

INFORMATION SHARING PLATFORM
TO SUPPORT COLLABORATIVE TEAMWORK
IN CONSTRUCTION

RAMZI BIN IBRAHIM

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To My Beloved Family

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ABSTRACT

Construction industry is one of the most challenging industries. It has many problems associated to its performance and the ability to satisfy the users' requirements. One of the most critical issues that need to be addressed by construction is related to the lack of information sharing among the project stakeholders. Therefore this research has been undertaken to address this issue within the context of Collaborative Teamwork Environment (CTW) in construction. The aim and the objective of the research are to identify the important elements of project reporting towards establishment of communication framework to support collaborative teamwork information sharing in Malaysian construction industry. This research also developed the Matrix Measurement Guidelines (MMG-CTW) as a useful tool to gauge the level of collaborative teamwork achievement that was created by the communication platform. The different methodologies were employed to generate qualitative and quantitative data at different stages of the research. These methodologies were: literature review; single stage postal questionnaire survey; interview; and project case study analysis. The data collected using the triangulation approach with the stated methodologies from the expert industry player's nationwide. The important elements and the current approach of project communication and the elements of the collaborative teamwork are the main variables that have been identified from the data collection and been used as the basis to develop the project communication platform. The research was divided into three main phases. The initial stage involved the evaluation of the current approach of the project communication and the collaborative teamwork environment in Malaysian construction industry. The second stage was the development of the MMG-CTW and the third stage was the establishment of the framework for the communication platform. This communication and information need have been integrated within the MS-SharePoint software and was tested its application on two selected case study projects and feedbacks generated from the users were used for improvement. As a result, the application of this groupware system is suitable for a medium size project because of its simplicity and user friendly. This research concludes that the implementation of CTW concept is still in the early stage in Malaysian construction industry. The practice of project reporting is still using simple tools such as email, telephone and traditional way of exchanging documents. The progress report, design concept, drawing and specification were identified as the top priority project reporting elements in project communication and information. There is an urgent need to improve the current communication system among project stakeholders. The groupware system developed in this research was validated by the expert panel can be a suitable tool for communication framework to support collaborative teamwork information sharing in Malaysian construction industry.

ABSTRAK

Industri pembinaan dikenalpasti sebagai satu industri yang mencabar. Ia menghadapi pelbagai masalah terutamanya untuk memenuhi kehendak pengguna. Antara isu kritikal industri pembinaan ini adalah ia masih kekurangan sistem perkongsian maklumat di antara ahli-ahli yang menguruskan projek binaan. Masalah ini dikenalpasti hasil dari ketidakseragaman proses kerja. Oleh itu, kajian ini dijalankan untuk mengenalpasti masalah kerja sepasukan dalam industri pembinaan. Tujuan dan objektif utama kajian ini adalah untuk mengenalpasti elemen komunikasi yang penting dan mewujudkan platform komunikasi dan perkongsian maklumat yang seragam. Kajian ini juga mewujudkan *Matrix Measurement Guidelines (MMG-CTW)* sebagai satu kaedah untuk menilai tahap kerja sepasukan yang diwujudkan oleh platform komunikasi yang telah dibangunkan. Pelbagai kaedah digunakan dalam kajian ini untuk mendapatkan data kualitatif dan kuantitatif mengikut fasa kajian yang berbeza. Kaedah yang digunakan adalah kajian *literature*, menggunakan borang kajiselidik, menemuduga ahli yang pakar dan kajian kes terhadap projek. Pengumpulan data menggunakan kaedah '*triangulation*' melibatkan pakar-pakar dalam bidang ini dari seluruh negara. Elemen komunikasi semasa, kaedah komunikasi yang sedang diamalkan dan elemen kerja sepasukan adalah antara data-data penting yang diperolehi dari pengumpulan data ini yang mana elemen-elemen ini dijadikan asas dalam membangunkan platform perkongsian maklumat. Kajian ini melibatkan tiga fasa. Fasa pertama melibatkan penilaian terhadap kepentingan komunikasi projek dan amalan konsep kerja sepasukan. Fasa kedua mewujudkan *MMG-CTW* manakala kajian fasa ketiga melibatkan pembangunan platform perkongsian maklumat. Maklumat ini diselaraskan dalam perisian *MS-SharePoint*. Sistem ini telah diuji ke atas projek kajian kes yang dipilih dan maklumbalas daripada ahli-ahli projek diambil kira bagi memperkemaskan sistem ini. Hasil yang didapati adalah, penggunaan sistem "*groupware*" ini sesuai bagi projek saiz pertengahan memandangkan kepada sifatnya yang mudah digunakan dan mesra pengguna. Kesimpulan yang diperolehi daripada kajian ini mendapati konsep kerja sepasukan di Malaysia masih di peringkat awal. Kaedah komunikasi antara ahli sesuatu projek masih menggunakan sistem yang ringkas seperti *e-mail*, telefon dan kaedah perkongsian maklumat secara tradisional. Laporan kemajuan, konsep rekabentuk, lukisan dan spesifikasi telah dikenalpasti sebagai elemen penting dalam komunikasi dan perkongsian maklumat yang diperlukan oleh pasukan binaan. Keadaan ini memerlukan tindakan yang drastik untuk meningkatkan sistem komunikasi di antara pihak yang terlibat dalam projek yang dijalankan. Sistem "*groupware*" yang dibangunkan dalam penyelidikan ini telah disahkan oleh sekumpulan pakar dalam pengurusan projek dan boleh dijadikan sebagai satu kaedah yang sesuai sebagai platform perkongsian maklumat dalam industri pembinaan di Malaysia.

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LIST OF ABBREVIATIONS

CTW	-	Collaborative Teamwork Environment
CIDB	-	Construction Industry Development Board
MCIMP	-	Malaysian Construction Industry Master Plan
CIOB	-	Chartered Institute of Buildings
FGVH	-	Felda Global Ventures Holdings
FGVPM	-	Felda Global Ventures Plantations Malaysia
FHB	-	Felda Holdings Berhad
MOF	-	Ministry of Finance
PKK	-	Pusar Khidmat Kontraktor

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter provides an introduction to the thesis on the subject of Information Sharing Platform to Support Collaborative Teamwork in Construction, conducted as fulfilment for the award of Doctor of Engineering at University Technology Malaysia. It sets out the context of study both within the construction industry and Felda Global Ventures Holdings Berhad (as an industrial sponsor), and offers justification for the research. In addition, it highlighted the novelty of the research work and outlines the main aims and objectives of the project, before describing the remaining structure of the thesis.

1.2 Research Background

The construction industry was associated with many weaknesses. The highly competitive nature and specialization of the industry has failed to provide the platform for close co-operation among project participants. Each of the participants has their own agenda and objective toward the project (Nam and Tatum 1992, Bedelian 1996). Each of the participants involved has absolute loyalty to their group and not to the ultimate client. They will try to minimize the risk of being wrong, therefore finger pointing and assigning blame is a familiar practice in construction (Williams, 1995). The adversarial nature of the relationships among the project participants were commonly quoted by researchers such as Hinze and Tracey (1994), Tarricone (1992), Harding (1996) and Puddicombe (1997). Albanese (1994) reported that from the research survey carried out on 60 large construction firms, 20 out of 28 responses received agreed that “*owner-contractor working relations can be best described as adversarial and uncooperative*”. A similar image of the Malaysian construction industry has also been indicated in 2007 Malaysian Construction Industry Master Plan published by Construction Industry Development Board (CIDB) Malaysia. The report defines the construction industry value chain, where it involves multiple stakeholders at different stages of the value chain and key sectors that could leverage on the construction industry: opportunities include building and construction materials, tooling, heavy equipment and machinery, finance, utilities and transportation, human resources, ICT, regulation and enforcement and research and development part. The report concluded that this indicated a potential source of future conflicts.

As a response to the weakness and inefficiency associated with the adversarial nature in delivering construction projects, several efforts were undertaken within the industry to overcome the persistent problems despite the continuous popularity of the traditional system. These efforts to improve the industry include: using alternative forms of procurement like design and build; project management contracts; partnering approach; improving the relationships within the supply chain; and increasing reliance on information technology to improve project communication. Consistent with needs of the construction industry and its clients,

this research is dedicated towards investigating the potential of applying an alternative approach to the project communication in the construction project. The research focuses on the aspect of improving the construction process by the concept of collaborative teamwork within the team player in construction project. A specific focus is made on to improve the communication environment, the team working environment, the collaborative concept and the application of a groupware system to support the objectives of achieving collaborative working environment. Achieving tomorrow's high-performance organizations will involve massive changes throughout their capability infrastructures. The complexity of implementing these changes will be daunting, and deserves a strategic approach. Groupware will support important, special new knowledge capabilities and sharing information in open environment in these infrastructures, and also can play a key role in an evolutionary strategy.

Despite many studies were done by other researchers on the method of improving project information sharing to support collaborative working environment many of them are simply too complex and lack of practical value due to the nature of construction players which are generally formed by a humble group of end user who appreciate the simplicity of the application and the end result that a particular system able to deliver. The groupware system that this project intends to achieve the following aspects:

- i. Integrated information system;
- ii. Effective communication between all members on and off site;
- iii. Co-coordinated and structured control of information & documentation;
- iv. Electronic in-built workflow;
- v. Storage of project data for the life of the project spanning 30 years;
- vi. Significant reduction in paper usage.

The system operates on a client server platform using suitable software to be determined later such as the kernel for developing and deploying cross-organizational communication via email, video conferencing and controlled access to the various construction procedures, forms and reference information via a series of databases requirement to be determined from the research.

1.3 Problem Statement

Construction Industry Development Board, Malaysia (CIDB) has launched the Malaysian Construction Industry Master Plan (MCIMP) on 10th December 2007. The report highlighted that the construction industry in Malaysia facing the challenges of inefficient and ineffective method of practice and inability to provide a total integrated solution. One of the areas that highlighted was the lack of formal knowledge sharing amongst the industry players or the project team. Related to that, the hypothesis was developed that there is lacking of sharing information between project team. The Researcher's initial case study in the sponsor's organization found that they are still working on traditional work culture such paper base document and face-to-face interaction and there was no single system that currently develop to make the team work collaboratively.

The Master Plan recommends that one of the strategic improvements on information sharing is to encourage knowledge sharing by leveraging on ICT in the construction industry for continuous improvement. The construction industry or the project itself needs a single point of access to the relevant information by the project team. The portal has to meet the requirements of all the stakeholders in the project. In addition, the portal needs to be user friendly and its access should be simple and easy. Information provided by this portal needs to be timely, accurate, comprehensive and relevant to its stakeholders. The main focus of this recommendation is on the role of the portal as sources of information to encourage knowledge sharing between the project team to encourage them work as a team and collaboratively.

The sponsor's organization where the Researcher is working is still highly depending on hard copy circulation of various documents and traditional communication platform such as face to face meeting, telephone conversation and correspondence as shows in Figure 1.1.



Figure 1.1: Sponsor's Organization Still Dependent on Hard Copy Materials and Conventional Communication.

1.4 Aim and Objective of the Research

The aim of the research is to establish the important elements towards establishment of communication framework to support collaborative teamwork information sharing in Malaysian construction industry.

To achieve such aim the following objectives were delineated for the research work:

- i. To identify the current approach of collaborative teamwork environment in Malaysian construction projects;
- ii. To determine the important elements of project communication to support collaborative teamwork environment;
- iii. To establish the Matrix Measurement Guideline (MMG) to map the level of application of collaborative teamwork environment concept in Malaysian construction companies;
- iv. To design the process and workflow of project reporting elements to support real time basis communication process for all stakeholders in collaborative teamwork environment;
- v. To develop a project reporting system as a framework which is transparent and real time basis to serve the client and team member's information need to create the real collaborative teamwork environment situation in construction projects;
- vi. To validate the designed project reporting framework to improve the effectiveness of the system.

1.5 Scope of the Study

The scope and limitations of this research are as follows:

- i. The data collected for this research is strictly within Malaysia only;
- ii. The Matrix Measurement Guidelines (MMG) developed based on limited data collected within construction industry only;
- iii. All data collected from respondent represent medium to large size construction project only;
- iv. The major groupware software used for this research is MS Sharepoint 2007;
- v. The MS Sharepoint used provides the general framework as platform for this Groupware system. However this research provide the detail content of communication elements as the framework for the whole Groupware system;
- vi. The communication elements established for the Groupware system is developed based on data generated from this research work;
- vii. This system established as conceptual model and have to customised within individual project;
- viii. Technicalities of Groupware system and IT system installation is not included in this research. The research focused more on the conceptual framework of the Groupware system.

1.6 Brief Research Methodology

The research methodologies consist of three phases. The first phase is the identification of the current approach of collaborative teamwork environment and project communication, the second phase is the establishment of matrix measurement guidelines as a tool to map the level of collaborative teamwork and the third phase is the establishment of the groupware system as the platform of project communication and collaborative teamwork as illustrates in Figure 1.2.

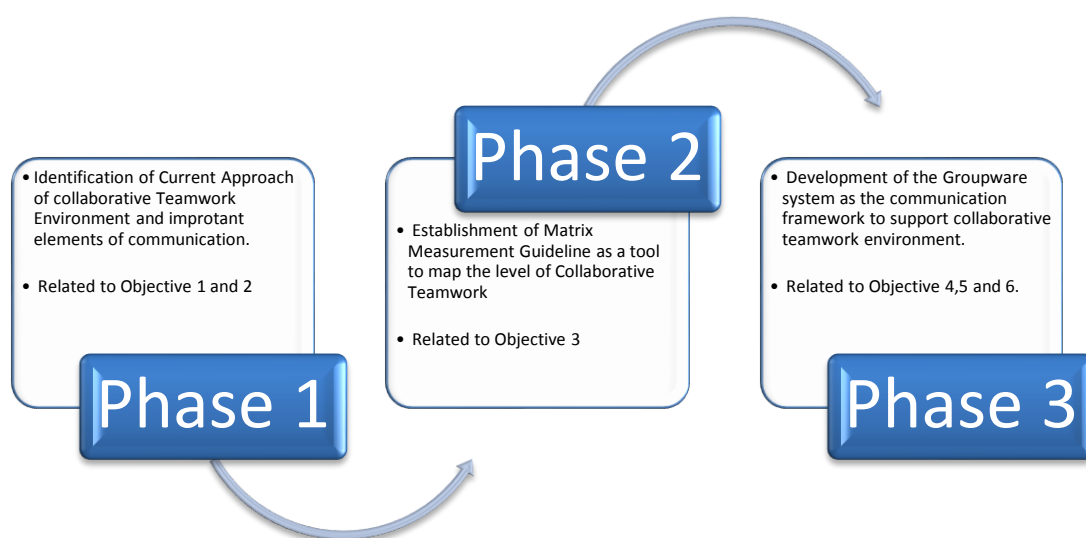


Figure 1.2: Three Phase of the Research

Each of these phases consists of different methodologies. The detail breakdown of the brief methodology is illustrated in Figure 1.3 below.

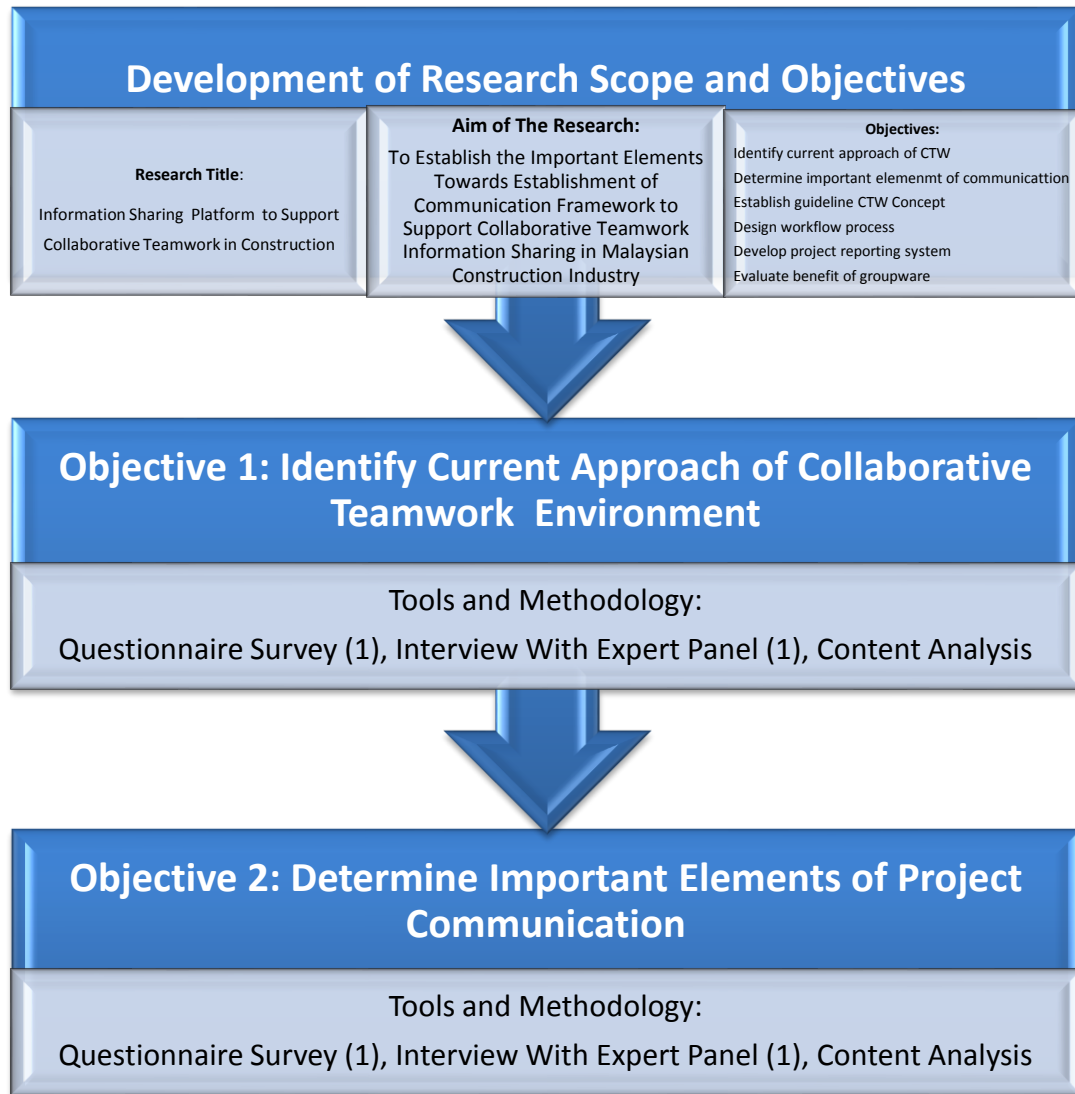


Figure 1.3: Brief Research Methodology

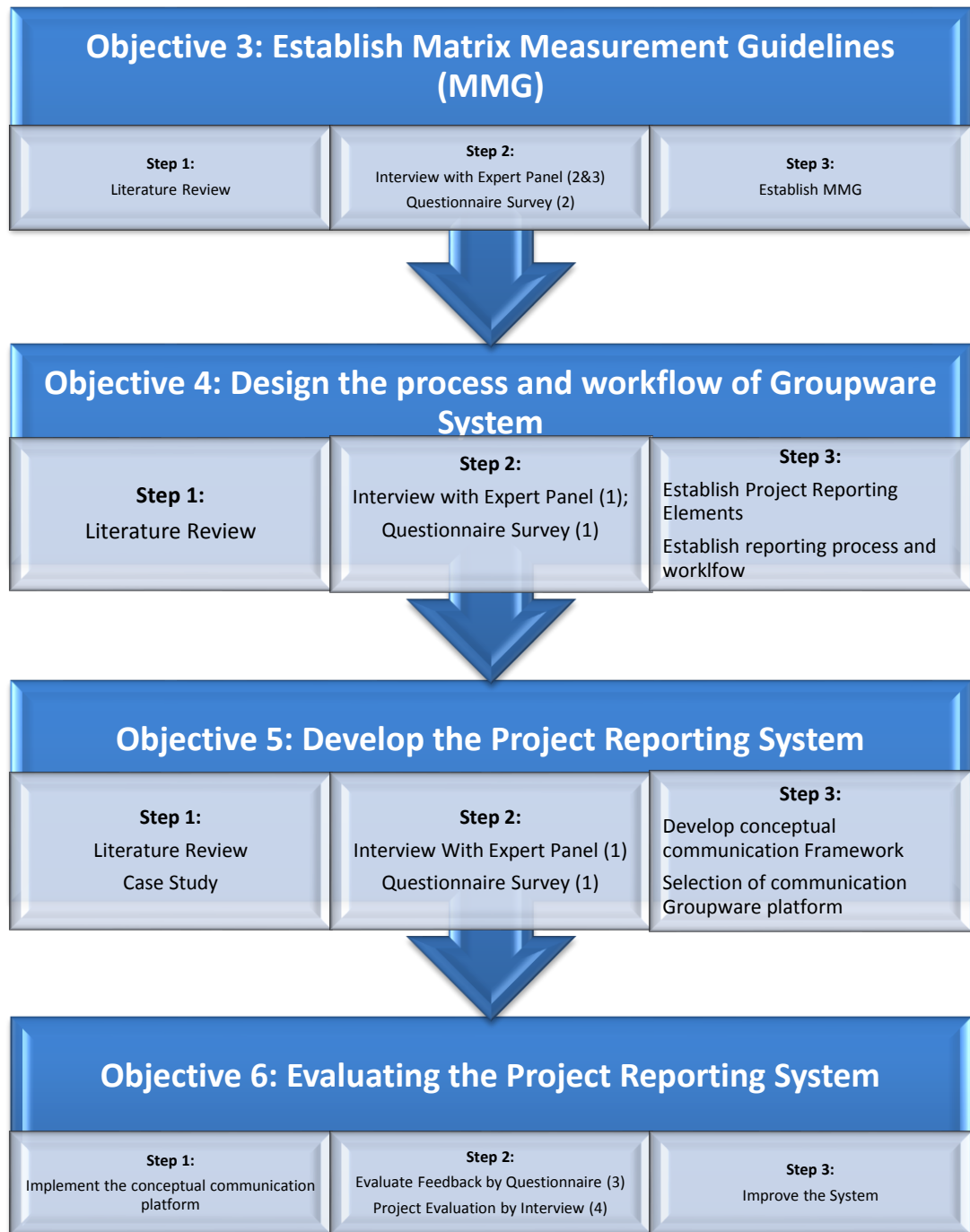


Figure 1.3: Brief Research Methodology (Continued..)

This research consist of three round of questionnaire survey and four round of interview survey as illustrate in Figure 1.4.

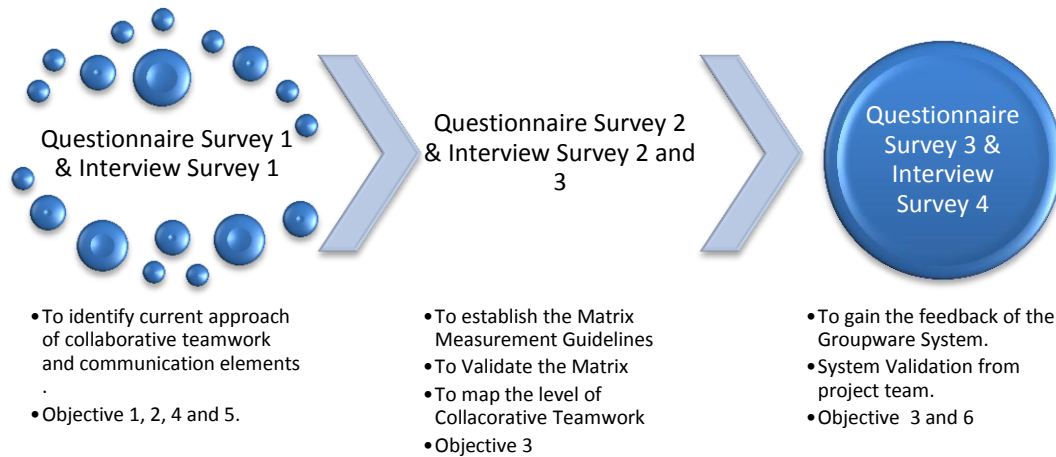


Figure 1.4: Questionnaire Survey and Interview Survey

1.7 Overview of the Sponsor's Organization

The sponsor's organization for this research is Felda Global Ventures Holdings Berhad (FGV), based in Malaysia, is a globally-integrated, diversified agri-commodities company with operations in ten countries across four continents. FGV principally involved in plantations, downstream and sugar businesses. FGV is a mother company of the researcher's organization.

Incorporated in Malaysia as a private limited company in 2007, Felda Global Ventures Holdings Sdn Bhd (FGV) initially operated as the commercial arm of Federal Land Development Authority (FELDA). On 28 June 2012, the company was

listed on the main market of Bursa Malaysia Securities Berhad as Felda Global Ventures Holdings Berhad.

Nowadays, Felda Global Ventures Holdings Berhad ranks among the top 20 companies on Bursa Malaysia with a market capitalization of RM16.6 billion. The Felda Global Ventures Holdings corporate structure summarized as Figure 1.5 below.

Source: <http://www.feldaglobal.com/> (Log on May 2014)

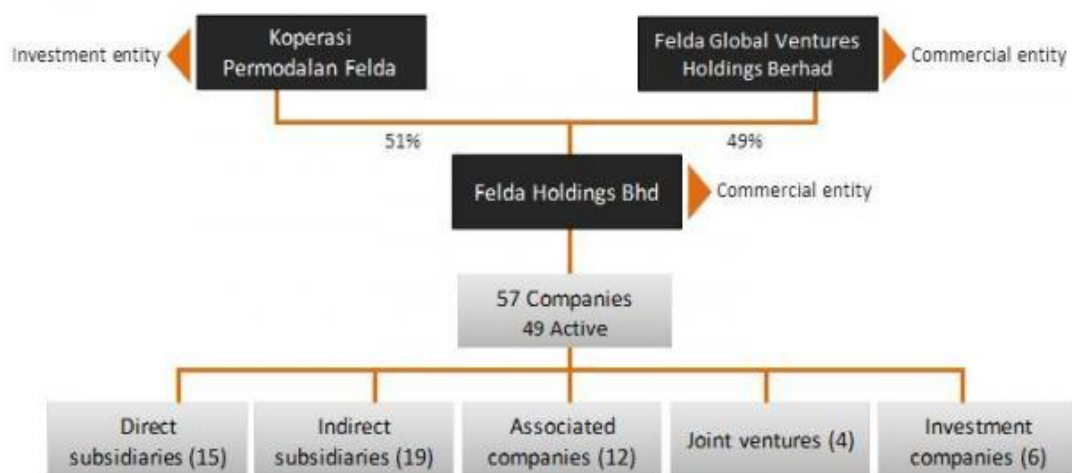


Figure 1.5: Felda Global Ventures Holdings Corporate Structure

Felda Holdings Bhd (Felda Holdings).

Felda Holdings Bhd. is an associate company of Felda Global Ventures Holdings Berhad which it hold 49% of the total share. Felda Holdings Berhad act as the commercial entity for Felda Global Ventures Holdings is the largest producer of crude palm oil (CPO) in the world. It produced 3.3 million metric tons of CPO in 2013. Formed under Land Ordinance Act. 1956 but incorporated on 6 September 1995, Felda Holdings Bhd. became a public company on 3 October 2003. Today, the total capitalization exceeds RM 5 Billion with RM 220 million in paid up capital. On the international front, Felda Holdings is a world leader, producing

almost 7% of world palm oil in 2013. It has operations in four countries overseas and enjoys a long-standing joint-venture partnership with large multinational, such as the Procter & Gamble company, USA.

Currently the Headquarters of Felda Global Ventures Holdings and Felda Holdings Berhad located at:

Menara FELDA,
Platinum Park, No. 11,
Persiaran KLCC,
50088 Kuala Lumpur. West Malaysia.

The Operation

In Malaysia, currently the Felda Global Ventures Holdings operates in 14 estates all over Malaysia. It's owned 135 estates with the total land area of 800,000 Hectares. and 71 Palm Oil Mills spread out in various locations as shown in Figure 1.4 below. This 135 locations need to be monitored for the various engineering projects such as infrastructure, buildings, water supply and manufacturing facilities including new development project including the maintenance project. This situation needs the good project management skills, efficient communication, coordination and collaboration within project team.



Figure 1.6: Felda Global Ventures Holdings Operational Area in Malaysia

Participation of the researcher in the Sponsor's Organization

The Researchers hold the position of the Operation Manager in engineering department in Felda Global Ventures Plantations (Malaysia) Sdn. Bhd. which is subsidiaries of Felda Global Ventures holdings Berhad and Felda Holdings Berhad as shows in figure 1.7.

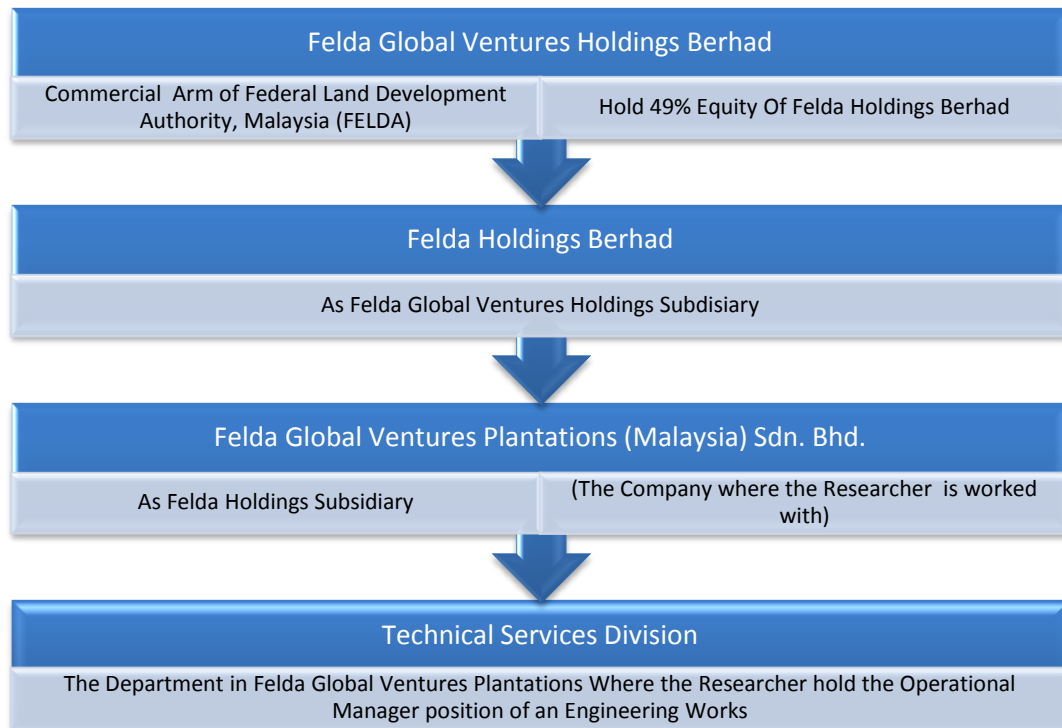


Figure 1.7: Researcher's Position in sponsor's Company

Table 1.1 shows that there is 175 total number of contract in 2014. The contract divided into two main groups consists of Buildings and Infrastructure. The building work included staff quarters, community hall, public amenities and shop lots meanwhile the infrastructure projects include access roads, agriculture roads and water supply. The nearest project site from the headquarters in Kuala Lumpur is ranging from 75 kilometres in Bentong, Pahang to as far as 1800 kilometres in Tawau, Sabah. Besides the company allocate the site staff, all of these projects monitored by the Technical Services Department in Kuala Lumpur and currently the headquarters staff are travelling on weekly basis to the project site and currently average project that can be visit in one week is only 3 to 4 projects.

Table 1.1: Total Number of Contract in 2014

Nos.	Type of Contract	Number of Contract
1	Buildings	146
2	Infrastructure	29
TOTAL CONTRACT		175

1.8 Summary of the Chapter

This thesis comprises four major components, which can be summarized as follows:

- i. Providing background, identifying the current collaborative teamwork approach in Malaysian construction industry;
- ii. Investigating the important elements for communication to support collaborative team work in Malaysian construction industry through interviews with the professionals and a questionnaire survey;
- iii. Making a contribution to the body of knowledge by evaluating the element of collaborative teamwork environment and develop Matrix Measurement Guideline to evaluate Collaborative Teamwork Environment (CTW) in Malaysian construction companies;
- iv. Making a contribution to the body of knowledge by designing, testing and analysing workflow and groupware platform in Microsoft SharePoint area to develop a new high performance communication system for Malaysian construction companies.

These contributions are presented in nine chapters as follows:

Chapter 1 introduces the background of the research, its aim and objectives. It also discusses the significance of the research, the scope of the research and a brief summary of the structure of the thesis.

Chapter 2 presents the findings from the literature review. It focuses on the overview of the Malaysian construction industry. This chapter related to the current performance, the Malaysian economy, the information and communication system that supporting collaborative teamwork in Malaysian construction industry.

Chapter 3 focuses on the discussion related to the project communication. It presents the methods of communication and discusses about the element of successful communication. It also discusses about problem and improvements of communication. Finally, the researcher discussed the method of communication in other industries.

Chapter 4 identifies the concept of teamwork, collaborative teamwork and the Information Technology (IT) tools in construction industry. It describes the definition of collaborative teamwork, the team development, the drivers and barriers to the teamwork performance, the objectives of the collaborative teamwork environment and the elements of collaborative teamwork in construction. Finally, the IT tools that support collaborative teamwork communication was discussed and reviewed based on previous research.

Chapter 5 discusses the methodology adopted for this research. It starts by discussing the method used to justify the need for this research through the content analysis of the literatures, interviews, and questionnaire survey. Then it discusses the method used for this research include general interview and questionnaire survey guidelines, the pilot study and the tools been used to analyse the above methods. An

explanation was given to each step in terms of their relation to this research, selection of criteria and the anticipated result of each method.

Chapter 6 presents the data collection procedures for the initial investigation to establish and justify the method that was described in previous section. All interview and questionnaire respondents and the details of their jobs and position were discussed throughout this chapter. The case studies and the required systems for developing groupware are also identified in this chapter.

Chapter 7 presents the data analysis for the investigation on current collaborative methods and its hindrances. It presents the results of interview and questionnaire survey to illustrate the problems and milestones of current methods and the need for developing new system for communication to support collaborative teamwork. Moreover, it provides the element of CTW to identify the major factors needed to implement CTW in construction firms. Then the matrix for evaluation of CTW in each Malaysian company is developed based on the results of questionnaires accordingly. The results of this chapter evaluate the reliability of the workflow and groupware in Chapter Eight.

Chapter 8 presents the finding of this research as a guide to design and implement a workflow in Malaysian construction industry. It also provides in details the website design which was run in UTM-CTMC. It discusses about different part of the website and method of reporting inside of it. The results of this chapter were finally validated by the project member to show its usefulness and reliability.

Chapter 9 concludes the results of the research. Discussions are made towards the achievement of the objectives of the research, on the contribution of the research to the existing knowledge, and recommendations are made for future research on the subject.

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