and Coulter, 2007). According to Buelens *et al.* (2006), the degree of formalisation in an organisation relates to the scale of the organisation. Large organisations tend to be more formalised in order to stabilise its environment. In addition, Smith and Peterson (2005), state that organisations in less economically developed countries tend to rely more on rules and bureaucratic mechanism than ones in more economically developed countries as a result of education and skills of staff. In public sector organisations, formalisation is also seen as a tool, creating formal rules for staff to follow, used for dealing with various demands of the clients they serve (Esman, 1991). In accordance with these concepts, together with Hofstede's research (1983) referred above (Centralisation), it can be considered that public sector design divisions in Thailand should have high degree of formalisation.

Mintzberg *et al.* (2003) point that complex works in professional organisations should not be standardised or formalised since rules and orders can obstruct the professionals from providing their services effectively. This is particularly the case in public sector design divisions where circulation of information or documents is purely for satisfying bureaucratic needs without any contribution to the enhancement of the design quality. In addition, formal procedures may inhibit the designers to provide quicker design solutions. For instance, in a private office, an architect can deliver a restoration design of a public toilet in days by sketching and explaining his design to the contractor. On the contrary, if a

public sector design division carries out the same job, the job would have to enter the formal procedures; the complete drawings must be produced as well as formal specification. This can be lengthy since coordination between the architect and the services engineer has to be done in document form, passing through the line of authority from architecture division to services engineering division. Hence, it can be seen that formalisation can delay the design execution by impeding the ease of execution of the tasks.

However, in the context of building design, standardisation of work, for example prefabricated design or standard architectural or engineering details, can assist the designers to deliver the design more quickly. Therefore, it can be argued that, in order to shorten the design period, a building design organisation should focus on developing standardised components and details rather than focusing on bureaucratic approval procedure.

2.7 Process to improve execution time

According to the factors examined above, it can be concluded that, in order to improve the execution time, a building design organisation should:

- Recruit skilled and experienced staff as well as enhance skills of existing staff so as to improve their efficiency and reduce mistakes and omissions which cause rework.
- Motivate its staff properly based on recognising the basic needs of professionals. However, it should be noted that individuals are not identical. They have different sets of expectation and need.
- Develop effective information base in the organisation
- Apply selective technologies as well as equipment which are compatible with such technologies and staffs' skills. In addition, skills of staff should be developed continually in order to catch up with new design support technologies.
- Adopt design management in order to cope with complexity of projects.
- Restructure the organisation so as to improve coordination within a functional area as well as communication and collaboration between project designers across functional areas, allow an appropriate degree of designers' decision-making authority, and improve procedures of work processes to support and facilitate job delivery of the staff. The following chapters investigate the influence of organisational structure on the design execution period in two representatives of public sector building design organisations in Thailand.

CHAPTER 3:
STUDY PROCESS AND CASE STUDIES

3.1 Hypotheses

A set of hypotheses was drawn up. These were:

- Departmentalisation can have either positive or negative effects on design execution period as it determines the communication routes among project staffs
- Public sectors design divisions in Thailand are probably centralised, and the approval process causes delay in design execution
- Public sectors design divisions in Thailand probably have high level of formalisation, and the formal procedure causes delay in design execution
- Applying matrix structure to the project teams can prevent delay in design execution since it improves communication and collaboration among project staffs

3.2 Methodology

The methodology adopted for this research combines both quantitative and qualitative research approaches. Two public sector design organisations, which have important roles in building-design works in Thailand, were targeted for data collection. The quantitative approach was used to survey the respondents' opinions toward the impacts of the following three aspects of organisational structure on causing and preventing delay:

1. Coordination within functional area, and communication and collaboration among project staffs across functional areas (Departmentalisation)
2. Decision-making authority in performing jobs (Centralisation)
3. Agility of execution of tasks (Formalisation)

The survey explored such impacts in the design process in order to find out the particular periods which are affected by such aspects of organisational structure. Staffs from various disciplines and levels involved in the design process in each organisation including architects, interior designers, engineers, draftsman, and cost estimators were surveyed by using questionnaires.

Beside the questionnaire, secondary data from the sample organisation records were collected to compare design execution period between using normal process and matrix structure. The design execution period refers to duration between receiving official request letter from client until delivering a project including architectural, structural, and related services engineering design, cost estimation and bills of quantities. The data were collected regarding all multidisciplinary building design projects completed in 2007.

However, there is a limitation of collecting such data since they are concerned as confidential to one of the sample organisations. This research, therefore, obtained such information from only one organisation. Hence, the analysis of this secondary data was concluded using data from a single source.

The qualitative approach was necessary for the following reasons:

- To help understand about working of the sample building design organisations in general and factors determining design execution period as well as factors that cause delay in particular.
- To help acquire detail and insight not directly available from the questionnaire.

The data collection methods used in the qualitative part of this research were informal and semi-structured interviews of design staffs. The informal interviews were conducted by asking contextual questions to the design staffs and let them talk about topics related to the questions. In the semi-structured interviews the outline of the discussion were determined in advance in order to obtain some specific information about the impacts of organisational structure in each stage of the design process.

3.3 Case study review

Two sample building design organisations contributed to this research are:

1. Department of Public Works and Town & Country Planning (DPT)
2. The Fine Arts Department (FAD)

Both organisations are Thailand public sector organisations involved in providing building design for the government sector. However, departmentalisation of the related functional groups in each organisation is different (as presented in Figure 5 and Figure 6).

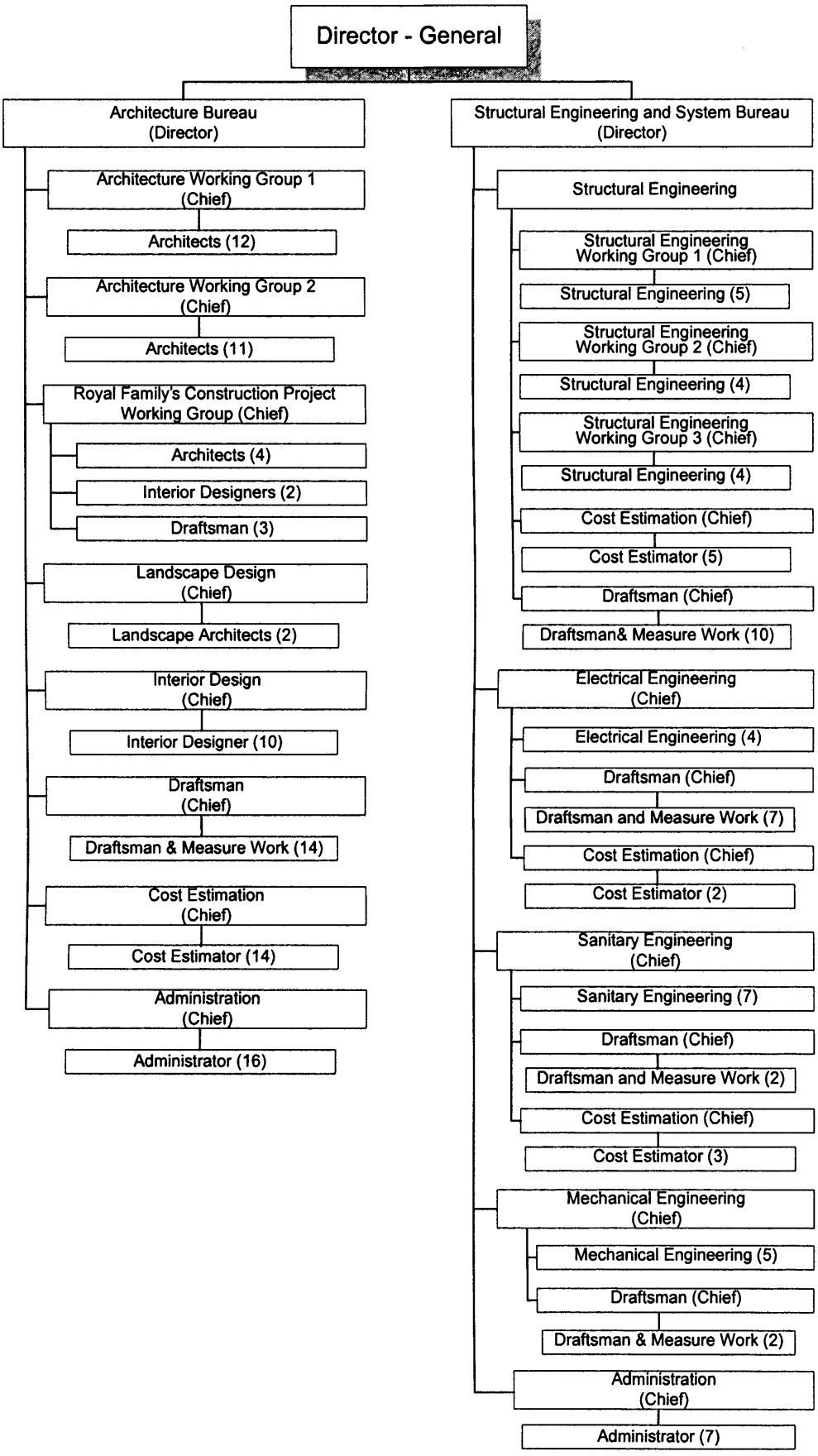

Figure 5: Departmentalisation of the design-related functional groups in DPT

Figure 5 demonstrates the departmentalisation of functional groups or divisions which involved in building-design works in DPT. It can be seen that DPT adopts product departmentalisation. 179 design-related staffs are separated into two autonomous divisions, namely Architecture Bureau and Structural Engineering and System Bureau. Each division contains supported sub-divisions (Draftsman, Cost estimation, and Administration). Indeed, the Structural Engineering and System Bureau itself is also sub-divided into four semi-autonomous functional groups, namely structural, electrical, sanitary, and mechanical engineering, sharing the same administrative part.

Originally, the staffs of both Architecture and Structural Engineering and System Bureau were included in one division. Separating into two divisions and dividing each division into many sub-divisions resulted from a growing number of staffs in the organisation. This results in an increasing number of chief positions in order to supervise the staffs in each sub-division. Consequently, some procedures for example flow of document and authorisation were added to support the new structure. Such procedures increase the level of hierarchical order as well as the level of formalisation.

Working process of DPT could be catagorised into two main types, normal process and matrix structure. The normal process starts when the Director-general receives the official request letter from the client. Firstly, the task would be assigned to the designer in the Architecture Bureau. Then, the design would be passed to related sub-divisions both within and across divisions. All task submissions have to be in document form consecutively through the lines of authority. On the contrary, when the matrix structure is applied, all project members from both divisions would be determined at the outset as well as the project leader. As a result, the project members can work together from the early stage of the design process. Furthermore, circulation of the documents to each project member can be done more quickly than in the normal process as the project leader could pass the task directly to each member regardless the lines of authority.

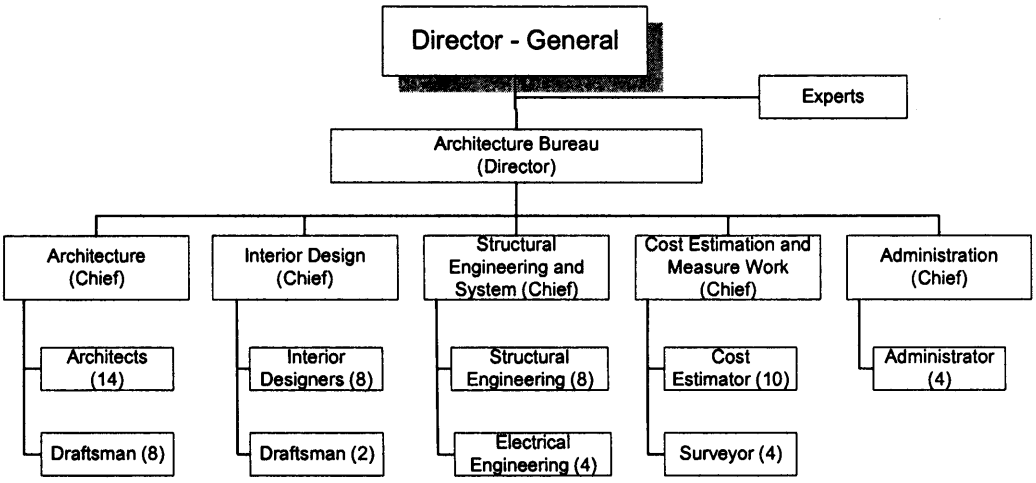

Figure 6: Departmentalisation of the design-related functional groups in FAD

The departmentalisation of functional groups involved in building-design works in FAD is presented in Figure 6. Unlike the DPT, all design-related staffs are included within one division, Architecture Bureau. Comprising 66 staffs, the bureau is divided into four sub-divisions supervised by one director. However, some projects involved with traditional architecture need to be supervised by experts outside the bureau.

It can be seen that the number of staffs in FAD is far less than in DPT. Obviously, there is no sanitary and mechanical engineer. As a result, the structural engineers are responsible for the sanitary engineering works while the mechanical engineering works are done by the electrical engineers.

Working process and collaboration among the project members across functional groups in FAD are similar to DPT, relies on circulation of documents. However, the tasks can be passed from one functional group to another in chief level. The director of the bureau is responsible for coordination with other divisions as well as maintaining a proper balance between functional groups within the division. Similar to DPT, the matrix structure is applied in some projects. Nevertheless, it is slightly different that is, in FAD, it involves combining staffs from different functional groups within only one division.

CHAPTER 4:
RESEARCH FINDINGS

A careful study of the data collected from the sample organisations led to research findings. In order to see the impacts of organisational structure in more depth, the survey broke down the design process into six, activity-oriented, stages (although it can be seen that there are four main stages, as stated in Chapter 1). These were:

1. Development of the brief
2. Conceptual and scheme design
3. Detailed design
4. Drawings and specification
5. Cost estimation of each task
6. Collecting all related tasks and producing BOQ

The key findings are discussed here, but a summary of all the results can be seen in Appendix 2.

4.1 Departmentalisation

4.1.1 Coordination within functional area

Respondents were asked which stages of the design process that coordination and discussions within functional area can shorten the design execution period. In general, as presented in Table 3 and Table 4, respondents both in DPT and FAD replied that shortening design execution time is possible through increasing coordination and discussion among staff during the detailed design stage, more than any other stage (72.3% and 70.4% respectively).

Considering by respondents' position, it can be seen that, in both organisations, draftsman and cost estimators' answers were highly related with their tasks. The reason is that they are unlikely to know much about other processes for example development of the brief or conceptual and scheme design. On the other hand, beside his own task, an architect might know a little of all processes because of his supervisory position.

Table 3: Opinion toward *coordination and discussions within functional area* in shortening project execution period in each stage of design process (DPT)

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Development of the brief	16 64.0%	3 60.0%	1 16.7 %	3 60.0 %	2 66.7 %	2 100.0%	6 50.0 %	1 14.3%	34 52.3 %
Conceptual and scheme design	19 76.0%	3 60.0 %	2 33.3 %	2 40.0 %	3 100.0 %	2 100.0 %	4 33.3 %	1 14.3 %	36 55.4 %
Detailed design	21 84.0 %	4 80.0 %	4 66.7 %	4 80.0 %	3 100.0 %	2 100.0 %	7 58.3 %	2 28.6 %	47 72.3 %
Drawings and specification	18 72.0 %	3 60.0 %	3 50.0 %	2 40.0 %	2 66.7 %	2 100.0 %	11 91.7 %	3 42.9 %	44 67.7 %
Cost estimation of each task	19 76.0 %	3 60.0 %	2 33.3 %	3 60.0 %	2 66.7 %	2 100.0 %	4 33.3 %	7 100.0 %	42 64.6 %
Collecting all related tasks and producing BOQ	16 64.0 %	3 60.0 %	3 50.0%	2 40.0 %	1 33.3%	2 100.0 %	4 33.3%	7 100.0 %	38 58.5%

Table 4: Opinion toward *coordination and discussions within functional area* in shortening project execution period in each stage of design process (FAD)

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Development of the brief	12 85.7 %		3 75.0 %	3 50.0%	18 66.7%
Conceptual and scheme design	8 57.1%		2 50.0 %	3 50.0%	13 48.1 %
Detailed design	11 78.6%	1 33.3%	3 75.0%	4 66.7 %	19 70.4%
Drawings and specification	10 71.4%	1 33.3%	4 100.0%	3 50.0 %	18 66.7%
Cost estimation of each task	10 71.4 %	1 33.3 %	1 25.0 %	5 83.3%	17 63.0 %
Collecting all related tasks and producing BOQ	11 78.6 %	1 33.3%	1 25.0 %	5 83.3 %	18 66.7 %

The respondents were also asked which stages of the design process that setting project working groups within functional area can shorten the design execution period. The results are demonstrated in Table 5 and Table 6. It was found that, while the ranking is slightly different, the respondents in both organisations share a mutual feeling that the drawings and specification stage is one of the most potential stages that design execution time can be reduced through setting project working groups within functional area (72.3% of respondents in DPT and 63.0% of respondents in FAD).

Considering by respondents' position, it was found that most of respondents who are designers in DPT thought that setting project working groups within functional area can shorten most execution time during the detailed design stage. However, the architects believed that drawing and specification stage and development of the brief are more influenced. This is relatively similar to the opinion of FAD architects who also thought that both stages are highly potential stages that execution time can be reduced through setting project working groups within functional area. The answers of draftsman and cost estimators in both organisations are very similar to the previous question, based on their own tasks.

Table 5: Opinion toward *setting project working groups within functional area* in shortening project execution period in each stage of design process (DPT)

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Development of the brief	22 88.0%	4 80.0%	2 33.3%	2 40.0%	2 66.7 %	2 100.0 %	6 50.0%	1 14.3 %	41 63.1 %
Conceptual and scheme design	20 80.0%	4 80.0 %	3 50.0 %	2 40.0%	3 100.0 %	2 100.0 %	5 41.7 %	1 14.3%	40 61.5%
Detailed design	21 84.0%	5 100.0%	5 83.3 %	4 80.0 %	3 100.0 %	2 100.0%	6 50.0%	1 14.3 %	47 72.3%
Drawings and specification	23 92.0%	3 60.0%	3 50.0 %	2 40.0 %	3 100.0 %	2 100.0%	9 75.0 %	2 28.6 %	47 72.3 %
Cost estimation of each task	17 68.0%	4 80.0%	3 50.0%	3 60.0%	2 66.7%	2 100.0 %	4 33.3%	7 100.0%	42 64.6%
Collecting all related tasks and producing BOQ	17 68.0%	5 100.0 %	3 50.0%	2 40.0 %	2 66.7 %	2 100.0 %	4 33.3%	7 100.0%	42 64.6%

Table 6: Opinion toward *setting project working groups within functional area* in shortening project execution period in each stage of design process (FAD)

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Development of the brief	12 85.7%		3 75.0 %	2 33.3 %	17 63.0%
Conceptual and scheme design	10 71.4%		3 75.0 %	2 33.3%	15 55.6 %
Detailed design	8 57.1%	1 33.3 %	3 75.0 %	3 50.0%	15 55.6 %
Drawings and specification	10 71.4 %	1 33.3 %	4 100.0%	2 33.3%	17 63.0 %
Cost estimation of each task	9 64.3%	1 33.3 %	2 50.0 %	4 66.7 %	16 59.3 %
Collecting all related tasks and producing BOQ	10 71.4%	1 33.3 %	2 50.0 %	4 66.7%	17 63.0 %

When asked what are the topics or issues of discussions with other staffs within functional area that assist in shortening the design execution period, it was found that respondents in both organisations essentially discuss with other staffs within functional area about their working experiences that are related to the project or the issues they are facing (as presented in Table 7). However, many respondents in DPT also ask for information from the experts within their functional area in order to finished their tasks more quickly.

Table 7: Topics or issues of discussions with other staffs within functional area

Topics or problems of discussions	DPT	FAD
About their working experiences that are related to the project or the issues I am facing	63.1%	70.4%
Asking for the recommendation in order to fulfil the project completion	53.8%	55.6%
Asking for information from the experts	61.5%	51.9%
It is a nature of my work that requires information from those staffs	44.6%	51.9%

4.1.2 Communication and collaboration among project staffs across functional areas

Respondents were asked which stages of the design process that communication and collaboration among project staffs across functional areas can shorten the design execution period. As shown in Table 8 and Table 9, respondents both in DPT and FAD replied that such communication and collaboration can shorten most design time during the detailed design stage (75.4% and 59.3% respectively).

Considering by respondents' position, it was found that most of designers from all functional areas in DPT thought that shortening design execution time is possible through increasing communication and collaboration among project staffs across functional areas during the detailed design stage, more than any other stage. The results are slightly different from those of designers in FAD, where the architects thought that development of the brief stage is more influenced as many of their projects are in historical sites. Therefore, they need to collaborate with experts at the outset. The answers of draftsman and cost estimators in both organisations are, once again, very similar to the previous questions, based on their own tasks.

Table 8: Opinion toward *communication and collaboration among project staffs across functional areas* in shortening project execution period in each stage of design process (DPT)

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Development of the brief	18 72.0 %	4 80.0 %	5 83.3 %	3 60.0 %	2 66.7%	2 100.0 %	6 50.0%	2 28.6%	42 64.6%
Conceptual and scheme design	19 76.0 %	4 80.0%	5 83.3 %	3 60.0%	3 100.0%	2 100.0%	5 41.7 %	1 14.3 %	42 64.6 %
Detailed design	20 80.0 %	4 80.0 %	6 100.0 %	4 80.0%	3 100.0 %	2 100.0%	8 66.7 %	2 28.6 %	49 75.4 %
Drawings and specification	12 48.0%	2 40.0%	3 50.0%	2 40.0 %	1 33.3%	2 100.0 %	9 75.0%	3 42.9%	34 52.3 %
Cost estimation of each task	12 48.0%	2 40.0%	4 66.7%	2 40.0%	1 33.3%	2 100.0 %	5 41.7%	6 85.7 %	34 52.3 %
Collecting all related tasks and producing BOQ	20 80.0%	4 80.0 %	3 50.0 %	3 60.0%	1 33.3 %	2 100.0 %	4 33.3%	6 85.7 %	43 66.2 %

Table 9: Opinion toward *communication and collaboration among project staffs across functional areas* in shortening project execution period in each stage of design process (FAD)

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Development of the brief	9 64.3%		1 25.0 %	3 50.0%	13 48.1%
Conceptual and scheme design	5 35.7%	1 33.3%	1 25.0%	3 50.0%	10 37.0 %
Detailed design	8 57.1%	3 100.0%	1 25.0%	4 66.7%	16 59.3%
Drawings and specification	7 50.0%	1 33.3%	3 75.0%	3 50.0%	14 51.9%
Cost estimation of each task	5 35.7%	1 33.3%	1 25.0%	5 83.3%	12 44.4%
Collecting all related tasks and producing BOQ	4 28.6%	1 33.3%	1 25.0 %	5 83.3 %	11 40.7%

Topics or issues of discussions with other project staffs across functional area are presented in Table 10. The answers of respondents in DPT and FAD are considerably different. While most of respondents in DPT only saw communication and collaboration among project staffs across functional areas as a nature of the design process (55.4%), most of respondents in FAD thought that working experiences of other project staffs could help them perform their tasks more quickly (63.0%).

Table 10: Topics or issues of discussions with other project staff across functional area

Topics or problems of discussions	DPT	FAD
About their working experiences that are related to the project or the issues I am facing	35.4%	63.0%
Asking for the recommendation in order to fulfil the project completion	38.5%	44.4%
Asking for information from the experts	49.2%	48.1%
It is a nature of my work that requires information from those staffs	55.4%	37.0%

When asked whether it is convenient to communicate and collaborate with other project staffs across functional areas in the current situation, most of respondents in both organisation replied "No" (66.2% of respondents in DPT and 59.3% of respondents in FAD). This finding supports the disadvantage of product departmentalisation (problems of collaboration between project staffs across functional areas; Robbins and Coulter, 2007; Greenberg and Baron, 2003). Many of respondents explained that formal procedure is the barrier to communication and collaboration among project staffs across functional areas. For example, one respondent wrote

It is tardy in collaborating with other staffs because I have to write formal letters through the lines of authority asking for such collaboration

Another respondent, supported this idea, wrote

Circulation of documents, from one functional area to another, wastes the design time

According to these views, it can be seen that both organisation have high degree of formalisation and it impedes the ease of execution of the tasks (as stated in Chapter 2). The impacts of formalisation on the design execution period will be discussed further in Section 4.3

Some respondents thought that the difficulty of communicating with other staffs may cause by the nature of work since many staffs have to go out for site visiting or meeting with clients. Nevertheless, a very small number believed that it is the personal issue.

Respondents were asked about their attitude toward the current departmentalisation of their organisation regarding its effects on design execution time. It was found that 60.0% of

respondents in DPT thought that the departmentalisation of their organisation should be improved. Most had a strong feeling that dividing design staffs into two separated divisions impedes effective collaboration. They believed that grouping all related staffs within one division or arranging working groups, each comprises staff from all related areas, would result in shorter design execution period. For example, one respondent wrote

Project staffs are absolutely separated by departmentalisation. As a result, the tasks can be transferred from one division to another only if they are completed. Frequently, such tasks need to be revised after receiving information from other project staffs in other divisions.

Some respondents stated that having two divisions increases procedure during the design process.

As the lines of authority are lengthen, document approval process takes longer period

Seeing the difficulty of communication and collaboration among project staffs as a serious problem, some respondents even suggested that there should be another sub-division, performing as coordinators among project staffs.

40.0% of respondents in DPT were satisfied with the current departmentalisation. Some of them claimed that it is reasonable and personal issue (skills and motivation) is more likely to influence the length of the design period.

On the contrary, 74.1% of respondents in FAD were satisfied with the current departmentalisation of their organisation. Most thought that, as all related staffs are grouped together within one division, the procedures such as formal communication between different divisions are decreased. As on respondent wrote

Building design needs collaboration among multidisciplinary project staffs. Being in the same division is more convenient as we can communicate easily.

Another respondent wrote

It is good that we are together in one division as, according to the bureaucratic system, it is quite tardy in collaborating with other divisions

However, the other 25.9% believed that there can be an improvement in the departmentalisation. Many of them thought that, although all related staffs are in the same division, they are still separated by the functional working groups. As one respondent suggested

For better communication, all staffs should be allocated into several working groups; each comprises staffs from all related functions

It can be seen that respondents in both organisation have a mutual viewpoint that communication and collaboration among project staffs play a significant role in the design process and departmentalisation can directly encourage or discourage such communication and collaboration.

4.2 Centralisation

The level of professionals' decision-making authority was examined in this part. About 66% of respondents in both organisations informed that it is the organisational standard procedure to pass their works through higher level of authority (which supports Hofstede's work (1983). Respondents were then asked which aspect of their work that decision has to be made by their superiors. More than two-third of respondents in both organisations replied that their superiors only examine their works to comply with organisational and professional standard while less than half of respondents experienced their superiors checking every detail of their works.

Respondents were also asked what level of autonomy they have in performing their jobs. The results, presented in Table 11 and Table 12, revealed that most of respondents in both DPT and FAD thought that they have relatively high autonomy in performing their jobs (63.1% and 77.8% respectively). Hence, it implies that these two organisations are relatively decentralised. This finding contradicts the work of Robbins and Coulter (2007) which pointed that large organisations which have stable environment tend to be centralised. Discussion with senior architects from both organisations revealed that the

nature of design work is not suitable for centralisation since the designers on the job have more information about the projects they are performing than their superior does. Therefore, the superior usually allows them to make decisions about their jobs.

Also, it was found that the answers of respondents from different positions in DPT were very diverse while those in FAD were very similar. Although it can be argued that the answers only reflect the management style of the current, impermanent, authority in each organisation, respondents' opinions still could be used for assessing the impacts of decentralisation on the design execution period.

Table 11: Opinion toward level of autonomy in performing jobs (DPT)

Level of autonomy	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Relatively low (Centralisation)	8	3	3	3	-	1	4	2	24
	32.0%	60.0%	50.0%	60.0%	-	50.0%	33.3%	28.6%	36.9%
Relatively high (Decentralisation)	17	2	3	2	3	1	8	5	41
	68.0%	40.0%	50.0%	40.0%	100.0%	50.0%	66.7%	71.4%	63.1%

Table 12: Opinion toward level of autonomy in performing jobs (FAD)

Level of autonomy	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Relatively low (Centralisation)	2	1	1	2	6
	14.3%	33.3%	25.0%	33.3%	22.2%
Relatively high (Decentralisation)	12	2	3	4	21
	85.7%	66.7%	75.0%	66.7%	77.8%

In order to investigate respondents' opinions toward the effect of decentralisation on the execution time in each stage of the design process, the survey provided three choices for each stage comprising "Shorten", "Lengthen", and "No effect". It was found that most of respondents in both organisations thought that, generally, the concept of decentralisation shortens the design execution time. Respondents in DPT replied that it shortens most

design time during the conceptual and scheme design stage (48.8%, as shown in Table 13) while respondents in FAD thought that the detailed design stage is more influenced (66.7%, as demonstrated in Table 14). However, it can be seen that respondents in both organisations had a mutual opinion that both stages are highly influenced in shortening the design time by decentralisation.

Table 13: Opinion toward concept of decentralisation in shortening project execution period in each stage of design process (DPT)

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 17)	(n= 2)	(n= 3)	(n= 2)	(n= 3)	(n= 1)	(n= 8)	(n= 5)	(n= 41)
Development of the brief	8 47.1 %	1 50.0 %	2 66.7 %	- -	2 66.7%	- -	2 25.0%	1 20.0 %	16 39.0%
Conceptual and scheme design	9 52.9%	1 50.0%	3 100.0%	1 50.0 %	2 66.7 %	1 100.0%	2 25.0%	1 20.0 %	20 48.8%
Detailed design	7 41.2 %	- -	3 100.0%	1 50.0 %	2 66.7 %	1 100.0%	2 25.0%	1 20.0 %	17 41.5%
Drawings and specification	7 41.2%	- -	2 66.7%	1 50.0 %	1 33.3%	1 100.0%	3 37.5 %	1 20.0 %	16 39.0%
Cost estimation of each task	2 11.8%	- -	2 66.7 %	1 50.0 %	1 33.3	1 100.0%	2 25.0 %	4 80.0 %	13 31.7%
Collecting all related tasks and producing BOQ	2 11.8 %	1 50.0 %	2 66.7%	1 50.0 %	1 33.3	1 100.0%	2 25.0 %	4 80.0 %	14 34.1%

Table 14: Opinion toward concept of decentralisation in shortening project execution period in each stage of design process (FAD)

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 12)	(n= 2)	(n= 3)	(n= 4)	(n= 21)
Development of the brief	9 75.0%	1 50.0%	1 33.3%	- -	11 52.4%
Conceptual and scheme design	9 75.0%	1 50.0%	1 33.3%	- -	11 52.4%
Detailed design	10 83.3%	2 100.0%	2 66.7%	- -	14 66.7%
Drawings and specification	6 50.0%	2 100.0%	2 66.7%	- -	10 47.6%
Cost estimation of each task	4 33.3%	1 50.0%	1 33.3%	2 50.0%	8 38.1%
Collecting all related tasks and producing BOQ	4 33.3%	1 50.0%	1 33.3%	2 50.0%	8 38.1%

Respondents were also asked to make a suggestion for the way of delivering their tasks more quickly and completely regarding their decision-making authority. As presented in Table 15, it can be seen that "More guidance from superior" was the least popular choice

for respondents in both organisations. 38.5% of respondents in DPT replied that they satisfied the current situation while 36.9% believed that more autonomy in performing their jobs would result in shorter design period. The reason for the existence of various opinions, based on discussion with senior design staffs, is that design work varies considerably in scale and complexity. As a result, the designers who are usually assigned small or simple projects tend to be satisfied with the present arrangements or prefer more autonomy. On the other hand, a small number of designers who are usually assigned large or complex projects as well as new or inexperienced staffs tend to prefer more guidance from their superior.

Interestingly, 55.6% of respondents in FAD, where most claimed that they have relatively high autonomy, still wanted more freedom in performing their tasks. This finding absolutely supports Mintzberg *et al.* (2003: Professional organisations) who state that professionals prefer high level of discretion and direct supervision destroys the effectiveness of their work as the responsibility for the service is transferred from the professionals to the administrative structure.

Table 15: Respondents' suggestion for the way of delivering their tasks more quickly and completely regarding their decision-making authority

Suggestions	DPT	FAD
More autonomy	36.9%	55.6%
More guidance from superior	24.6%	18.5%
The current situation is fine	38.5%	25.9%

Respondents were asked about their attitude toward the concept of decentralisation (or centralisation, depending on their opinion) in their organisation regarding its effects on design execution time. It was found that most of respondents in both organisations satisfied the current situation (56.9% of respondents in DPT and 66.7% of those in FAD). For example, one respondent wrote

Generally, the superior allow us a high level of autonomy in our jobs. Moreover, when we feel like we cannot solve the problem, he (the superior) can give suggestions and is even ready to share the responsibility with us.

Some of respondents who dissatisfied thought that the organisation should be more decentralised. For example, one respondent wrote

Centralisation benefits staffs in higher level, giving them an authority to direct staffs in lower position what to do. Consequently, the lower-positioned staffs' tasks are often interfered, and therefore delayed, by those of the higher-positioned ones.

On the contrary, some respondent believed that decentralisation has some drawbacks. For example, one respondent wrote

Giving staffs too much decision-making authority results in poor coordination and conflict among project staffs since each staff has his way to deal with problems.

However, some respondents suggested that the concept of centralisation and decentralisation should not be absolute. Rather, it should be flexible depending on the context of each project (which supported Buelens *et al.*, 2006).

4.3 Formalisation

This part investigated the agility of execution of tasks which might be impeded by formalisation in the sample organisations. Respondents were asked which level of strictness to follow rules or formal procedures in their organisation. Most of respondents in DPT replied "High" (52.3%) while most of FAD respondents replied "Medium" (85.2%). In addition, most of respondents in both organisations thought that formalisation is necessary for their works (87.7% of respondents in DPT and 81.5% of those in FAD). The most important reason, according to the respondents, is that the work of public sector organisations needs reference documents (66.7% of respondents in DPT and 85.2% of those in FAD) while other reasons such as help in rechecking their works in order to minimise errors or establishing the standard of works for all clients seems to be seen as less important (as shown in Table 16).

Table 16: Opinion toward necessity of formalisation (reasons for existence of rules and formal procedures)

Necessity of formalisation	DPT	FAD
To use as reference documents	66.7%	85.2%
To establish the standard of work for all clients	47.4%	22.2%
To recheck in order to minimise errors	47.4%	33.3%

The survey applied the same methodology used in the question about decentralisation in order to investigate respondents' opinions toward the effect of formalisation on the execution time in each stage of the design process. It was found that most of respondents both in DPT and FAD had a mutual opinion that, in general, formalisation in their organisation results in lengthy design execution period. As presented in Table 17 and Table 18, respondents in DPT thought that formalisation lengthens most time during drawings and specification stage while respondents in FAD replied that it lengthen most time during the cost estimation of each task.

Although the answers of respondents in both organisations are different, the finding implies that formalisation seems to have a negative effect on execution time during the stages involving formal documents rather than the stages involving design. Nevertheless, respondents who are architects in both organisations replied that formalisation delays most time during the detailed design stage. The reason may be that the architects usually take the project coordinator position and the detailed design stage highly involves coordination and collaboration between project staffs.

Table 17: Opinion toward formalisation in lengthening project execution period in each stage of design process (DPT)

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Development of the brief	17 68.0%	3 60.0%	4 66.7%	3 60.0%	1 33.3%	- -	1 8.3%	1 14.3%	30 46.2%
Conceptual and scheme design	11 44.0%	4 80.0%	3 50.0%	4 80.0%	2 66.7%	2 100.0%	1 8.3%	1 14.3%	28 43.1%
Detailed design	18 72.0%	2 40.0%	3 50.0%	5 100.0%	1 33.3%	2 100.0%	2 16.7%	1 14.3%	34 52.3%
Drawings and specification	17 68.0%	2 40.0%	4 66.7%	5 100.0%	- -	2 100.0%	4 33.3%	1 14.3%	35 53.8%
Cost estimation of each task	16 64.0%	1 20.0%	3 50.0%	5 100.0%	1 33.3%	2 100.0%	- -	5 71.4%	33 50.8%
Collecting all related tasks and producing BOQ	16 64.0%	2 40.0%	3 50.0%	4 80.0%	1 33.3%	2 100.0%	- -	5 71.4%	33 50.8%

Table 18: Opinion toward formalisation in lengthening project execution period in each stage of design process (FAD)

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Development of the brief	4	1	1	-	6
	28.6%	33.3%	25.0%	-	22.2%
Conceptual and scheme design	4	1	2	-	7
	28.6%	33.3%	50.0%	-	25.9%
Detailed design	6	1	1	-	8
	42.9%	33.3%	25.0%	-	29.6%
Drawings and specification	5	1	1	-	7
	35.7%	33.3%	25.0%	-	25.9%
Cost estimation of each task	5	1	1	2	9
	35.7%	33.3%	25.0%	33.3%	33.3%
Collecting all related tasks and producing BOQ	4	1	1	2	8
	28.6%	33.3%	25.0%	33.3%	29.6%

When asked about their attitude toward formalisation in their organisation regarding its effects on design execution time, the answers of respondents in both organisations were different. While most of respondents in DPT satisfied the current level of formalisation in their organisation, those in FAD did not. However, the explanation of respondents who satisfied and dissatisfied in both organisations were very similar. Most of those who satisfied, although some of them agreed that it delays the execution time, insisted that formalisation is essential for public sector organisations and formal, document-formed, communication assists in following up their works. On the contrary, most of those who dissatisfied suggested that some procedures should be decreased in order to shorten execution time. Many of respondents, especially architects, seemed to have a strong feeling about this. For example, one respondent wrote

There are too many procedures. Consequently, collaboration between project staffs is inconvenient especially when I have to coordinate with staffs in another division. Moreover, some people do not start working unless they receive the formal document.

Another respondent wrote

In the execution of a project, lots of time is wasted in circulation of documents. According to the formal procedure, sometimes it takes weeks to ask for a staff in another functional area to join the project team.

Similarly, another respondent wrote

Communication and collaboration among staffs both within and across functional areas in the same organisation should be achieved informally in order to save time

Nevertheless, some respondents remained neutral. For example, one respondent suggested

Formalisation is necessary for public service. However, the management should allow informal collaboration so that the work can be finished more quickly.

Another respondent also suggested

In some urgent projects, setting a project team led by a project manager who can lead all project staffs at the outset (matrix structure) can shorten a lot of time since we do not have to waste our time with the circulation of documents among staffs.

All of these, again, indicate the importance of communication and collaboration among project staffs during the design process and prove that formalisation can delay the process by impeding the ease of execution of tasks.

4.4 Matrix structure

Respondents were asked about their experiences of being a part of matrix-structured project teams. It was found that matrix structure would be essentially applied to urgent projects (around two-third of respondents in both organisations). In addition, more than half of respondents participated in special projects which adopted matrix-structured teams.

It was found that, when the matrix structure was applied, the Directors of the bureau in both organisations were mostly assigned to be the project leader (according to 38.5% of experienced respondents in DPT and 63.0% of those in FAD). Nevertheless, in DPT, the staffs in higher position were appointed to be a project leader in a slightly less proportion (33.8% of experienced respondents).

When asked whether applying matrix structure to the project teams cause conflict between lines of authority, most experienced respondents in both organisations replied "Sometimes" (64.6% of respondents in DPT and 77.8% of those in FAD). Respondents were then asked if such conflicts affect design execution period, most replied "Yes, a little bit" (62.2% of experienced respondents in DPT and 87.0% of those in FAD).

However, most of respondents thought that applying matrix structure to the project teams mostly shorten design execution time (78.5% of respondents in DPT and 59.3% of those in FAD). They then were asked which stages of the design process that such application can shorten the design execution period. As demonstrated in Table 19 and Table 20, in general, respondents both in DPT and FAD thought that applying matrix structure to the project teams shortens most design execution time during the detailed design stage (66.2% and 48.1% respectively). This relates to the respondents' answers in the question regarding the importance of coordination and discussions within functional area as well as communication and collaboration among project staffs across functional areas in shortening the design execution time, indicating that such coordination and collaboration can shorten most time during the detailed design stage. Moreover, according to the respondent mentioned above, applying matrix structure to the project teams results in less formal communication among project staffs. Hence, it can be concluded that applying matrix structure to the project teams can shorten design execution period as it enhances coordination and communication among project staffs.

Table 19: Opinion toward *applying matrix structure to the project team* in shortening project execution period in each stage of design process (DPT)

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Development of the brief	19 76.0 %	4 80.0 %	3 50.0%	3 60.0%	2 66.7%	1 50.0%	5 41.7 %	1 14.3%	38 58.5%
Conceptual and scheme design	21 84.0%	4 80.0%	3 50.0%	4 80.0 %	3 100.0%	2 100.0%	4 33.3 %	1 14.3%	42 64.6%
Detailed design	21 84.0 %	3 60.0 %	4 66.7 %	4 80.0 %	3 100.0 %	2 100.0 %	5 41.7 %	1 14.3%	43 66.2%
Drawings and specification	5 20.0%	1 20.0 %	4 66.7%	4 80.0 %	2 66.7 %	2 100.0%	9 75.0%	1 14.3%	28 43.1%
Cost estimation of each task	5 20.0%	1 20.0%	2 33.3 %	4 80.0 %	2 66.7 %	2 100.0%	5 41.7%	6 85.7%	27 41.5 %
Collecting all related tasks and producing BOQ	5 20.0%	2 40.0%	2 33.3 %	3 60.0%	2 66.7 %	2 100.0%	5 41.7%	6 85.7 %	27 41.5%

Table 20: Opinion toward *applying matrix structure to the project team* in shortening project execution period in each stage of design process (FAD)

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Development of the brief	6	1	1	2	10
	42.9%	33.3%	25.0%	33.3%	37.0%
Conceptual and scheme design	4	1	1	2	8
	28.6%	33.3%	25.0%	33.3%	29.6%
Detailed design	7	3	1	2	13
	50.0%	100.0%	25.0%	33.3%	48.1%
Drawings and specification	5	2	2	2	11
	35.7%	66.7%	50.0%	33.3%	40.7%
Cost estimation of each task	4	1	1	2	8
	28.6%	33.3%	25.0%	33.3%	29.6%
Collecting all related tasks and producing BOQ	4	1	1	2	8
	28.6%	33.3%	25.0%	33.3%	29.6%

4.4.1 Comparing design execution period between using normal process and applying matrix structure to the project teams

Data collected from DPT regarding all multidisciplinary building design projects completed in 2007 are demonstrated in Table 21. The execution periods are catagorised by scale of projects, medium and large sorted by budget, as the matrix structure had not been applied with small projects in 2007.

Table 21: Number of days spent on design execution in 2007 (DPT)

		No.	Project scale	
			Medium	Large
Working structure	Normal process	1	120	180
		2	180	120
		3	540	240
		4	180	-
		5	510	-
		6	510	-
		7	90	-
		8	150	-
		9	120	-
		10	240	-
		11	240	-
		12	270	-
		13	180	-
		14	60	-
		15	120	-
		16	300	-
		17	120	-
		18	420	-
		19	330	-
		20	180	-
		21	150	-
		Avg. days	**239**	**180**
	Matrix structure	1	45	90
		2	25	-
		3	120	-
		Avg. days	**63**	**90**

24 medium-scale projects were completed in 2007, 21 projects were completed by the normal process while the other 3 projects adopted the matrix structure. It can be seen that, in average, the design execution periods of the projects adopted the matrix structure were far less (63 days) than those of the projects adopted the normal process (239 days).

Also, DPT completed 4 large-scale projects in 2007, 3 projects were completed by the normal process whilst 1 project adopted the matrix structure. Similarly, applying matrix structure resulted in shorter execution time (90 days against 180 days).

4.5 Other factors that cause delays in design execution

The interviews with the design staffs in both sample organisations revealed that, beside the aspects of organisational structure, other causes of delays in design execution could be summarised as follows:

- The amount of work in the organisations

  As both organisations are responsible for providing free, both new buildings and refurbishment, design for all government organisations, a large number of tasks is sent to them each fiscal year. This makes them different from private-sector design firms which could determine the amount of work or even select the projects they want, corresponding with the number and skills of staffs in the organisations. In addition, many of design staffs in DPT and FAD are not only responsible for the design work but are also responsible for consulting work as well as being the inspector committee for both public and private sector construction projects in all regions as the representatives of the government. As a result, they have less time for design work.

- Different staffs prioritise the same project differently

  Most of staffs in both organisations hold many tasks in their hands simultaneously. Also, project scheduling is based on the urgency of the clients. Therefore, the tasks are not finished consecutively. Rather, each staff usually deals with his most urgent task first. Nevertheless, it is normal that most of staffs, in all functional areas, have more than one urgent project at the same time particularly around the fiscal year end. Furthermore, there is no common project priority list for all staffs to comply.

  As all projects involve multidisciplinary tasks, the fact that every staff has his own project priority list impedes the effective collaboration among the project members and therefore results in delay in some projects. Moreover, some projects those do not have "Urgent" title seems to have longer period of execution since they may be suspended for completing the more urgent ones.

CHAPTER 5:
CONCLUSION AND RECOMMENDATION

This research investigated the impacts of three aspects of organisational structure, namely departmentalisation, centralisation, and formalisation, on causing and preventing delay in design execution experienced by two public sector building design organisations in Thailand. The key findings can be summarised as follows:

- Departmentalisation affects coordination and collaboration both within and across functional areas. It was found that coordination within functional area and communication and collaboration among project staffs across functional areas can shorten design execution period. In addition, it was found that grouping design-related staffs together facilitates communication whilst dividing project staffs into separated divisions impedes effective collaboration since the communication routes, according to the formal procedure in the bureaucratic system, are lengthened. Therefore, the finding confirms the drawback of product departmentalisation (poor communication across functional areas) as well as confirms the hypothesis that departmentalisation can have either positive or negative effects on design execution.

- The findings revealed that both sample organisations are relatively decentralised. In addition, according to the respondents, the concept of decentralisation shortens the design execution period. This finding is different from previous research result (Robbins and Coulter, 2007). Hence, the hypothesis about centralisation in public sector design divisions in Thailand is invalid. The reason is the nature of design work is more suitable for decentralisation. It was also found that design-related staffs prefer autonomy in performing their jobs to guidance from their higher authorities in order to deliver their tasks more quickly and completely. However, it should be emphasised that the scale and the complexity of projects as well as staffs' skill also influence the ability to make decision about their tasks. Unskilled or inexperienced staffs as well as staffs who are assigned the complex or large projects may need more guidance from their superior in order to deliver their task more quickly and completely.

- The levels of formalisation in the sample organisations were found to be medium to high. This finding supports Esman (1991), stating that public sector organisations rely heavily on formal rules and procedures. In addition, although it is necessary for public sector organisations to be formalised, the findings revealed that formalisation results in lengthy design execution period since a number of reference documents must be produced during the design process. Furthermore, formalisation also impedes the ease of collaboration since communication among project staffs has to be in formal document form, circulating through the lines of authority. The hypothesis about formalisation in public sector design divisions in Thailand is, therefore, in conformity with these findings.

- Both sample organisations usually apply the matrix-structured project teams to urgent projects. Although it causes a little conflict between lines of authority (which supports Buelens *et al.*, 2006), the finding revealed that applying matrix structure to project teams shorten design execution period as it enhances coordination and collaboration among project staffs especially during the detailed design stage. This finding is in conformity with Greenberg and Baron (2003), pointing that the matrix departmentalisation improves coordination among co-worker. Moreover, the secondary data collected from one of the sample organisations also supported this finding. Hence, the hypothesis about the potential of matrix-structured project teams in preventing delay is positive.

- It was found that public sector design divisions in Thailand have a large amount of work in the organisations and many of design staffs have many responsibilities, namely design work, consulting work, and being the inspector committee for a number of construction projects. These factors also contribute to delay in design execution. In addition, the fact that different staffs prioritise the same project differently directly hinders effective collaboration among the project staffs and hence causes delays since some of them may give priority to another project and suspend the current project for completing the more urgent one first.

According to the primary research findings, it is suggested that, in order to improve the design execution time, public sector design organisations might:

- Restructure the design-related divisions, grouping all related staffs within one division and allocate them into several working groups, each comprises staffs from all related functions. Each group should set up a common project priority list and the group leaders should be appointed to manage all projects complying with such lists.

- Allow professionally qualified staffs a high level of autonomy in their jobs. However, senior staffs should be appointed to supervise new and inexperienced staffs. In addition, new and inexperienced staffs should report the work progress to their supervisors occasionally. Moreover, organisational standard as well as work templates should be clearly established so as to maintain the unity of work in the organisation.

- As formalisation is necessary for public sector organisations but it also contributes to the design delay, the management should balance the concept of formalisation in the organisation. For example, circulation of documents should be done in parallel with collaborative, prompt, working. Collaborative work should be commenced without waiting for the formal documents. The documents should be used as tools for referencing and rechecking to minimise errors rather than for deferring the execution.

The research pointed out the aspects of organisational structure influencing the design execution period in public sector design organisations in Thailand which can be seen as mechanistic organisations. The future research may be the investigation of impacts of organisational structure on the design time in organic organisations. The research findings, together with the findings of this research, would clarify the impacts of organisational structure in the larger picture and would lead to the solutions for better design productivity for the whole industry.

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WEBSITES FOR CASE STUDIES

Department of Public Works and Town & Country Planning
www.dpt.go.th

The Fine Arts Department
www.finearts.go.th

APPENDIX 1:

QUESTIONNAIRE

Participant's information

Gender: ☐ Male ☐ Female

Position: ☐ Architect ☐ Interior designer ☐ Structural engineer ☐ Electrical engineer ☐ Sanitary engineer ☐ Mechanical engineer ☐ Draftsman ☐ Cost estimator

Level: ☐ 1-2 ☐ 3-5 ☐ 6-7 ☐ 8 or higher ☐ Temporary employee

Bureau: _____ **Duration of employment:** _____

Instructions:

1. **There is no right or wrong answer.**
2. **Your answer should be the one you believe best describes your feeling or experience.**
3. **Please answer all questions relevant to you.**
4. **"Execution period" refers to duration between receiving official request letter from client until delivering a project including architectural, structural and related services engineering design, cost estimation and bills of quantities.**

Part 1: Departmentalisation

1.1 General information

1. How much percentage of your tasks delivered on time?

   ☐ More than 80% ☐ 51%-80%

   ☐ 25%-50% ☐ Less than 25%

2. How do you think about your scope of work?

   ☐ Too much responsibility ☐ Appropriate ☐ Less than it should be

   If you think you have too much responsibility, is it the cause of time overrun?

   ☐ Yes ☐ No

3. How do you think about your tasks?

   ☐ Too many ☐ Appropriate ☐ You can do more

   If you think you have too many tasks, is it the cause of time overrun?

   ☐ Yes ☐ No

4. Is the number of staff in your division sufficient for the workload?

   ☐ Too many ☐ Sufficient ☐ Insufficient

5. How does duplication of functions in each division affect the execution period?

   ☐ Mostly shortens execution period ☐ Mostly lengthens execution period ☐ No effect

1.2 Coordination within functional area

6. Do you think that **coordination and discussions within functional area** shorten the execution period in the following stages of design process?

	Yes	*No*
• Development of the brief	☐	☐
• Conceptual and scheme design	☐	☐
• Detailed design	☐	☐
• Construction drawing and specification	☐	☐
• Cost estimation in each division	☐	☐
• Gathering Construction drawing and cost estimation from each division and producing the BOQ	☐	☐

7. Do you think that **setting project working groups within functional area** shorten the execution period in the following stages of design process?

	Yes	*No*
• Development of the brief	☐	☐
• Conceptual and scheme design	☐	☐
• Detailed design	☐	☐
• Construction drawing and specification	☐	☐
• Cost estimation in each division	☐	☐
• Gathering Construction drawing and cost estimation from each division and producing the BOQ	☐	☐

8. What are the topics or problems of discussions that assist in shortening the execution period? (You can choose more than one choice)

☐ About their working experiences that are related to the project or the issues you are facing

☐ Asking for the recommendation in order to fulfill the project completion

☐ Asking for information from the experts

☐ It is the nature of your work that requires information from other staffs within functional area

☐ Others (please specify) _____

1.3 Communication and collaboration between project staff across functional areas

9. Do you think that **communication and collaboration between project staff across functional areas** shorten the execution period in the following stages of design process?

	Yes	*No*
• Development of the brief	☐	☐
• Conceptual and scheme design	☐	☐
• Detailed design	☐	☐
• Construction drawing and specification	☐	☐
• Cost estimation in each division	☐	☐
• Gathering Construction drawing and cost estimation from each division and producing the BOQ	☐	☐

10. What are the topics or problems of discussions that assist in shortening the execution period? (You can choose more than one choice)

☐ About their working experiences that are related to the project or the issues you are facing

☐ Asking for the recommendation in order to fulfill the project completion

☐ Asking for information from the experts

☐ It is the nature of your work that requires information from other staffs across functional areas

☐ Others (please specify) _____

11. At present, is it convenient for you to communicate and collaborate with project staff across functional areas?

☐ Yes ☐ No (please gives reasons) _____

12. Would communication and collaboration be more efficient if the staffs in another division whom you usually collaborate with are in the same division with you?

☐ Yes ☐ Not always ☐ No effect

13. What is your attitude toward the current departmentalisation of your organisation regarding its effects on execution period?

☐ Satisfactory (please give reasons below)

☐ Dissatisfactory (please give recommendation below)

_____

_____

_____

1.4 Matrix structure

14. In your organisation, please specify the characteristic of the projects that matrix structure is applied (You can choose more than one choice).

☐ Urgent projects ☐ Ad-hoc projects ☐ Others _____

15. What level of staffs who are usually appointed to be the project leaders?

☐ Higher than Director of a bureau ☐ Director of a bureau or equivalent

☐ Lower than Director of a bureau

16. Does matrix structure cause conflict between two lines of authority?

☐ Yes ☐ Sometimes ☐ No

Do such conflicts affect the project execution period?

☐ Yes, very much ☐ Yes, a little bit ☐ No

17. Does matrix structure mostly assist in shortening the execution time?

☐ Yes ☐ No

18. How does matrix structure affect project execution period in the following stages of design process?

	Shorten	*Lengthen*	*No effect*
• Development of the brief	☐	☐	☐
• Conceptual and scheme design	☐	☐	☐
• Detailed design	☐	☐	☐
• Construction drawing and specification	☐	☐	☐
• Cost estimation in each division	☐	☐	☐
• Gathering Construction drawing and cost estimation from each division and producing the BOQ	☐	☐	☐

Part 2: Centralisation

Centralisation describes the extent to which authority and decision making are reserved for the upper levels of the organisation, which is the opposite of decentralisation.

19. Which aspect(s) of work that decision has to be made by your superior? (You can choose more than one choice)
    - ☐ Examining that your works comply with organisation and professional standard
    - ☐ Checking every detail of your work
    - ☐ It is the organisational standard procedure to pass your works through higher level of authority
    - ☐ Others (please specify) _____

20. What level of autonomy do you consider you have in performing your jobs?
    - ☐ Relatively low (centralisation) please go to question no. 23 (don't do no. 24)
    - ☐ Relatively high (decentralisation) please go to question no. 24 (don't do no. 23)

21. How does the **concept of centralisation** in your organisation affect project execution period in the following stages of design process?

	Shorten	*Lengthen*	*No effect*
• Development of the brief	☐	☐	☐
• Conceptual and scheme design	☐	☐	☐
• Detailed design	☐	☐	☐
• Construction drawing and specification	☐	☐	☐
• Cost estimation in each division	☐	☐	☐
• Gathering Construction drawing and cost estimation from each division and producing the BOQ	☐	☐	☐

22. How does the **concept of decentralisation** in your organisation affect project execution period in the following stages of design process?

	Shorten	*Lengthen*	*No effect*
• Development of the brief	☐	☐	☐
• Conceptual and scheme design	☐	☐	☐
• Detailed design	☐	☐	☐
• Construction drawing and specification	☐	☐	☐
• Cost estimation in each division	☐	☐	☐
• Gathering Construction drawing and cost estimation from each division and producing the BOQ	☐	☐	☐

23. In order to deliver the design **more quickly** and **completely**, would you prefer more freedom in your decisions about your jobs or more guidance from your superior?

☐ More autonomy ☐ More guidance ☐ It's ok now

24. What is your attitude toward centralisation (or decentralisation) in your organisation regarding its effects on execution period?

☐ Satisfactory (please give reasons below)

☐ Dissatisfactory (please give recommendation below)

_____

_____

_____

Part 3: Formalisation

Formalisation refers to the strictness of rules and procedures of work processes which indicate the level of job standardisation in the organisation.

25. In which level of strictness to follow rules or procedures of work processes in your organisation?

☐ High ☐ Medium ☐ Low

26. Are such rules or procedures necessary for your works?

☐ Yes ☐ No

If yes, please specify the reasons (You can choose more than one choice)

☐ To use as reference documents ☐ To establish the standard of work for all clients

☐ To recheck in order to minimise errors ☐ Others (please specify) _____

27. How does formalisation in your organisation affect project execution period in the following stages of design process?

	Shorten	*Lengthen*	*No effect*
• Development of the brief	☐	☐	☐
• Conceptual and scheme design	☐	☐	☐
• Detailed design	☐	☐	☐
• Construction drawing and specification	☐	☐	☐
• Cost estimation in each division	☐	☐	☐
• Gathering Construction drawing and cost estimation from each division and producing the BOQ	☐	☐	☐

28. What is your attitude toward formalisation in your organisation regarding its effects on execution period?

☐ Satisfactory (please give reasons below)

☐ Dissatisfactory (please give recommendation below)

_____

_____

_____

Part 4:

Please mark only one answer from the available choices. This answer should be the one you believe best describes your feeling or experience
(5: Strongly agree, 4: Agree, 3: Unsure, 2: Disagree, 1: Strongly disagree)

29. Departmentalisation influences coordination within functional area	1	2	3	4	5
30. Departmentalisation influences communication and collaboration between project co-workers across functional areas	1	2	3	4	5
31. Proximity to colleagues encourages collaboration and discussion	1	2	3	4	5
32. Separation of project co-workers makes little questions between them difficult to be supported	1	2	3	4	5
33. Design period would be shorten if matrix structure is adopted (designers from different divisions are brought together at the outset led by a project leader)	1	2	3	4	5

End of survey
Thank you for your cooperation

APPENDIX 2:

SUMMARY OF QUANTITATIVE RESULTS

Respondents' information (DPT)

Respondents' information	Frequency	%
1. Sex		
Male	51	78.5
Female	14	21.5
Total	65	100.0
2. Position		
Architect	25	38.5
Interior designer	5	7.7
Structural engineer	6	9.2
Electrical engineer	5	7.7
Sanitary engineer	3	4.6
Mechanical engineer	2	3.1
Draftsman	12	18.5
Cost estimator	7	10.8
Total	65	100.0
3. Level		
1-2	1	1.5
3-5	16	24.6
6-7	22	33.8
8 or higher	20	30.8
Temporary employee	6	9.3
Total	65	100.0
4. Bureau		
Architecture	43	66.2
Structural Engineering and System	22	33.8
Total	65	100.0
5. Duration of employment		
Less than 10 years	25	38.5
11-20 years	28	43.1
More than 20 years	12	18.5
Total	65	100.0

Respondents' information (FAD)

Respondents' information	Frequency	%
1. Sex		
Male	24	88.9
Female	3	11.1
Total	27	100.0
2. Position		
Architect	14	51.9
Structural engineer	3	11.1
Draftsman	4	14.8
Cost estimator	6	22.2
Total	27	100.0
3. Level		
1-2	2	7.4
3-5	7	25.9
6-7	15	55.6
8 or higher	2	7.4
Temporary employee	1	3.7
Total	27	100.0
4. Bureau		
Architecture	27	100.0
Total	27	100.0
5. Duration of employment		
Less than 10 years	14	51.9
11-20 years	7	25.9
More than 20 years	6	22.2
Total	27	100.0

Part 1: Departmentalisation

1.1 General information

1. How much percentage of your tasks delivered on time?

Percentage of on-time-delivered tasks	DPT	FAD
More than 80%	35.4%	70.4%
51- 80%	33.8%	29.6%
25 – 50%	21.5%	-
25%	9.2%	-

2. How do you think about your scope of work?

Opinion	DPT	FAD
Too much responsibility	36.9%	25.9%
Appropriate	60.0%	66.7%
Less than it should be	3.1%	7.4%

If you think you have too much responsibility, is it the cause of time overrun?

Opinion	DPT	FAD
Yes	95.8%	71.4%
No	4.2%	28.6%

3. How do you think about your tasks?

Opinion	DPT	FAD
Too much	33.8%	11.1%
Appropriate	61.5%	81.5%
You can do more	4.6%	7.4%

If you think you have too many tasks, is it the cause of time overrun?

Opinion	DPT	FAD
Yes	86.4%	100.0%
No	13.6%	-

4. Is the number of staff in your division sufficient for the workload?

Opinion	DPT	FAD
Too many	7.7%	3.7%
Sufficient	33.8%	70.4%
Insufficient	58.5%	25.9%

5. How does duplication of functions in each division affect the execution period?

Opinion	DPT	FAD
Mostly shortens execution period	27.7%	48.1%
Mostly lengthens execution period	46.2%	22.2%
No effect	26.2%	29.6%

1.2 Coordination within functional area

6. Do you think that **coordination and discussions within functional area** shorten the execution period in the following stages of design process?

DPT: Opinion toward *coordination and discussions within functional area* in shortening project execution period in each stage of design process

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Development of the brief	16 64.0%	3 60.0%	1 16.7 %	3 60.0 %	2 66.7 %	2 100.0%	6 50.0 %	1 14.3%	34 52.3 %
Conceptual and scheme design	19 76.0%	3 60.0 %	2 33.3 %	2 40.0 %	3 100.0 %	2 100.0 %	4 33.3 %	1 14.3 %	36 55.4 %
Detailed design	21 84.0 %	4 80.0 %	4 66.7 %	4 80.0 %	3 100.0 %	2 100.0 %	7 58.3 %	2 28.6 %	47 72.3 %
Drawings and specification	18 72.0 %	3 60.0 %	3 50.0 %	2 40.0 %	2 66.7 %	2 100.0 %	11 91.7 %	3 42.9 %	44 67.7 %
Cost estimation of each task	19 76.0 %	3 60.0 %	2 33.3 %	3 60.0 %	2 66.7 %	2 100.0 %	4 33.3 %	7 100.0 %	42 64.6 %
Collecting all related tasks and producing BOQ	16 64.0 %	3 60.0 %	3 50.0%	2 40.0 %	1 33.3%	2 100.0 %	4 33.3%	7 100.0 %	38 58.5%

FAD: Opinion toward *coordination and discussions within functional area* in shortening project execution period in each stage of design process

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Development of the brief	12 85.7 %		3 75.0 %	3 50.0%	18 66.7%
Conceptual and scheme design	8 57.1%		2 50.0 %	3 50.0%	13 48.1 %
Detailed design	11 78.6%	1 33.3%	3 75.0%	4 66.7 %	19 70.4%
Drawings and specification	10 71.4%	1 33.3%	4 100.0%	3 50.0 %	18 66.7%
Cost estimation of each task	10 71.4 %	1 33.3 %	1 25.0 %	5 83.3%	17 63.0 %
Collecting all related tasks and producing BOQ	11 78.6 %	1 33.3%	1 25.0 %	5 83.3 %	18 66.7 %

7. Do you think that **setting project working groups within functional area** shorten the execution period in the following stages of design process?

DPT: Opinion toward *setting project working groups within functional area* in shortening project execution period in each stage of design process

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Development of the brief	22 88.0%	4 80.0%	2 33.3%	2 40.0%	2 66.7 %	2 100.0 %	6 50.0%	1 14.3 %	41 63.1 %
Conceptual and scheme design	20 80.0%	4 80.0 %	3 50.0 %	2 40.0%	3 100.0 %	2 100.0 %	5 41.7 %	1 14.3%	40 61.5%
Detailed design	21 84.0%	5 100.0%	5 83.3 %	4 80.0 %	3 100.0 %	2 100.0%	6 50.0%	1 14.3 %	47 72.3%
Drawings and specification	23 92.0%	3 60.0%	3 50.0 %	2 40.0 %	3 100.0 %	2 100.0%	9 75.0 %	2 28.6 %	47 72.3 %
Cost estimation of each task	17 68.0%	4 80.0%	3 50.0%	3 60.0%	2 66.7%	2 100.0 %	4 33.3%	7 100.0%	42 64.6%
Collecting all related tasks and producing BOQ	17 68.0%	5 100.0 %	3 50.0%	2 40.0 %	2 66.7 %	2 100.0 %	4 33.3%	7 100.0%	42 64.6%

FAD: Opinion toward *setting project working groups within functional area* in shortening project execution period in each stage of design process

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Development of the brief	12 85.7%		3 75.0 %	2 33.3 %	17 63.0%
Conceptual and scheme design	10 71.4%		3 75.0 %	2 33.3%	15 55.6 %
Detailed design	8 57.1%	1 33.3 %	3 75.0 %	3 50.0%	15 55.6 %
Drawings and specification	10 71.4 %	1 33.3 %	4 100.0%	2 33.3%	17 63.0 %
Cost estimation of each task	9 64.3%	1 33.3 %	2 50.0 %	4 66.7 %	16 59.3 %
Collecting all related tasks and producing BOQ	10 71.4%	1 33.3 %	2 50.0 %	4 66.7%	17 63.0 %

8. What are the topics or problems of discussions that assist in shortening the execution period?

Topics or problems of discussions	DPT	FAD
About their working experiences that are related to the project or the issues I am facing	63.1%	70.4%
Asking for the recommendation in order to fulfil the project completion	53.8%	55.6%
Asking for information from the experts	61.5%	51.9%
It is a nature of my work that requires information from those staffs	44.6%	51.9%

1.3 Communication and collaboration between project staff across functional areas

9. Do you think that **communication and collaboration between project staff across functional areas** shorten the execution period in the following stages of design process?

DPT: Opinion toward *communication and collaboration among project staffs across functional areas* in shortening project execution period in each stage of design process

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Development of the brief	18 72.0 %	4 80.0 %	5 83.3 %	3 60.0 %	2 66.7%	2 100.0 %	6 50.0%	2 28.6%	42 64.6%
Conceptual and scheme design	19 76.0 %	4 80.0%	5 83.3 %	3 60.0%	3 100.0%	2 100.0%	5 41.7 %	1 14.3 %	42 64.6 %
Detailed design	20 80.0 %	4 80.0 %	6 100.0 %	4 80.0%	3 100.0 %	2 100.0%	8 66.7 %	2 28.6 %	49 75.4 %
Drawings and specification	12 48.0%	2 40.0%	3 50.0%	2 40.0 %	1 33.3%	2 100.0 %	9 75.0%	3 42.9%	34 52.3 %
Cost estimation of each task	12 48.0%	2 40.0%	4 66.7%	2 40.0%	1 33.3%	2 100.0 %	5 41.7%	6 85.7 %	34 52.3 %
Collecting all related tasks and producing BOQ	20 80.0%	4 80.0 %	3 50.0 %	3 60.0%	1 33.3 %	2 100.0 %	4 33.3%	6 85.7 %	43 66.2 %

FAD: Opinion toward *communication and collaboration among project staffs across functional areas* in shortening project execution period in each stage of design process

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Development of the brief	9 64.3%		1 25.0 %	3 50.0%	13 48.1%
Conceptual and scheme design	5 35.7%	1 33.3%	1 25.0%	3 50.0%	10 37.0 %
Detailed design	8 57.1%	3 100.0%	1 25.0%	4 66.7%	16 59.3%
Drawings and specification	7 50.0%	1 33.3%	3 75.0%	3 50.0%	14 51.9%
Cost estimation of each task	5 35.7%	1 33.3%	1 25.0%	5 83.3%	12 44.4%
Collecting all related tasks and producing BOQ	4 28.6%	1 33.3%	1 25.0 %	5 83.3 %	11 40.7%

10. What are the topics or problems of discussions that assist in shortening the execution period?

Topics or problems of discussions	DPT	FAD
About their working experiences that are related to the project or the issues I am facing	35.4%	63.0%
Asking for the recommendation in order to fulfil the project completion	38.5%	44.4%
Asking for information from the experts	49.2%	48.1%
It is a nature of my work that requires information from those staffs	55.4%	37.0%

11. At present, is it convenient for you to communicate and collaborate with project staff across functional areas?

Opinion	DPT	FAD
Yes	33.8%	40.7%
No	66.2%	59.3%

12. Would communication and collaboration be more efficient if the staffs in another division whom you usually collaborate with are in the same division with you?

Opinion	DPT	FAD
Yes	16.9%	66.7%
Not always	69.2%	25.9%
No effect	13.8%	7.4%

13. What is your attitude toward the current departmentalisation of your organisation regarding its effects on execution period?

Attitude toward the current departmentalisation	DPT	FAD
Satisfactory	40.0%	74.1%
Dissatisfactory	60.0%	25.9%

1.4 Matrix structure

14. In your organisation, please specify the characteristic of the projects that matrix structure is applied (You can choose more than one choice).

Characteristic of the projects	DPT	FAD
Urgent projects	75.4%	72.0%
Special projects	58.5%	56.0%

15. What level of staffs who are usually appointed to be the project leaders?

Level of staff	DPT	FAD
Higher than Director of a bureau	33.8%	18.5%
Director of a bureau	38.5%	63.0%
Lower than Director of a bureau	27.7%	18.5%

16. Does matrix structure cause conflict between two lines of authority?

Does matrix structure cause conflict between two lines of authority?	DPT	FAD
Yes	4.6%	7.4%
Sometimes	64.6%	77.8%
No	30.8%	14.8%

Do such conflicts affect the project execution period?

Does such conflict affect design execution period?	DPT	FAD
Yes, very much	24.4%	4.3%
Yes, a little bit	62.2%	87.0%
No	13.3%	8.7%

17. Does matrix structure mostly assist in shortening the execution time?

Opinion	DPT	FAD
Yes	78.5%	59.3%
No	21.5%	40.7%

18. How does matrix structure affect project execution period in the following stages of design process? (The findings presented here are the representatives of the most respondents in each organisation)

DPT: Opinion toward *applying matrix structure to the project team* in ***shortening*** project execution period in each stage of design process

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Development of the brief	19 76.0 %	4 80.0 %	3 50.0%	3 60.0%	2 66.7%	1 50.0%	5 41.7 %	1 14.3%	38 58.5%
Conceptual and scheme design	21 84.0%	4 80.0%	3 50.0%	4 80.0 %	3 100.0%	2 100.0%	4 33.3 %	1 14.3%	42 64.6%
Detailed design	21 84.0 %	3 60.0 %	4 66.7 %	4 80.0 %	3 100.0 %	2 100.0 %	5 41.7 %	1 14.3%	43 66.2%
Drawings and specification	5 20.0%	1 20.0 %	4 66.7%	4 80.0 %	2 66.7 %	2 100.0%	9 75.0%	1 14.3%	28 43.1%
Cost estimation of each task	5 20.0%	1 20.0%	2 33.3 %	4 80.0 %	2 66.7 %	2 100.0%	5 41.7%	6 85.7%	27 41.5 %
Collecting all related tasks and producing BOQ	5 20.0%	2 40.0%	2 33.3 %	3 60.0%	2 66.7 %	2 100.0%	5 41.7%	6 85.7 %	27 41.5%

FAD: Opinion toward *applying matrix structure to the project team* in ***shortening*** project execution period in each stage of design process

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Development of the brief	6 42.9%	1 33.3%	1 25.0%	2 33.3%	10 37.0%
Conceptual and scheme design	4 28.6%	1 33.3%	1 25.0%	2 33.3%	8 29.6%
Detailed design	7 50.0%	3 100.0%	1 25.0%	2 33.3%	13 48.1%
Drawings and specification	5 35.7%	2 66.7%	2 50.0%	2 33.3%	11 40.7%
Cost estimation of each task	4 28.6%	1 33.3%	1 25.0%	2 33.3%	8 29.6%
Collecting all related tasks and producing BOQ	4 28.6%	1 33.3%	1 25.0%	2 33.3%	8 29.6%

Part 2: Centralisation

19. Which aspect(s) of work that decision has to be made by your superior?

Which aspects of your work that decision has to be made by your superior?	DPT	FAD
Examining that your works comply with organisational and professional standard	84.6%	77.8%
Checking every detail of your work	44.6%	11.1%
It is the organisational standard procedure to pass their works through higher level of authority	66.2%	66.7%

20. What level of autonomy do you consider you have in performing your jobs?

DPT: Opinion toward level of autonomy in performing jobs

Level of autonomy	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Relatively low (Centralisation)	8	3	3	3	-	1	4	2	24
	32.0%	60.0%	50.0%	60.0%	-	50.0%	33.3%	28.6%	36.9%
Relatively high (Decentralisation)	17	2	3	2	3	1	8	5	41
	68.0%	40.0%	50.0%	40.0%	100.0%	50.0%	66.7%	71.4%	63.1%

FAD: Opinion toward level of autonomy in performing jobs (FAD)

Level of autonomy	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Relatively low (Centralisation)	2	1	1	2	6
	14.3%	33.3%	25.0%	33.3%	22.2%
Relatively high (Decentralisation)	12	2	3	4	21
	85.7%	66.7%	75.0%	66.7%	77.8%

21. How does the **concept of centralisation** in your organisation affect project execution period in the following stages of design process? (The findings presented here are the representatives of the most respondents in each organisation)

DPT: Opinion toward concept of ***centralisation*** in ***lengthening*** project execution period in each stage of design process

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 17)	(n= 2)	(n= 3)	(n= 2)	(n= 3)	(n= 1)	(n= 8)	(n= 5)	(n= 41)
Development of the brief	3 37.5%	1 33.3%	2 66.7%	- -	- -	- -	- -	1 50.0%	7 29.2%
Conceptual and scheme design	4 50.0%	2 66.7%	2 66.7%	- -	- -	- -	- -	1 50.0%	9 37.5%
Detailed design	6 75.0%	3 100.0%	2 66.7%	1 33.3%	- -	1 100.0%	- -	1 50.0%	14 58.3%
Drawings and specification	5 62.5%	3 100.0%	2 66.7%	- -	- -	1 100.0%	2 50.0%	1 50.0%	14 58.3%
Cost estimation of each task	2 25.0%	2 66.7%	2 66.7%	- -	- -	1 100.0%	- -	1 50.0%	8 33.3%
Collecting all related tasks and producing BOQ	2 25.0%	2 66.7%	2 66.7%	- -	- -	1 100.0%	- -	1 50.0%	8 33.3%

FAD: Opinion toward concept of ***centralisation*** in ***shortening*** project execution period in each stage of design process

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 12)	(n= 2)	(n= 3)	(n= 4)	(n= 21)
Development of the brief	1 50.0%	- -	- -	1 50.0%	2 33.3%
Conceptual and scheme design	1 50.0%	- -	- -	2 100.0%	3 50.0%
Detailed design	1 50.0%	1 100.0%	- -	1 50.0%	3 50.0%
Drawings and specification	1 50.0%	- -	1 100.0%	2 100.0%	4 66.7%
Cost estimation of each task	1 50.0%	- -	- -	2 100.0%	3 50.0%
Collecting all related tasks and producing BOQ	1 50.0%	- -	- -	2 100.0%	3 50.0%

22. How does the **concept of decentralisation** in your organisation affect project execution period in the following stages of design process? (The findings presented here are the representatives of the most respondents in each organisation)

DPT: Opinion toward concept of ***decentralisation*** in ***shortening*** project execution period in each stage of design process

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 17)	(n= 2)	(n= 3)	(n= 2)	(n= 3)	(n= 1)	(n= 8)	(n= 5)	(n= 41)
Development of the brief	8 47.1 %	1 50.0 %	2 66.7 %	- -	2 66.7%	- -	2 25.0%	1 20.0 %	16 39.0%
Conceptual and scheme design	9 52.9%	1 50.0%	3 100.0%	1 50.0 %	2 66.7 %	1 100.0%	2 25.0%	1 20.0 %	20 48.8%
Detailed design	7 41.2 %	- -	3 100.0%	1 50.0 %	2 66.7 %	1 100.0%	2 25.0%	1 20.0 %	17 41.5%
Drawings and specification	7 41.2%	- -	2 66.7%	1 50.0 %	1 33.3%	1 100.0%	3 37.5 %	1 20.0 %	16 39.0%
Cost estimation of each task	2 11.8%	- -	2 66.7 %	1 50.0 %	1 33.3	1 100.0%	2 25.0 %	4 80.0 %	13 31.7%
Collecting all related tasks and producing BOQ	2 11.8 %	1 50.0 %	2 66.7%	1 50.0 %	1 33.3	1 100.0%	2 25.0 %	4 80.0 %	14 34.1%

FAD: Opinion toward concept of ***decentralisation*** in ***shortening*** project execution period in each stage of design process

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 12)	(n= 2)	(n= 3)	(n= 4)	(n= 21)
Development of the brief	9 75.0%	1 50.0%	1 33.3%	- -	11 52.4%
Conceptual and scheme design	9 75.0%	1 50.0%	1 33.3%	- -	11 52.4%
Detailed design	10 83.3%	2 100.0%	2 66.7%	- -	14 66.7%
Drawings and specification	6 50.0%	2 100.0%	2 66.7%	- -	10 47.6%
Cost estimation of each task	4 33.3%	1 50.0%	1 33.3%	2 50.0%	8 38.1%
Collecting all related tasks and producing BOQ	4 33.3%	1 50.0%	1 33.3%	2 50.0%	8 38.1%

23. In order to deliver the design **more quickly** and **completely**, would you prefer more freedom in your decisions about your jobs or more guidance from your superior?

Suggestions	DPT	FAD
More autonomy	36.9%	55.6%
More guidance from superior	24.6%	18.5%
The current situation is fine	38.5%	25.9%

24. What is your attitude toward centralisation (or decentralisation) in your organisation regarding its effects on execution period?

Attitude toward the concept of decentralisation in your organisation	DPT	FAD
Satisfactory	56.9%	66.7%
Dissatisfactory	43.1%	33.3%

Part 3: Formalisation

25. In which level of strictness to follow rules or procedures of work processes in your organisation?

Level of formalisation	DPT	FAD
High	52.3%	7.4%
Medium	46.2%	85.2%
Low	1.5%	7.4%

26. Are such rules or procedures necessary for your works?

Opinion	DPT	FAD
Yes	87.7%	81.5%
No	12.3%	18.5%

If yes, please specify the reasons

Necessity of formalisation	DPT	FAD
To use as reference documents	66.7%	85.2%
To establish the standard of work for all clients	47.4%	22.2%
To recheck in order to minimise errors	47.4%	33.3%

27. How does formalisation in your organisation affect project execution period in the following stages of design process? (The findings presented here are the representatives of the most respondents in each organisation)

DPT: Opinion toward formalisation in ***lengthening*** project execution period in each stage of design process

Design process	Architect	Interior designer	Structural Engineer	Electrical Engineer	Sanitary Engineer	Mech. Engineer	Draftsman	Cost Estimator	**Total**
	(n= 25)	(n= 5)	(n= 6)	(n= 5)	(n= 3)	(n= 2)	(n= 12)	(n= 7)	(n= 65)
Development of the brief	17 68.0%	3 60.0%	4 66.7%	3 60.0%	1 33.3%	- -	1 8.3%	1 14.3%	30 46.2%
Conceptual and scheme design	11 44.0%	4 80.0%	3 50.0%	4 80.0%	2 66.7%	2 100.0%	1 8.3%	1 14.3%	28 43.1%
Detailed design	18 72.0%	2 40.0%	3 50.0%	5 100.0%	1 33.3%	2 100.0%	2 16.7%	1 14.3%	34 52.3%
Drawings and specification	17 68.0%	2 40.0%	4 66.7%	5 100.0%	- -	2 100.0%	4 33.3%	1 14.3%	35 53.8%
Cost estimation of each task	16 64.0%	1 20.0%	3 50.0%	5 100.0%	1 33.3%	2 100.0%	- -	5 71.4%	33 50.8%
Collecting all related tasks and producing BOQ	16 64.0%	2 40.0%	3 50.0%	4 80.0%	1 33.3%	2 100.0%	- -	5 71.4%	33 50.8%

FAD: Opinion toward formalisation in ***lengthening*** project execution period in each stage of design process (FAD)

Design process	Architect	Structural Engineer	Draftsman	Cost Estimator	**Total**
	(n= 14)	(n= 3)	(n= 4)	(n= 6)	(n= 27)
Development of the brief	4	1	1	-	6
	28.6%	33.3%	25.0%	-	22.2%
Conceptual and scheme design	4	1	2	-	7
	28.6%	33.3%	50.0%	-	25.9%
Detailed design	6	1	1	-	8
	42.9%	33.3%	25.0%	-	29.6%
Drawings and specification	5	1	1	-	7
	35.7%	33.3%	25.0%	-	25.9%
Cost estimation of each task	5	1	1	2	9
	35.7%	33.3%	25.0%	33.3%	33.3%
Collecting all related tasks and producing BOQ	4	1	1	2	8
	28.6%	33.3%	25.0%	33.3%	29.6%

28. What is your attitude toward formalisation in your organisation regarding its effects on execution period?

Attitude toward formalisation in your organisation	DPT	FAD
Satisfactory	52.3%	40.7%
Dissatisfactory	47.7%	59.3%

Part 4:

DPT

Opinion	Strongly agree	Agree	Unsure	Disagree	Strongly disagree	$\bar{X}$	S.D.
Departmentalisation influences coordination within functional area	11 16.9%	22 33.8%	17 26.2%	14 21.5%	1 1.5%	3.43	1.06
Departmentalisation influences communication and collaboration between project co-workers across functional areas	18 27.7%	23 35.4%	18 27.7%	6 9.2%	- -	3.82	.95
Proximity to colleagues encourages collaboration and discussion	12 18.5%	25 38.5%	16 24.6%	12 18.5%	- -	3.57	1.00
Separation of project co-workers makes little questions between them difficult to be supported	31 47.7%	26 40.0%	7 10.8%	1 1.5%	- -	4.34	.73
Design period would be shorten if matrix structure is adopted	16 24.6%	27 41.5%	14 21.5%	4 6.2%	4 6.2%	3.72	1.10

FAD

Opinion	Strongly agree	Agree	Unsure	Disagree	Strongly disagree	$\bar{X}$	S.D.
Departmentalisation influences coordination within functional area	4 14.8%	7 25.9%	11 40.7%	5 18.5%	4 14.8%	3.37	.97
Departmentalisation influences communication and collaboration between project co-workers across functional areas	6 22.2%	4 14.8%	12 44.4%	4 14.8%	1 3.7%	3.37	1.11
Proximity to colleagues encourages collaboration and discussion	4 14.8%	11 40.7%	5 18.5%	4 14.8%	3 11.1%	3.33	1.24
Separation of project co-workers makes little questions between them difficult to be supported	17 63.0%	7 25.9%	1 3.7%	1 3.7%	1 3.7%	4.41	1.01
Design period would be shorten if matrix structure is adopted	8 29.6%	12 44.4%	2 7.4%	1 3.7%	4 14.8%	3.70	1.35