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นางนวลทิพย์ แก้วศรี

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วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาวิศวกรรมศาสตรดุษฎีบัณฑิต
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ลิขสิทธิ์ของจุฬาลงกรณ์มหาวิทยาลัย

A STUDY OF WORKING EXPERIENCES, OUTSTANDING CHARACTERISTICS AND SUITABLE ROLES OF FEMALE ENGINEERS IN THAILAND CONSTRUCTION INDUSTRY: A CASE STUDY OF FEMALE CIVIL ENGINEERS

Mrs. Nuanthip Kaewsri

ศูนย์วิทยทรัพยากร
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A Dissertation Submitted in Partial Fulfillment of the Requirements
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นวลทิพย์ แก้วศรี : การศึกษาประสบการณ์ คุณลักษณะ และบทบาทหน้าที่ที่เหมาะสมของวิศวกรหญิงในอุตสาหกรรมก่อสร้างไทย: กรณีศึกษาวิศวกรโยธาหญิง (A Study of Working Experiences, Outstanding Characteristics and Suitable Roles of Female engineers in Thailand Construction Industry: A Case Study of Female Civil Engineers) อ.ที่ปรึกษาวิทยานิพนธ์หลัก: รองศาสตราจารย์ ดร. ธนิต ธงทอง, 183 หน้า.

วิศวกรโยธาเป็นบุคลากรหลักในการทำโครงการก่อสร้างในประเทศที่กำลังพัฒนาอย่างประเทศไทย แม้ว่าในปัจจุบันประเทศไทยมีจำนวนวิศวกรโยธาหญิงเพิ่มขึ้นเป็นจำนวนมาก แต่งานวิจัยทางด้านการประกอบอาชีพทางวิศวกรรมของวิศวกรหญิงยังมีอยู่น้อยมาก งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาถึงประสบการณ์ของวิศวกรโยธา เพื่อทำให้สามารถระบุถึงปัญหาในการประกอบอาชีพ คุณลักษณะเด่น และบทบาทหน้าที่ที่เหมาะสมของวิศวกรโยธาหญิงที่ประกอบอาชีพในบริษัทรับเหมาก่อสร้างไทย เพื่อสามารถนำผลการศึกษามาใช้ในการบริหารความแตกต่างของบุคลากรได้อย่างมีประสิทธิภาพมากขึ้นในบริษัทรับเหมาก่อสร้างในประเทศไทย การวิจัยครั้งนี้มีการเก็บรวบรวมข้อมูลจากวิศวกรหญิงจำนวน 104 คน และวิศวกรชายจำนวน 47 คน เครื่องมือที่ใช้ในการเก็บข้อมูลคือ แบบสอบถาม และแบบสอบถามกึ่งสัมภาษณ์ นอกจากนั้นแล้วยังมีการเก็บข้อมูลเชิงคุณภาพ โดยการสัมภาษณ์แบบเจาะลึก จำนวน 24 ข้อมูลประกอบด้วย หัวหน้า เพื่อนร่วมงาน และลูกน้องของวิศวกรหญิง รวมทั้งการสัมภาษณ์แบบเจาะลึกจาก 10 วิศวกรหญิงและ 10 วิศวกรชาย ที่เป็นเจ้าของบริษัทและหัวหน้าของวิศวกรหญิง โดยใช้หลักการการวิเคราะห์เนื้อหาในการวิเคราะห์ข้อมูลเชิงคุณภาพ และใช้หลักการทางสถิติในการวิเคราะห์ข้อมูลเชิงปริมาณ หลังจากนั้นตรวจสอบผลที่ได้จากการวิจัย โดยผู้ทรงคุณวุฒิวิศวกรโยธาหญิง

การศึกษาเกี่ยวกับประสบการณ์พบว่า วิศวกรหญิงที่ทำงานในบริษัทรับเหมาก่อสร้างมีข้อจำกัดในบทบาทหน้าที่ ไม่สามารถทำงานได้ทุกบทบาทหน้าที่เหมือนวิศวกรชายในบริษัทรับเหมาก่อสร้าง ซึ่งทำให้มีประสบการณ์ทำงานเกี่ยวกับ ความยากในการทำงาน ปัญหาในการทำงาน ความก้าวหน้าในการทำงาน การจัดทำเส้นทางอาชีพของบริษัทให้กับวิศวกรหญิง แตกต่างจากวิศวกรหญิงที่ไม่ได้ทำงานในบริษัทรับเหมาก่อสร้าง นอกจากนั้นแล้วยังพบว่าวิศวกรหญิงและชายในบริษัทรับเหมาก่อสร้างและวิศวกรหญิงที่ทำงานในบริษัทที่ไม่ใช่รับเหมาก่อสร้างมีความคิดเห็นเกี่ยวกับความเหมาะสมที่ผู้หญิงจะเป็นวิศวกรโยธา การทำงานให้ประสบความสำเร็จในอุตสาหกรรมก่อสร้างแตกต่างกันในด้านอัตราการลาออกของวิศวกรหญิงเปรียบเทียบกับวิศวกรชายนั้น วิศวกรหญิงมีอัตราการลาออกมากกว่าวิศวกรชาย โดยคิดเป็นค่าเฉลี่ยพบว่าวิศวกรหญิงทำงาน 1.0-1.9 ปีต่อบริษัท ส่วนวิศวกรชายทำงาน 2.0-2.9 ปีต่อบริษัท และยังพบว่า การถูกเลือกปฏิบัติ ความขัดแย้งระหว่างงานและชีวิตครอบครัว การคุกคามทางเพศ และ ความพึงพอใจต่อความก้าวหน้าในการประกอบอาชีพ เป็นปัญหาส่วนใหญ่ต่อการลาออกจากบริษัทรับเหมาก่อสร้างของวิศวกรหญิง และจากการวิเคราะห์ regression model พบว่าปัญหาที่เป็นตัวทำนายเจตนาการลาออกของวิศวกรหญิง คือความพึงพอใจต่อความก้าวหน้าในการประกอบอาชีพ (adjusted R^2 = 0.620) ซึ่งสามารถอธิบายการแปรปรวนได้ 62 เปอร์เซ็นต์ในการทำนาย

จากการศึกษาคุณสมบัติเด่นของวิศวกรหญิงที่เป็นประโยชน์ในการทำงานที่แตกต่างจากวิศวกรชายพบว่า วิศวกรหญิงมีการสื่อสารและการเจรจาต่อรองที่ดี มีความละเอียดรอบครอบในการทำงานเอกสารและมีทักษะในการใช้ภาษาอังกฤษประสานงานที่ดี และยังทราบถึงกรณีศึกษาเกี่ยวกับคุณสมบัติเด่นของวิศวกรหญิงที่เป็นประโยชน์ในการทำงานที่แตกต่างจากวิศวกรชายในแต่ละมุมมองได้แก่ มุมมองหัวหน้างาน เพื่อนร่วมงานและลูกน้อง นอกจากนั้นมีการวิเคราะห์บทบาทหน้าที่ที่สามารถก้าวหน้าได้มากที่สุด บทบาทหน้าที่ที่สถานประกอบการนิยมใช้วิศวกรหญิง คุณลักษณะเด่นของวิศวกรหญิง การวิเคราะห์ความรับผิดชอบและเส้นทางความก้าวหน้าในแต่ละบทบาทหน้าที่ของวิศวกรโยธาในบริษัทรับเหมาก่อสร้าง เพื่อกำหนดบทบาทหน้าที่ที่เหมาะสมของวิศวกรหญิงในการทำงานในบริษัทรับเหมาก่อสร้างไทยซึ่งได้แก่ วิศวกรประสานงาน วิศวกรประมาณราคา และวิศวกรวางแผนและตรวจติดตามความก้าวหน้าในการทำงาน

ดังนั้น จากผลการวิจัยคุณลักษณะเด่นและบทบาทหน้าที่ที่เหมาะสมสามารถใช้เป็นกลยุทธ์ในบริษัทรับเหมาก่อสร้าง เพื่อใช้ความสามารถของวิศวกรโยธาหญิงได้อย่างเต็มประสิทธิภาพ ซึ่งจะทำให้บริษัทเห็นถึงประโยชน์ของการมีวิศวกรหญิงอยู่ในองค์กร ในทางกลับกันเมื่อวิศวกรหญิงได้ทำงานในบทบาทหน้าที่ที่เหมาะสมแล้วทำให้มีโอกาสก้าวหน้าและประสบความสำเร็จในการประกอบอาชีพเพิ่มขึ้น

ภาควิชา วิศวกรรมโยธา ลายมือชื่อนิสิต นวลทิพย์ แก้วศรี

สาขาวิชา วิศวกรรมโยธา ลายมือชื่อ อ.ที่ปรึกษาวิทยานิพนธ์หลัก

ปีการศึกษา 2553

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KEYWORDS: WOMEN IN CONSTRUCTION / CIVIL ENGINEERING / DIVERSE WORKFORCE / OUTSTANDING CHARACTERISTICS / SUITABLE ROLES
NUANTHIP KAEWSRI: A STUDY OF WORKING EXPERIENCES, OUTSTANDING CHARACTERISTICS AND SUITABLE ROLES OF FEMALE ENGINEERS IN THAILAND CONSTRUCTION INDUSTRY: A CASE STUDY OF FEMALE CIVIL ENGINEERS. ADVISOR: ASSOC. PROF. TANIT TONGTHONG, Ph.D., 183 pp.

Civil engineers occupy a key position in construction in developing countries such as Thailand. Even though the number of female civil engineers in Thailand has increased considerably, there has been a lack of research regarding them. This study aimed at investigating the working experiences of women in engineering field so as to identify problems in the occupation, outstanding characteristics, and suitable roles of female civil engineers working in an occupation which women have not traditionally held. It was anticipated that the study findings could be used to more effectively manage differences in manpower in construction companies in Thailand. In this study, data were collected from 104 female engineers and 47 male engineers using questionnaires and interviews. Qualitative data were also gathered by means of in-depth interviews using 24 interview questions asked of superiors, colleagues, and subordinates of female engineers. Ten female engineers and ten male engineers who were company owners and superiors of female engineers were also interviewed. Content analysis was utilized to analyze qualitative data, while statistical measures were used to analyze quantitative data. The findings were validated by experts who were successful women engineers.

According to the study findings, when considering working experiences of women engineers, it was found that there are limitations in the roles they were able to perform compared to men. Thus, they experience some difficulties in doing their jobs. Work-related problems, career advancement, and career paths of female engineers working in contractor companies are different from those of female engineers in non-contractor firms. In addition, it was found that male and female engineers working for contractors and female engineers in non-contractor firms have different opinions regarding what it takes for women to be successful in the construction industry. As regards the resignation of female engineers in construction companies, their rate of turnover is higher than that of men. On average, women work for 1.0-1.9 years per company, while men work for 2.0-2.9 years per company. The findings also revealed that discrimination, conflicts between work and family, sexual harassment, and satisfaction with career advancement are major reasons for female engineers' resignation. Besides this, the analysis of regression model of a problem which can predict attitudes toward the resignation of female engineers is the satisfaction with career advancement (adjusted $R^2 = 0.620$), which are explain 62 per cent of the variance in the prediction.

With regard to the outstanding roles of female engineers which benefit their career in a different way compare to men engineers, the findings indicated that female engineers have better communication and negotiation skills. They are more careful in paper work and have better English skills for work coordination. Case studies of different perspectives of the superiors, colleagues, and subordinates of female engineers were also conducted. The roles and responsibilities frequently assigned to female engineers as well as responsibilities and career path in contractor firms were analyzed with outstanding characteristics of female engineers to identify the role of female engineers where can yield the most advancement for their career. This was done so as to determine the roles and responsibilities appropriate for women working in this field, which were found to be as follow: work coordinating, estimation and cost engineering, and project planning and progress monitoring.

Thus, the findings on outstanding characteristics and suitable roles of female civil engineers can be used for strategic planning in construction companies to maximize these women's potential and capabilities as well as to realize the benefits of having female engineers in their organization. When female engineers are positioned in their most appropriate roles for in construction companies, they are more likely to be successful in their career.

Department: Civil Engineering Student's Signature _____
Field of Study: Civil Engineering Advisor's Signature _____
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Special thanks also go to all the women and men working as engineers who shared their time and experiences with me so that I might be able to pass this knowledge on for others to learn from.

I also wish to thank all my friends, both inside and outside Chulalongkorn University, for their help and support.

I would like to offer praise to Tersak Kaewsri for his blessing, love and mercy throughout my life. My husband always encourages me to pursue my dream. Likewise, my son and daughter have also been a great source of inspiration for me.

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Chapter I
Introduction

1.1 Background

Thailand is a developing country with many small and large sized construction projects. Civil engineers are, thus, in great demand. Each year the Thai government invest a lot of money in developing civil engineering personnel (Office of the Higher Education Commission: OHEC, 2010). However, the number of civil engineering students graduating every year cannot address demands of the Thai construction industry. Civil engineers have many important roles in both site-based work and office-based work. Civil engineers' jobs before the construction phase include assessing the feasibility of a project, planning and designing, estimating, purchasing and hiring. When a project is approved, civil engineers will have to monitor and supervise the project. When the above-mentioned roles of civil engineers are taken into account, construction projects obviously cannot be successfully carried out without civil engineers' work.

According to the Thai labor market, women account for 49 per cent of the total workforce in the Thai labor market, slightly lower than the percentage of men (National Statistical Office in Thailand: NSO, 2009). The gender pattern of the Thai workforce has changed dramatically in the last 20 years: the male labor increased by 4 per cent whereas the female labor skyrocketed by over 40 per cent. Thai women employees predominate in certain occupational sectors such as manufacturing, education, health and services in the banking, insurance and retail trades (NSO, 2009). On the other hand, women account for only 16 per cent of the construction workforce, indicating that construction is a heavily male-dominated industry (NSO, 2009). Construction is a male-dominated industry, so women are faced with major challenges when they try to develop their careers in this sector. In addition, although women constitute over half of the Thai workforce and the number of women graduates with civil engineering degrees continues to increase during the last ten years, they are still under-represented in the Thai construction industry. This shows a lack of studies exclusively on women engineers' careers, which can be applied by human resources departments of contractor companies.

1.2 Current Status of Women Graduates in Civil Engineering Field and in the Thai Construction Industry

Thirty-three public universities and eight private universities in Thailand produce civil engineering graduates each year (Council of Engineering: COE, 2010). Data from the Office of the Higher Education Commission (OHEC) show that the number of women

graduating with degrees in civil engineering steadily increased from 7.6 per cent in 2003 to 12.4 per cent in 2008 and would continue to increase in the future (Figure 1.2). This implies that there will be more women civil engineers entering the construction industry.

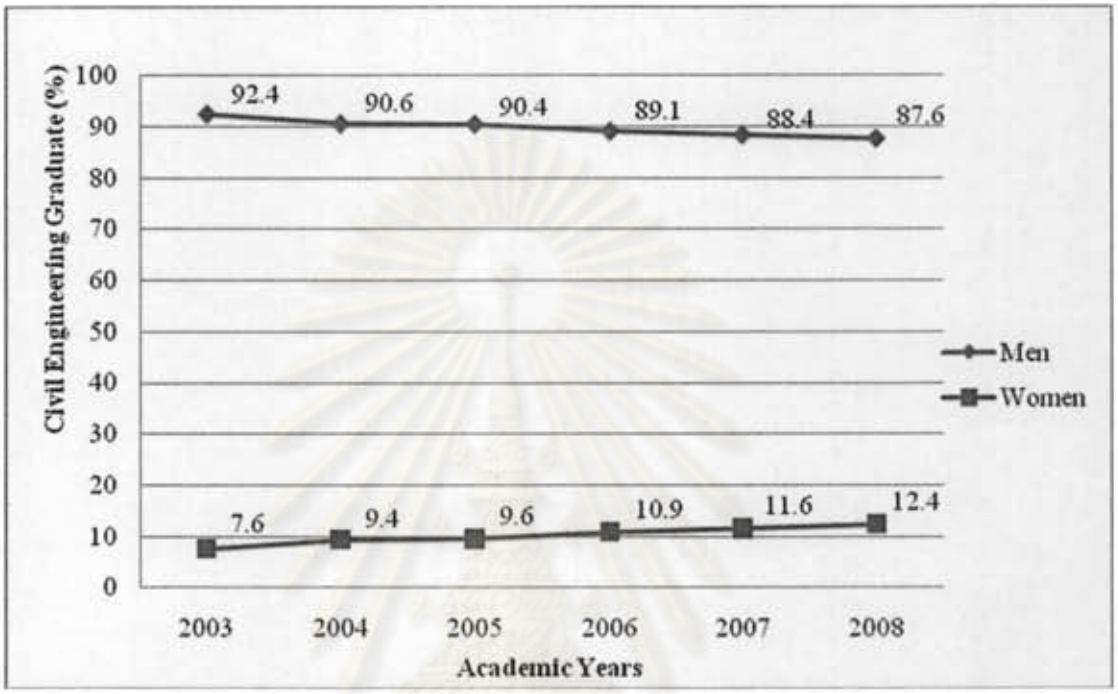

Figure 1.1 Comparison of Female and Male Graduates in Civil Engineering by Academic Year

Table 1.1 Classification of civil engineers with registered engineering licenses

Classification of Civil Engineers	Men		Women	
	Number	Per cent	Number	Per cent
Associate Engineers	39,094	81.4	2,528	95.3
Fellow Engineers	7,369	15.3	115	4.4
Chartered Engineers	1,555	3.3	9	0.3
Total	**48,018**	**100.0**	**2,652**	**100.0**

Source; Council of Engineering in Thailand, 2009

Contrary to the increasing number of women with degrees in civil engineering, women engineers tend to get promoted engineering licenses less often than their men counterparts. The data from the Thailand Council of Engineers on career achievement based on the type of license for professional engineering practices (Table 1.1) show that out of 50,670 civil engineers holding licenses for professional engineering practice, the promotion rate of women civil engineers from associate engineers to charter engineers was at 0.3 per cent, while the promotion rate of men civil engineers

from associate engineers to charter engineers was at 3.3 per cent. It also shows that the promotion rate of women civil engineers from associate engineers to fellow engineers was at 4.4 per cent, while the promotion rate of men civil engineers from associate engineers to fellow engineers was at 15.3 per cent. This implies that women civil engineers have fewer opportunities to advance in their careers than their male counterparts.

Surprisingly, the number of women graduating with degrees in civil engineering increased dramatically during 2003-2008 by 111 per cent. In contrast, the number of men graduating with degrees in civil engineering increased by 23 per cent. Out of all civil engineers working in the Thai construction industry during 2003-2008, the number of women engineers increased by 79 per cent and men by 28 per cent (OHEC; COE, 2010). This shows a significant increase in the number of women graduating with degrees in civil engineering and working in the Thai construction industry compared to men.

1.3 Problem Statements

A survey in the UK by Bennett, Marilyn, Davidson and Gale (1999) and Fielden, Davison, Gale, and Davey (2000) found that the image of the construction industry such as hazardous work, hard work and wages in this profession is not much higher than other occupations. This has made both men and women reluctant or uninterested to enter the industry and enrollment in civil engineering programs has declined. In the same period of the mid-1990s, it was forecast that in developed countries such as the UK, USA, Canada, and EU country, there would be a shortage of engineers by 2020, and that the effect would be felt all over the world (Fair Play, 1995; Amaratunga, Haigh, Lee, Shanmugam, and Elvitigala, 2005; Canada and the World Backgrounder, 2004; Dainty and Edwards, 2003; Mann, 2004). Most researchers focused on how to raise participation levels of women in the construction workplaces in an attempt to solve labour issues and skill shortage rather than equality of opportunity (Agapiou, 2002). Many studies focused on obstacles faced by women upon entering the industry sector, their development and retention. For example, a study on obstacles preventing women from entering this career path was conducted by Fielden et al. (2000) who found out that women were reluctant to choose this career for several reasons, namely the poor image of the industry, a lack of information and knowledge of the field, male-predominant criteria, recruiting procedures and methods, sex segregation, male-dominant culture, and hostile working environment. Ultimately, women do not have many role models and mentors to coach and train them (Khazanet, 1996; Yates, 2001). A study of Gale (1994) in the UK found that women engineers tended to stagnate in the organizational hierarchies of contractor companies. The study suggested that the working culture and structure of the construction industry should be changed to give women more opportunities for career advancement (Dainty, Neale, and Bagilhole, 2000a; Dainty, Bagilhole and Neale, 2000b).

In addition, Bennett et al., (1999) conducted a study in the UK which found that professional women already working in the construction industry had higher expectations and had more commitment to stay in the construction sector than female undergraduates, professional men were assigned to supervise significantly more people than professional women, and fewer women than men over 36 years were found in the construction industry.

Another barrier confronted by women engineers in construction is work-life conflict (Lingard and Lin, 2004; Lingard and Francis, 2005). It was found that the nature of construction fieldwork such as long working hours, uncertain working times, holiday work, etc. make women's work-life conflict greater than that of men. In addition, women were faced with sexual harassment as they have to work with men most of the time (Bagilhole and Woodward, 1995; Dainty and Lingard, 2006; Madikizela and Haupt, 2010). Furthermore, women engineers also are confronted by inequality of opportunity regarding promotion in their careers. The CEOs of construction and consulting companies interviewed said that the major impediment for the promotion of women engineers was that women left the career track earlier than men (Khasanet, 1996), pointing to the pressing need to promote equality in workplaces for diverse workforce (Agapiou, 2002; Clarke and Gribling, 2008; French and Strachan, 2009).

Khazanet undertook a study in 1996 in the USA on women engineers' working conditions and proposed guidelines for solving the problems which women engineers faced. This study was aimed at bringing about better recognition and promotion opportunities for women engineers, and subsequently to attract and retain those with valuable experience. Another study in the USA suggested ways to recruit and retain women engineers (Yates, 2001) in the construction industry. A critical pool of women engineers could serve as a focal point that could help construction companies become aware of the importance of senior women engineers acting as mentors, advisers and role models in engineering careers (Khazanet, 1996; Yates, 2001). The research by Fielden et al. (2000) and Yates (2001) suggest promoting women engineers' entry into the construction industry and solving women engineers' problems relating to the male-dominated culture by initiating campaigns that can help change the culture. Later in 2007, Menches and Abraham proposed guidelines for all concerned parties to promote bringing more women into the construction industry in order to meet future demand. These guidelines seemed to be supported by the public sector such as professional associations, labour unions, and universities but not as much by the private sector.

Nevertheless, past campaigns did not solve the problems of women engineers in the long run. The first step to solving these problems is to make companies or entrepreneurs appreciate the value of women engineers' presence and create a women-friendly working environment. Research into this matter is still in its early stages. Unless greater emphasis is placed on women engineers' presence, it will be difficult to make changes in the private sector.

1.3.1 In other countries, there has already been research on the work experiences of women engineers in the construction industry to find solutions to the lack of women in the workforce. As Thailand is a developing country, construction projects are one of the keys to the nation's development. These projects boost employment and drive the Thai economy forward as can be seen from the fact that construction contributed an estimated 7.8% of GDP in 2008 (Kasikorn Research, 2011). If there is a lack of civil engineers in the workforce, Thailand will be more affected more than developed countries. Therefore, both men and women civil engineers are indispensable for the nation's development. Considering the above-mentioned work characteristics, previous research revealed that women engineers had to face more problems in their careers more than their male counterparts. Hence, studying the work experiences of women civil engineers is of great importance. Also, there should be studies on the difficulties, career progression and problems of working of women engineers in order to enhance diversity management and retain them in the construction industry.

1.3.2 Previous foreign research has been conducted with the aim of retaining women in the construction industry for a longer time period. The culture of male working styles has been altered by encouraging women to work as civil engineers and create a more supportive culture globally. However, in Thailand, this is a long-term plan because at present, women engineers are still under-represented in the construction industry (5.8% of all engineers, See Table 1.1). If there are more studies that help private companies see the advantages of female engineers that are different from those of men engineers, they will be more aware of their value and women-friendly policies will be increased. This can be seen from previous research regarding other professions which found that advancement in women's career achievement was due to women-oriented policies of organizations (Burk and Nelson, 2002). Unless organizations recognize the importance of women engineers, those policies will not materialize. The research gap is a lack of research on women engineers' advantages for contractor companies. If contractor companies see the difference women's presence can make, their policies will be more supportive and consequently women engineers will be more likely to succeed in their careers. Thus, this research places emphasis on studying the outstanding characteristics of female engineers that are beneficial for contractor companies and how they are different from those of men engineers.

1.3.3 Working in male-dominated culture women engineers found that they had enjoyed less career advancement than their male counterparts due to their restricted roles in pilot study of this research. Also, the nature of construction work caused women engineers to face many restrictions of working in contractor companies such as outdoor conditions (severe weather), night time work or long working hours,

holiday work, supervised male labor, and geographical instability. This is known as "men value" (Lingard, and Francis, 2005). Thus, research on directions for increasing career opportunities for women engineers is necessary. Identifying suitable roles of women engineers is one way to increase their chances for advancement. After a literature review, the researcher found that there was a lack of studies on suitable roles of women engineers relating to the diverse roles of civil engineering which contractor companies could apply to job allocations for women, maximizing the benefit they would receive from women engineers and which could be used as guidelines to increase women's career opportunities.

1.4 Research Objectives

This research attempts to look into the prima-facie evidence regarding women engineers' careers in construction, to suggest job allocation strategies to fill gaps in the work of men engineers, and to facilitate management of diverse workforces for project managers to maximize their women engineers' performance and to increase women engineers' career opportunities. The main objectives are as followed:

1) To explore work experiences of women engineers in the construction industry in order to identify problems and factors influencing their careers.

2) To identify advantages of women engineers' presence in the construction industry by presenting outstanding characteristics different from those of men engineers.

3) To identify suitable roles of women engineers in the Thai construction industry.

1.5 Research Hypothesis

Women engineers have outstanding characteristics that are beneficial to Thai contractor companies in the way different from those of men engineers.

1.6 Research Scope

The details of research scope are as follows.

1.6.1 Data of women civil engineering careers in this research were collected from the Thai construction companies both contractor companies and non-contractor companies. In this study, non-contractor companies included consultancy companies, construction management companies, developer companies, and suppliers of construction materials.

1.6.2 Data including experiences, opinions, and problems in the construction industry careers of women engineers working in contractor companies and in non-

contractor companies were collected and compared. Turnover experiences calculated from men and women engineers who are currently working in contractor companies.

1.6.3 Instruments used in the research were questionnaires and semi-structured interviews.

1.6.4 The method of survey data collection was getting information in person and through in-depth interviews.

1.7 Research Methodology

This research was designed into two stages, according to the following procedures.

1.7.1 Primary Stage or Pilot study:

1) Literature from previous Thai and foreign research of women in construction, theories of relevant civil engineering roles, diversity management and careers were studied.

2) Women engineers' superiors, colleagues and subordinates were asked how the advantages of the existence of women engineers are different from men in the Thai construction industry. Suggestions of the case study were also recommended.

3) Problems in contractor company careers for women engineers' regarding turnover were studied in this pilot study.

4) The experiences of career progression/advancement in construction were gathered from women engineers to get women engineers' career advancement compared to those of male colleagues.

5) Data analysis and the results got from this step were used to develop the final questionnaire and semi-structured interview.

6) Validity and reliability of the questionnaire were concluded.

1.7.2 Secondary Stage:

1) Data gathering consisted of two steps: firstly, a questionnaire survey was conducted to measure: suitable roles; demographic characteristics; work characteristics; organization characteristics; problems in non-traditional careers such as discrimination, sexual harassment, work-life conflict, satisfaction of career progression and intent to leave faced by women engineers in the construction industry; and women engineers' career choices in construction. Secondly, semi-structured in-depth interviews of experiences of women and men in contractor companies and women in non-contractor companies who have worked in the construction industry at an established career stage (not over 10 years) were conducted. Several topics were studied and compared, namely, women engineers' experiences regarding advancement in construction compared to those of men engineers'; career path guidelines provided by companies for women engineers;

career difficulties; working problems found in construction industry such as sexual harassment, work-life conflict, equality of opportunity; perceptions about whether women should be civil engineers; opinions about working for career advancement in the Thai construction industry; weaknesses and strengths of women engineers from men engineers' perspectives in construction companies; turnover rates, turnover causes and recommendations for next generations of women engineers of how to become successful in the construction industry.

2) Data analysis – Two types of analysis were conducted. 1) Qualitative analysis of experiences of men engineers who work with female engineers was conducted to determine outstanding characteristics of women engineers. The analysis of suitable roles were based on the data gathered from female and male owners of contractor companies, female and male superiors of women engineers, and women civil engineers working in contractor companies. A comparative analysis of outstanding characteristics of women engineers was also performed. The analysis results were then verified by women engineering experts. 2) Quantitative analysis including a comparison of turnover rates, experiences, and perceptions of men and women engineers working in contractor companies and women in non-contractor companies. Furthermore, an analysis was conducted to determine the relationships between demographic variables, work characteristic variables, organizational variables and implication of turnover intention. In addition, analysis results such as outstanding characteristics of women civil engineers that were different from those of men engineers, suitable roles of women engineers in Thai construction, work experiences of women engineers working for contractor and non-contractor companies, turnover rates of women and men engineers working in contractor companies as well as factors influencing construction careers and turnover were discussed.

3) Conclusions and recommendations were given.

1.8 Definition of Terms

1.8.1 Under-representation refers to the number of women engineers in the construction industry which less than 10 % of all engineers (Court and Moralee, 1995).

1.8.2 Non-Traditional Career. An NTC is any profession in which less than 25% of the workforce is women (Department of Labor of the US, 2003).

1.8.3 Women civil engineers refer to women graduating with a bachelor's degree in civil engineering and applying their civil engineering knowledge to their careers in the construction industry.

1.8.4 Career advancement/progression are the progression for any employee to be developed through a sequence of jobs, involving continually more advanced or diverse activity and resulting in wider or improved skills, greater responsibility and prestige, higher status and higher income.

1.8.5 Career achievement is the opportunity for any employee to succeed to their expectation.

1.8.6 Career success is the opportunity for any employee to develop in their career in terms of promotion, remuneration, and new knowledge.

1.8.7 Discrimination is an unfair treatment of a person or group on the basis of prejudice.

1.8.8 Harassment is to disturb or irritate persistently, to wear out or exhaust, systematic persecution by besetting with annoyances, threats, or demands.

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Chapter II
Literature Reviews

2.1 Introduction

This chapter focuses on Thai economic and social data related to careers of women civil engineering in the construction industry, previous Thai and foreign literature reviews, and important theories related to the research topic in order to determine the research standpoint, and hypothesis. Additionally, socio-economic conditions in Thailand, labor force data in Thai industry, non-traditional careers, diversity management, women careers in construction, career barriers and implications for their turnover are studied in this chapter.

2.2 Socio-economics in Thailand

In Thailand, similar to many other developing countries, the construction sector is the driving force for country development. Due to its nature, the construction industry, contributing 6.3 per cent of the National Gross Domestic Product (GDP), has a dynamic structure and includes a wide range of activities (ADB, 2008), which directly affect other businesses such as metal, cement, wood and ceramic suppliers, and etc.

Table 2.1 Number of workers by gender and economic activity (in Thousands)

Economic Activities	Total	Men	Women	% Women
Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel	608	542	66	10
Wholesale trade and commission trade, except of motor vehicles and motorcycles	593	261	332	56
Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods	1,790	878	912	51
Hotels and restaurants	926	348	578	62
Real estate activities	197	112	85	43
Computer and related activities	33	21	12	36
Renting of machinery and equipment without operators; research and development and other business activities	394	297	97	25
Recreational and other service activities	439	126	313	71
Manufacturing	4,647	2,231	2,416	52
Construction	288	241	47	16
Other land transport, storage and warehousing, activities of travel agencies and telecommunications	317	223	94	30
Hospital activities	339	156	183	54
Total	10,571	5,436	5,135	49

Source: The Construction Industry Survey, National Statistical Office, Ministry of Information and Communication Technology in Thailand (2009)

Many businesses go up and down following the construction industry's status.

Table 2.1 shows contributions of women and men in economic activities in Thailand. According to the table, women tend to be clustered in recreational and other service activities. However, while the number of women in the workforce in almost all economic activities is relatively equal to that of men, the number of women working in the sale, maintenance and repair of motor vehicles and motorcycles, retail sale of automotive fuel, renting of machinery and equipment without operators and construction was less than that of men due to the fact that these are non-traditional careers which are considered unsuitable for women.

Thai women were proud of working outside the home and being financially independent and able to provide financial support to other family members. As a result, there were larger numbers of women in the Thai labor force than its neighbors (ADB, 2008). A report from the National Statistical Office (2009) revealed that women represented 51.35 per cent of the total population of Thailand while men represented 48.65 per cent. Data from the Ministry of Education showed the number of people studying in primary schools up until doctoral degrees (See Figure 2.1). According this latest report, at the junior high school level, the number of male students was slightly higher than female students, and at the bachelor's level, the number of female students was slightly higher than male students. However, the numbers of female and male students were similar at all levels.

Data from the National Statistical Office (2009) reporting the number of women and men in the labor market showed that men represented 50.23 per cent while women represented 49.77 per cent of the labor force, men representing a slightly higher proportion of the Thailand's labor force.

Furthermore, according to the Human Development Report, 2008, Thai women had better educational and job opportunities than women in other Asian countries with the exception of the Philippines. Thai women work in the private sector as officers (45%), supervisors (42.2%), department managers (41.5%) and directors (28.7%) (Wirth, 2004). Another report revealed that women's labor force participation rate depended on the number of children they had: the more children they had, the lower the rate. In other words, the less domestic work they had, the more time they had to invest in work outside the home and support their families (ADB, 2008).

In Thai society, women are expected to work outside the home and support their families. A wife or a daughter earning an income is the pride of the family, and highly respected by people outside the family. Thai women's labor force participation rate, therefore, is higher than that of other countries in the same region. Nevertheless, in some careers, notably technical and engineering jobs, women are affected by overwhelming socio-cultural biases. In Thailand, more women work as civil servants than men, but they are given low positions such financial, accounting, research and data collecting jobs, rather than jobs dealing with planning or implementing policies.

According to a study by Lawler (1996), even though a lot of Thai women are in

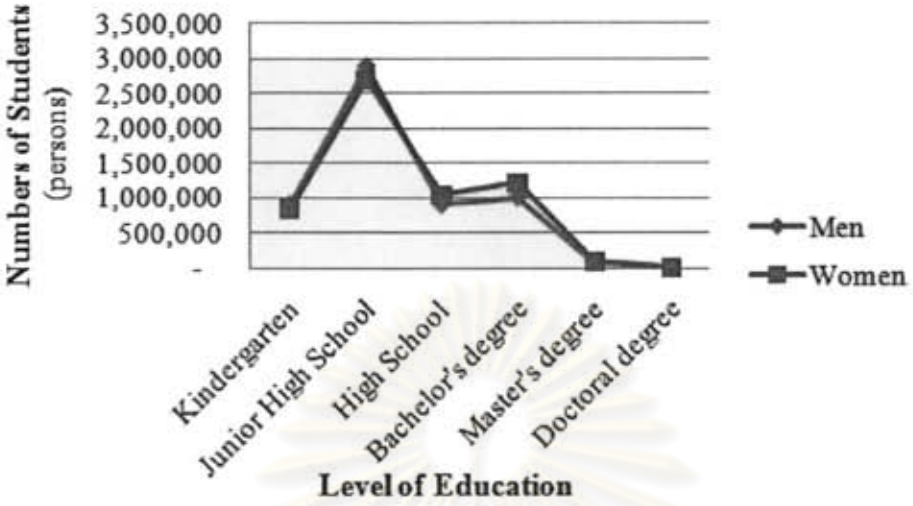

Figure2.1 Number of female and male students by level of education in Thailand

the labor force, they are overtly discriminated against on a daily basis. There is no law protecting women against discrimination in the workplace. One example was pointed out in a study on women working in the Thai mass communications industry. It was found that sexual discrimination highly impacted women's career development, and women in senior positions found themselves hitting the glass ceiling, not being recognized and adequately rewarded (Suriyasarn, 1994).

Thailand has experienced a lack of personnel and under-representation of women working in science and technology resulting in women becoming dissatisfied because their voices were not being heard in the workplace especially in construction companies.

Studies of women in construction in Asia are fewer than those in Western countries, where evidence has shown that factors that had direct and indirect influences on under-representation of women in construction were the image of the construction industry (Gale, 1994; Bennett et al., 1999; Fielden et al., 2000, 2001), career knowledge (Gale, 1994; Fielden et al., 2000; Agapiou, 2002), culture and working environment (Bennett et al., 1999; Dainty et al., 2000a ; Fielden et al., 2000), family commitments (Fielden et al., 2000; Agapiou, 2000; Lingard and Francis, 2005; Lingard and Lin 2004), male-dominated training causes, and recruitment practices (Fielden et al., 2000, 2001).

Construction sites are characterized by a high level of hard and heavy activity, dirtiness and working with machines. Based on these characteristics and conventional work culture, women are considered inappropriate for engineering careers (Powell, Bagilhole, Dainty, and Neale, 2004). In addition, traditional practices dictate that engineering careers are for men and there are more men in these occupations than in others. Most women are regarded as not having a true understanding of the jobs. They choose to become engineers because they find engineering careers prestigious and

trendy, but as they move along the career path, they become disappointed because they do not progress in their careers (Bagihole, 2003).

2.3 Non-Traditional Careers

According to a nonprofit organization named Family Economic Self-Sufficiency (FESS, 2003), non-traditional occupations (NTOs) are jobs that are often regarded as men's jobs. According to the Department of Labor of the US, an NTO is any profession in which less than 25 per cent of the workforce is women. The Internet System for Education and Employment Knowledge (ISEEK, 2003) Organization agreed with Luxton's view by commenting that it was a misconception that women were unable to do hard or messy jobs because many traditional women's jobs such as nursing babies and raising children could at times be very dirty, hard and messy.

Women working in construction companies help speed up economic development in many ways such as raising productivity and promoting use of resources in a more efficient way. In addition, women help bring about long-lasting significant social returns (UNDAF, 2000). There is a worldwide shortage of civil engineers to work in many construction projects, and according to ISEEK (2003), it is a misconception that women work in non-traditional careers because of economic needs.

Many researchers have suggested that as more women enter the non-traditional occupation labor force, they would behave more like men in their career development. Others have suggested that women's careers were different and would tend to remain so in the near future (Anna, Chandler, Jansen, and Neal, 1999). Reinhold (2003) stated that women should not wait for opportunities to come their way: they needed to open the window of opportunity by getting their skills seen and recognized. Droste (2003) noted that traditionally male-dominated fields were attracting more women. Her-Own-Words™ (2003) presented a series of videos showing women who were involved in building construction, engineering, architecture, welding, highway construction and many other non-traditional occupations, with great success.

According to Weiler (2001) opined about women's positions in the workplace by referencing a report by the National Association of Women Business Owners (NFWBO) of the US stating that 7.7 million women owned businesses, employed 15.5 million people and generated $1.4 trillion in sales. A study in the UK reported that there were an increasing number of women in construction, representing over 18% of the professional workforce (Dainty, Bagilhole, Ansari and Jackson, 2004). It can therefore be safely concluded that more and more women are getting involved in non-traditional occupations worldwide.

As stated in previous Chapter , the number of women graduating with civil engineering degrees has continuously increased over the past ten years (1999-2008), representing 48.5 per cent of all women engineers or when compared to men. The current percentage is 12.3 of all students graduating with civil engineering degrees with a high tendency to increase in the future. Statistically, Thai men and women are

given equal educational and employment opportunities, however, civil engineering careers are not being sufficiently studied for managerial benefits and career advancement of women engineers.

To enter a civil engineering program is not easy: higher scores than other fields of study are required, not to mention educational expenses and lab fees (Office of the Higher Education Commission (OHEC), 2008). Additionally, to graduate with a civil engineering degree requires a tremendous investment of money and time. It is a waste of time and national resources then for a female student to get a civil engineering degree and work as a civil engineer for a couple of months, then quit her job and shift to another career path. Average women engineers' participation in management jobs remains very low, with women significantly under-represented in senior positions (Hossain and Kusakabe, 2005). The country has not gained enough benefit from educational support for women studying civil engineering because they quit their jobs as civil engineers before long (Ogunlana, Rost, Robles, Kusakabe and Kelkar, 1993). Given the recent significant increase of women engineers in construction, it is high time women engineers be given job opportunities the same way that they are given educational opportunities so as to keep them in the construction industry and help develop the country.

2.4 Diversity Management

2.4.1 Diverse Roles of Civil Engineers

General roles of civil engineers in construction projects are planning and designing construction phases. They work closely with clients to update them on the progress of projects and other professionals, namely architects and contractors, and use a variety of computer software for modeling and designing purposes. They also perform feasibility studies for projects and are in charge of utilizing materials, equipment and labor in the most effective and efficient way. They also have to evaluate possible impacts of the projects on the environment and ensure compliance with health and safety legislation of projects. Finally, they solve problems that may occur along the way and try to achieve deadlines within pre-determined budgets (Exforsis, 2006; The community for civil engineering, 2009).

Considering diverse roles of civil engineers as mentioned above, allocating the right jobs to the right persons is important for a successful project. As the number of women civil engineers have increased over the past ten years, companies will benefit significantly from higher personnel performance derived from effective human resource management and proper job assignment (Mondy, 2010).

2.4.2 Importance of a Diverse Workforce

According to Brief (2008), a diverse workforce represents different perspectives of race and gender. However, at present, the mainstream research community in Thailand emphasizes solely gender because racial problems are negligible in Thailand. There is a need for a diverse workforce of civil engineers in construction in terms of gender because it brings about a healthier organization and encourages many productive activities such as brainstorming and creative thinking resulting in increased competitiveness and a stronger customer base (Parasuraman and Greenhaus, 1997). This research suggests that any organization placing importance on its staff's career success can benefit more from their skills. Another reason for which construction organizations should have a diverse workforce is so as to prevent a lack of skilled workers or a labor shortage in the UK, the USA and Canada in particular, the countries that influence the global construction industry (Menches and Abraham, 2007).

2.5 Women's Career, Career Success and Career Development

2.5.1 Women's Career

Career researchers (e.g., Mavin, 2001) argued that traditional careers in the fields of education, employment and retirement were based on working lives of men whilst women's careers progressed in a completely different pattern (Larwood and Gutek, 1987). According to Buffadi, Smith, O'Brien, and Erdwins (1999), experiences, roles, and relationships outside the work environment played an important role in shaping women's attitudes towards their work and traditional careers did not recognize that career flexibility such as career breaks to have children or care for dependents was important for women.

In addition, Sharifi, Findlay and Parker (1995) reported that organizations played an influencing role by reproducing and sustaining some structural difficulties confronted by women in the organizations, consequently resulting in their limited career options.

A study by Davidson and Cooper (1992) also revealed that during the past two decades, there had been a significant increase in the number of women who were pursuing managerial and professional careers, but that they hit a glass ceiling (Morrison and Glinow, 1990). This circumstance shows that, overall, women are ready and motivated to enter organizations and take on managerial and senior positions, but organizations provide them with no room to grow professionally.

2.5.2 Career Success

The concept of a career was defined by Schein in 1978 as a set of stages reflecting an individual's needs and motives in relation to work, and society's expectations from an individual's activities that will result in monetary rewards and

promotions for that individual. Hence, careers reflect both individuals' and society's definitions of activities in their work life.

A factor analysis revealed five aspects of the meaning of career success: status, time for self, challenge, security, and society. Maanen and Barley (1984) stated that people tried to find success in their careers by identifying themselves with their relevant work-related communities that shared similar work experiences and made them feel that career advancement or success they had achieved was meaningful.

2.5.3 Career Development

Various definitions of career development have been suggested by many researchers and schools of thought looking at career development both from an individual point of view and an organizational viewpoint. From the school of human capital's position, career development is the result of human capital expense and each individual has a unique assets and skills such as time, effort, education, and personal characteristics. How much one succeeds in their career depends on how much capital one spends on the job (Davidson and Cooper, 1992).

On the other hand, the structural school of thought holds that career development is the result of organizational structures and processes, and career success is dependent on intrinsic factors of organizations such as cultures, systems, processes and policies (Kirchmeyer, 1998).

Furthermore, Decenzo and Robbins (2003: 281-284) wrote in their book about the career stages defined by Super (1957). He proposed a five stage model that is generalizable to most people during their adult years, regardless of the type of work

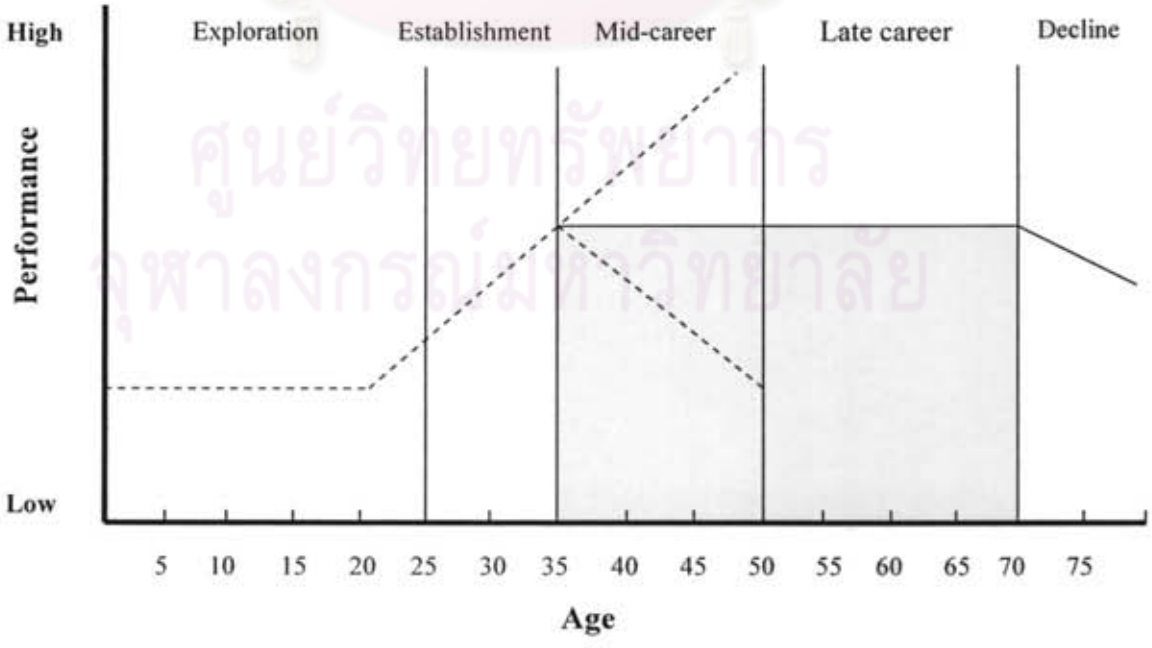

Figure 2.2 Stages in career development (Adapted from Super, 1957)

they do. The five career stages consist of exploration, establishment, mid-career, late career, and decline.

2.6 Women's Careers in Construction

Even though construction is one of Thailand's largest industries in terms of GDP proportion and the number of people involved, empirical research into the nature of this highly complex labor market has not been sufficiently conducted resulting in a lack of information of how to manage staff in construction organizations. As cited by Fielden et al. (2000), people working in construction could be categorized into two groups: managers and professionals; and labor.

Professional women are under-represented in this industry (Gale, 1994; Khazanet, 1996; Dainty et al., 2000a, b; Fielden et al., 2000, 2001). Women generally prefer to work in office environments. Besides, most women are employed to work in supportive or non-professional positions such as secretaries and clerks. Women's under-representation in construction was due to the nature of the industry, i.e. geographical instability, long work hours, extreme weather conditions, short-term projects, and male-dominated culture.

A major difference between construction and other industries is the products. Typical companies such as textile manufacturers or automotive companies have fixed manufacturing plants whereas construction companies have buildings as their products and move their workplace on a project-by-project basis. This mobile characteristic of the construction industry is beneficial to the country because it stimulates the local economy and generates income for local people. Civil engineers are in high demand in Thailand, a developing country with infrastructure needs (Hossain, 2007). Unfortunately, only a small number of civil engineers are produced each year. A recent report by the Thailand Research Fund revealed that the percentage of women graduating in engineering from all universities in 2008 was 12.3 per cent, a 111 per cent increase from 2003. Even though the women-to-men civil engineer ratio is apparently increasing, women engineers remain under-represented in construction.

Dainty, Neale, and Bagilhole (1999) did a study in the UK entitled "Women Careers in Large Construction Companies: Expectations Unfulfilled?" The study pointed out a hostile and discriminatory environment for women and pressures created by the demanding work environment combined with resentment from male managers and colleagues. The authors argued that women were unlikely to progress unless the male culture was decreased. Bagilhole (2003) found that women had problems in career progression compared with men and the problems existed for women at every career stage. This resulted in women finding themselves approximately at one level below their male counterparts with the same qualifications.

Chandra and Loosemore (2004) explored self-perceptions of women in construction by comparing them to female self-perceptions in other male-dominated and female-dominated industries. They provided more information for managers who

had the responsibility to reverse the current trend of under-representation of women in the construction industry. In 2003, Everson explored women's perspective of career progression in the USA through online questionnaires. Her result was similar to that of Dainty et al. (2000a). Both studies revealed that women thought of their careers as different compared to those of men; women chose construction without any reservations and they would attempt to do anything in order to accomplish their work in construction. In addition, construction is considered one of the industries where women are under-represented due to many factors such as unpleasant conditions of construction sites, long work hours, adverse weather conditions, unsettled workplaces and short-term work (Arslan and Kivrak, 2005). Lack of role models is another reason for which women are excluded in the industry, especially at the management level (Fielden et al., 2001). Furthermore, researchers found that besides under-representation, women in construction generally occupied the secretarial, clerical, and human resources positions. It can be said that Thai culture does not see the value of women and deems that business conflicts are better managed by men.

Dainty et al. (2000a) did a study in the UK and found that fairness in construction was not well balanced because managerial positions were usually assigned to men rather than women. Women are often responsible for supportive and office-based work to avoid long work hours and geographical instability. Unlike men, women had difficulties balancing work and responsibilities at home because they had to work outside their houses and take care of household work. Consequently, women often do not stay for a long time in an organization while men could enjoy success and advancement in the organization. Thus, men seem to be more loyal than women to their organization. It was further found that there had been various pressures from the recent recession which caused shifts in organizations, i.e. downsizing, reorganization, etc. Women viewed this as development in their careers while men viewed this as a setback in theirs. Bessler (2006) raised the question: "What is the experience of being a woman in construction management?" in her Ph.D. thesis and found five primary themes in her research: opportunity, communication, caring, being on site and working in a changing industry. She explored definitions of the following terms that are significant to the construction experience: 1) appreciation, 2) pride, 3) satisfaction, 4) knowledge, 5) humiliation, 6) voice, 7) style, 8) stress, 9) caring, 10) teamwork, 11) integrity, 12) family, and 13) changes.

The health and safety of women in construction is a vital issue to be considered if construction companies want to attract more women to work in their organizations. Loosemore and Waters (2004) studied gender differences in occupational stress among professionals in seven large international construction companies and found that the factors that caused most stress for women were opportunities for personal development, salaries, problems keeping up with new ideas, business trips and minor jobs. On the other hand, men experienced slightly higher levels of stress than women. They appear to suffer more stress in relation to risk taking, discipline, mistakes,

redundancy and career progression. These differences reflected women's traditional and continued under-representation in the construction industry.

Despite the presence of safety standards in construction work, construction sites are still considered hazardous zones. For example, a study by Sullivan, Dunlop, Englund, and Frankowski, 2002 reported that in 2001, 20.3 per cent of all work-related deaths among workers were in construction. The number of non-fatal injuries in construction was at a high level compared to that of other industries. There are a number of reports on employee absence due to non-fatal injuries and illnesses. Welch, Goldenhar, and Hunting, (2000) did a study in the USA and found that causes of death were different for the women and men. They also found that the death toll of women falling from high places was lower than that of men but the death toll of women involved in motor vehicle crashes and homicides on the job were higher than that of men and the average age of female fatalities was 35, and that of male was 46. When many factors including material and equipment sizes, unclean facilities, stress and mental health issues from sexual harassment, verbal abuse by co-workers, personal protective equipment (PPE) designed for men and the lack of occupational health training were taken into account, it can be concluded that careers in construction were traditionally reserved for men and can cause great danger for women. Previous studies also found that safety problems of women in construction were not just physical injuries. Monahan (1988) conducted a study in the USA and found that women in large projects often had mental health problems derived from sexual harassment and social isolation they experienced on the job. These two issues are critical because they put women under great pressure.

2.7 Women's Career Progression in Construction

A study in the UK (1989) predicted that there would be a skill shortage at the professional level in the construction industry (Harris Research Center, 1989). In response to this potential shortage, in 1995, the UK government initiated incentive campaigns to encourage women to work in construction. Consequently, in 1999, the number of women engineers had significantly increased. However, according to the study by Dainty et al. (1999, 2000a), even though women had easier access to the construction industry thanks to government's campaigns, they found themselves landing on careers filled with problems and obstacles to their advancement while their male counterparts thrived in their professions. In this same study, career movement of women professionals compared to that of men professionals were studied. It was found that during the first twelve years of their careers, women professionals had less advancement than men professionals. However, when they were over 35 years old, they moved to a higher level at a faster pace. Factors negatively influencing women's career progression were work/family conflicts and explicit discriminatory actions by their male coworkers. It was also found that the structural and cultural environment in construction had forced women to choose either 1) to confront barriers to their

careers, 2) to conform to male-dominated workplaces, 3) to leave their organization, or 4) to leave the construction industry. Recommendations from this research are that attitudes toward women's performance should be changed and work/family-friendly policies should be developed to recruit and retain a diverse workforce. Later in Australia, in the study by Lingard and Lin, 2004, a work/life balance of industrial professionals was studied and it was found that women had more work/life conflicts than men resulting in their career under-achievement.

In addition, in 2006, Dainty and Lingard concluded that hindrances to career progression of women engineers were discrimination, sexual harassment, and work/life conflicts, all of which derived from the fact that the construction industry was a male-dominated sphere. In the past, most men worked outside the home and left all the house work to women. Therefore, work conditions were designed to exclusively suit men's conditions: long work hours, holiday working, long distance and geographical instability. There has been no flexibility in construction, shift exchanges, work sharing or options of working near the house. As a result, it is difficult for women to succeed in the construction industry (Lingard, 2004).

Another study by Dainty et al. (1999, 2000a) found four obstacles to career achievement of professional women: 1) organizational culture favoring men; 2) culture emphasizing skills women do not possess; 3) male-oriented cultural values and explicit discrimination against women; and 4) limited options for women such as shift exchange and job rotation. Khazanet (1996) argued that women's under-achievement in construction was due to their inability to balance their work and family responsibilities, and working as an engineer is a fulltime job with an unpredictable work schedule.

In 1996, Khazanet, in the US, did a study on female engineers' work conditions and guidelines for solving problems they faced to bring about greater recognition and promotion, and subsequently to keep down turnover rates of those with valuable experience. In 2001, in order that construction companies were aware of their women engineers' important roles, Yates suggested ways to recruit and retain female engineers, which are retention of senior female engineers regarded as role models and preparation of mentors and neutral persons to listen to and give professional consultations to female engineers.

Later in 2007, Menches and Abraham, proposed guidelines for all involved parties supported by professional associations, labor unions and universities to promote women in construction in order to meet future demand. However, much previous research of women in construction, particularly in Western countries such as the USA and Australia, seem to try to solve skill shortages, equality of opportunities and diversity in this workplace (Dainty et al., 1999, 2000a, 2001. 2004; Yates, 2001; Fielden, 2000, 2001; Briscoe, 2005; Clarke and Gribling, 2008).

There have been a large number of foreign studies of the obstacles to career advancement of women in construction. Over the past 15 years (since 1995), the issue of professional and skill shortages has been in focus in many developed countries

including the US, the UK, EU countries and Australia. As a result, there have been an increasing number of women entering the construction. Additionally, the hierarchical style emphasizing teamwork in project development has attracted more women as well as men to work in the industry. The study in the UK by Dainty et al. (2000a) showed that teamwork or project-based work proved beneficial for women because teamwork involved cooperation, coordination and communication, which are women's strengths (Hossain and Kusakabe, 2005). Teamwork seems to give women more job opportunities at least at the junior and middle management levels (Metcalfe and Linstead, 2003, Dainty and Lingard, 2006).

Another study showed that women were able to get promoted with the support from their organizations, which had policies in favor of high-potential employees, social support and mentoring programs for women employees (Burke, Rothstein, and Bristor, 1995).

2.8 Women Engineer's Career Barriers in Construction Careers and Turnover

Bagilhole et al. (2000) noted that construction sites in the UK were predominated by male culture and discrimination against women. This explained high turnover rates of women employees in construction companies. Studies by Lingard and Lin (2004) and Lingard and Francis (2005) in Australia about work-life conflicts of female and men engineers found that female engineers were more encumbered with work outside the home and household responsibilities. This was because of their social and cultural environment. Also, ever-changing construction conditions required their fulltime attention and labor. As a result, female engineers scored higher than their male counterparts in terms of work-life conflicts and turnover rates.

Construction companies have to allocate large budgets for recruiting and training new engineers. Training for new engineers also required a large amount of budget. Any time when those engineers leave them, construction companies lose a lot of valuable knowledge and experience. Along with the above-mentioned turnover rates of women engineers, this has led to various studies on women civil engineers. According to a study by Loosemore and Waters (2004) in Australia, it was found that turnover rates of female engineers were higher than those of men engineers in Australian construction companies. A study by Fielden et al. (2000, 2001) and Dainty et al. (2000a, b) found that in the UK, women engineers quitted their jobs because they did not find the career achievement that they had pursued. It was further reported that turnover rates of engineers in the construction industry translated into significant losses of money for construction companies. Employee turnover can have an adverse impact on organizational effectiveness. This is particularly true for experienced or competent employees (Lingard, 2004). A study in the US (1997) found that over the past ten years, construction companies had invested at least $600,000 in engineer hiring including training, recruiting, salaries and rewards (Lingard and Francis, 2004).

If turnover rates of women engineers could be kept low, expenses related to the issue would definitely decrease.

These studies went on to explore the problems and obstacles to career advancement of women civil engineers in construction. Sources of the problems are organizational culture and structure, work practices, nature of work and other factors derived from organizations (Dainty and Lingard, 2006; Fielden et al., 2001; Lingard and Lin 2004).

In 1994, Gale's research in the UK construction industry found that construction is a male-dominated sector filled with conflicts, crisis and barriers to women's career progression. According to the studies done by Dainty et al. (2000a, b) and Fielden et al. (2000, 2001), an information gathering from women engineers working in the UK construction industry indicated that women engineers were discriminated against and excluded from career advancement because of the male-dominated nature of the industry. Women were given small jobs, keeping them progressing slowly in their workplaces and their pay rises lower than that of their male counterparts.

In addition, sexual harassment in the organizational culture in this male-dominated work field caused them to feel isolated unless they could adapt themselves. In 2006, Dainty and Lingard made a conclusion that women engineers in the construction industry had different problems from their male counterparts such as indirect discrimination, sexual harassment and work-life conflicts, which were the main obstacles to their career progression. Two main causes of the problems can be explained as follows.

2.8.1 Nature of Construction Fieldwork

Construction has been perceived as one of the most difficult types of work. Most construction projects are complicated, time-consuming, unique and fast-moving (Oglesby, Parker and Howell, 1989). Therefore, they required a wide range of specialized services (Clough, Sear and Sears, 2000). Projects are developed one after another. Consequently, there are few repetitions and few second chances to learn from earlier mistakes. In addition, fast-paced work schedules, various designs and viewpoints, and several parties involved make it even more difficult to do.

Each particular project usually starts with a conceptual design followed by design, procurement and construction. A variety of specialists are required at each stage, so construction projects normally involve several parties such as financial organizations, government agencies, engineers, architects, lawyers, insurance companies, contractors, material manufacturers and suppliers, and building trading agencies.

Long work hours of construction work creates work-life conflicts for women (Lingard, 2003). A study in the US by Sullivan et al. (2002), found that the average work hours in construction were 4-5 per cent more than those in other industries. Women in construction consider long work hours as part of their work

culture and they should take full responsibility regardless of their individual circumstances (Bagilhole et al., 2000).

2.8.2 Construction Organizational Culture

A number of writers (Newman, 1995; Schein, 1992) described culture as having different layers. Schein (1992) described three levels of culture: 1) human inventions including behavior, processes and physical objects; 2) values such as mission statements and policy documents; and 3) ambiguous assumptions, which sometimes are in conflict with the values and with each other. This framework can explain unequal opportunities for women in organizations. Companies with women-unfriendly policies may be exposed by women's lack of progress compared to their male colleagues. Attitudes about gender and behavior in organizational culture are generally unfriendly to women and hinder their progress (Wilson, 2005). One person can influence the recruitment and promotion of another person with similar qualifications in terms of sex, social, background and education (Kvande and Rasmussen, 1993). The pursuit of self-interest and power is a basic process in all organizations, and should be viewed as a political system. After an overview of organization culture, the following is a description of the male-dominated culture of the construction industry.

The construction industry displays a male-dominated culture where relationships are characterized by arguments, conflicts and crises (Gale, 1994). As a result, women and men employees find themselves in a very unfriendly environment. Women in construction face the same stereotyping problems as women in other sectors. In this profession, stereotypes are added by the nature of the career and the people working in this profession (Langford, Hancock, Fellows, and Gale, 1994). Women who work in construction tend to be in technical specialist positions rather than general managerial positions (Bennett et al, 1999).

Women in construction admitted that most male-dominated environments were worsened by sexual harassment (CIB, 1996). Professor Michael Romans, a former president of the Chartered Institute of Building, stated that the construction industry was "a boy's own culture sustained through language and behavior." Davey, Davison, Gale, A., Hopley, and Jones (1999) pointed out that in construction, male values such as long work hours, competition, independence, full-time working, and rewards and expectations were major factors of career achievement. Davidson and Cooper (1992) indicated that women who wanted to enter the male-dominated culture either had to act like men in order to be successful, leave if they could not adapt to the culture, or remain in the industry without behaving like men but maintaining unimportant positions.

The nature of construction site-based work causes many problems to women as follows.

1) Discrimination

A study in the US found that since women were under-represented in this industry, they lack the opportunity to train and receive less attention in an organization (Sommerville, Kennedy, and Orr, 1992). Moreover, women are given unimportant responsibilities or unclear work scopes compared men, so they cannot perform. Consequently, they received lower salaries than men (Fielden et al., 2000, 2001). Amaratunga et al. (2005) conducted a study in the UK and found that women experienced discrimination in many aspects such as in recruitment practices and male-dominated training courses, and had work-related problems such as long work hours, working in remote places and geographical instability. In 1994, Gale conducted a study in the UK on discrimination in recruitment practices and found that these practices made it difficult for women to enter the construction sector. Women in US studies were also found to be less satisfied in this industry (Yates 1993, 2001). Bagilhole et al. found that discriminatory behavior at the management level clearly existed because women were most often subordinates. Furthermore, Fielden et al., 2000 and Dainty et al., 1999 found that the absence of role models also caused discrimination in the construction industry. Both studies were conducted in the UK.

2) Work-family conflict

Women's family responsibilities greatly affected their professional advancement. Their roles as mothers had different impacts on their careers compared with men's roles as fathers. Men seem to have more organizational and cultural support when it comes to career achievement while women appear to be at a disadvantage because they have childcare and family responsibilities as their primary roles. These conflicts caused career obstacles and dilemmas for women engineers (Evetts, 1996).

To make the matter worse for women, organizations are unfriendly towards family responsibilities resulting in women having work-family conflicts (Sposito, 1993). A recent study by Higgins, Duxbury and Johnson (2000) revealed that while women still had family duties as their primary responsibilities, both men and women needed to balance the demands of work and family. One example can be found in the report from the Australian Bureau of Statistic, 2003, where it was found that mothers were more likely than fathers to take a leave of absence from work to care for a sick child. Therefore, women are more likely to face conflicts between work and family in a working environment with long work hours like construction (Gutek, Searle, and Kelpa, 1991).

Women's motivation in construction careers was further reduced when they could not find the right balance between work and family life. Similarly, in 1993, a work options survey done in British Columbia, showed that 17 per cent of women surveyed stated that they quitted their jobs temporarily or permanently because their jobs did not offer them flexible work options (Dainty et al., 1999). Nonetheless, the main reason for women quitting their jobs was childcare (MacDermid, Lee, Buck and Williams, 2001; Maddock and Parkin, 1994).

Greenhaus and Beutell (1985) stated that work demands conflicted with family demands. Work-family conflicts have always been linked to negative outcomes for individuals, families and employing organizations. Moreover, Lingard and Francis (2005) stated that work interference with family life has been associated with job dissatisfaction, career dissatisfaction, and intention to quit (Lingard and Francis, 2005, 2007). Martins, Eddleston, and Veiga (2002) also reported that work-family conflicts had a strong negative relationship with career satisfaction among women throughout their working lives but they only adversely affected men's career satisfaction when they were 40 or more. This may be because men appeared to be more willing to give up their personal lives to their work than women (Lingard and Francis, 2005).

Work-family conflicts are common experiences for women, especially when organizational culture is in favor of men than women (Mavin, 2001). For example, a recent study in the UK reported that women managers in male-dominated companies with long, rigid work schedules had more difficulty in balancing the demands of work and family than women in other companies (Lingard and Sublet, 2002). Construction working practices seem to come from traditional male-dominated careers that favor long work hours and high commitments. Women who find that they cannot fully comply with these practices feel they do not belong there and did not want to join the industry (Dainty and Lingard, 2006). Empirical evidence revealed that companies with rigid work hours had difficulty in attracting employees who would like to enjoy both work and family lives (Ramussen, 1993; Radchawong, 2006).

Orthner and Pittman (1986) reported that family-friendly policies increased organizational commitment. However, family-friendly work is not often seen in construction. Previous studies, both in the UK and Australia, revealed that construction companies did not provide flexible work policies apart from those stated by law. As a result, employees, especially female employees, were faced with work-family conflicts and not committed to their organizations (Lingard and Francis, 2005).

Work practices in construction designed by men who originally dominated the sector included long, rigid and uncertain work hours, working in remote places and geographical changes. This caused work-life conflicts for women and influenced their levels of commitment to the companies they worked for. Lingard and Lin (2004), Lingard (2005), Lingard and Francis (2005) conducted studies on work-family conflicts in Australian construction companies. They stated that women had more work-family conflicts than men. Khazanet (1996) did a study in the US suggesting that there was an imbalance between work and family responsibilities. The researcher proposed several solutions for this problem such as a family-friendly program for women and men employees that helped construction organizations attract and retain men and women with family responsibilities. In addition, a UK study found that women began their careers with mindsets different from men. Workplace environments were more important to women students than men students. Women

students considered work conditions one of the motivations for career choices. The researcher also suggested brainstorming activities to bring forth changes in order to reduce conflicts, attract women to work in construction and build a good working climate for a diverse workforce.

3) Sexual harassment

Construction is not familiar among women because they do not want to be surrounded by men and may feel threatened by sexual harassment. Bagilhole et al. (2000) found that women working in this sector had problems of sexual harassment, verbal abuse, offensive behavior, etc. Furthermore, Welch et al (2000) did a study in the US and found that women who faced sexual harassment might suffer from some mental illnesses that might impact their work and performance. Women engineers faced more unsafe conditions than women in other industries such as working with motor vehicles, at high and underground levels, working at night and in remote places (Fielden et al., 2000, 2001; Bagilhole et al., 2000; Bagihole, 2003; Bagilhole and Woodward, 1995).

Asaforemention, there is a lack of studies about women civil engineers in Thailand even though there are an increasing number of women civil engineers in construction. Nonetheless, their work-related problems seemed to limit their full exercise of their capacities and skills. All information gained at this step will be used to develop the hypothese and conceptual framework of this dissertation presented in Chapter 4.

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Chapter III
Research Methodology

3.1 Introduction

This chapter describes research methodology used in this research including datacllection and analysis techniques. Details are described as follows.

3.2 Type of Research

The research is a combination of exploratory and explanatory approaches (Nueman, 1994: 19-20).

An exploratory approach was conducted to identify:

- Experiences and problems of women engineers in contractor careers;
- Outstanding characteristics of women engineers in construction;
- Suitable roles of women civil engineers in the construction industry.

An explanatory approach was conducted to identify:

- Experiences of female and men engineers working in contractor companies compared to those working in non-contractor companies;
- Demographic variables, work characteristics and organization factors influencing problems of women engineers in non-traditional careers;
- The relationship between problems of women engineers in non-traditional careers and turnover intention.

3.3 Research Design

A research method, as part of the research methodology, is related to data collecting tools or techniques such as questionnaires, interviews, case studies, oral histories, etc. Presently, many scholars advocate the use of both quantitative and qualitative research tools, possibilities and problems of research relations, and strategies of developing a more inclusive methodology. This research covers a variety of topics such as women engineers' careers, a fuller and more accurate account of superiors, colleagues, their subordinates and workplace environments. By the same token, a qualitative research method is important in a sense that it explores experiences, individual reflections, practices and interactions of engineers in their workplaces. Both qualitative and quantitative approaches are, thus, included in this study. Qualitative data are useful for exploring experiences of women and men while quantitative data enables researchers to obtain clear-cut answers to carefully-bound questions. Quantitative research tells researchers what happens while qualitative research contextualizes findings such as individual perceptions of career

advancement, work difficulties, obstacles in non-traditional careers for both men and women.

This study is conducted as a case study to reveal the complex nature of different dimensions of knowledge of individuals as well as organizational environments. In order to understand women engineer's circumstances in the Thai construction industry, in-depth interviews with female and men engineers in contractor companies were conducted to gather relevant data, a step called a pilot study.

After the data from the pilot study was analyzed, hypotheses and objectives of this research were established. Then, men and women engineers' experiences and women engineer's problems in the construction industry were identified by means of questionnaires and in-depth interviews. The next step was to identify the relationship of women engineers' problems in non-traditional careers and influencing factors, namely demographic variables, work characteristics, and organization factors, and the relationship between the problems of women engineers in non-traditional careers and their turnover intention. (See Table 3.1)

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Table 3.1 Summary of themes separated by research stages and objectives

Stages/Objectives	Methods	Themes	Respondents
Pilot survey	Both qualitative and quantitative	- Specifying women engineer's perceptions of career advancement in the Thai construction industry and most common causes of women engineers' turnover	Women engineers
		- Specifying the most common roles of civil engineers in the Thai construction industry	Both women and men engineers in contractor firms.
Objectives			
1. To explore experiences and problems in non-traditional careers and to clarify factors affecting women's engineers' problems and implications to turnover	Both qualitative and quantitative	- Exploring the experiences about career advancement, difficulty, problems in non-traditional career	Men and women engineers
		- Comparing men and women engineers about turnover rate and causes of turnover	Men and women engineers
		- Identifying influencing factors of problems in contractor career confronted by women engineers: demographic variables, job-related variables and organization factors	Women engineers
2. To identify outstanding characteristics	Qualitative	- Identifying outstanding women engineers' characteristics in the contractor companies	Men superiors, peers, and subordinates of women
3. To identify suitable roles of women engineers	Both qualitative and quantitative	- Specifying civil engineering roles in contractor organization	Company owners, superiors of women engineers
		- Specifying career path for each role in the organization structure	Company owners, superiors of women engineer
		- Identifying the suitable roles of women engineers in the contractor companies	Companies owners, superiors of women engineers and senior women engineers

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3.4 Instrument Development

The literature review and the data gathered from the pilot study were employed to conduct semi-structured interviews and questionnaires, which had been validated by experts in construction. Reliability was tested before data were collected. The questionnaire contained both close-ended and open-ended questions regarding respondent's demographic characteristics, work characteristics, organizational characteristics, and professionals' problems in construction companies. Opinions on suitable roles for women engineers were also discussed. Supplemental information from the semi-structured interviews including career advancement, career path guidelines, career difficulties, problems in non-traditional careers, perceptions of working for progression in civil engineering careers and women and men engineers' turnover were also obtained.

It is essential to point out that this study focuses on women engineers' experiences and problems because of their non-traditional careers in the construction industry and the researcher tried to approach it from the women's standpoint. Throughout history there has been a lack of research on women engineers in the Thai construction industry. Main problems of women engineers' turnover emerging from the literature reviews and pilot study include discrimination, work-life conflicts, sexual harassment and satisfaction of career progression. To effectively examine connections among the problems, the questionnaires were designed to cover these variables.

Part 1: Personal/Individual Information: age, work hours, family responsibility, site work experience, tenure, promotion, and salary increases

Part 2: Work characteristics: fieldwork hours/week, going upcountry, uncertain work times, and male domination

Agree to the highest level	=	5	scores
Agree to a high level	=	4	scores
Agree to an average level	=	3	scores
Agree to a low level	=	2	scores
Agree to the lowest level	=	1	scores

Part 3: Organizational characteristics: work value, support from superiors, training and development and gender diversity climate. The organizational characteristics were measured by adapting a questionnaire by Mor Barak et al. (1998). There are seven questions. All questions have answers in a 5-score scale described as follows.

Highly agree	=	5	scores
Agree	=	4	scores
Neutral	=	3	scores
Disagree	=	2	scores
Strongly disagree	=	1	scores

Part 4: Problems of Working in the Construction Industry: The questions use a 5-score and 7-score Likirt's rating scale as follows.

1) Discrimination in workplace was measured by 4 questions. The answers for the questions are in 5-score Likirt's rating scale as follows.

Highly agree	=	5	scores
Agree	=	4	scores
Neutral	=	3	scores
Disagree	=	2	scores
Strongly disagree	=	1	scores

2) Work-life Conflicts are measured by a work/family conflict scale adapted from a questionnaire by Stephen and Sommer (2002). There are 14 questions. Seven-scores in the scale can be described as follows.

Highly agree	=	7	scores
Agree	=	6	scores
Somewhat agree	=	5	scores
Neither agree nor disagree	=	4	scores
Somewhat disagree	=	3	scores
Disagree	=	2	scores
Strongly disagree	=	1	scores

3) Sexual Harassment is measured by a sexual harassment experiences questionnaire (Frequency of Sexual Harassment at Workplace, 1988) adapted from Urdu. There are 11 questions. Scores in the scale can be described as follows.

Frequently, if not always	=	5	scores
Fairly Often	=	4	scores
Sometimes	=	3	scores
Once in a while	=	2	scores
Not at tall	=	1	scores

4) Satisfaction of Career Progression with three questions is adapted from Greenhaus et al., (1990). Scores in the scale can be described as follows.

Highly agree	=	5	scores
Agree	=	4	scores
Neutral	=	3	scores
Disagree	=	2	scores
Strongly disagree	=	1	scores

5) Turnover Intention with three questions is adapted from Lingard (2003). Scores in the scale can be described as follows.

Frequently, if not always	=	5	scores
Fairly Often	=	4	scores
Sometimes	=	3	scores
Once in a while	=	2	scores
Not at tall	=	1	scores

The steps below were used to translate points into measurement values. Scores are averaged and divided into different ranges, each of which gives a different meaning. With the use of mathematic principles, the seven-score scale was first changed into the five-score scale and calculated following these steps.

1) Classify scores of questions from each obstacle.
2) Find a score range: $= \frac{\text{maximum score} - \text{minimum score}}{\text{Number of ranges}}$

Example Score range $= \frac{5-1}{5}$

$= 0.80$

Scores are classified into five ranges.

First range	Average Value 1.00 – 1.79	meaning the respondents have lowest problems.
Second range	Average Value 1.80 – 2.59	meaning the respondents have low problems.
Third range	Average Value 2.60 – 3.39	meaning the respondents have an average problems.
Fourth range	Average Value 3.40 – 4.19	meaning the respondents have high problems.
Fifth range	Average Value 4.20 – 5.00	meaning the respondents have highest problems.

Part 5: Roles and responsibilities promoting women engineers' career progression: the statistics used to analyze data are frequency, percentage, mean and standard deviation.

Scales were used according to the recommendations of their developers. Thus, some scales had five point responses while one had seven. It is essential that standard protocols are used because changing response options can threaten the validity of the scale.

3.5 Instrument Reliability Testing

The improved version of questionnaires was used in a tryout where 35 women civil engineers working in construction participated. The acquired data was checked and scored according to the criteria. After that, statistical values were identified to test the reliability of the questions of problems in non-traditional careers. Cronbach's coefficient-α was selected to measure the instrument's validity. The calculating formula is:

$$\alpha = \left[\frac{n}{n-1}\right]\left[1-\frac{\sum S_i^2}{S_t^2}\right]$$

where α = coefficient of instrument

n = the number of questions in the instrument

S_i^2 = variance of each question's score

S_t^2 = variance of each question's score

According to the testing, Cronbach's alpha coefficients of the questionnaire are found at 0.775. Details of each part are as follows.

3.6 Reliability and Completeness of Data

3.6.1 Secondary Data

Secondary data was collected from government institutes' reports, annual reports, published books, published documents, statistics, journals, previous studies, Internet sources, etc. Primarily, it was used to analyze profiles of women engineers in the construction industry and classify construction companies in Thailand into different groups. Then, it was used to analyze literature gaps and identify problems confronted by women in non-traditional careers.

3.6.2 Primary Data

Primary data was directly collected from respondents through case studies, in-depth interviews and questionnaires. In the first interview scheduled, data was gathered from women engineers, women engineers' male superiors, male peers and male subordinates. A flash drive was used to record all interviews. The data derived from this pilot survey step was used to revise the questionnaire and the semi-structured interview that was conducted based on the literature review. After that, the revised questionnaires were used to gather data from 35 women engineers in contractor companies for the purpose of reliability testing. Finally, the final version of the questionnaires was completed and used to gather data from women engineers working in the Thai construction industry. Additionally, the researcher conducted in-depth interviews in person with both women engineers and men engineers. Interview sessions with men and women employers/representatives were also conducted in person by the researcher. Each session lasted one to one and a half hours. In some cases, the interviews were divided into two sub-sessions. The language used in the interviews was Thai. The interviews were recorded on a flash drive and transcribed. Then the acquired transcripts were read repeatedly and prepared for inductive analysis. Throughout this process, data was gathered in a manner that ensures participants' confidentiality and anonymity.

3.7 Sampling Design

One of the major goals of the sampling design was to ensure that the selected sample represented the whole population. Probability sampling techniques can provide confidence that any study is representative of the population, and sampling bias is eliminated since samples are drawn using random selection techniques (Cooper and Schindler, 2001). In order to use probabilistic random sampling, data on the population or a population list is needed. Unfortunately, there is no updated list of women engineers in the Thai construction industry. Thus, it was not possible to have an exact sampling list of women engineers working in the Thai construction industry. Therefore, a non-probabilistic sampling incorporating snowball technique was adopted to select qualified women engineer respondents. Nueman (1994) also explained that this technique was a direct and indirect data collecting technique in which the first respondent gave new leads for the researcher to further collect information until sufficient information is processed into data for analysis.

Table 3.2 Profile of informants

Type of Business	**Gender**				**Total**
	Women (Person)	**%**	**Men (Person)**	**%**	**(Person)**
1. Contractor Companies	57	55	47	100	104
2. Construction Management Companies	4	4	0		4
3. Consult Design & Supervision Companies	2	2	0		2
4. Consult Design Companies	19	18	0		19
5. Developer Companies	14	13	0		14
6. Supplier Companies	8	8	0		8
Total	**104**	**100**	**47**	**100**	**151**

3.8 Area of Study

As most large- and medium-sized contractor companies and non-contractor companies are located in Bangkok, it was selected as research area for this study.

3.9 Data Collecting Process

3.9.1 Pilot Study

3.9.1.1 The researcher contacted interviewees via the phone and met them in person on the dates agreed upon.

3.9.1.2 Appointment Date: the researcher submitted letters requesting data collection to contractors with prior appointments including five large companies and three medium-sized companies in Bangkok.

3.9.1.3 The researcher interviewed 12 women engineers.

3.9.1.4 While conducting the in-depth interviews, the researcher used an interview guide and observed postures, tones, characteristics of the interviewees and the work atmosphere and surroundings.

3.9.1.5 At the beginning of each interview session, the researchers asked for permission from the interviewees to record information onto a recorder and the researcher wrote down the content of the interviews. The interview was conducted in a casual and informal manner. Before each interview session, the researcher explained the objectives of the research and the data collection. Each interview session lasted between 30-90 minutes.

3.9.1.6 Data were summarized and considered from two perspectives: women's and men's. In order to maintain confidentiality, interviews were conducted anonymously throughout this research.

3.9.2 Final Data Collection

3.9.2.1 Data collection in this phase was done by the researcher and two staff (see Figure 3.1).

9.9.2.2 The researcher made appointments with respondents via phone and submitted letters requesting to conduct an interview and gather information.

3.9.2.3 The researcher gathered information using questionnaires and the semi-structured interview in the companies where women engineers worked. Each interview session lasted approximately 30-60 minutes. At the end of each session, the researcher asked the women engineers to give references of men engineers to whom the researcher could ask for opinions about the presence of women engineers in their workplaces. Each interview session lasted approximately 30-60 minutes. (Interviews with men engineers were conducted in contractors companies only.)

3.9.2.4 Out of all the respondents, 57 completed questionnaires from women engineers in contractor companies, 47 complete questionnaires from men engineers in contractor companies and 47 questionnaires from women engineer in non-contractors were received. (The data collecting process starting from the pilot study was initiated in July 2008 and completed in December 2009.) Details of the interviewees are shown in Table 3.2. In order to maintain confidentiality and eliminate bias, anonymous informants and informants' companies were used throughout this research.

3.9.2.5 All questionnaires from women civil engineers were checked and 57 questionnaires were found applicable.

3.9.2.6 Applicable or complete questionnaires were coded onto a coding sheet. Then data were recorded onto a computer by the Statistical (SPSS) program.

3.9.2.7 Using 360 degree feedback interview, 24 engineers comprising of 3 men supervisors and 3 women superiors, 13 men colleagues and 5 subordinates of women engineers at the company of the interviewees. (A 360-degree feedback survey yields more diverse aspects of individuals' appraisal and points out outstanding characteristics of those people. Additionally, Zenit (2007) found that application of this method for the purpose of development is more effective that for the purpose of decision-making. His study is consistent with the study of Luthan, Peterson, and Suzanne (2003), who reported that the 360-degree feedback survey raised levels of satisfaction and commitment, decreased employee turnover intention and improved overall corporate performance.) For the data collection by interviews, the ethnographic future research method (Petrote and Chumniprasart, 2004.: 166-167) was employed to collect data in this phase. The content of each interview session was transcribed and written onto Microsoft Word files. Then the NU-DIST® (NVivo8) was used to sort data with the external materials command. Data were imported into a new source and classified into different cases. The coding command was then applied for content analysis.

3.9.2.8 Ten female owners and superiors and 10 male owners and superiors were interviewed in-depth. The ethnographic future research method was also employed to collect data in this phase. Each interview session lasted approximately 30-60 minutes.

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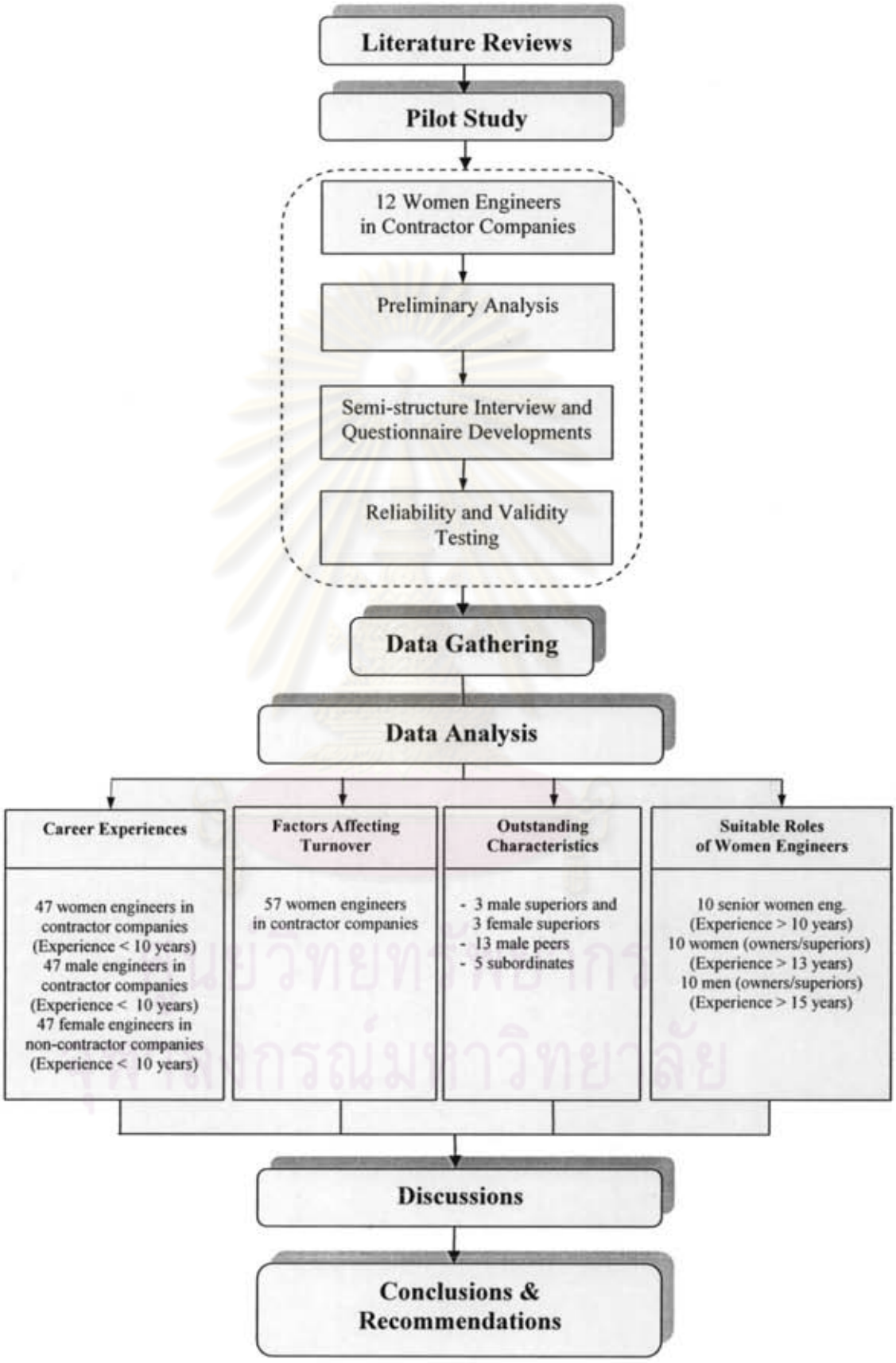

Figure 3.1 Research mapping

3.10 Data Analysis

3.10.1 First Session: Qualitative Data Analysis

Data from the pilot survey was analyzed to achieve a clear research hypothesis, objectives and designs. Since the next session was a quantitative analysis, reasons were analyzed and interpreted. Additionally, the research content was analyzed to find data with the same meaning. A reliable qualitative data analysis was subsequently achieved. Data analysis following Section 3.9.1.6 was done in order to apply the outcomes of outstanding characteristics of women engineers. In addition, frequency, percentage, mean and standard deviation were used to analyze other data at this stage.

3.10.2 Second Session: Quantitative and Qualitative Data Analysis

3.10.2.1 Initially, descriptive statistics were applied to this data set in order to describe the data in different ways: frequency, percentage, mode, mean and standard deviation. Further, results from semi-structured interviews were used to complement the details of finding. Then, in the analysis process, content analysis was used to analyze and sort data that yielded the same meaning to make it easier to present the qualitative data analysis. Data were gathered in compliance with this research's structure, which is based on previous studies and the pilot study. In addition, qualitative data analysis was performed under themes.

3.10.2.2 Inferential statistics were then applied to this data set. The data were gathered to measure the levels of 1) discrimination problems; 2). work-family conflicts; 3) sexual harassment; and 4) satisfaction of career progression. The data were then analyzed to Pearson's correlation. Independent variables and dependent variables were found by way of measuring the correlation of variables. A multiple regression was used to find the coefficient correlation of more than three variables. One variable was a dependent variable and the others independent variables. Value prediction and a variance analysis were performed through One-Way ANOVA method because there were more than two groups of factors. Chong-ho Yu (2010) concluded that conventional statistical procedures were called parametric tests. In a parametric test, a sample statistic is acquired to appraise population parameters. Since this appraisal involves a sample, a sampling distribution, population, and certain parametric assumptions are required to assure that all components are compatible with each other. For example, in Analysis of Variance (ANOVA) there are three assumptions:

- Observations are independent.
- The sample data have a normal distribution.
- Scores in different groups have homogeneous variances.

In a repeated measure design, it is assumed that the data structure complies with the compound symmetry. A regression model assumes the absence of collinearity, the absence of auto correlation, random residuals, linearity, etc. In structural equation modeling, the data should be multivariate normal.

Statistical significance was determined at a 95 % confidence interval.

Meanings of correlation coefficients are as follows.

0.80 - 1.00	=	related to a very high level
0.60 - 0.79	=	related to a high level
0.40 - 0.59	=	related to a average level
0.20 - 0.39	=	related to a low level
0.00 - 0.19	=	related to a very low level

3.11 Verification of the Results

After the data analysis phase, this research verified the data by using three women experts who are well-known in the Thai construction industry. The data collection was done by in-depth interviews and the ethnographic future research method was employed to collect the data. This provides not only a clear picture of the research findings but also a way to justify suitable roles of women civil engineers in construction and lets the researcher draw conclusions and make recommendations in a systematic and thorough manner.

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Chapter IV
Pilot Survey

4.1 Introduction

As mentioned in Chapter 3, this chapter deals with data obtained from a pilot survey on women engineers in 8 contractor companies. There were 12 women engineers in this phase consisting of 3 with 5 years of experience, 3 with 6 years of experience, 2 with 8-10 years of experience, and 4 with over 10 years of experience in contractor companies. The data include career progression of women engineers compared to that of their male counterparts, the most common problems confronted by women engineers in this career path impacting turnover, the most common roles for civil engineers in contractor companies and the research feedback.

4.2 Women Civil Engineer's Career Progression

Data gathered from in-depth interviews with 12 women engineers regarding their career progression compared to that of men are briefly presented as follows.

"We face slower career progression because we have more limitations than men. To progress fast in a construction company you have to know all the ins and outs of construction site work. In addition, it is difficult for a woman to be assigned to any fieldwork position. If women have fieldwork experience, they will make progress, get promoted and be better paid at a faster pace. If they have worked at construction sites, their superiors will consider them as having more qualifications. Most women engineers are assigned to do office work such as coordination, planning, contract compiling, price estimation, procurement and recruitment, etc."

Project Engineer, 12 years of experience

"Women engineers have less career progression because they can't do all the things that men can, such as climbing up to a high place to inspect work, and going down a tunnel, etc. That's why most women do office work. Pay raises are performance-based. Women's performance is unclear, unlike that of those who undertake projects. After the projects are completed, they get recognized as part of successful projects. Construction companies see more value in those working in construction projects because they are the key to their businesses. Therefore, those who work in construction projects are considered more valuable. This makes women progress more slowly than men."

Purchaser, 16 years of experience

"Women have less career advancement because they are not given important assignments. On the other hand, men always get important jobs, even in the office. Women engineers have less chance to become supervisors and project managers than men. Most women without experience working at construction sites are usually given jobs like stock checking, etc."

Site Engineer, 6 years of experience

"Women have less career progression because they cannot do many things that men can. Construction companies are different from companies as consulting firms, real estate companies, etc, where women engineers can do all the work that the men do. In a construction company, the main activity is construction. Therefore, anyone directly involved in construction has a more outstanding performance and appears more valuable to the company, and in turn, gets more attention."

Site Office Engineer, 5 years of experience

"As a woman engineer, unless you are the owner, your career advancement is really limited due to the limited roles in the workplace. Most women engineers are assigned to do office work. Some jobs require fieldwork experience in order to perform well such as price estimation and designing. Women engineers have to ask for advice from more experienced engineers. They can't do it on their own. Compared to other male engineers graduating in the same year, women engineers make slower progress in their careers. It is difficult for them to be promoted to supervisors. That's why they have less career advancement, especially in male-dominated workplaces with high competition."

Owner, 10 years of experience

"If you are a woman, you don't get equal recognition compared to men i.e. recognition from their bosses, superiors, subordinates and consultants. In the beginning, you have to prove that you can do it as men engineers. I've seen a lot of friends graduating in the same year changing their careers. Most of them said they didn't see career advancement in construction industry. Some said they didn't get the chance to use the knowledge they acquired from school and felt that they did not have any progress, so they quit their jobs. Women are usually designed to do office work. That's why they can't do many things men can and that limits their career advancement, at least in the beginning of their career. However, if you can make it through the trial period and show everybody that you can do it, after a while you make progress in your career. But the chance for a woman to become a project manager is very slim. That's the reason why I've decided to open my own company. In addition, most companies think that women with families will quit soon so they don't give them important positions. Women with families in particular are not given important responsibilities and sent to training to improve their skills like men; the companies fear they won't reap the benefits of investment in them."

Owner, 14 years of experience

"Most women engineers don't have fieldwork experience so they don't have a clear picture of how construction sites are operated as men who have worked at construction sites do. Working in construction means you have to compete with time. Men can work into the night at construction sites while women can't because they are more vulnerable to hazards. Most companies don't allow women to be at construction sites so men engineers' work stands out more and consequently they make more progress. Women make some progress in support work but they don't have any chance to become project managers. Women can make progress but not to the point that men can."

Project Engineer, 17 years of experience

"Looking at the big picture, women engineers make less progress than men in construction companies because they cannot do many things men can. Most of the time their superiors think that they should not work at construction sites and they are more suitable for documentation work. Some women work in construction companies for a while then quit their jobs because they don't see career advancement. This is the case especially when they don't have fieldwork experience because their work is not as good as those who have worked at construction sites. Planning, for example, requires experience and skills of people who have worked at construction sites."

Planner, 6 years of experience

"Construction companies don't want women to work at construction sites because they don't like the idea of women supervising men. Besides, they are not sure whether women can perform well there. This is the reason why women think they don't gain additional experience and decide to go work in consulting and land development companies instead. Even when it comes to design work, superiors and clients put more trust in men engineers than females. Personally, I think this is a kind of sexual discrimination. Maybe engineering is a male-dominated profession so they give more credit to men."

Designer, 5 years of experience

"I make progress like men engineers and get the same pay raise as them because I get the same assignments."

Designer, 5 years of experience

"Usually I get the jobs that don't contribute to my career progression such as project coordinating, phones answering and don't require my engineering knowledge. As a result, my jobs are not distinctive and I feel like I don't make progress

in my career. More importantly, I receive unimportant assignments. Whenever there is a lack of liquidity in the company I work for, I assume I will be one of the first people to be laid off."

Estimator, 6 years of experience

"Women engineers make less progress compared to their male counterparts. I see my male friends who graduated in the same year as me making progress and getting high salaries. Most of them have supervised projects before, which gave them work experience and allowed them to become project engineers within three years. After five years they are project managers. For this research to really be beneficial to women engineers of future generations, women engineers working in consulting or land development companies or other companies unrelated to contractors should be interviewed in order to find out the real, underlying problems. Then women engineers may be on the same footing as their male counterparts. Maybe women are less capable physically at construction sites. Apart from that, they should be equal to men."

Planner, 8 years of experience

Based on the above statements, 91.6 per cent, or 11 out of 12 women, think that women engineers make less career progress than men due to numerous work limitations. Most feel the limitation of work is due to discrimination which happens in the work place. Some women who do not have much experience are assigned to do office work. Some women engineers feel that they hardly make progress and decide to quit their jobs. By the same token, some women engineers in this research felt that most women engineers had self-imposed limitations in their work; they prefer to do support work because they are not sure that they can work at construction sites and are concerned about their safety. There was only one woman engineer in this study who mentioned that she could progress in her career like men because she received the same assignments and pay raises equal to her male counterparts. These 11 statements were later analyzed regarding the source of restriction in women's role in construction.

Furthermore, women engineers think that construction projects are the backbone of construction companies so any employees getting to work at construction sites are more recognized. On the other hand, for consulting companies or developers, both female and men engineers had equal opportunities to partake in continuing professional development to improve their practice. As a result, women engineers' roles and responsibilities in consulting companies or developers are not as restricted as in contractor companies.

A useful piece of advice was given to future women engineers: women engineers working in consulting companies or land development companies should be interviewed in order to effectively address the problems confronted by women

engineers. Fewer opportunities for progress in their careers have caused many women to quit their jobs and work in other companies or change careers.

4.3 Most Common Problems of a Non-Traditional Career that Cause Women Engineers to Leave Contractor Companies

Data from 12 women engineers with over-five-years experience in contractor companies are presented in Table 4.1.

Table 4.1 Women engineers' problems of turnover from constractor companies

No.	Problems	Score (%)	Categories of problems
1.	Working time: finishing work late at night or early in the morning causing problems at home	6 (50.0%)	Work-family conflict
2.	Unequal opportunities given by men superiors (Salary and reward do not increase as male peers.)	7 (58.33%)	Discrimination
3.	Most of the time superiors assign unimportant jobs to female engineers so they try to look for new jobs that offer them career advancement.	3 (16.67%)	Discrimination
4.	Feel less progress or advancement difficulty	11 (91.67%)	Unsatisfied with progression
5.	They are looked down upon, sexually and physically harassed at construction sites.	2 (16.67%)	Sexual harassment
6.	Superiors sexually take advantage of women subordinates.	2(16.67%)	Sexual harassment
7.	Women engineers have to supervise projects late at night and are afraid of harassment from drunken workers when they have to go home at night.	4 (33.33%)	Sexual harassment
8.	Inappropriate environment: construction sites are dirty and hot.	2 (16.67%)	Work characteristics
9.	Women with household responsibilities usually quit their jobs if they have to work at construction sites.	2 (16.67%)	Work-family conflict
10.	Women have to get more field experience if they want career advancement.	2 (16.67%)	Unsatisfied with career
11.	Women quit their jobs to further their education.	6 (50.0%)	Career progression

Table 4.1 Women engineers' problems of turnover from contractor companies (Cont.)

No.	Problems	Score (%)	Categories of problems
12.	If companies do not have construction projects, female engineers will be fired before men engineers.	3 (25.0%)	Discrimination
13.	Superiors do not offer good salaries and benefits to women the same as men.	3 (25.0%)	Discrimination
14.	Women engineers quit their jobs to take care of children because they do not have time for the children while working.	4 (33.33%)	Work-family conflict

From preliminary survey in the table, it can be seen that problems that lead to high turnover rates of women engineers in contractor are: 1) no career advancement (91.67% of all women engineers who answered the questionnaire); 2) unequal opportunities (58.33% of all women engineers who answered the questionnaire); 3) late work hours, working in the countryside, household responsibilities and field work (50% of all women engineers who answered the questionnaire); and 4) late work hours at night women fear of danger from drunken workers and quitting jobs to take care of children (33.33% of all women engineers who answered the questionnaire). The rest can be seen in the table.

The problems can be preliminary placed in order as follows: 1) unsatisfactory progression; 2) discrimination; 3) work-family conflicts; and 4) sexual harassment.

4.4 Roles of Civil Engineers in the Contractor Companies

Clarification of the roles of civil engineers in the contractor companies were asked of 12 women engineers with the objective of applying the acquired data to develop a new interview form for future data gathering. Interview results are shown below.

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Table 4.2 Roles of civil engineers in the contractor companies

No.	Civil Engineering Roles	Women (persons)	Percent (%)
1.	Estimating	12	100
2.	Purchasing and Hiring	12	100
3.	Planning and Monitoring	12	100
4.	Designing	12	100
5.	Coordinating	12	100
6.	Contract Administrative	12	100
7.	Supervision/ Site Engineers	12	100
8.	Other: Site Office Engineers	7	58
9.	Other: Quantity Surveyors	7	58

From the above table, the roles of civil engineers working in contractors as defined by the majority of interviewees were estimating, purchasing, planning and monitoring, designing, coordinating, contract administration, supervising, and others including serving as site office engineers. and quantity surveyors.

4.5 Research Feedback

An initial survey was conducted in which opinions of 12 informants were given. Two topics were asked using a 5-point rating scale. One point means least agreement. Two means low agreement. Three means agree to an extent. Four means highly agree. Five means totally agree. Details are as follows.

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Table 4.3 Study of advantages of women engineers' presence in construction

Description	Score range					Mean	Standard deviation
	1	2	3	4	5	(μ)	S.D.
1. Due to a wide scope of roles and responsibilities of civil engineers that require both men and women, do you think it will be beneficial for project managers if there are more studies on job allocations of engineers?				11	1	4.08	0.288
2. To what extent do you agree with the study of experiences, obstacles and solutions in engineering careers with an attempt to retain women in the construction industry? (Especially women engineers who have just started working)				5	7	4.58	0.515

The study of diversity in the workforce and proper job assignment in the construction industry as seen in the above table shows that 11 people or 91.67 per cent of all respondents highly agree and 1 person or 8.33 per cent of all respondents totally agree. As a result, the mean is 4.08 and the standard deviation is 0.288, which are reliable values.

From the above table shows the results of the study of experiences, obstacles and suggestions regarding engineering careers with an attempt to retain women engineers in the construction industry, it can be concluded that 5 respondents (or 42 per cent of all respondents) highly agree and 7 respondents (or 58 per cent totally) agree. As a result, the mean is 4.58 and the standard deviation is 0.515, which are reliable values.

Thus, the research feedback regarding guildelines for project managers to properly allocate work and women engineers to realize problems was found at high level. Finally, the useful information from the literature search and the information gained from this chapter (Table 4.1) were used to develop a research framework for analysis of factors affecting women engineers' problems in contractor careers and implication regarding turnover. The framework is presented as follows.

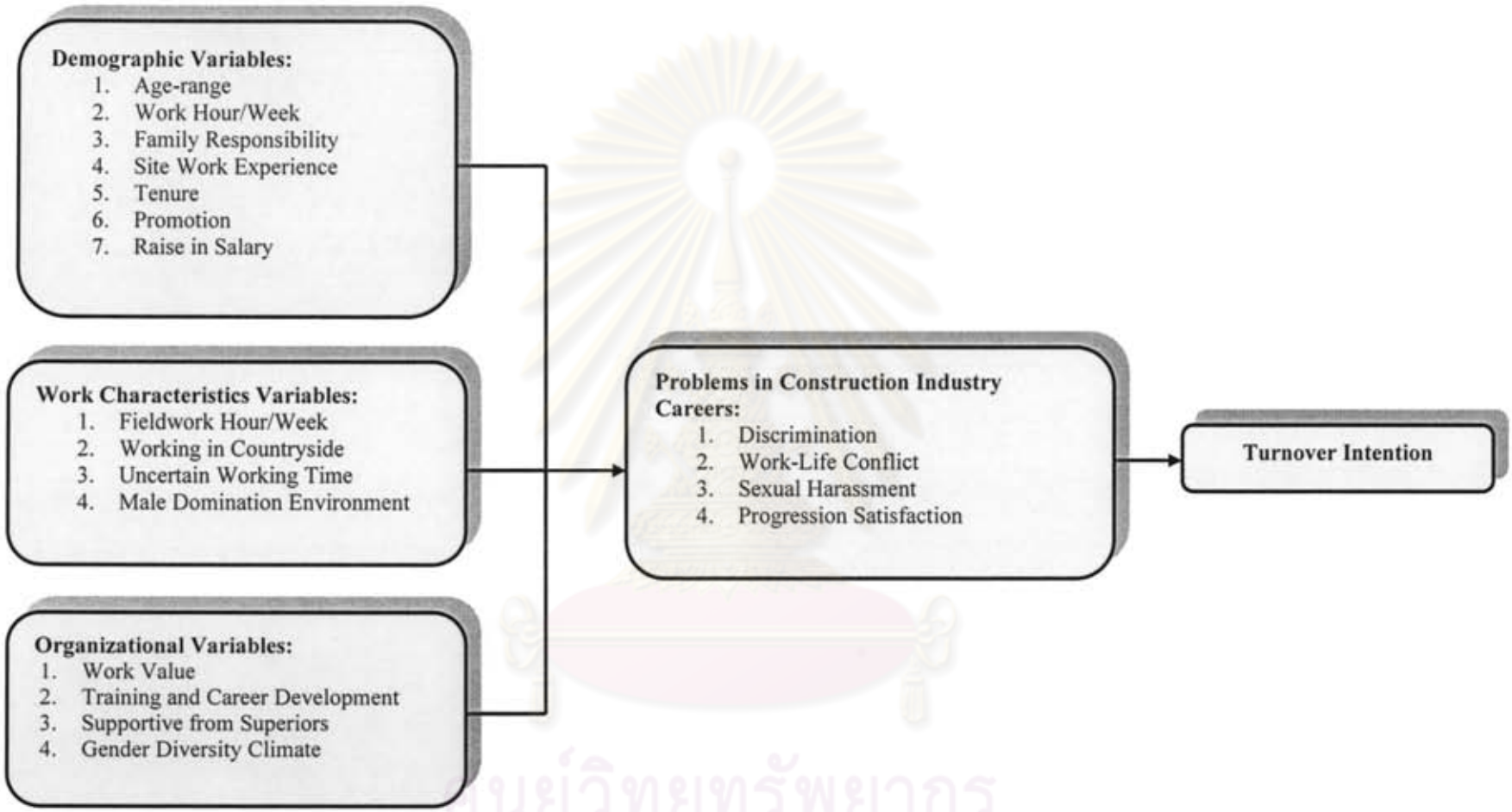

Figure 4.1 Conceptual framework of factors affecting career problems in contractor companies and implication for turnover

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Chapter V
Work Experience in the Thai Construction Industry

5.1 Introduction

Chapter 4 provided information regarding 12 women engineers, 11 of the 12 women engineers (91.6%) who worked in contractor companies felt that they did not advance in their careers as fast as men engineers because of restrictions that precluded them from fulfilling the many roles that men engineers could. Most women engineers opined that contractor companies mainly deal with construction projects, so engineers who work at construction sites were more recognized in their companies. These women suggested in the interviews that other subsectors such as non-contractor businesses (i.e. consulting companies, real estate developers, and construction material suppliers, etc.) which placed emphasis on knowledge of civil engineers, placed fewer restrictions on women and offered women engineers more opportunities to advance in their careers. Because of this, it is clear there are needs to research on women engineers working in non-contractor companies and turnover rate of men engineers compared to those of female engineers merits for further study.

This chapter presents data gained from in-depth interviews with 47 male and 47 female engineers in contractor companies as well as 47 female engineers in non-contractor companies. The results of the data analysis are grouped into three components. Component 1, a comparative analysis of work experiences from two viewpoints of women engineers working in contractor companies and those working in non-contractor companies, was performed in regard to difficulties in careers, sexual harassment, work/family conflicts, sexual equality in the construction industry, advancement in non-traditional careers, guidelines of career paths for women engineers and recommendations for future success for women engineers. Component 2, a comparative analysis of work experiences from three viewpoints of men engineers and women engineers who work in contractor companies and women engineers who work in non-contractor companies, was conducted regarding opinions about the appropriateness of women working as civil engineers, and opinions about careers advancement in the Thai construction industry. Component 3, a comparative analysis of work experiences from the viewpoints of male engineers and female engineers who work in contractor companies, was performed in regard to turnover rates and the main reasons for turnover. Finally, opinions about the weaknesses and strengths of women engineers for each role from the viewpoint of men engineers in contractor companies were obtained.

5.2 Profile of Informants

Primary data of the informants are shown in Table 5.1.

Table 5.1 Details of informants

Categories	Contractor				Non-Contractor		Total (person)
	Men	%	Women	%	Women	%	
1. Type of Business							
1.1 Contractors	47	100	47	100	-	-	94
1.2 Construction Management	-				4	9	4
1.3 Consult Design & Supervision.	-				2	4	2
1.4 Consult Design	-				19	40	19
1.5 Developers	-				14	29	14
1.6 Suppliers	-				8	17	8
Total	47	100	47	100	47	100	141
2. Age-range							
2.1 23-27 yr	27	51	29	62	20	43	76
2.2 28-32 yr	20	49	18	38	26	57	64
2.3 33-37 yr	-	-	-	-	1	2	1
Total	47	100	47	100	47	100	141
3. Work Location							
3.1 Head Office	16	34	26	55	44	94	86
3.2 Site Office	2	4	20	43	3	6	25
3.3 On-Site	29	62	1	2	-	-	30
Total	47	100	47	100	47	100	141
4. Marital Status							
4.1 Single	33	70	40	85	36	77	109
4.2 Married	14	30	7	15	11	23	32
Total	47	100	47	100	47	100	141
5. Family Responsibility							
5.1 No Responsibility	41	87	32	68	34	72	107
5.2 Elderly Care	3	6	11	24	5	11	19
5.3 Child Care	3	6	3	6	8	17	14
5.4 Both Child and Elderly Care	-	-	1	2	-	-	1
Total	47	100	47	100	47	100	141
6. Education Level							
6.1 Bachelor Degree	28	60	34	72	22	47	84
6.2 Master' s Degree	15	31	9	19	20	43	44
6.3 Others.(in.the.graduate..program.)	4	9	4	9	5	10	13
Total	47	100	47	100	47	100	141
7. Salary (Baht)							
7.1 10,000-20,000	11	23	23	49	9	19	43
7.2 21,000-50,000	30	64	23	49	36	77	89
7.3 51,000-100,000	6	13	1	2	2	4	9
Total	47	100	47	100	47	100	141
8. Site Work Experiences							
8.1 0-1 yr.	7	15	37	79	43	19	87
8.2 2-4 yr.	21	45	9	19	4	9	34
8.3 5-10 yr.	19	40	1	2	-	-	20
Total	47	100	47	100	47	100	141
9. Tenure							
9.1 0-1 yr.	13	28	28	60	27	57	68
9.2 2-4 yr.	29	62	16	34	17	36	62
9.3 5-10 yr.	5	10	3	6	3	6	21
Total	47	100	47	100	47	100	141

The profile of informants comprising civil engineers working in private companies are shown in Table 5.1. There were 47 men engineers and 47 women engineers working in contractor companies, 47 women engineers who worked in non-contractor companies i.e. 4 women engineers in construction management companies, 2 women engineers in design and inspection companies, 19 women engineers in design and consulting companies, 14 women engineers in real estate companies, 8

women engineers in supply material companies. The total number of civil engineers participating in this research was 141.

In the contractor companies, there were more men who were 23-27 years old (57%) than those who were 28-32 years old (43%); similarly in contractor companies, there were more women who were 23-27 years old (62%) than those who were 28-32 years old (38%). However, in the non-contractor companies, there were fewer women engineers who were 23-27 years old (43%) than those who were 28-32 (55%) and there was only one woman engineer (2%) who was more than 32 years old. Most men engineers worked at construction sites (62%). Most women worked at headquarter offices, both in contractor companies (55%) and non-contractor companies (94%).

As for marital status, most men were single (70%) and most women (85%) in contractor companies were single, while in non- contractor companies 77 per cent of the women were single. Regarding family responsibilities, men engineers (87%) and women engineers (68%) in contractor companies and women engineers (72%) in non-contractor companies did not have family responsibilities.

With reference to education levels, there were more men in contractor companies who had Bachelor's degrees (60%) than those with Master's degrees (32%) and those who were studying for Master's degrees (9%). Likewise, in contractor companies, there were significantly more women who had Bachelor's degrees (72%) than those with Master's degrees (18%). However, in non-contractor companies, the percentage of women with Bachelor's degrees (47%) was only slightly higher than that of women with Master's degrees (43%); women who were studying for Master's degrees (6%) were only slightly fewer than men who are pursuing their Master's degrees (9%).

In regard to salaries, most men engineers (64%) and women engineers (77%) in non-contractor companies had salaries of 21,000-50,000 Baht. However, among women engineers in contractor companies, about half of them had salaries in the range of 10,000-20,000 Baht and another half drew salaries of 21,000-50,000 Baht (Table 2). Regarding site work experience, most women in contractor (79%) and non-contractor companies (91%) had 0-1 year experience.

For more details from interviewees, most women (62%) who worked in non-contractor companies did not have site work experience, and in the 5 -10 years experience category, there was only one woman engineer. Regarding site work experience, most women in contractor (79%) and non- contractor companies (91%) had 0-1 year experience. For more details from interviewees, most women (62%) who worked in non-contractor companies did not have site work experience, and in the 5 - 10 years experience category, there was only one woman engineer. Regarding men engineers with site work experience, 40 per cent of them had worked 5-10 years; those who had 2 - 4 years site work experience made up 45 per cent of the male engineering workforce.

Finally, tenure was analyzed. Most men (62%) had worked in the same positions for 2-4 years while 28 per cent of them had worked in the same positions for 0-1 year,

and 10 per cent were in the 5-10 years category. As for women engineers, 60 per cent of them had worked in the same positions for 0 to 1 year in contractor companies. In non-contractor companies, the figure was 57 per cent.

5.3 Comparative Perspectives of Women Engineers in Contractor Companies and Non-Contractor Companies

A comparative analysis of work experiences from perspectives of women engineers working in contractor companies and those working in non-contractor companies was performed in regard to difficulties in construction careers, problems/obstacles in construction careers, sexual harassment, work/family conflicts, sexual equality in the construction industry, advancement in construction industry as a non-traditional career, guidelines of career paths for women engineers, and recommendations for success for future women engineers. The interviews with 47 women engineers from contractor companies and 47 women engineers from non-contractor companies are described as follows:

5.3.1 Difficulties of Careers in the Thai Construction Industry

Women engineers' difficulties of careers in the construction industry included difficulties of studying civil engineering, difficulties of job application, and difficulties of success in the workplace can be explained as follows.

5.3.1.1 Difficulties of studying civil engineering

Data from interviewees regarding difficulties of studying civil engineering are shown with scores given by interviewees in descending order in Table 5.2.

Table 5.2: Challenges of studying civil engineering n = 94

Rank	Contractor	Score	Rank	Non-Contractor	Score
1.	Women are less tolerate than men when studying outdoors or in the sun.	24	1.	Heavy work in laboratories such as carrying heavy instruments or materials is difficult for women.	16
2.	Heavy work in laboratories such as carrying heavy instruments or materials is difficult for women.	14	2.	Women are less tolerate than men when studying outdoors or in the sun.	11
3.	When studying in labs, men learn faster and are more talented.	12	3.	When studying in labs, men learn faster and are more talented.	9
4.	In class practices, women are less flexible.	7	4.	In class practices, women are less flexible.	8

Table 5.2: Challenges of studying civil engineering (Cont.) n = 94

Rank	Contractor	Score	Rank	Non-Contractor	Score
5.	Calculation-related classes are difficult for women.	6	5.	In designing classes, women cannot understand the designs as men do.	7
6.	In designing classes, women cannot understand the designs as men do.	5	6.	Women cannot stay up all night to study as men do.	3
7.	Women cannot stay up all night to study as men do.	1	7.	Calculation-related classes are difficult for women.	2
8.	-	-	8.	Chemical classes are difficult for women.	2

From Table 5.2, it was found that the top three difficulties of studying civil engineering confronted by women engineers in contractor companies and non-contractor companies were studying in laboratories where they had to carry heavy materials such as cement blocks, studying in the sun, slower learning pace and less talent and less flexibility than men engineers.

Based on the two perceptions, it can be concluded that women engineers working in both contractor companies and non-contractor companies had the same first three difficulties when they studied civil engineering.

5.3.1.2 Difficulties of job application

Data from informants about difficulties of job application are shown with scores given by informants in descending order in Table 5.3.

Table 5.3 Challenges of job application n = 94

Rank	Contractor	Score	Rank	Non-Contractor	Score
1.	Men are always the first to be selected.	31	1.	Graduates from public universities are selected first.	26
2.	There are a few positions for women engineers.	23	2.	It is difficult to find jobs right after graduation.	18
3.	Graduates from public universities are selected first.	18	3.	People with hands-on experience are preferred.	17
4.	Some positions require working upcountry so women are not selected.	7	4.	Some positions require working upcountry so women are not selected.	6
5.	People with hands-on experience are preferred.	5	5.	-	-
6.	It is difficult to find jobs right after graduation.	3	6.	-	-
7.	Men are more suitable for late work hours.	2	7.	-	-

From Table 5.3 it can be seen that the first three difficulties of women engineers working in contractor companies are preference of men by most companies, fewer positions for women engineers in contractor companies and preference of graduates from public universities by most companies.

As for women engineers working in non-contractor companies, the first three difficulties were preference of graduates from public universities by most companies, difficulty to find jobs right after graduation and preference of people with hands-on experience.

It can be implied that women engineers working in contractor companies had difficulties in the first three levels that were different from those of women engineers working in non-contractor companies.

5.3.1.3 Difficulties of working in workplaces

Data from informants about difficulties of working successfully in their workplaces are shown with scores given by informants in descending order in Table 5.4.

Table 5.4 Challenges of working successfully in workplaces n = 94

Rank	Contractor	Score	Rank	Non-Contractor	Score
1	Little knowledge of site-based work makes it difficult for women to work.	27	1	Workers give less respect to women who inspect construction sites compared to men.	23
2	Women find it more difficult to control subordinates compared to men.	19	2	Little knowledge of site-based work makes it difficult for women to work.	16
3	Women hardly receive recognition from superiors or subordinates.	18	3	Women hardly receive recognition from superiors or subordinates.	15
4	Women have difficulty working at construction sites.	13	4	Women have to adapt themselves to work with male colleagues.	6
5	Women have to adapt themselves to work with male colleagues.	7	5	Women have to climb to high places to inspect work.	5
6	Women have to adapt themselves to work in an organization.	6	6	Women have to adapt themselves to work in an organization.	3
7	Women work as coordinators at construction sites.	4	7	Women feel under pressure and need to further their education.	1
8	Women have to climb to high places to do the work inspection.	1	8	There are unfamiliar softwares that are difficult to use in the beginning.	1

Table 5.4 Challenges of working successfully in workplaces (Cont.) n = 94

Rank	Contractor	Score	Rank	Non-Contractor	Score
9	Women work under pressure and need to further their education.	1	9	-	-
10	Women have to do site inspection and coordinate with subcontractors and workers.	1	10	-	-

According to Table 5.4, it can be seen that the greatest difficulty of women engineers working in contractor companies is little knowledge about site-based work, followed by difficulty of controlling subordinates compared to men engineers and difficulty of getting recognition from superiors and subordinates.

Women engineers working in non-contractor companies opined that the number-one problem they had was less recognition from contractors during site inspection, followed by little knowledge about site work, and difficulty getting recognition from superiors or subordinates.

In conclusion, the first three difficulties faced by women engineers working in contractor companies and non-contractor companies are relatively the same.

5.3.2 Experiences of Problems/Obstacles in Non-Traditional Careers

The results of women engineer's problems in non-traditional careers including sexual harassment, work-family conflicts, and equality of opportunity are shown in the following table.

5.3.2.1 Sexual harassment

The data are described as in Table 5.5.

Table 5.5 Sexual harassment in the construction industry n = 94

	Contractor		Non-contractor	
	Number	**Per cent**	**Number**	**Per cent**
Presence	11	23.0	6	13.0
Absence	36	77.0	41	87.0
Total	**47**	**100.0**	**47**	**100.0**

Table 5.5 shows that 11 women engineer or 23 per cent of all women engineers working in contractor companies felt sexually harassed. Examples of harassing behaviors were flirting, talking in a sexual way, touching bodies, touching hands, requesting women engineers to stay working late, asking women engineers to become minor wives, and offers of financial support. In one case a woman engineer was asked to take care of a consultant who was flirtatious, even they knew a consultant is playboy and dangerous for women engineer. Some women engineers opined that when men get together, they talk about dirty stories. Thirty-six women engineers or 77 per cent of all women engineers working in contractor companies did not feel sexually harassed in workplaces saying that civil engineering is a prestigious profession so other people paid respect for them.

As for perspectives of women engineers working in non-contractor companies regarding sexual harassment, it was found that six women engineers or 13 per cent of all women engineers working in non-contractor companies opined that there was sexual harassment in their workplaces. Some examples are dirty talks, inappropriate description of bodies, calling into one's office, trying to have a dinner date with women engineers, asking them about their love life, etc. Forty-one women engineers or 87 per cent of women engineers working in non-contractor companies did not find sexual harassment in their workplaces saying that most people paid respect to civil engineers.

Perceptions about sexual harassment of women engineers working in contractor companies were different from those of women engineers working in non-contractor companies. Women engineers working in contractor companies felt that there was slightly more sexual harassment in their workplaces.

5.3.2.2 Work-family conflicts in construction careers

The data are described as in Table 5.6.

Table 5.6 Work-family conflicts in construction industry n = 94

	Contractor		**Non-contractor**	
	Number	**Per cent**	**Number**	**Per cent**
Presence of conflicts	12	26.0	3	6.0
Absence of conflicts	35	74.0	44	94.0
Total	**47**	**100.0**	**47**	**100.0**

Table 5.6 shows that 12 women engineers or 26 per cent of all women engineers working in contractor companies found that there were work-family

conflicts in their workplaces such as working upcountry for a long time while having to take care of family responsibilities, unstable work hours making women unable to take care of their children and their parents, working over the weekends and having no time for families. Sometimes women engineers worked in offices late into the night to get recognized and promoted because men engineers do that. However, unlike women, men did not have family responsibilities. Some conflicts were unmanageable such as remote workplaces that did not allow women time to do anything else at night. Thirty-five women engineers or 74 per cent of all women engineers working in contractor companies answered that they did not have work-family conflicts adding that they did not have family responsibilities.

Three women engineers or 6 per cent of all women engineers working in non-contractor companies opined that they had work-family conflicts such as little children that required their constant time and attention, husbands working and having no time for family chores and taking care of a sick mother. Forty-four women engineers or 94 per cent of all women engineers working in non-contractor companies said that there were no work-family conflicts because they did not have unmanageable family responsibilities, did not have heavy workloads all the time and most companies gave them two days off per week when they could take care of family matters.

It can be seen that women engineers working in contractor companies had different work-family conflicts from women engineers working in non-contractor companies and women engineers working in contractor companies had slightly more conflicts.

5.3.2.3 Equality of opportunities in the construction industry

The data are described as in Table 5.7.

Table 5.7 Equal career opportunities in the construction industry n = 94

	Contractor		Non-Contractor	
	Number	**Per cent**	**Number**	**Per cent**
Equal	3	6.0	36	77.0
Unequal	44	94.0	11	23.0
Total	**47**	**100.0**	**47**	**100.0**

Table 5.7 shows that three women engineers or 6 per cent of all women engineers working in contractor companies opined that there was sexual equality, adding that they had good and efficient superiors who treated everybody equally and their companies gave equal opportunities to women and men at both at

work sites and in offices. Forty-four women engineers or 94 per cent of women engineers working in contractor companies opined that there was no sexual equality in their workplaces. They gave the following reasons in descending order. Most of the time, men are recruited into construction companies. Women engineers are hardly assigned to work at construction sites. Superiors give more important jobs to men engineers. Organizations or male superiors have a mindset about men working more efficiently than women and do not want to give opportunities to women. Most of the time superiors' notions were that women engineers cannot supervise subordinates, do not have enough leadership and get fewer acceptances from subordinates, superiors and colleagues compared to men engineers. Opinions of women engineers are not taken into consideration.

Thirty-six women engineers or 77 per cent of all women engineers working in non-contractor companies found that there was sexual equality in their workplaces. They said they had opportunities to work in all the positions that men engineers could. With good and fair superiors, they also have equal opportunities to get promoted and higher raises. Eleven women engineers or 23 per cent of all women engineers working in non-contractor companies opined that there was no sexual equality in their workplaces. They opined that superiors thought that women could not do site inspection work and did not have enough leadership. They also opined that women were highly discriminated against in their workplaces, and there were a lot of jobs that were considered unsuitable for women. Unlike men, women were hardly given important jobs, recognition from superiors, colleagues, customers and project owners.

It can be concluded that women engineers working in contractor companies had different perceptions about equality in workplaces than women engineers working in non-contractor companies and women engineers working in contractor companies were confronted with more inequality than women engineers working in non-contractor companies. The majority of women engineers working in non-contractor companies opined that there was equality in their workplaces.

5.3.3 Career Progression

The results of women engineers' career advancement in the construction industry compared to those of men engineers are shown in Table 5.8.

Table 5.8 Perceptions of career advancement in construction industry n = 94

Career Advancement	Contractor		Non-contractor	
	Number	Per cent	Number	Per cent
Had equal career advancement compared to men engineers	8	17.0	22	47.0
Had less career advancement compared to men engineers	39	83.0	25	53.0
Total	**47**	**100.0**	**47**	**100.0**

From Table 5.8 it can be stated that eight women engineers or 17 per cent of all women engineers from contractor companies thought that they had equal career advancement to men engineers at the same levels, and 39 women engineers or 83 per cent of all women engineers from contractor companies found that they had less career advancement compared to men engineers at the same levels in the construction industry. Twenty-two women engineers or 47 per cent of all women engineers from non-contractor companies thought that they had equal career advancement to men engineers at the same levels, and 25 women engineers or 53 per cent of all women engineers from non-contractor companies found that they had less career advancement compared to men engineers at the same levels in the construction industry.

It can be concluded that the number of female engineers from contractor companies who found less career advancement compared to men engineers was significantly higher than female engineers who thought that they had equal career advancement to men engineers (8 and 39). Conversely, the number of female engineers from non-contractor companies who answered that they had equal career advancement to men engineers was not significantly different from the number of female engineers who found less career advancement compared to men engineers (22 and 25).

Female engineers who found that they had equal career advancement to men engineers thought that the companies they worked for gave the same assignments to both men and women and offered the same starting salaries and performance-based raises. In addition, female engineers working in design and consulting companies and developers added that sometimes they even had higher salary raises than men engineers.

Female engineers who answered that they had less career advancement compared to men engineers gave two main reasons. First, most of the time men engineers were assigned to do important jobs because women were considered inappropriate for the jobs that most men dominate culturally such as site-based work

and were unable to supervise men workers and that the jobs were too dangerous for them, etc. This resulted in women not being able to show their performance, getting fewer promotions and receiving lower salary rises. Second, women engineers had limitations prohibiting them from working at construction sites. Some of them said they were not sure whether they could work with subcontractors and supervise subordinates. Some said site work was not suitable for physical conditions of women and construction sites were dirty and dangerous for women. Women don't understand the construction method clearly as same as men do because little site work experience, subsequently, they could not do as diverse work as men could.

Moreover, women engineers who worked in contractor and non-contractor companies admitted that site work experience was important for their career advancement and performance. Women engineers who did not have direct site work experience sought for new knowledge from site visits, self-study and the Internet. Some companies provided mentors for them so they could improve their efficiency.

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5.3.4 Career Path

The results of career path guidelines for women engineers in construction companies are shown in Table 5.9

Table 5.9 Career path guidelines n = 94

Career Path	Contractor		Non-contractor	
	Number	Per cent	Number	Per cent
Career path guideline	4	9.0	18	38.0
No career path guideline	43	91.0	29	62.0
Total	**47**	**100.0**	**47**	**100.0**

It can be seen in Table 5.8 that 9 per cent of contractor companies provided career path guidelines for women engineers whilst 91 per cent did not, and 38 per cent of non-contractor companies provided career path guidelines for women engineers whilst 62 per cent did not. It can be concluded that non-contractor companies provided more career path guidelines to women engineers than contractor companies (91.0%).

5.3.5 Recommendations for Career Success in the Construction Industry for Future Women Engineers

Recommendations for future women engineers for working successfully in the construction industry are presented in descending order and similar answers are placed in the same categories.

Table 5.10 Survey of guidelines to work successfully in the Thai construction industry

n = 94

Ranking	Suggestions	Score (%)
1.	Pay attention to work and be eager to learn new things that can be applied at work.	36
2.	Learn from senior engineers.	33
3.	Learn from colleagues.	29
4.	Pay attention to main subjects including computer programs because women can compete with men intellectually rather than physically.	28
5.	Try to apply knowledge to work to get recognition from subordinates.	26
6.	Try to be decisive and dare make decisions and suggest new ideas.	21
7.	Try doing one's best before asking for help from other people.	17
8.	Try to be good in design courses.	12
9.	Practice speaking, ordering, reporting and presenting because men are not good at these skills.	11
10.	Try to be confident and strive for achievement.	9
11.	Focus on detailed documentation work.	9
12.	Find new experience to develop one's career. Knowledge about sites is important. If you do not have experience, try to find ways to increase knowledge.	9
13.	Have perseverance and be patient.	7
14.	Try to be hard-working and not decline work assigned.	7
15.	Try to be well-prepared and specialize in knowledge area.	6
16.	Always find knowledge about new technologies.	6
17.	Listen to other people's opinions.	5
18.	Choose other subjects apart from civil engineering.	1
19.	Treat all engineers equal regardless of their gender.	1
20.	Take responsibility when making mistakes	1
21.	Try to be good at language skills.	1

From Table 5.10 the first five recommendations were: 1) pay attention to work and be eager to learn new things that can be applied to work; 2) learn from senior engineers; 3) learn from colleagues; 4) pay attention to main subjects including computer programs because women can compete with men intellectually rather than physically; and 5) try to apply knowledge to work to get recognition from subordinates.

5.4 Comparative Perceptions of Male and Female Engineers in Contractor Companies and Non-Contractor Companies

A comparative analysis of work experiences from three viewpoints of 141 civil engineers including of 47 male and 47 female engineers who work in contractor companies and 47 female engineers who work in non-contractor companies was conducted regarding opinions about appropriateness of women working as civil engineers.

5.4.1 Appropriateness of Women Working as Civil Engineers

Attempts to investigate opinions about appropriateness of women working as civil engineers are shown in Table 5.11.

Table 5.11 Appropriateness of women working as civil engineers n = 141

Women working as civil engineers	**Contractor**				**Non-Contractor**		**Total**
	Men		**Women**		**Women**		
	Number of respondent	**Per cent**	**Number of respondent**	**Per cent**	**Number of respondent**	**Per cent**	
Appropriate	7	15.0	16	34.0	34	72.0	57
Not appropriate	40	85.0	31	66.0	13	28.0	84
Total	**47**	**100.0**	**47**	**100.0**	**47**	**100.0**	**141**

From Table 5.11 it can be seen that seven men engineers or 15 per cent of all men engineers working in contractor companies opined that women should be civil engineers. The majority of them thought that civil engineering work was varied including support work and production work, which are equally important and indispensable in construction projects and that women were better at detailed work, design calculation and communications skills. Forty men engineers or 85 per cent of men thought that women should not be civil engineers stating that construction projects included outdoor work and women's bodies were not as strong as men's. Furthermore, construction work, working at night and working upcountry were not appropriate jobs for women, and women could not supervise men so even if they became civil engineers, they would not advance in their careers.

Sixteen women engineers or 34 per cent of all women engineers working in contractor companies thought that women should be civil engineers. They stated that civil engineering jobs were varying including estimation, procurement-recruitment, coordination, inspection, QA, QC, design and documentation work, which are more appropriate for women because they have patience and better communication skills. Therefore, if women do coordination work, mistakes can be lessened, and women who are civil engineers can fill men's work. Thirty-one women engineers or 66 per cent of all women engineers thought that women should not be civil engineers. They

gave reasons that site work was not appropriate for women and women had fragile physical conditions. Moreover, women can be in greater danger than men, and have limited career advancement due to limited site work knowledge. Furthermore, women engineers thought that there was sexual inequality in contractor companies. One women civil engineer talked about her experiences, as quoted:

Thirty-four women engineers or 72 per cent of all women engineers working in non-contractor companies felt that women should become civil engineers. They stated that civil engineering was a field with a wide scope of work including designing, inspection, planning and supervising. Therefore, women are more suitable for this profession because they have good communication and coordination skills, which can reduce communication mistakes. Women's strengths, namely delicacy, honesty, tidiness and command of English, can lessen men's mistakes and complement their work. Due to a wide range of work in civil engineering, women are recommended to get more experience and knowledge from site work and other sources so they can be proud of their careers like men since traditionally this profession has belonged to men. Thirteen women engineers or 28 per cent of all women engineers working in non-contractor companies thought that women should not become civil engineers saying that most construction companies put more trust in male civil engineers so women engineers do not receive recognition and advance in their careers as men do.

It can be concluded that the three perceptions about women in civil engineering were different. Most men engineers working in contractor companies thought that women should not be civil engineers, followed by most women engineers in contractor companies. The third group was women engineers working in non-contractor companies who thought that women should be civil engineers.

5.4.2 Women Civil Engineers' Opinions of Working for Progression in the Thai Construction Industry

The opinions about career advancement and success in the construction industry are shown in Table 5.12

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Table 5.12 Opinions about career advancement and success in the construction industry n =141

Descriptions	Contractor				Non-Contractor	
	Men		Women		Women	
	Mean	S.D.	Mean	S.D.	Mean	S.D.
1. To be successful in civil engineering, one must have site work experience.	4.34	0.479	4.28	0.452	3.15	0.751
2. Having no site work experience in the long run can make one lose confidence in work.	3.43	0.500	3.15	0.416	2.45	0.544
3. People with site work experiences have more chances of promotions and salary raises.	4.23	0.428	4.38	0.491	3.64	0.486
4. Companies gain equal benefits from women and men engineers.	4.94	0.247	4.34	0.522	4.57	0.500
5. Getting promoted (from associate engineers to professional and professional to charter engineers) leads to career advancement.	4.36	0.486	4.13	0.337	3.74	1.010
6. Civil engineering is unsuitable for women because career advancement is limited to men.	2.83	0.842	2.89	0.729	2.47	0.687
7. Civil engineering is unsuitable for women because of limitations such as dislike of working outdoors, fear of climbing, etc.	3.79	0.414	3.18	0.613	3.00	0.659
8. Overall satisfaction with work in construction industry.	3.68	0.663	3.28	0.649	3.91	0.408

* The level of mean interpreted as include; 1.0-1.79 = lowest, 1.80-2.59 = low, 2.60-3.39 = average, 3.40-4.19 = high, 4.20-5.00 = highest

Table 5.12 explains and compares opinions about working in non-traditional careers like the construction industry of men and women engineers in contractor companies and women engineers working in non-contractor companies.

First, to be successful in civil engineering careers, one must have site work experience. When mean (μ) was taken into consideration, it was found that men engineers working in contractor companies had the highest mean (μ=4.34), followed by female engineers working in contractor companies (μ=4.28), and female engineers working in non-contractor companies (μ=3.15). This shows that both male and female engineers working in contractor companies agreed to the highest level that to be successful in civil engineering careers they must have site work experience whilst female engineers working in non-contractor companies agreed to an average level with this opinion.

Second, having no site work experience in the long run can make one lose confidence in work. When the mean (μ) is taken into account, it was found that men engineers working in contractor companies had the highest mean (μ=3.43), followed by women engineers working in contractor companies (μ=3.15), and women engineers working in non-contractor companies (μ=2.45). This shows that both male

and female engineers working in contractor companies agreed to an average level that having no site work experience in the long run can make them lose confidence in their jobs, and female engineers working in non-contractor companies agreed with this statement to a low level.

Third, people with site work experience have more chance of promotions and salary raises compared to those without site work experience. When the mean (μ) is taken into account, it was found that female engineers working in contractor companies had the highest mean (μ=4.34), followed by men engineers working in contractor companies (μ=4.28), and female engineers working in non-contractor companies (μ=3.64). This shows that both male and female engineers working in contractor companies agreed to the highest level that people with site work experience had more chance of promotions and salary raises compared to those without site work experience, and women engineers working in non-contractor companies agreed with this statement to a high level.

Fourth, companies gain equal benefits from female and men engineers. When the mean (μ) is taken into consideration, it was found that men engineers working in contractor companies had the highest mean (μ=4.94), followed by female engineers working in non-contractor companies (μ=4.57), and female engineers working in contractor companies (μ=4.34). This shows that both male and female engineers working in contractor and non-contractor companies agreed to the highest level that companies gain equal benefits from women and men engineers.

Fifth, getting promoted to higher levels (from associate to professional and from professional to charter) leads to career advancement. When the mean (μ) is taken into account, it was found that men engineers working in contractor companies had the highest mean (μ=4.36), followed by female engineers working in contractor companies (μ=4.13), and female engineers working in non-contractor companies (μ=3.74). This shows that men engineers and female engineers working in contractor companies and female engineers working in non-contractor companies had different ideas about the statement "Getting promoted to higher levels (from associate to professional and from professional to charter) leads to career advancement." Men engineers working in contractor companies agreed with that statement to the highest level while female engineers working in contractor companies and female engineers working in non-contractor companies agreed with the statement to a high level.

Sixth, civil engineering is unsuitable for women because career advancement is limited to men. When the mean (μ) is considered, it was found that female engineers working in contractor companies had the highest mean (μ=2.83), followed by men engineers working in contractor companies (μ=2.89), and female engineers working in non-contractor companies (μ=2.47). This shows that men engineers and female engineers working in contractor companies agreed to an average level that civil engineering was unsuitable for women because career advancement was confined to men whilst women engineers working in non-contractor companies agreed with the statement to a low level.

Seventh, civil engineering is unsuitable for women because women have limitations such as climbing to high places. When mean (μ) is taken into consideration, it was found that women engineers working in contractor companies had the highest mean (μ=3.81), followed by men engineers working in contractor companies (μ=3.79), and female engineers working in non-contractor companies (μ=3.00). This shows that both male and female engineers working in contractor companies agreed to a high level that civil engineering was unsuitable for women because women had limitations such as climbing to high places, whilst women engineers working in non-contractor companies agreed to an average level with this opinion.

Eighth, a question about overall work satisfaction in the construction industry was asked. When the mean (μ) is taken into account, it was found that women engineers working in non-contractor companies had the highest mean (μ=3.91), followed by men engineers working in contractor companies (μ=3.68), and female engineers working in contractor companies (μ=3.28). This shows that female engineers working in non-contractor companies and men engineers working in contractor companies agreed that overall work satisfaction was at a high level whilst female engineers working in contractor companies thought that overall work satisfaction was at an average level.

5.5 Comparison of Turnover Rates of Female Engineers and Male Engineers Working in Contractor Companies

The data on the turnover rates and reasons for their turnover were collected from a survey of women engineers and men engineers working in contractor companies. Turnover rates of 47 women and 47 men below 32 years of age, or in their first ten years of working, were compared. These values were based on the average duration that an engineer remained in service with one company, and were calculated using the following Formula.

$$\text{Average years of working (years/company)} = \frac{\begin{array}{l}\text{(Current age - Age upon bachelor's degree completion}\\ \text{- No. of years of higher education}\\ \text{- No. of years of being job less)}\end{array}}{\text{No. of companies an individual has worked for}}$$

The results obtained by using Formula 1 giving the average years of working for one company of men and women engineers are analyzed and presented in Figure 5.1.

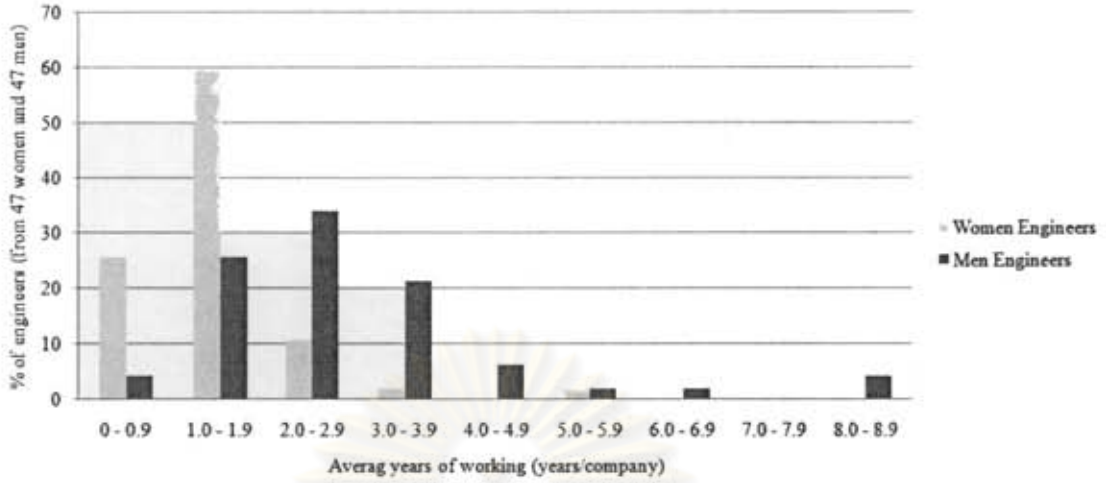

Figure 5.1 Comparison of average working years of women and men engineers in a company

It can be seen from Figure 5.1 that more than 80 per cent of women engineers had worked in one company for less than two years; 26 per cent of women engineers had worked in one company less than one year. The graph also reveals that 60 per cent of women engineers had worked in a company for 1.0-1.9 years. As for men engineers, the graph shows that over 80 per cent of them had worked in one company for 1.0-3.9 years; 26 per cent of them had worked in one company for 1.0-1.9 years; 34 per cent of them had worked in one company for 2.0-2.9 years; and 21 per cent of them had worked in one company for 3.0-3.9 years. The figure also shows that there was only one woman engineer who had worked in one company for 5.0-5.9 years (the longest in this survey), whilst there were two men engineers, or 4 per cent of all men engineers, who had worked in one company for the longest period of time, i.e. 8.0-8.9 years. The comparisons in Figure 1 show that the average working years of women engineers were fewer than those of men in all the categories of same company employment. Therefore, these figures show that women engineers changed their workplaces more often than men engineers. The reasons for the turnover of women and men engineers are shown in Figure 5.2.

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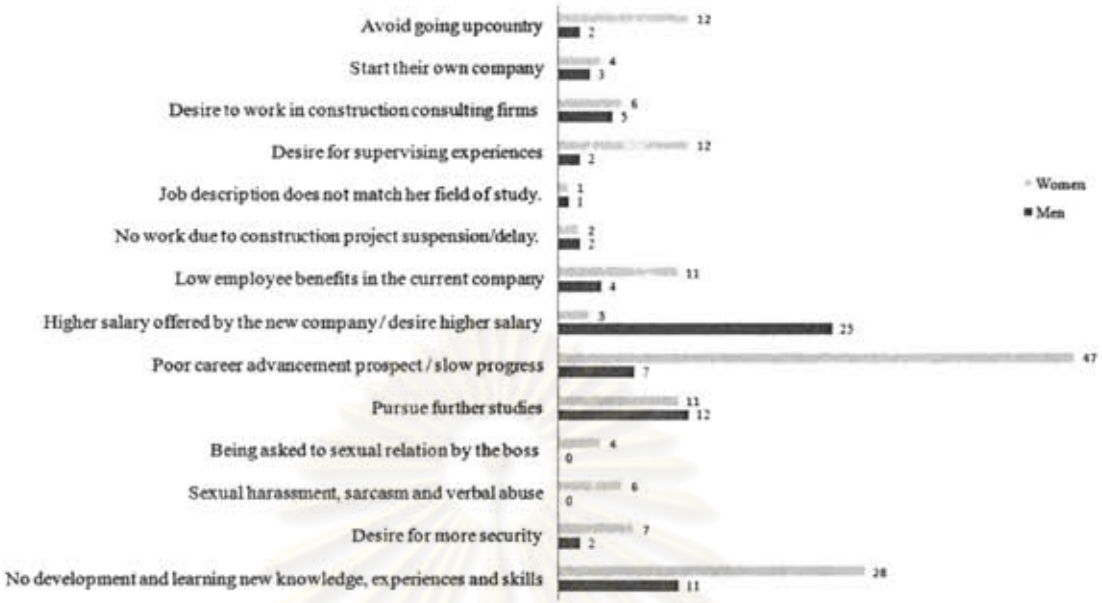

Figure 5.2 Major causes of women and men civil engineers leaving contractor companies

As shown in Figure 5.2, the top reason for women engineers leaving their jobs was poor career advancement prospects, leading to a feeling of under-achievement. This reason was cited 47 times. The second leading cause of women engineers leaving was the slow work progress linked to the difficulty in acquiring the necessary knowledge, experiences and skills. This reason was given 28 times. The third most important cause of turnover in the careers of women engineers was the desire for experience in supervising a workforce and to go upcountry. This reason was given 12 times. Where men engineers are concerned, the most important reason among for leaving their jobs was the desire for better remuneration. This reason was given 25 times. The second most important reason for turnover among men was the desire to pursue higher education. A total of 12 responses were recorded. The third most important cause was slow progress in the acquisition of knowledge, experiences and skills. This accounting for 11 responses. Therefore, it is clear that the foremost reasons for women engineers and men engineers leaving their jobs are different. Men engineers aspired to have better emolument whereas women engineers were unhappy with what they perceived as under-achievement in their careers where advancement opportunities were limited and slow to come by.

When reasons for the employment turnover of women and men engineers were investigated, it was noted that women quitted their jobs because of sexual harassment, sarcasm and verbal abuse while men engineers did not face these problems (See Figure 5.2). In contractor companies, women engineers had to work mainly with men superiors, colleagues and subordinates. In addition, construction site work was hazardous, and being a predominantly male domain, women were more prone to sexual harassment.

5.6 Strengths and Weakness of Women Civil Engineers in Comparison with Men Civil Engineers Working in Various Positions in the Contractor Companies

Data from interviews with 47 male civil engineers are shown in Table 5.13 with the number of male civil engineers working at each position in descending order.

Table 5.13 Strengths and weaknesses of women civil engineers in each position

No.	Position	Strengths	Weaknesses
1.	Estimation engineer	- Women are more careful and tidier. - Women can inspect construction methods at sites when estimating prices. - Women are hard-working and tolerant of redundant work. - Women have good communication skills. - Women have high determination at work. - Women are more concentrated on work. - Women have various working styles.	- Women have less site work experience. - Women cause mistakes when estimating prices. - Women are sometimes indecisive. - Women are less talented to lobby for projects than men. - Women cause too much open contradiction.
2.	Procurement-Recruitment engineer	- Women are polite and have good negotiation skills. - Women are thorough with comparison work. - Women know how to solve problems at hand. - Women are patient and cautious. - Women have systematic work planning strategies. - Women are honest, do not take bribes and unnecessarily entertain people. - Women are able to tell details of goods or materials.	- Women are sometimes softhearted. - Men are more suitable for some particular jobs such as inspecting products.
3.	Contract administration engineer	- Women are highly responsible. - Women are more detailed. - Women are tidier and more systematic. - Women are more patient with jobs that require delicacy such as reviewing contracts. - Women are better at English.	- They are not as flexible as men at construction sites.
4.	Design engineer	- Women are patient with routine work. - Women are tidier. - Women are cautious and check jobs before handing them over.	- Women do not have site work experience so they have limited designing capacity. - Women do not have site work experience so they make a lot of mistakes.

Table 5.13 Strengths and weaknesses of women civil engineers in each position (Cont.)

No.	Position	Strengths	Weaknesses
		- Women are creative so they can do many jobs.	- Women are not flexible in some circumstances. - Superiors put more trust in men than women. - Women cannot entertain people. (Entertainment is important when dealing with clients.)
5.	Coordinating engineer	- Women are good at persuading people, which is useful when working among men. - Women are good at reducing potential conflicts. - Women have better negotiation skills. - Women speak more softly than men engineers. - Women are more polite and use words that are suitable for coordinating work. - Women can reduce disputes among parties.	- Women cannot entertain people at night time. - Women do not have respect from men engineers who always insult their ideas.
6.	Site engineer	- Women are more detailed when inspecting jobs. - Women are good at documentation work. - Women are more able to negotiate with subcontractors.	- Women with family responsibilities have problems when they have to work at night or upcountry. - Women have constraints of physical conditions. - Women have little respect from subordinates. - Women cannot inspect work at high places while men can. - Women are more prone to danger than men.
7.	Planning and monitoring	- Women are more bold to criticize work and more detailed when inspecting projects. - Women are more detailed and careful. - Women are claimer when assessing work progress. - Women have systematic work plans. - Women are detailed when planning and inspecting work.	- Women are at risk of being insulted and defamed. - Women do not have site work experience so sometimes projects are not feasible.
8.	Site office engineer	- Women are more polite and use words that are suitable for coordinating work. - Women are more detailed and careful.	- Women are sometimes indecisive.

Table 5.13 Strengths and weaknesses of women civil engineers in each position (Cont.)

9.	Quantity surveyor	- Women are more detailed, cautious and perform thorough inspection when they have knowledge about the jobs.	- Most women have little knowledge about technical work and sometimes they do not know what to inspect.
10.	Others…	-	-

5.7 Discussion

This chapter presents an analysis of data on the multi-faceted hurdles faced by women engineers in contractor firms. There are three parts. In the first part, work experience of women engineers in the construction industry was viewed from the perspectives of two groups of women engineers, namely those working in contractor companies as well as those from non-contractor companies. Work challenges, problems in non-traditional careers, women's career advancement compared to men's, and career path guidelines provided to women engineers were the issues taken into consideration by the two groups of women engineers. Women engineers working in non-contractor companies seemed to have more opportunities of advancing in their careers and faced fewer problems of working in non-traditional careers than women engineers working in contractor companies. Thus, women engineers working in contractor companies had more limited career opportunities than women engineers working in non-contractor companies.

The second part of this study is concerned with whether women should be civil engineers, and their career progression in the construction industry. The perceptions of three groups of engineers including women and men engineers working in contractor companies, and women working in non-contractor companies were compared. Women and men engineers working in contractor companies shared the view that women should not be civil engineers because they had fewer career opportunities than their male counterparts in contractor companies, whilst women working in non-contractor companies thought otherwise. Further, the perceptions of both women and men engineers were similar with regard to opportunities for career progression for women in the construction industry.

In the third part, the perspectives of both women and men working in contractor companies were taken into account. The employment turnover rates for women engineers in contractor companies were higher than those of their male counterparts in contractor companies. Unlike men engineers who usually left because of their desire for higher salaries, women engineers in contractor companies left mainly because of dissatisfaction with career prospect.

Hence, working in non-contractor companies seems to be a desirable option for women engineers. Unless contractor companies undertake major policy changes regarding women engineers, the latter might shy away from embarking on civil

engineering careers in contractor companies. The findings of the current study will bring about such changes so as to encourage women engineers to achieve more in their careers as civil engineers, and to work as professionals on par with men. Besides, the information from this study can be used by construction and construction-related companies to motivate attract and retain women engineers in the Thai construction industry.

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Chapter VI
Factors Influencing Women Engineers' Careers in Contractor Organization and Implications for Their Turnover

6.1 Introduction

This chapter presents data analysis of questionnaires collected from 57 women engineers. The pilot study conducted in this research revealed that there were four problems leading to women engineers' high turnover, namely discrimination, work-life conflicts, sexual harassment and slow career progression; and factors influencing these problems were discrimination, work-life conflicts, sexual harassment and satisfaction of career progression. A research framework with both independent and dependent variables was then developed as seen in Chapter 4 (Figure 4.1). In this chapter, analysis results were presented, i.e. respondent profiles, work characteristics, organizational characteristics, discrimination problems, work-life conflicts, sexual harassment, satisfaction of career progression and turnover intentions. After that, an ANOVA hypothesis testing and analysis of the relationship between independent variables and dependent variables were conducted. Finally, the relationship between the four problems and turnover intentions were analyzed using the Pearson's correlation technique and factors influencing turnover of women engineers working in Thai contractor companies were found using the stepwise multiple regression.

Asaforemention, the themes emerging in the next section are explanatory survey results; statistical hypothesis testing; relation among demographic characteristics, work characteristics, organizational characteristics, and obstacles in contractor companies; correlation analysis between demographic characteristics, work characteristics, organizational characteristics and obstacles in contractor companies; multiple regression model prediction of problems/obstacles in contractor careers; correlation analysis between obstacles/problems in contractor careers and turnover intention; multiple regression of turnover intention model and discussion of the result. The details are described as follow.

6.2 Explanatory Survey Results

6.2.1 Profile of Respondents

Data of demographic characteristics are shown in the following table.

Table 6.1 Demographic characteristics n = 57

Demographics	Categories	Number	%
1. Work Location	1.1 Head Office	26	45.0
	1.2 Site Office	29	51.0
	1.3 Construction Field	2	4.0
2. Age-range	2.1 23-27 years	29	51.0
	2.2 28-32 years	21	37.0
	2.3 33-37 years	3	5.0
	2.4 38-42 years	3	5.0
	2.5 Over 42 years	1	2.0
3. Work Hours	3.1 30-40 hr.	6	11.0
	3.2 41-50 hr.	38	67.0
	3.3 51-60 hr.	10	18.0
	3.4 Over 60 hr.	3	5.0
4. Family Responsibility	4.1 No Responsibility	34	61.0
	4.2 Elderly Care	12	21.0
	4.3 Child Care	4	16.0
	4.4 Both Child and Elderly Care	1	2.0
5. Site Work Experience	5.1 0-1 years	40	70.0
	5.2 2-4 years	12	21.0
	5.3 5-10 years	4	7.0
	5.4 over 10 years	1	2.0
6. Tenure	6.1 0-1 years	35	62.0
	6.2 2-4 years	19	33.0
	6.3 5-10 years	3	5.0
7. Promotion	7.1 None	41	72.0
	7.2 1 time	10	18.0
	7.3 2 times	3	5.0
	7.4 over 2 times	3	5.0
8. Raise in Salary	8.1 None	12	21.0
	8.2 less than 1 time /yr	11	19.0
	8.3 1 time/yr	17	30.0
	8.4 over 1 time / yr	17	30.0

In Table 6.1 shows the data gathered from 57 women engineers who answered the questionnaires and can be categorized into eight groups as follows.

Work Location: the majority or 51 per cent of all respondents worked in site offices, 45 per cent worked in head offices and only two respondents or 4 per cent of all respondents worked at construction sites supervising workers.

Age range: the majority or 51 per cent of all respondents were 23-27 years old, 37 per cent were 28-32 years old and only one respondent or 2 per cent of all respondents were over 42 years old.

Work hours: the majority or 67 per cent of all respondents worked 41-50 hours/week, 18 per cent worked 51-60 hours/week and 5 per cent worked over 60 hours/week.

Family responsibility: the majority or 61 per cent of all respondents did not have family responsibilities, 21 per cent took care of the elderly, 16 per cnet took care of children and one person or 2 per cent of all respondents took care of both the elderly and children.

Site work experience: forty persons or 70 per cent of all respondents had 0-1 years of site work experience. It was further found that the majority of this group of respondents or 28 respondents did not have any site work experience at all. Twenty-one per cent of all respondents had 2-4 years of site work experience, 4 percent had 5-10 years of work experience and one respondent or 2 per cent of all respondents have over ten years of work experience.

Tenure: the majority or 62 per cent of all respondents had been in their current positions for 0-1 years, 33 per cent had been in their current positions for 2-4 years and 5 per cent had been in their current positions for 5-10 years.

Number of promotions: the majority or 72 per cent of all respondents had never been promoted, 18 per cent had been promoted one time, 5 per cent had been promoted two times and 5 per cent had been promoted more than two times.

Number of salary raises: 30 per cent of all respondents were given a salary raise once a year, 30 per cent were given salary raises more than one time a year, 21 per cent had never had a salary raise, and lastly 19 per cent were given a salary raise less than once a year.

6.2.2 Work Characteristics

Data of work characteristics are shown in the following table.

Table 6.2 Work characteristics n = 57

Work Characteristics	Categories	Number	%
1. Fieldwork Hours	1.1 None	2	4.0
	1.2 1-2 days/month	30	52.0
	1.3 1-2 days/week	2	4.0
	1.4 Over 4 days/week	23	40.0
2. Going Upcountry	2.1 None	46	81.0
	2.2 1-2 days/month	9	15.0
	2.3 1-2 days/week	2	4.0
3. Uncertain Work Times	3.1 Agree to lowest level	1	2.0
	3.2 Agree to low level	30	52.0
	3.3 Agree to average level	9	16.0
	3.4 Agree to high level	17	30.0

Table 6.2 Work characteristics (Cont.) n = 57

Work Characteristics	Categories	Number	%
4. Male Domination	4.2 Agree to low level	21	37.0
	4.3 Agree to average level	23	40.0
	4.4 Agree to high level	13	23.0

It can be seen from Table 6.2 that the majority of women engineers or 52% of all women engineers worked 1-2 days/month at consturciton sites. Twenty-three respondents, 40% of all women engineers worked more than 4 days/week at construction sites. Eighty-one percent of all respondents had never worked upcountry. Fifteen percent of them worked up country 1-2 days/month. The majority of respondents, 52% of all women engineers, agreed that their work schedules were uncertain to a low level. Thirty percent of all respondents agreed that their work schedules were uncertain to a high level. Finally, 40% of all respondents found that they mainly worked with men to an average level, 37% found that they mainly worked with men to a low level and 23% found that they mainly worked with men to a high level.

6.2.3 Organizational Characteristics

The following table shows characteristics of organizations where women engineers worked.

Table 6.3 Mean and standard deviation of organizational characteristics n = 57

Organizational Characteristics	Mean (μ)	S.D.	Value Level
Work Value	3.07	0.915	average
Training and Development Opportunities	2.98	0.885	average
Support from Superiors	2.63	0.909	average
Gender Diversity Climate	2.74	0.641	average
Total	**2.86**	**0.837**	**average**

*The mean difference is significance at the 0.05 level.

Table 6.3 shows that an average level of organizational characteristics (μ=2.86, S.D = 0.837): an average opinion about work value (μ=3.07, S.D=0.915); training and development opportunities (μ= 2.98, S.D.=0.885); support from superiors (μ=2.63, S.D.= 0.909); and gender diversity climates (μ=2.74, S.D. = 0.641).

6.2.4 Career Obstacles in Contractor Firms

Obstacles/problems in contractor careers are shown in the below table.

Table 6.4 Mean and standard deviation of women engineers' problems in contractor companies n = 57

Problems in Contractor Careers	Mean (μ)	S.D.	Level
Discrimination	3.93	0.593	High
Work-Life Conflicts	2.72	0.996	Average
Sexual Harassment	2.84	1.251	Average
Progression Satisfaction	1.95	0.666	Low
Total	**2.86**	**0.877**	**average**

*The mean difference is significance at the 0.05 level.

It was found from Table 6.4 that respondents found an average level of problems (μ = 2.86, S.D.= 0.877) in construction careers. When each problem was separately considered, it was found that discrimination was at a high level (μ = 3.93, S.D.=0.593), work-life conflicts were at an average level (μ = 2.72, S.D.=0.996), sexual harassment was at an average level (μ= 2.84, S.D.= 1.251) and satisfaction of career progression was at a low level (μ= 1.95, S.D.= 0.666).

6.2.5 Turnover Intention

Turnover intention is shown in the following table.

Table 6.5 Mean and standard deviation of turnover intention of women civil engineers n = 57

Turnover Intention	Mean (μ)	S.D.	Level
Many times they think of finding new jobs.	3.12	0.743	average
They are trying to find information about job applications.	3.48	0.778	high
They want to change jobs within the next year.	2.78	0.944	average
Total	**3.13**	**0.616**	**average**

*The mean difference is significance at the 0.05 level.

Table 6.5 shows that overall turnover intention of respondents was at an average level (μ=3.13, S.D. = 0.616). When each aspect was considered, it was found that women engineers' thinking of finding new jobs was at a high level (μ=3.12, S.D.=0.743), looking for information about job applications was at an average level (μ=3.48, S.D.=0.778), and wanting to change jobs within the next year was at an average level (μ=2.78, S.D.=0.944).

6.3 Statistical Hypothesis Testing

The research framework in Chapter 4 (Figure 4.1) was used to develop the hypothesis testing. The null hypotheses are described as follows.

Hypothesis 1: Women engineers who had different demographic characteristics perceived different problems in construction companies.

In addition to Hypothesis 1, there are seven sub-hypotheses as follows.

Hypothesis 1.1: Women engineers in different age ranges perceived different problems in contractor companies.

Hypothesis 1.2: Women engineers with different work hours perceived different problems in contractor companies.

Hypothesis 1.3: Women engineers who had different family responsibilities perceived different problems in contractor companies.

Hypothesis 1.4: Women engineers who had different site work experiences perceived different problems in contractor companies.

Hypothesis 1.5: Women engineers who had different lengths of tenure perceived different problems in contractor companies.

Hypothesis 1.6: Women engineers who had different promotion profiles perceived different problems in contractor companies.

Hypothesis 1.7: Women engineers who had different salary raise profiles perceived different problems in contractor companies.

Hypothesis 2: Women engineers who had different work characteristics perceived different problems in contractor companies.

In addition to Hypothesis 2, there are four sub-hypotheses as follows.

Hypothesis 2.1: Women engineers who had different fieldwork hours perceived different problems in contractor companies.

Hypothesis 2.2: Women engineers who had different requirements of going upcountry perceived different problems in contractor companies.

Hypothesis 2.3: Women engineers who had different uncertain work time perceived different problems in contractor companies.

Hypothesis 2.4: Women engineers who had different levels of male domination in their workplaces perceived different problems in contractor companies.

Hypothesis 3: Women engineers who had different organizational characteristics perceived different problems in contractor companies.

In additional to Hypothesis 3, there are four sub-hypotheses as follows.

Hypothesis 3.1: Women engineers who had different perceptions of work values perceived different problems in contractor companies.

Hypothesis 3.2: Women engineers who had different perceptions of training and development opportunities perceived different problems in contractor companies.

Hypothesis 3.3: Women engineers who had different perceptions of support from superiors perceived different problems in contractor companies.

Hypothesis 3.4: Women engineers who had different perceptions of gender diversity climates perceived different problems in contractor companies.

6.4 Relation among Demographic Characteristics, Work Characteristics, Organizational Characteristics, and Obstacles in Contractor Companies

The statistical hypothesis testing mentioned above was done by One-Way ANOVA. The results are explained below.

6.4.1 Analysis of Different Problems/Obstacles and Demographic Characteristics and Hypothesis Testing

Demographic characteristics, namely age, work hours, family responsibilities, site work experiences, tenure, promotion, and salary raisesa are illustrated in Tables 6.6 - 6.12.

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Table 6.6 Multiple comparison of women civil engineers' obstacles classified by age range n = 57

Obstacles	Age-range	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	23-27 yr.	29	4.07	0.530	High	3.977	0.007*
	28-32 yr.	21	3.86	0.573	High		
	33-37 yr.	3	3.67	0.577	High		
	38-42 yr.	3	4.00	0.000	High		
	Over42 yr.	1	2.00	0.000	Low		
	Total	57	3.93	0.593	High		
Work-Life Conflict	23-27 yr.	29	2.31	0.712	Low	5.338	0.001*
	28-32 yr.	21	2.90	1.044	Average		
	33-37 yr.	3	4.33	0.577	High		
	38-42 yr.	3	3.33	1.155	Average		
	Over42 yr.	1	4.00	0.000	High		
	Total	57	2.72	0.996	Average		
Sexual Harassment	23-27 yr.	29	4.00	1.131	High	2.796	0.035*
	28-32 yr.	21	2.29	1.271	Low		
	33-37 yr.	3	2.00	1.000	Low		
	38-42 yr.	3	3.00	1.000	Average		
	Over42 yr.	1	3.28	0.000	Average		
	Total	57	2.91	1.251	Average		
Progression Satisfaction	23-27 yr.	29	2.86	0.639	Average	0.392	0.813
	28-32 yr.	21	2.60	0.775	Average		
	33-37 yr.	3	2.33	0.577	Low		
	38-42 yr.	3	2.00	0.000	Low		
	Over42 yr.	1	2.00	0.000	Low		
	Total	57	2.36	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.6 shows that women engineers in different age ranges perceived four types of obstacles differently.

It was found that women engineers in different age ranges had different problems of discrimination ($p = 0.007$), work-life conflicts ($p = 0.001$) and sexual harassment ($p = 0.035$) with the significance level of 0.05, which is consistent with the hypothesis 1.1.

On the other hand, different age ranges did not affect satisfaction of career progression ($p = 0.813$) with a 0.05 significance level, which was inconsistent with the hypothesis 1.1.

Table 6.7 Multiple comparison of women civil engineers' problems classified by work hours per week n = 57

Obstacles	Work hours	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	30-40 hr.	6	3.83	0.408	High	1.090	0.362
	41-50 hr.	38	4.03	0.636	High		
	51-60 hr.	10	3.70	0.483	High		
	Over 60 hr.	3	3.67	0.577	High		
	Total	57	3.93	0.593	High		
Work-Life Conflict	30-40 hr.	6	2.50	0.837	Low	7.459	0.000*
	41-50 hr.	38	2.42	0.793	Low		
	51-60 hr.	10	3.10	1.033	Average		
	Over 60 hr.	3	3.33	1.155	Average		
	Total	57	2.84	0.996	Average		
Sexual Harassment	30-40 hr.	6	2.83	1.329	Average	2.078	0.114
	41-50 hr.	38	3.08	1.217	Average		
	51-60 hr.	10	2.30	1.160	Low		
	Over 60 hr.	3	1.67	1.155	Lowest		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	30-40 hr.	6	1.83	0.753	Low	0.398	0.755
	41-50 hr.	38	1.95	0.695	Low		
	51-60 hr.	10	1.90	0.568	Low		
	Over 60 hr.	3	2.33	0.577	Low		
	Total	57	1.95	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.7 shows that women engineers with different working hours per week had different perceptions of the four types of obstacles listed in the table. Details are as follows.

Women engineers of different work hours had different problems only of work-life conflicts (p = 0.000) at the significance level 0.05, which is consistent with the hypothesis 1.2.

Whereas, different work hours per week did not affect discrimination (p = 0.362), sexual harassment (p = 0.114) and satisfaction of career progression (p = 0.755) at the significance level 0.05, which was inconsistent with the hypothesis 1.2.

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Table 6.8 Multiple comparison of women civil engineers' problems classified by family responsibilities n = 57

Obstacles	Family Responsibility	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	No responsibility	34	4.09	0.514	High	2.579	0.063
	Elderly	12	3.75	0.622	High		
	Child	9	3.56	0.726	High		
	Both	2	4.00	0.000	High		
	Total	57	3.93	0.593	High		
Work-Life Conflict	No responsibility	34	2.03	0.300	Low	71.272	0.000*
	Elderly	12	3.33	0.778	Average		
	Child	9	4.11	0.333	High		
	Both	2	4.50	0.707	Highest		
	Total	57	2.72	0.996	Aver.		
Sexuaul Harassment	No responsibility	34	3.00	1.231	Average	1.305	0.283
	Elderly	12	3.00	1.414	Average		
	Child	9	2.22	0.972	Low		
	Both	2	2.00	1.414	Low		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	No responsibility	34	1.85	0.610	Low	0.866	0.465
	Elderly	12	2.08	0.900	Low		
	Child	9	2.00	0.500	Low		
	Both	2	2.50	0.500	Low		
	Total	57	1.95	0.707	Low		

*The mean difference is significance at the 0.05 level.

Table 6.8 shows that women engineers with different family responsibilities had different perceptions of the four types of obstacles listed in the table.

Women engineers of different family resposibilities had different problems of work-life conflicts (p = 0.000), at the significance level 0.05, which is consistent with the hypothesis 1.3.

Whereas, different family responsibilities did not affect discrimination (p = 0.063), sexual harassment (p = 0.283) and satisfaction of career progression (p = 0.465) at the significance level 0.05, which was inconsistent with the hypothesis 1.3.

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Table 6.9 Multiple comparison of women civil engineers' problems classified by site work experience n = 57

Obstacles	Site Work Experience	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	0-1 yr.	40	4.02	0.530	High	2.364	0.041*
	2-4 yr.	12	3.83	0.577	High		
	5-10 yr.	4	3.25	0.957	Average		
	Over 10 yr.	1	4.00	0.000	High		
	Total	57	3.93	0.593	High		
Work-Life Conflict	0-1 yr.	40	2.50	0.816	Low	2.790	0.049*
	2-4 yr.	12	3.08	1.311	Average		
	5-10 yr.	4	3.50	1.000	High		
	Over 10 yr.	1	4.00	0.000	High		
	Total	57	2.72	0.996	Average		
Sexual Harassment	0-1 yr.	40	2.90	1.257	Average	0.461	0.710
	2-4 yr.	12	2.50	1.382	Low		
	5-10 yr.	4	3.25	0.957	Average		
	Over 10 yr.	1	3.00	0.000	Average		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	0-1 yr.	40	1.85	0.700	Low	0.996	0.402
	2-4 yr.	12	2.17	0.577	Low		
	5-10 yr.	4	2.25	0.500	Low		
	Over 10 yr.	1	2.00	0.000	Low		
	Total	57	1.95	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.9 shows that women engineers with different site work experience had different perceptions of the four types of obstacles listed in the table.

Women engineers who different site work experience had different problems of discrimination ($p = 0.081$), work-life conflicts ($p = 0.049$), at the significance level 0.05, which is consistent with the hypothesis 1.4.

Whereas, different site work experience did not affect sexual harassment ($p = 0.710$) and satisfaction of career progression ($p = 0.402$) at the significance level 0.05, which was inconsistent with the hypothesis 1.4.

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Table 6.10 Multiple comparison of women civil engineers' problems classified by tenure n = 57

Obstacles	Tenure	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	0-1 yr.	35	4.05	0.539	High	5.958	0.005*
	2-4 yr.	19	3.75	0.452	High		
	5-10 yr.	3	3.00	1.000	Average		
	Total	57	3.93	0.593	High		
Work-Life Conflict	0-1 yr.	35	2.62	0.962	Average	2.882	0.065
	2-4 yr.	19	2.75	1.055	Average		
	5-10 yr.	3	4.00	0.000	High		
	Total	57	2.72	0.996	Average		
Sexual Harassment	0-1 yr.	35	2.79	1.298	Average	0.157	0.855
	2-4 yr.	19	3.00	1.206	Average		
	5-10 yr.	3	3.00	1.000	Average		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	0-1 yr.	35	1.88	0.670	Low	0.961	0.389
	2-4 yr.	19	2.08	0.669	Low		
	5-10 yr.	3	2.33	0.577	Low		
	Total	57	1.95	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.10 shows that women engineers with different tenures had different perceptions of the four types of obstacles listed in the table. Details are below.

Women engineers with different tenures had different problems of discrimination ($p = 0.005$) at the significant level 0.05, which is consistent with the hypothesis 1.5.

Whereas, different tenures did not affect work-life conflicts ($p = 0.065$), sexual harassment ($p = 0.855$), and satisfaction of career progression ($p = 0.389$) at the significance level 0.05, which was inconsistent with the hypothesis 1.5.

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Table 6.11 Multiple comparison of women civil engineers' problems classified by promotion n = 57

Obstacles	Promotion	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	Never	41	4.05	0.545	High	4.103	0.011*
	1 time	10	3.70	0.483	High		
	2 times	3	4.00	0.000	High		
	Over 2 times	3	3.00	1.000	Average		
	Total	57	3.93	0.593	High		
Work-Life Conflict	Never	41	2.41	0.865	Low	7.233	0.000*
	1 time	10	3.30	0.823	Average		
	2 times	3	3.33	1.155	Average		
	Over 2 times	3	4.33	0.577	Highest		
	Total	57	2.72	0.996	Average		
Sexual Harassment	Never	41	2.90	1.281	Average	2.184	0.036*
	1 time	10	2.60	1.265	Average		
	2 times	3	3.00	1.000	Average		
	Over 2 times	3	2.67	1.528	Average		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	Never	41	1.85	0.654	Lowest	3.098	0.008*
	1 time	10	2.20	0.789	Low		
	2 times	3	2.00	0.000	Average		
	Over 2 times	3	2.33	0.577	high		
	Total	57	1.95	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.11 shows that the frequency of promotions that women engineers received resulted in thier different perceptions of the four types of obstacles listed in the table.

Women engineers with different promotions had different problems of discrimination ($p = 0.048$), work-life conflicts ($p = 0.000$), sexual harassment ($p = 0.036$) and satisfaction of career progression ($p = 0.008$) at the significance level 0.05, which is consistent with the null hypothesis 1.6.

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Table 6.12 Multiple comparison of women civil engineers' problems classified by salary increase (Time/Year) n = 57

Obstacles	Salary Raise	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	Never	12	4.00	0.603	High	4.613	0.006*
	< 1 time	17	4.18	0.405	High		
	1 time	17	4.12	0.485	High		
	> 1 time	11	3.53	0.624	High		
	Total	57	3.93	0.593	High		
Work-Life Conflict	Never	12	2.33	0.778	Low	4.023	0.012*
	< 1 time	17	2.36	0.809	Low		
	1 time	17	2.59	0.870	Low		
	> 1 time	11	3.35	1.115	Average		
	Total	57	2.72	0.996	Average		
Sexual Harassment	Never	12	3.08	0.996	Average	3.361	0.025*
	< 1 time	17	3.64	1.206	High		
	1 time	17	2.24	1.251	Low		
	> 1 time	11	2.76	1.200	Average		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	Never	12	1.50	0.522	Low	5.023	0.000*
	< 1 time	17	2.09	0.701	Low		
	1 time	17	1.94	0.748	Low		
	> 1 time	11	2.18	0.529	Low		
	Total	57	1.95	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.12 shows that the number of salary incrases per year of women engineers caused them to have different perceptions of the four types of obstacles listed in the table.

It was found that women engineers of different levels of salary raise had different problems of discrimination ($p = 0.006$), work-life conflicts ($p = 0.012$), sexual harassment ($p = 0.072$) and satisfaction of career progression ($p = 0.043$) at the significance level 0.05, which is consistent with the hypothesis 1.7.

6.4.2 Analysis of Different Problems/Obstacles and Work Characteristics, and Hypothesis Testing

Work characteristics, i.e. fieldwork hours/week, uncertain times, long distance commutes, frequent changes of workplace, and male domination, are illustrated in Tables 6.13 - 6.16.

Table 6.13 Multiple comparison of women civil engineers' problems classified by fieldwork hours n = 57

Obstacles	Field work (hour)	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	Never	2	4.00	0.000	High	0.478	0.699
	1-2days/month	30	3.90	0.607	High		
	1-2days/week	23	3.50	0.707	High		
	> 4days/week	2	4.00	0.603	High		
	Total	57	3.93	0.593	High		
Work-Life Conflict	Never	2	3.00	1.414	Average	2.573	0.064
	1-2days/month	30	2.70	0.915	Average		
	1-2days/week	23	4.50	0.707	Highest		
	> 4days/week	2	2.57	0.992	Low		
	Total	57	2.72	0.996	Average		
Sexual Harassment	Never	2	2.00	0.000	Low	3.350	0.026*
	1-2days/month	30	2.47	1.196	Low		
	1-2days/week	23	2.50	2.121	Low		
	> 4days/week	2	3.43	1.121	High		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	Never	2	1.50	0.707	Lowest	0.501	0.683
	1-2days/month	30	1.90	0.712	Low		
	1-2days/week	23	2.00	0.000	Low		
	> 4days/week	2	2.04	0.638	Low		
	Total	57	1.95	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.13 shows that women engineers with different fieldwork hours had different perceptions of the four types of obstacles listed in the table.

Women engineers who had different fieldwork hours had different problems of sexual harassment ($p = 0.026$) at the significance level 0.05, which is consistent with the hypothesis 2.1.

On the other hand, different fieldwork hours did not affect discrimination ($p = 0.699$), work-life conflicts ($p = 0.064$), and satisfaction of career progression ($p = 0.683$) at the significance level 0.05, which was inconsistent with the hypothesis 2.1.

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Table 6.14 Multiple comparison of women civil engineers' problems classified by requirements to go upcountry n = 57

Obstacles	Up Country (Time)	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	Never	46	4.02	0.537	High	4.359	0.018*
	1-2days/month	9	3.67	0.707	High		
	1-2days/week	2	3.00	0.000	Average		
	Total	57	3.93	0.593	High		
Work-Life Conflict	Never	46	2.72	0.953	Average	1.366	0.102
	1-2days/month	9	2.33	0.866	Low		
	1-2days/week	2	4.50	0.707	Highest		
	Total	57	2.72	0.996	Average		
Sexual Harassment	Never	46	2.70	1.245	Average	1.292	0.071
	1-2days/month	9	3.78	0.833	High		
	1-2days/week	2	2.00	1.414	Low		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	Never	46	1.93	0.680	Low	0.724	0.489
	1-2days/month	9	1.89	0.601	Low		
	1-2days/week	2	2.50	0.707	Low		
	Total	57	1.95	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.14 shows that the number of upcountry trips of women engineers resulted in their different perceptions of the four types of obstacles listed in the table.

It was found that women engineers who had different requirements to go upcountry had different problems of discrimination ($p = 0.018$) at the significance level 0.05, which is consistent with the hypothesis 2.2.

On the other hand, different requirements of going upcountry did not affect work-life conflicts ($p = 0.018$) and sexual harassment ($p = 0.034$), satisfaction of career progression ($p = 0.489$) at the significance level 0.05, which was inconsistent with the hypothesis 2.2.

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Table 6.15 Multiple comparison of women civil engineers' problems classified by uncertain work time n = 57

Obstacles	Uncertain Time	Number (person)	Mean (μ)	S.D.	Level	F	*P*
Discrimination	Lowest	1	4.00	0.000	High	0.229	0.876
	Low	30	3.87	0.629	High		
	Average	17	4.00	0.500	High		
	High	9	4.00	0.612	High		
	Total	57	3.93	0.593	High		
Work-Life Conflict	Lowest	1	3.00	0.000	Average	0.310	0.818
	Low	30	2.80	1.031	Average		
	Average	17	2.44	1.014	Low		
	High	9	2.71	0.985	Average		
	Total	57	2.72	0.996	Average		
Sexual Harassment	Lowest	1	1.00	0.000	Low	2.405	0.078
	Low	30	2.63	1.129	Average		
	Average	17	2.67	1.414	Average		
	High	9	3.41	1.228	High		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	Lowest	1	3.00	0.000	Average	0.172	0.329
	Low	30	1.87	0.681	Low		
	Average	17	1.89	0.601	Low		
	High	9	2.06	0.659	Low		
	Total	57	1.95	0.666	Low		

*The mean difference is significance at the 0.05 level.

Table 6.15 shows that women engineers who had different levels of uncertain work time had different perceptions of the four types of obstacles listed in the table. Details are below.

Women engineers' different levels of uncertain work time did not affect discrimination ($p = 0.876$), work-life conflicts ($p = 0.818$), sexual harassment ($p = 0.078$), and satisfaction of career progression ($p = 0.329$) at the significance level 0.05, which was inconsistent with the hypothesis 2.3.

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Table 6.16 Multiple comparison of women civil engineers' problems classified by male domination n = 57

Obstacles	Male Domination	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	Low	21	3.95	0.590	High	12.690	0.002*
	Average	23	3.78	0.671	High		
	High	13	4.15	0.376	High		
	Total	57	3.93	0.593	High		
Work-Life Conflict	Low	21	3.00	1.140	Average	2.660	0.020*
	Average	23	2.65	0.885	Average		
	High	13	2.38	0.870	Low		
	Total	57	2.72	0.996	Average		
Sexual Harassment	Low	21	1.86	0.727	Low	33.373	0.000*
	Average	23	2.91	1.083	Average		
	High	13	4.31	0.480	Highest		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	Low	21	2.00	0.707	Low	7.415	0.032*
	Average	23	1.78	0.600	Lowest		
	High	13	2.15	0.689	Low		
	Total	57	1.95	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.16 shows that different levels of male domination faced by women engineers in their workplaces led to their different perceptions of the four types of obstacles listed in the table.

Women engineers with different levels of male domination had different problems of discrimination ($p = 0.002$), work-life conflicts ($p = 0.020$), sexual harassment ($p = 0.000$) and satisfaction of career progression ($p = 0.032$) at the significance level 0.05, which is consistent with the hypothesis 2.4.

6.4.3 Analysis of Different Problems/Obstacles and Organization Characteristics and Hypothesis Testing

Organization characteristics namely work value, training and development, support from superiors and diversity climates are illustrated in Tables 6.17 – 6.20.

Table 6.17 Multiple comparison of women civil engineers' problems classified by work value n = 57

Obstacles	Work Value	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	Strongly disagree	4	4.00	0.641	High	2.440	0.725
	Disagree	12	3.88	0.600	High		
	Neutral	23	3.90	0.577	High		
	Agree	18	4.20	0.447	High		
	Total	57	3.93	0.593	High		
Work-Life Conflict	Strongly disagree	4	2.25	0.639	Low	3.064	0.036*
	Disagree	12	3.08	1.038	Average		
	Neutral	23	2.57	1.397	Low		
	Agree	18	3.00	0.707	Average		
	Total	57	2.72	0.996	Average		
Sexual Harassment	Strongly disagree	4	2.00	0.875	Average	3.946	0.013*
	Disagree	12	3.08	1.256	Average		
	Neutral	23	3.15	1.414	Low		
	Agree	18	1.60	1.342	Lowest		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	Strongly disagree	4	1.71	0.550	Lowest	2.901	0.043*
	Disagree	12	2.04	0.676	Low		
	Neutral	23	1.75	0.756	Lowest		
	Agree	18	2.60	0.548	Average		
	Total	57	1.95	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.17 shows that women engineers with different work values had different perceptions of the four types of obstacles listed in the table. Details are below.

Women engineers with different work values had different problems of work-life conflicts (p = 0.0.036), sexual harassment (p = 0.013) and satisfaction of career progression (p = 0.043) at the significance level 0.05, which is consistent with the hypothesis 3.1.

On the other hand, different work values did not affect discrimination (p = 0.725), at the significance level 0.05, which was inconsistent with the hypothesis 3.1.

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Table 6.18 Multiple comparison of women civil engineers' problems classified by training and development opportunities n = 57

Obstacles	Training Opportunity	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	Disagree	34	3.94	0.600	High	4.655	0.014*
	Neutral	18	3.83	0.618	High		
	Agree	5	4.20	0.447	Highest		
	Total	57	3.93	0.593	High		
Work-Life Conflict	Disagree	34	2.41	0.892	Low	1.003	0.475
	Neutral	18	3.22	1.060	Average		
	Agree	5	3.00	0.707	Average		
	Total	57	2.72	0.996	Average		
Sexual Harassment	Disagree	34	3.09	1.215	Average	0.093	0.337
	Neutral	18	2.72	1.127	Average		
	Agree	5	1.60	1.342	Lowest		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	Disagree	34	1.76	0.606	Low	4.795	0.012*
	Neutral	18	2.11	0.676	Low		
	Agree	5	2.60	0.548	Average		
	Total	57	1.95	0.666	Low		

*The mean difference is significant at the 0.05 level.

Table 6.18 shows that women engineers with different training and development opportunities had different perceptions of the four types of obstacles listed in the table. Details are below.

Women engineers with different opportunities for training and development had different problems of discrimination ($p = 0.014$) and satisfaction of career progression ($p = 0.012$) at the significance level 0.05, which is consistent with the hypothesis 3.2.

On the other hand, different opportunities for training and development did not affect work-life conflicts ($p = 0.475$), and sexual harassment ($p = 0.337$), at the significance level 0.05, which was inconsistent with the hypothesis 3.2.

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Table 6.19 Multiple comparison of women civil engineers' problems classified by support from superiors n = 57

Obstacles	Superior Supported	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	Strongly disagree	4	3.25	0.500	Average	2.661	0.043*
	Disagree	17	4.05	0.539	High		
	Neutral	38	3.57	0.000	Average		
	Agree	6	4.00	0.787	Average		
	Strongly agree	2	4.00	0.000	Average		
	Total	57	3.93	0.593	Average		
Work-Life Conflict	Strongly disagree	4	2.25	1.258	Low	3.083	0.024*
	Disagree	17	2.55	0.889	Low		
	Neutral	38	3.57	0.000	High		
	Agree	6	4.00	0.976	High		
	Strongly agree	2	3.00	1.414	High		
	Total	57	2.72	0.996	Average		
Sexual Harassment	Strongly disagree	4	3.25	0.957	Average	0.703	0.593
	Disagree	17	2.88	1.273	Average		
	Neutral	38	2.71	0.707	Low		
	Agree	6	1.50	1.380	Low		
	Strongly agree	2	3.00	1.414	Average		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	Strongly disagree	4	2.00	0.000	Low	2.129	0.035*
	Disagree	17	2.00	0.698	Low		
	Neutral	38	1.86	0.000	Low		
	Agree	6	2.00	0.690	Low		
	Strongly agree	2	1.00	0.000	Lowest		
	Total	57	1.95	0.666	Low		

*The mean difference is significance at the 0.05 level.

Table 6.19 shows that women engineers with different support from their superiors had different perceptions of the four types of obstacles listed in the table. Details are below.

Women engineers with different support from superiors had different problems of discrimination ($p = 0.043$), work-life conflicts ($p = 0.024$), and satisfaction of career progression ($p = 0.035$) at the significance level 0.05, which is consistent with the hypothesis 3.3.

On the other hand, different support from superiors did not affect sexual harassment ($p = 0.593$), at the significance level 0.05, which was inconsistent with the hypothesis 3.3.

Table 6.20 Multiple comparison of women civil engineers' problems classified by gender diversity climates n = 57

Obstacles	Diversity Climate	Number (person)	Mean (μ)	S.D.	Level	F	*p*
Discrimination	Disagree	12	3.50	0.674	High	4.542	0.015*
	Neutral	34	4.03	0.926	High		
	Agree	11	4.09	0.179	High		
	Total	57	3.93	0.593	High		
Work-Life Conflict	Disagree	12	3.00	0.892	Average	5.037	0.010*
	Neutral	34	2.41	1.060	Low		
	Agree	11	3.36	1.036	Average		
	Total	57	2.72	0.996	Average		
Sexual Harassment	Disagree	12	2.67	1.215	Average	8.049	0.001*
	Neutral	34	3.26	1.127	Average		
	Agree	11	1.73	1.411	Low		
	Total	57	2.84	1.251	Average		
Progression Satisfaction	Disagree	12	2.17	0.606	Low	2.028	0.365
	Neutral	34	1.85	0.676	Low		
	Agree	11	2.00	0.716	Low		
	Total	57	1.95	0.666	Low		

*The mean different is significance at the 0.05 level.

Table 6.20 shows women engineers who worked in different gender diversity climates had different perceptions of the four types of obstacles listed in the table. Details are below.

Women engineers who worked in different gender diversity climates had different problems of discrimination ($p = 0.015$), work-life conflicts ($p = 0.010$), sexual harassment ($p = 0.001$), and satisfaction of career progression ($p = 0.009$) at the significance level 0.05, which is consistent with the hypothesis 3.4.

6.5 Correlation Analysis between Demographic Characteristics, Work Characteristics, Organizational Characteristics and Obstacles in Contractor Companies

Correlation analysis using Bivariate Pearson correlation was conducted among: demographic variables including age ranges, work hours per week, family responsibilities, site work experience, tenure, promotion and salary raises; work characteristic variables such as fieldwork hours, going upcountry, uncertain work time, and male domination; organizational characteristic variables such as work value, training and development opportunity, superior support, and gender diversity climate; and problems/obstacles of women engineers in construction careers such as discrimination, work-life conflicts, sexual harassment, and satisfaction of career progression and implication of women engineers' turnover. Details of the analysis are presented in Table 6.21.

Table 6.21 Pearson correlations between demographic characteristics, work characteristics, organizational variables and four obstacles in contractor companies

No.	Variables	1	2	3	4	5	6	7	8	9
1	Age-range	-								
2	Work Hours	0.219**	-							
3	Family Responsibility	0.624**	0.399**	-						
4	Site Work Experience	0.067	0.122	0.212**	-					
5	Tenure	0.433**	0.019	0.224**	0.235	-				
6	Promotion	0.708**	0.312**	0.613**	0.345	0.252**	-			
7	Raise in Salary	0.626**	0.166*	0.440**	0.237**	0.228**	0.453**	-		
8	Fieldwork Hours	-0.154	-0.015	-0.131	-0.122	-0.243*	-0.061	-0.206**	-	
9	Going Upcountry	0.094	0.165*	-0.089	0.111	0.133	0.191*	0.100	0.143	-
10	Uncertain Time	-0.089	0.002	-0.155	0.023	-0.095	-0.090	-0.054	0.688**	0.145
11	Male Domination	-0.058	-0.068	-0.163*	0.145	-0.135	0.073	-0.025	0.515**	0.081
12	Work Value	-0.049	-0.144	-0.161*	0.068	0.072	-0.077	0.134	-0.201*	0.044
13	Training and Development	0.043	-0.126	0.030	0.168	0.171*	-0.011	-0.247**	-0.422**	-0.038
14	Supportive from Superior	0.278**	-0.109	0.193*	0.268	0.257**	0.248**	0.309**	-0.295**	-0.005
15	Diversity Climate	0.059	-0.075	0.010	0.034	0.125	-0.003	0.334**	-0.312**	-0.084
16	Discrimination	-0.222**	-0.046	-0.183	-0.288**	-0.522**	-0.130	-0.214**	0.392**	-0.226**
17	Work-life Conflicts	0.468**	0.261**	0.760**	0.023	0.221	0.430**	-0.294**	-0.082	0.048
18	Sexual Harassment	-0.214**	0.126	-0.207**	0.011	-0.069	-0.062	-0.163**	0.318**	0.127
19	Progression Satisfaction	0.170*	-0.166*	0.095	0.036	0.325**	0.093	0.369**	-0.095	0.045

** Correlation is significance at the 0.01 level (2-tailed);

* Correlation is significance at the 0.05 level (2-tailed)

Table 6.21 Pearson correlations between demographic characteristics, work characteristics, organizational variables and four obstacles in contractor companies (Cont.)

No.	Variables	10	11	12	13	14	15	16	17	18	19
1	Age-range										
2	Work Hours										
3	Family Responsibility										
4	Site Work Experience										
5	Tenure										
6	Promotion										
7	Raise in Salary										
8	Field Work Hours										
9	Going Upcountry										
10	Uncertain Work Time	-									
11	Male Domination	0.395**	-								
12	Work Value	-0.207**	-0.135	-							
13	Training and Development	-0.315**	-0.256**	0.535**	-						
14	Supportive from Supperior	-0.127	0.085	0.140	0.227**	-					
15	Diversity Climate	-0.189*	-0.072	0.349**	0.405**	0.346**	-				
16	Discrimination	0.100	0.264**	0.018	-0.152	-0.266**	-0.220**	-			
17	Work-life Conflicts	-0.113	-0.034	-0.072	0.116	0.282**	-0.124	-0.142	-		
18	Sexual Harassment	0.269**	0.684**	-0.174*	-0.173*	0.010	-0.110	0.064	-0.097	-	
19	Progression Satisfaction	-0.239**	-0.236**	0.420**	0.607**	0.363**	0.485**	-0.404**	0.128	-0.067	-

** Correlation is significance at the 0.01 level (2-tailed);

*Correlation is significance at the 0.05 level (2-tailed)

Bivariate Pearson correlations in Table 6.21 show that demographic, work, and organizational characteristic variables are correlated with four dimensions of obstacles of women engineers, namely discrimination, work-life conflicts, sexual harassment and satisfaction of career progression. Explanations are given by ranking factors affecting these obstacles as shown in Table 6.22-6.25.

Table 6.22 Ranking factors affecting discrimination n = 57

Rank	Factor Affecting Discrimination	Correlation Value
1	Tenure	-0.522**
2	Fieldwork Hours	0.392**
3	Supportive from Superior	-0.266**
4	Male Domination	0.264**
5	Site Work Experience	-0.228**
6	Going Upcountry	-0.226**
7	Age-range	-0.222**
8	Gender Diversity Climate	-0.220**
9	Salary Raise	-0.214**

**The mean difference is significance at the 0.01 level (2-tailed).

*The mean difference is significance at the 0.05 level (2-tailed).

All factors presented in Table 6.22, consisting of five demographic characteristics, three work characteristics and two organizational variables, have both negative and positive associations with discrimination problems of women engineers. In reference to demographic variables, tenure ($r = -0.522$, $p = 0.000$), site work experience ($r = -0.228$, $p = 0.000$), age range ($r = -0.222$, $p = 0.005$), and salary raise ($r = -0.214$, $p = 0.007$), were negatively correlated with discrimination. Next, work characteristic variables; field work hours ($r = 0.392$, $p = 0.000$), and male domination ($r = 0.264$, $p = 0.001$), were positively correlated with discrimination while going upcountry ($r = -0.226$, $p = 0.004$) was negatively correlated with discrimination. Lastly, among organizational variables, superiors' support ($r = -0.266$, $p = 0.001$), and gender diversity climates ($r = -0.220$, $p = 0.005$) were negatively correlated with discrimination.

Particularly, tenure was a factor that had significantly negative relationships with discrimination problems of women engineers. This implied that women engineers with high tenure were likely to have fewer discrimination problems. In summary, the longer the tenure, the fewer discrimination problems women engineers tended to have in their careers.

In addition, going upcountry, support from superior, salary raises, age ranges and site work experience also affected the number of discrimination problems perceived by women engineers.

Moreover, fieldwork hours and male domination were factors having significant positive relationships with discrimination problems of women engineers. This implied that women engineers with those work characteristics (fieldwork hours and male domination) were likely to have discrimination problems. In other words, the higher the level of those factors they had, the more discrimination problems they tended to have in their careers. In conclusion, all factors having both significantly negative and positive relationships as presented in Table 6.22 made women engineers perceive discrimination problems in different ways.

Table 6.23 Ranking factors affecting work-life conflicts n = 57

Rank	Factor Affecting Work-Life Conflicts	Correlation Value
1	Family Responsibilities	0.760**
2	Age-range	0.468**
3	Promotion	0.430**
4	Salary Raise	0.294**
5	Superiors' support	0.282**
6	Work Hours	0.261**
7	Tenure	0.221**

**The mean difference is significance at the 0.01 level (2-tailed).
*The mean difference is significance at the 0.05 level (2-tailed).

All the factors presented in Table 6.23, which consisted of seven demographic characteristics and one organizational variables, had positive associations with work-life conflicts of women engineers. All demographic variables, family responsibilities ($r = 0.760$, $p = 0.000$), age range ($r = 0.468$, $p = 0.000$), promotions ($r = 0.430$, $p = 0.000$), salary raises ($r = 0.294$, $p = 0.000$), work hours ($r = 0.261$, $p = 0.001$), and tenure ($r = 0.221$, $p = 0.005$) were positively correlated with work-life conflicts. Next, no work characteristic variables were negatively correlated with work-life conflicts. Lastly, among organizational variables, support from superiors ($r = 0.282$, $p = 0.000$) was positively correlated with work-life conflicts, and gender diversity climates ($r = -0.224$, $p = 0.001$) were negatively correlated with discrimination.

Particularly, family responsibilities were the factor that had a significantly positive relationship with work-life conflicts of women engineers. This implied that women engineers with high family responsibilities were likely to have high work-life conflicts. It can be concluded that the higher the level of family responsibilities they had, the more work-life conflicts they tended to have in their careers.

In addition, age range, promotions, salary raises, superiors' support, work hours and tenure also affected occurrence of work-life conflicts perceived by women engineers. In other words, when the levels of those factors were high, women engineers seemed to have more work-life conflicts. In conclusion, all factors having

significant positive relationships as seen in Table 6.23 made women engineers perceive work-life conflicts in the same ways.

Table 6.24 Ranking factors affecting sexual harassment n = 57

Rank	Factor Affecting Sexual Harassment	Correlation Value
1	Male Domination	0.684**
2	Field Work Hours	0.318**
3	Uncertain Work Schedules	0.269**
4	Age-range	-0.214**
5	Family Responsibilities	-0.207**
6	Work Value	-0.174*
7	Training and Development Opportunities	-0.173*
8	Salary Raises	-0.163**

**The mean difference is significance at the 0.01 level (2-tailed).
*The mean difference is significance at the 0.05 level (2-tailed).

All variables presented in Table 6.24, which consisted of three demographic characteristics, three work characteristics and two organizationl variables, had both negative and positive associations with discrimination problems of women engineers. Of the demographic variables, age range (r = -0.214, p = 0.007), family responsibilities (r = -0.207, p = 0.009) and salary raises (r = -0.163, p = 0.041) were negatively correlated with sexual harassment. Next, work characteristic variables, male domination (r = 0.684, p = 0.000), fieldwork hours (r = 0.318, p = 0.000), and uncertain work time (r = 0.269, p = 0.001) were positively correlated with sexual harassment. Lastly, among organizational variables, work value (r = -0.174, p = 0.029), and training and development opportunities (r = -0.173, p = 0.030) were negatively correlated with sexual harassment.

Particularly, male domination was the factor having highly significant positive relationships with the sexual harassment of women engineers. This implied that women engineers who worked in highly male-dominated workplaces were likely to have high sexual harassment problems. In other words, the higher the level of male domination women engineers faced, the more sexual harassment problems they tended to have in their careers.

In addition, fieldwork hours and uncertain work schedules also affected occurrence of sexual harassment problems perceived by women engineers. In other words, the higher the levels of these variables they had, the more possibility of sexual harassment there would be.

Moreover, age range, family responsibilities, work value, training and development opportunities and salary raises were factors that had significant negative relationships with sexual harassment problems of women engineers. In other words, the higher the level of those factors they had, the little sexual harassment problems

they tended to have in their careers. In conclusion, all factors having both significantly negative and positive relationships as presented in Table 6.24 made women engineers perceive sexual harassment problems in different ways.

Table 6.25 Ranking factors affecting satisfaction of career progression n = 57

Rank	Factor Affecting Progression Satisfaction	Correlation Value
1	Training and Development Opportunity	0.607**
2	Gender Diversity Climate	0.485**
3	Work Value	0.420**
4	Salary Raise	0.369**
5	Superior Support	0.363**
6	Tenure	0.325**
7	Uncertain Work Schedule	-0.239**
8	Male Domination	-0.236**
9	Age-range	0.170*
10	Work Hours	-0.166*

**The mean difference is significance at the 0.01 level (2-tailed).

*The mean difference is significance at the 0.05 level (2-tailed).

All factors presented in Table 6.25, which consisted of four demographic characteristics, three work characteristics and four organizational variables had both negative and positive associations with satisfaction of career progression of women engineers. Of the demographic variables, salary raises (r = 0.369, p = 0.000), tenure (r =0.325, p = 0.000), and age range (r = 0.170, p = 0.032) were positively correlated with satisfaction of career progression while work hours per week (r = -0.166, p = 0.038) were negatively correlated with satisfaction of career progression. Next, work characteristics, uncertain work (r = -0.239, p = 0.002) and male domination (r = -0.236, p = 0.003) were negatively correlated with satisfaction of career progression. Lastly, among organization variables, training and development opportunities (r = 0.607, p = 0.000), gender diversity climates (r = 0.485, p = 0.000), work value (r = 0.420, p = 0.000) and superiors' support (r = 0.363, p = 0.000) were positively correlated with satisfaction of career progression.

Particularly, training and development opportunities were the factor having significantly positive relationships with the satisfaction of the career progression of women engineers. This implied that women engineers with high training and development opportunities in workplaces were likely to have high satisfaction of career progression. It can be concluded that more training and development opportunities resulted in higher satisfaction of career progression of women engineers.

In addition, organizations' gender diversity climates, work value, salary raises, superiors' support, tenure and age range also affected satisfaction of career

progression perceived by women engineers. In other words, the higher the level of these factors, the more satisfied with career progression women engineers were.

Moreover, uncertain work schedule, male domination and work hours were factors having significantly negative relationships with satisfaction of career progression of women engineers. In other words, with a higher level of those factors, women engineers seemed to be less satisfied with career progression. In conclusion, all factors having both significant negative and positive relationships as presented in Table 6.25 caused women engineers to perceive satisfaction of career progression in different ways.

6.6 Multiple Regression Model Prediction of Problems/Obstacles in Contractor Careers

In the previous section, results from the correlation analysis identified the significant independent variables for each obstacle in non-traditional careers (discrimination, work-life conflicts, sexual harassment, and progression satisfaction). Some of those dependent factors have significantly positive influence while some have significantly negative influence on resulting dependent variables. In this section, a stepwise multiple regression procedure was performed to test the ability of the independent variables to predict contractor careers' problems. In the last section, variables that were not significantly correlated with the dimensions were removed. The remaining variables were analyzed in this section.

6.6.1 Discrimination Obstacle Model

The regression model of discrimination obstacle has been developed, with the results of this model summarized in Tables 6.26 and 6.27. The R-Square value is 0.411. It presents a linear relationship with three independent variables, namely demographic, work characteristic and organizations factors.

Table 6.26 Discrimination model summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.522[a]	0.273	0.268	1.012
2	0.590[b]	0.348	0.339	0.962
3	0.641[c]	0.411	0.400	0.917

a. Predictors: (Constant), Tenure

b. Predictors: (Constant), Tenure, Fieldwork hours

c. Predictors: (Constant), Tenure, Fieldwork hours, Male domination

d. Dependent Variable: Discrimination

Table 6.26 represented the third model (R square = 0.411) consisting of three independent variables of the discrimination model, selected and presented in Table 6.27 below. These variables were tenure, fieldwork hours, and male domination. Tenure variable had significantly negative relationships with discrimination in the correlation analysis while the fieldwork hour and male domination variables had a significantly positive relationship with discrimination in the correlation analysis. The beta values of all these independent factors from multiple regression analysis were also presented in Table 6.27.

Table 6.27 Multiple regression analysis for discrimination model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Standard Error	Beta		
1	(Constant)	4.442	0.175		25.379	0.000
	Tenure	-0.691	0.090	-0.522	-7.652	0.000
2	(Constant)	3.654	0.250		14.593	0.000
	Tenure	-0.600	0.088	-0.454	-6.789	0.000
	Fieldwork Hours	0.260	0.062	0.282	4.215	0.000
3	(Constant)	4.280	0.284		15.074	0.000
	Tenure	-0.505	0.087	-0.382	-5.778	0.000
	Fieldwork Hours	0.283	0.059	0.307	4.796	0.000
	Male Domination	0.694	0.170	0.261	4.073	0.000

a. Dependent Variable: Discrimination

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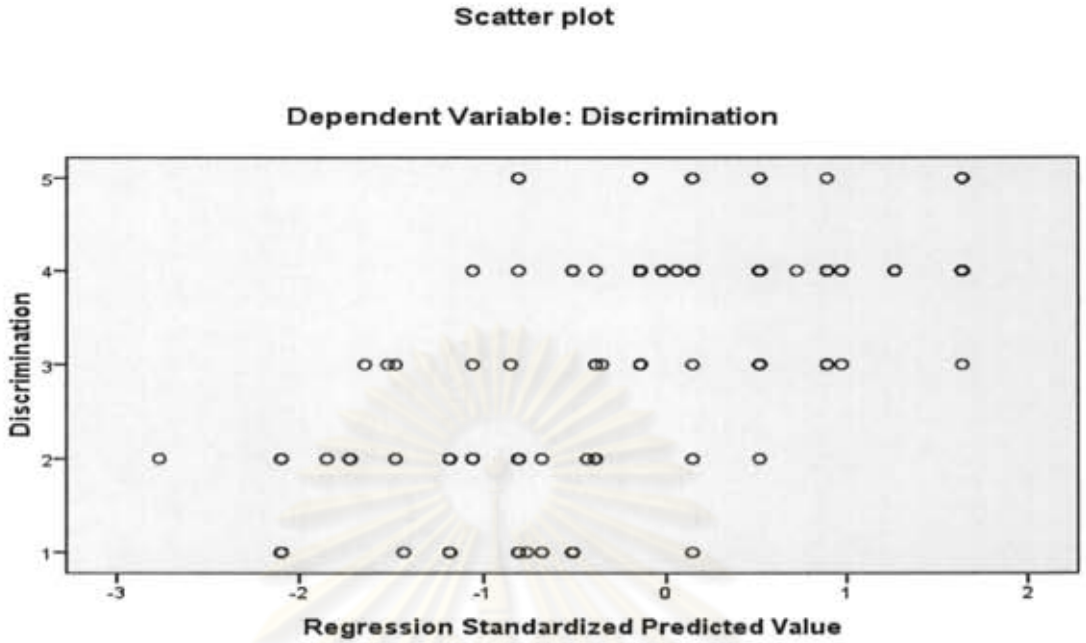

Figure 6.1 Discrimination scatter plot

Table 6.28 Summary of demographic characteristics, work characteristics and organizational predictors of discrimination n = 57

Variables	Cumulative R^2	Cumulative Adjusted R^2	Stanadardized Beta(β)	p
Tenure	0.273	0.268	-0.382	0.000
Fieldwork Hours	0.348	0.339	0.307	0.000
Male Domination	0.411	0.400	0.261	0.000

Note R^2 values are cumulative and represent the change in R^2 as each variable is entered into the model.

Table 6.28 shows that 40 per cent of the variation can be explained by the regression model. In regard to discrimination (adjust R^2 = 0.400), significant demographic predictors included tenure (β = -0.382, p = 0.000), work characteristics variables included fieldwork hours (β = 0.307, p = 0.000), and male domination (β = 0.261, p = 0.000). No significant predictor was from organizational variables.

6.6.2 Work-Life Conflict Model

The regression model of work-life conflicts was developed, with the results of this model summarized in Tables 6.29 and 6.30. The R-Square value was 0.597 presenting a linear relationship with three independent factors, namely demographic, work characteristic and organizations factors.

Table 6.29 Work-life conflict model summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.760[a]	0.578	0.575	0.746
2	0.773[b]	0.597	0.592	0.731

a. Predictors: (Constant), Family responsibility

b. Predictors: (Constant), Family responsibility, Support from superior

c. Dependent Variable: Work-life conflicts

The results from Table 6.29 above show the second model (R square = 0.597), consisting of two independent variables of the work-life conflict model, selected and presented in Table 6.30 below. These variables were family responsibilities, superiors' support. Family responsibility and superiors' support variables had significantly positive relationships with work-life conflicts in the correlation analysis. The beta values of all these independent factors from multiple regression analysis were also presented in Table 6.30.

Table 6.30 Multiple regression analysis for work-life conflict model

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Standard Error	Beta	t	Sig.
1	(Constant)	1.229	0.126		9.749	0.000
	Family Responsibility	0.958	0.066	0.760	14.613	0.000
2	(Constant)	0.832	0.192		4.343	0.000
	Family Responsibility	0.924	0.066	0.733	14.101	0.000
	Support from Superiors	0.153	0.056	0.141	2.707	0.008

a. Dependent Variable: Work-life conflicts

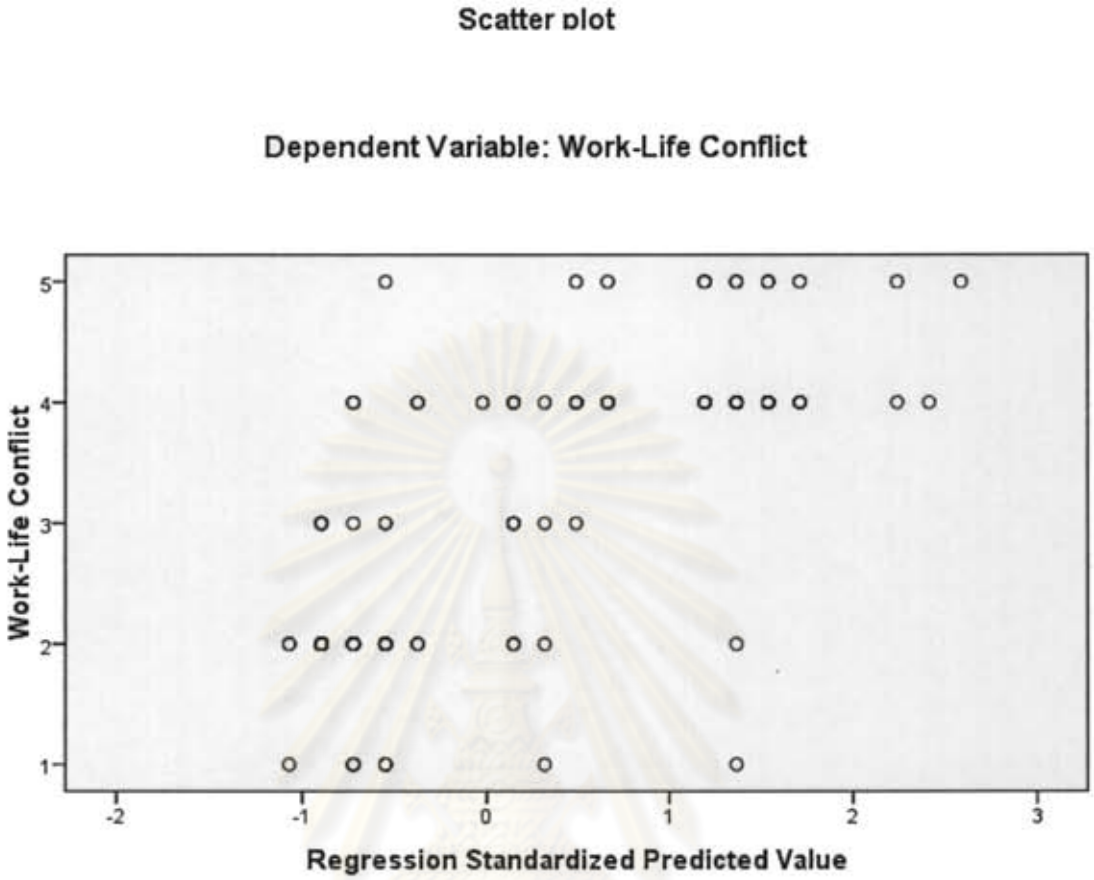

Figure 6.2 Work-life conflict scatter plot

Table 6.31 Summary of demographic characteristics, work characteristics and organizational predictors of work-life conflicts n = 57

Variables	Cumulative R^2	Cumulative Adjusted R^2	Stanadardized Beta(β)	p
Family Responsibilities	0.578	0.575	0.726	0.000
Superiors' support	0.597	0.592	0.180	0.001

Note R^2 values are cumulative and represent the change in R^2 as each variable is entered into the model.

Table 6.31 shows that 59 per cent of the variation can be explained by the regression model. In regard to work-life conflicts (adjust $R^2 = 0.592$), significant demographic predictors included family responsibilities ($\beta = 0.726$, $p = 0.000$) and organization variables included superior support ($\beta = 0.180$, $p = 0.001$). There was no significant predictor from work characteristics variables.

6.6.3 Sexual Harassment Model

The regression model of sexual harassment obstacles was developed, the results of which were summarized in Tables 6.32 and 6.33. The R-Square value was

0.498. This presents a linear relationship with three independent variables, namely demographic, work characteristic and organizations factors.

Table 6.32 Sexual harassment model summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.684[a]	0.468	0.464	0.864
2	0.706[b]	0.498	0.491	0.842

a. Predictors: (Constant), Male domination

b. Predictors: (Constant), Male domination, Age-range

c. Dependent Variable: Sexual harassment

Table 6.32 represents the second model (R square = 0.498), which consisted of two independent variables of the sexual harassment model, and was selected and presented in Table 6.33. These variables were male domination and age range. The male domination factor had a significantly positive relationship with sexual harassment in the correlation analysis while the age range variable had a significantly negative relationship with sexual harassment in the correlation analysis. The beta values of all these independent factors from multiple regression analysis were also presented in Table 6.33.

Table 6.33 Multiple regression analysis for sexual harassment model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Standard Error	Beta		
1	(Constant)	0.344	0.207		1.663	0.098
	Male Domination	0.897	0.077	0.684	11.704	0.000
2	(Constant)	0.791	0.249		3.176	0.002
	Male Domination	0.884	0.075	0.674	11.814	0.000
	Age-range	-0.217	0.071	-0.174	-3.056	0.003

a. Dependent Variable: Sexual Harassment

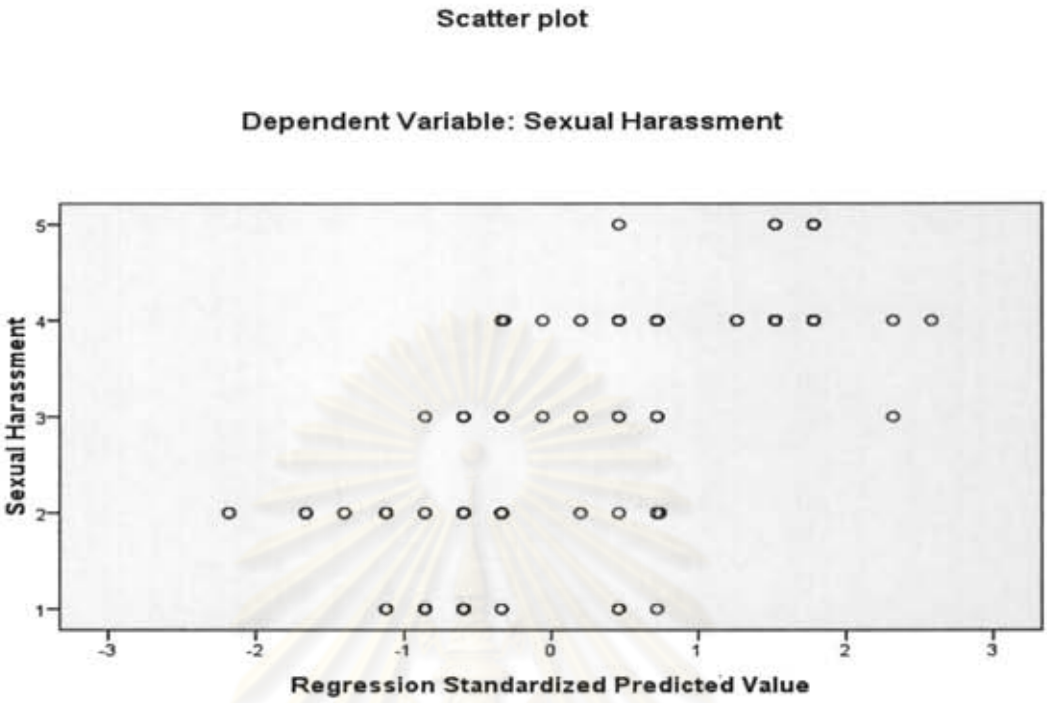

Figure 6.3 Sexual harassment scatter plot

Table 6.34 Summary of demographic characteristics, work characteristics and organizational predictors of sexual harassment n = 57

Variables	Cumulative R^2	Cumulative Adjusted R^2	Stanadardized Beta(β)	p
Male domination	0.468	0.464	0.674	0.000
Age range	0.498	0.491	-0.174	0.003

Note R^2 values are cumulative and represent the change in R^2 as each variable is entered into the model.

Table 6.34 shows that 49 per cent of the variation can be explained by the regression model. In regard to sexual harassment (adjust R^2 = 0.491), significant demographic predictors included age range (β = -0.174, p = 0.003). The work characteristic variable was male domination (β = 0.674, p = 0.000). There was no significant predictor from organizational variables.

6.6.4 Prediction of Satisfaction of Career Progression Model

The regression model of progression satisfaction was developed, the results of which were summarized in Tables 6.35 and 6.36. The R-Square value was 0.495. This presents a linear relationship with three independent factors, namely demographic, work characteristic and organizations factors.

Table 6.35 Satisfaction of career progression model summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.607[a]	0.368	0.364	0.811
2	0.661[b]	0.437	0.429	0.768
3	0.693[c]	0.480	0.470	0.740
4	0.703[d]	0.495	0.482	0.732

a. Predictors: (Constant), Training and development

b. Predictors: (Constant), Training and development, Organizational diversity climate

c. Predictors: (Constant), Training and development, Organizational diversity climate, Tenure

d. Predictors: (Constant), Training and development, Organizational diversity climate, Tenure, Support from superior

e. Dependent Variable: Progression Satisfaction

Table 6.35 represents the forth model (R square = 0.495), consisting of four independent variables of the progression satisfaction model, and was selected and presented in Table 6.36 below. These variables were training and development opportunities, gender diversity climates, tenure, and support from superiors. All these variables had significantly positive relationships with progression satisfaction in the correlation analysis. The beta values of all these independent factors from multiple regression analysis were also presented in Table 6.36.

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Table 6.36 Multiple regression analysis for the satisfaction of career progression model

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.764	0.150		11.747	0.000
	Training and Development	0.483	0.051	0.607	9.537	0.000
2	(Constant)	1.187	0.195		6.094	0.000
	Training and Development	0.391	0.052	0.491	7.451	0.000
	Diversity Climate	0.296	0.068	0.286	4.339	0.000
3	(Constant)	0.877	0.206		4.249	0.000
	Training and Development	0.366	0.051	0.460	7.184	0.000
	Diversity Climate	0.282	0.066	0.272	4.272	0.000
	Tenure	0.241	0.067	0.212	3.595	0.000
4	(Constant)	0.683	0.224		3.043	0.003
	Training and Development	0.359	0.051	0.451	7.091	0.000
	Diversity Climate	0.242	0.068	0.233	3.560	0.000
	Tenure	0.210	0.068	0.185	3.086	0.002
	Superior support	0.127	0.061	0.132	2.095	0.038

a. Dependent Variable: Progression satisfaction

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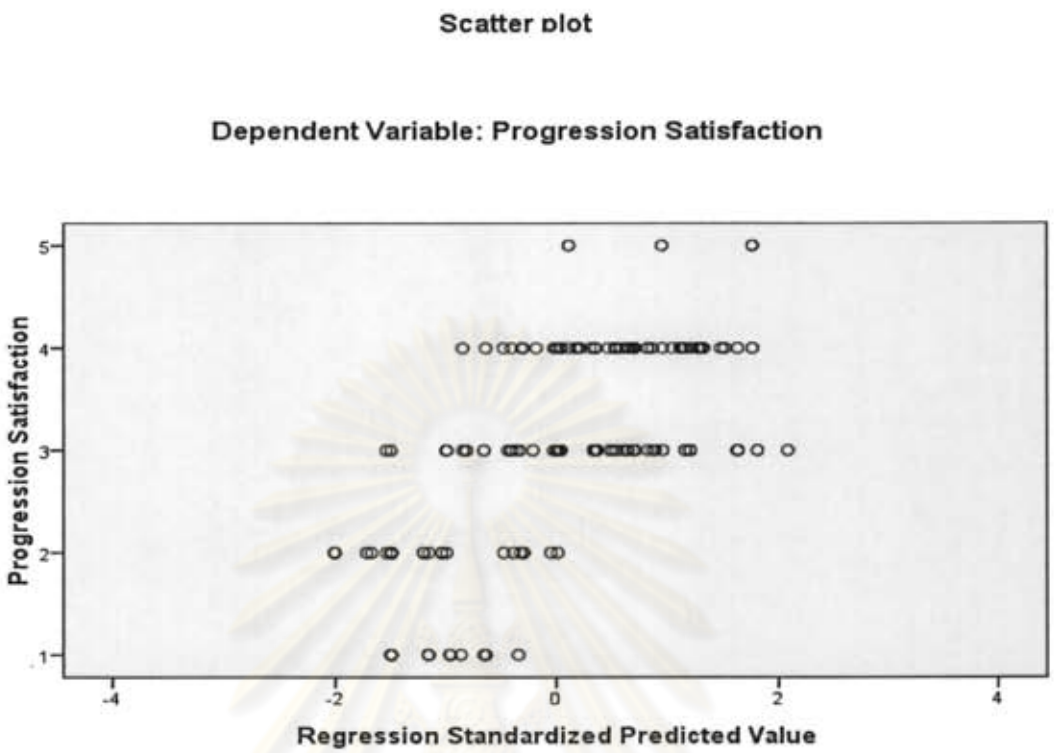

Figure 6.4 Satisfaction of career progression scatter plot

Table 6.37 Summary of demographic characteristics, work characteristics, and organizational predictors of career progression satisfaction n = 57

Variables	Cumulative R^2	Cumulative Adjusted R^2	Stanadardized Beta(β)	p
Training & Development	0.368	0.364	0.451	0.000
Diversity Climate	0.347	0.429	0.233	0.000
Tenure	0.480	0.470	0.185	0.002
Superiors' support	0.495	0.482	0.132	0.038

Note R^2 values are cumulative and represent the change in R^2 as each variable is entered into the model.

Table 6.37 shows that 48 % of the variation can be explained by the regression model. In regard to career progression satisfaction (adjust $R^2 = 0.482$), significant demographic predictors were tenure only ($\beta = 0.185$, $p = 0.002$). Next, organizational variables included training and development opportunities ($\beta = 0.451$, $p = 0.000$), gender diversity climates ($\beta = 0.233$, $p = 0.000$), and superiors' support ($\beta = 0.132$, $p = 0.038$). There was no significant predictor from work characteristic variables.

6.7 Correlation Analysis between Obstacles/Problems in Contractor Careers and Turnover Intention

Bivariate Pearson correlations between demographic variables, obstacles in contractor careers and turnover intention are shown in Table 6.38.

Table 6.38 Pearson correlation coefficients for turnover, obstacles in contractor companies and satisfaction of career progression n = 57

Variables	1	2	3	4	5
1. Discrimination	-				
2. Work-Life Conflicts	-0.039	-			
3. Sexual Harassment	-0.156	-0.108	-		
4. Progression Satisfaction	-0.228	-0.220	-0.080	-	
5. Turnover Intention	0.331*	0.110	0.141	-0.737**	-

** Correlation is significance at the 0.001 level (2-tailed);
* Correlation is significance at the 0.05 level (2-tailed)

From Table 6.38 above, results can be summarized in Table 6.39 below.

Table 6.39 Ranking factors affecting turnover intention n = 57

Rank	Factor Affecting Turnover Intention	Correlation Value
1	Satisfaction of Career Progression	-0.737**
2	Discrimination	0.331**

**The mean different is significance at the 0.01 level (2-tailed).
*The mean different is significance at the 0.05 level (2-tailed).

The data in Table 6.39 shows bivariate correlation coefficients of obstacles in non-traditional careers, satisfaction of career progression and turnover intention of the respondents. The two variables, namely satisfaction progression and discrimination, were found affecting turnover intention. Progression satisfaction negatively affected turnover intention, while discrimination positively affected turnover intention.

Particularly, satisfaction of career progression was a variable with significantly negative relationship with turnover intention of women engineers. This implied that women engineers with high satisfaction of career progression were less likely to resign. In other words, with a higher level satisfaction in their career progression, women engineers tended to change their jobs less often.

In addition, discrimination also affected occurrence of turnover intention of women engineers. In other words, the higher the level of discrimination they had, the higher the possibility there would be for them to resign. In conclusion, the two

variables having both significant negative and positive relationships as presented in Table 6.39 caused women engineers to perceive turnover intention in different ways.

6.8 Multiple Regression of Turnover Intention Model

A stepwise multiple regression procedure was applied to test the ability of the independent variables to predict the turnover intention of the respondents. It is a sequent procedure of Bivariate Pearson correlations, in which a large number of independent variables and those that were not significantly correlated with the dimensions were omitted. Those that were significantly correlated were analyzed in this section. The results of the analysis are shown in Tables 6.40 and 6.41. The R-Square value is 0.620.

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Table 6.40 Turnover intention model summary

Model	R	R Square	Adjusted R Square	Standard Error of the Estimate
1	0.787[a]	0.620	0.613	0.570

a. Predictors: (Constant), Progression Satisfaction

b. Dependent Variable: Intention

The results from Table 6.40 above show the forth model (R square = 0.620), which consisted of one independent factor on the turnover intention model, and was selected and presented in Table 6.41 below. It was found that progression satisfaction had a significantly negative relationship with turnover intention in the correlation analysis. The beta values of all these independent factors from multiple regression analysis were also presented in Table 6.41.

Table 6.41 Multiple regression analysis for turnover intention

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Standard Error	Beta		
1	(Constant)	5.848	0.244		23.965	0.000
	Progression Satisfaction	-0.950	0.100	-0.787	-9.475	0.000

a. Dependent Variable: Intention

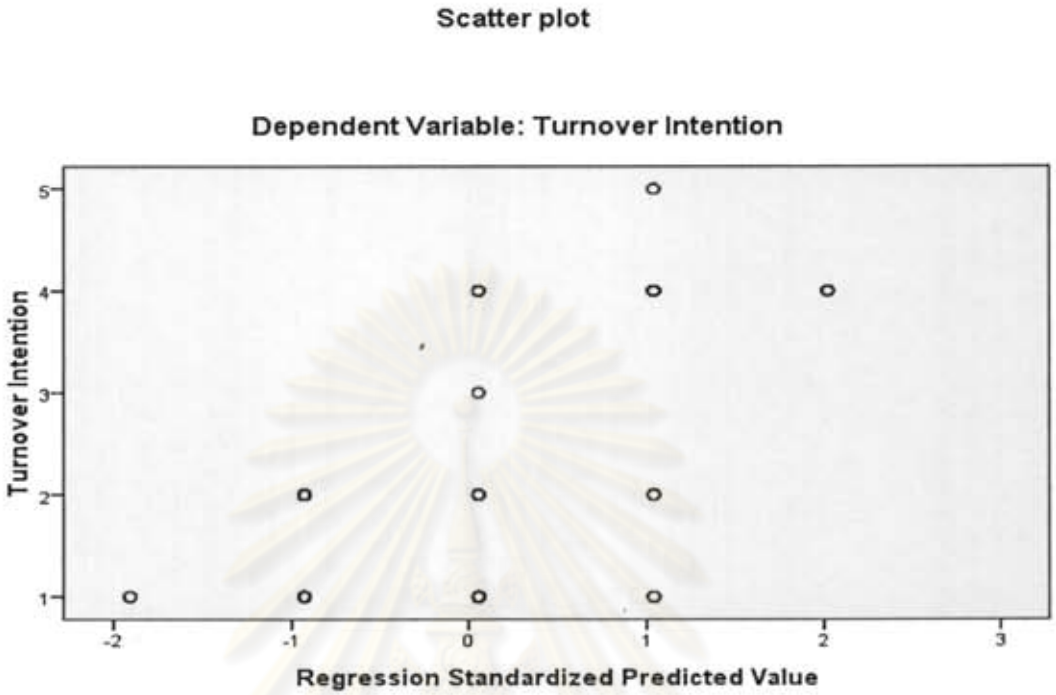

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Figure 6.5 Turnover intention scatter plot

Table 6.42 Summary of discrimination, work-life conflicts, sexual harassment, and career progression satisfaction predictors of turnover intention n = 57

Variables	Cumulative R^2	Cumulative Adjusted R^2	Stanadardized Beta(β)	p
Career Progression Satisfaction	0.620	0.613	-0.787	0.000

Note R^2 values are cumulative and represent the change in R^2 as each variable is entered into the model.

Table 6.42 shows that 62% of the variation can be explained by the regression model. In regard to turnover intention (adjust R^2 = 0.620), career progression satisfaction (β = -0.787, p = 0.000) was the only one significant predictor. Discrimination, work-life conflicts, and sexual harassment were not significant in this model as predictors.

6.9 Discussion

Analyses of factors affecting problems in contractor companies were presented in this chapter. The descriptive statistics, namely mean, percentage and S.D. of demographic factor, work characteristic factors, organizational factors, four problems in contractor career and turnover intentions were calculated. After that ANOVA analysis was employed to test statistic hypothesis. Then the inferential statistic, namely, Perason

Correlation and Stepvise Regression analysis were performed to analyse the relation and prediction. There are discussed as follow.

According to women engineers' careers in the Thai contractor, it was found that women engineers had a high level of discrimination problems, a medium level of work-life conflicts and sexual harassment problems, and a low level of satisfaction of career progression.

One-way ANOVA analysis was employed to test statistical hypotheses. It appeared that only one variable, uncertain work schedule, out of the work characteristic factors did not make women perceived different of four problems in contractor firms. This can be seen from p values of the four problems that had a significance level more than 0.05 values. But uncertain work schedules were including analysing the correlation model because it could affect the relationship.

After that, a Bivariate Pearson correlation and multiple regression analysis were conducted between demographic variables, work-related variables, organizational variables, and four dimensions of obstacles in contractor careers. It can be interpreted from the analysis results that demographic variables, work-related variables and organizational variables were correlated with four dimensions of obstacles in contractor careers. In the following procedure, the regression model was performed to test the ability of the correlated variables to predict problems in contractor careers.

Allowing for four main dimensions of obstacles, it can be stated that:

1) The factors that predicted discrimination were tenure, fieldwork hour, and male domination at an average level of variation (adjust $R^2 = 0.400$), which can be explained by the regression model for discrimination. The relationship between these factors and discrimination problems as perceived by women engineers as follows. Women engineers with high tenure were likely to have a low level of discrimination problems. Male domination also affected discrimination problems. In other words, the higher the level of male domination variables they have, the more discrimination problems women engineers seemed to have in their careers.

2) Factors that predict work-life conflicts include family responsibilities and superiors' support at an average level of variation (adjust $R^2 = 0.592$), which can be explained by the regression model for work-life conflicts. The relationship between both variables and work-life conflict perceived by women engineers was described as follows. Women engineers with high family responsibilities were likely to have a lot of work-life conflicts. This result was in congruence with studies in Australia revealing that even though women worked outside their houses, their first priority was family responsibility. Thus, women tended to be confronted with work-family conflicts forcing them to satisfy accepted time constraints of the construction industry (Lingard and Lin, 2004; Lingard and Francis, 2005; Lingard and Francis, 2007). It can be concluded that the higher the level of superiors' support factors, the higher the possibility there will be more women engineers to have work-life conflicts in their careers. This might be that superiors' support made women engineers want to show their abilities, leading to more work-life conflicts.

3) The factors that predicted sexual harassment were male domination and age range at an average level of variation (adjust $R^2 = 0.491$), which could be explained by the regression model for sexual harassment. The relationship between these factors and sexual harassment problems perceived by women engineers was described as follows. Women engineers who worked in male-dominated workplaces were likely to have a high level of sexual harassment problems. It can be concluded that the higher the level of male domination there was in their workplace, the more sexual harassment problems tended to appear. Furthermore, age range was another factor having a significant negative relationship with sexual harassment problems of women engineers. In other words, the more age range variables there were, the fewer sexual harassment problems women engineers tended to have in their careers.

4) The variables that predicted satisfaction of career progression included training and development opportunities, gender diversity climates, tenure and support from superiors at an average level of variation (adjust $R^2 = 0.482$), which can be explained by the regression model for satisfaction of career progression. The relationship between these factors and satisfaction of career progression perceived by women engineers was described as follows. Women engineers with high training and development opportunities, gender diversity climates, tenure and support from superiors in their workplaces were likely to have high satisfaction of career progression. In other words, the higher the level of these factors, the higher satisfaction of career progression women engineers tended to have in their careers.

Next, an analysis of Bivariate Pearson correlations between obstacles in construction careers and turnover intention revealed that obstacles in contractor careers, including discrimination, were positively correlated with turnover intention. This means that women engineers faced with a high level of discrimination in their workplaces were likely to have high turnover intention. A negative correlation of satisfaction of career progression with turnover intention means that women engineers with high satisfaction of career progression were less likely to resign.

An analysis of the means of this data set of women engineers also revealed that women engineers found a high level of occurrence of discrimination ($\mu = 3.93$) and a low level of satisfaction of career progression ($\mu = 1.95$). In this study, three items were tested. The item 'You are looking for a new job by looking at job ads.' had a high level of mean ($\mu = 3.48$). The other two items had a medium level of mean. Overall, women engineers' turnover intention was at a medium level, which is in accordance with correlation analysis in this section.

Finally, the multiple regression model was subsequently conducted to test the ability of the variables correlated with turnover intention. It was found that 62 per cent of the variation could be explained by the regression model of turnover intention and satisfaction of career progression was only one of the significant predictors in the descending order of significant beta coefficients.

Chapter VII
The Advantage of Women Engineer's Presence in Contractor Companies

7.1 Introduction

As explained in Chapter 6, women engineers were confronted with many barriers and dissatisfaction of career progression. One way to mitigate their dissatisfaction of career progression was for them to receive more support from construction companies. If construction companies can see the advantages of women engineers' presence in their companies, more women-friendly policies and a better working environment will be provided to support women engineers. This chapter presents the advantages of female engineers that are different from men engineers. The data include outstanding characteristics of women engineers, benefits of female engineers' presence as compared to men engineers, and characteristics of women engineers suitable for contractor supervising positions. The qualitative data obtained was transcribed word for word, and later classified under general conceptual headings and coded under themes revealed by the raw data, using the NUDIST® software to extract and investigate the data obtained. The resulting themes show the over-arching themes where the major issues of the data emerged which were then highlighted and coded.

7.2 Informant Profiles

Table 7.1 Informants' profiles according to gender and position

Position	Superiors		Men	Men	Total
	Women	Men	Peers	Subordinators	
Company Owner	2	-	-	-	2
Project Engineer	1	3	2	-	6
Site Engineer	-	-	5	1	6
Estimator	-	-	3	2	5
Designer	-	-	2	-	2
Planner	-	-	1	-	1
Foreman	-	-	-	2	2
Sum	3	3	13	5	24
Total	**6**		**13**	**5**	**24**

Table 7.1 shows profiles of the informants including two women engineer company owners, two men project managers, one woman project manager, and one man project engineer who was a superior of women engineers, 13 men co-workers in civil engineering, five women subordinates, and nine women civil engineers. They all have worked in contractor companies for 2-22 years.

7.3 Outstanding Characteristics of Women Civil Engineers

Interview sessions were conducted with 24 informants including three women and three men superiors, 13 men peers and five men subordinates of women engineers, as shown in Figure 7.1 below:

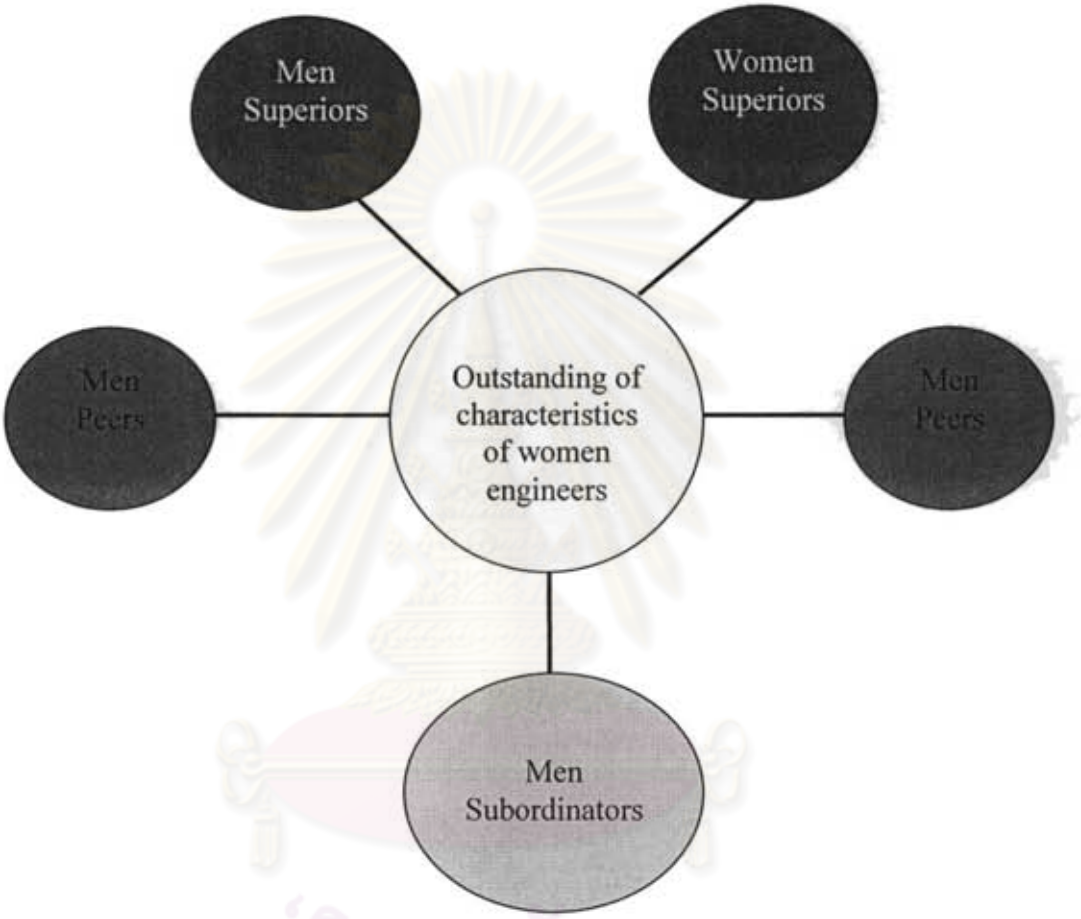

Figure 7.1 Presents three groups of interviewees who provided outstanding characteristics of female engineers.

7.3.1 Outstanding Characteristics of Female Engineers which are Different from Those of Male Engineers

Interview results can be viewed from three different perspectives: superiors,' peers' and subordinates.'

7.3.1.1 Superiors' perspective

The statements of three men and three women are described as follows.

"Women are more detailed than men so they are more suitable for documentation and other office work such as price estimation, designing, procurement-recruitment. One example can be seen from a quality assurance/quality control (QA/QC) inspection of a housing project by one female engineer and one male engineer. The female engineer was able to compile two to three pages of the house's defects whereas the male engineer could produce only one page of defects for the same house. This shows that women are more detailed than men."

Project engineer, 22 years of experience

"Women engineers are more detailed and good followers. They also have good negotiating and coordinating skills, and most of the time a better command of English than men. Another distinctive characteristic of women is that they are honest, which is suitable for positions which require honest people to protect the benefits of the company they work for such as procurement, quantity surveyor and specification inspection. This helps the company keep the costs down and retain benefit."

Project engineer, 18 years of experience

"Unlike men, women are afraid to take risks. I think it's their good point that they consult with their superiors or experts so potential problems are decreased. Men sometimes take too many risks that they don't consider consequences of their decisions for the company they work for. Negative traits of women that make them unsuitable for fieldwork are their lack of leadership, their fear of sexual harassment, their lack of knowledge and skills to work with machinery."

Project engineer, 16 years of experience

"Women are more detailed and tolerant of routine work. For example, one man and one woman were assigned to work in an office and estimate prices. Within one year the male engineer requested to work at a construction site because he was bored with the job in the office. On the other hand, the woman could stay there longer because she knew she was more suitable to work in the office than at construction sites."

Project engineer, 17 years of experience

"I know one woman engineer who used to be an employee. Now she has her own contractor company. She does everything by herself starting from planning, designing, and price estimation to construction supervision. She has done all that. What really stood out was that her documents were more detailed and her negotiation skill was better than men."

Owner, 10 years of experience

"I used to have a female engineer who had much better negotiation skill than men engineers. I undertook a 13-story building project. When it was time to ask for an installment due, we sent a male engineer to submit the job to the consultant. Knowing

that the job was a little bit delayed, that engineer got into a fight with that consultant instead, so the installment was not approved. I tried sending this woman engineer to negotiate with that consultant. This time we got the installment. I found out later that the male engineer did not take responsibility for the delayed job, and acted like he was the boss on top of that. As a result, the consultant got angry and didn't approve the installment."

Owner, 14 years of experience

It can be explained that most superiors of women engineers found that women engineers' good traits/characteristics that were different from men engineers were that they were detailed, had good negotiation and communication skills that were able to reduce conflicts, were good at coordination, and had good English skills. Next, they were better followers than men. In addition, they were honest which was suitable for positions which required honest people to protect benefits of the company they worked for such as procurement, quantity surveyor and specification checking. The fact that women were afraid to take risks and consulted with their superiors or experts was good for the companies they worked for because it reduced problems that might occur. Men engineers were sometimes inclined to take too many risks. Another good characteristic of women engineers was that they could stand routine work better than men. They were aware that their career options were not as varying as men's so they chose to do documentation and other office work, which they could do better because they were more detailed.

Furthermore, men engineers who were superiors of female engineers mentioned negative traits of women that made them unsuitable for construction supervision, which were their lack of leadership, their fear of sexual harassment, their lack of knowledge and skills to work with machinery.

7.3.1.2 Peers' perspective

The statements of 13 male colleagues are described as follows.

"Women are more detailed so they are more suitable for documentation jobs. They also have better negotiation skills so they are more suitable for coordination jobs. When women engineers work at a construction site, it can be noticed that the place is tidy and clean. Men don't care about cleanliness and tidiness. They only focus on working to meet the deadlines. Women have more 'housewife' habits."

Project engineer, 15 years of experience

"There are not many women engineers with fieldwork experience, but that can be offset by other skills and knowledge including designing, price estimation or other documentation work which are supportive of construction projects and as important as construction work. It is suitable for women engineers because they are more detailed

and good at coordinating. People working at construction sites are usually given more attention, but if there is no support team, construction cannot be done in an effective way. A good support team is an integral component of a successful project."

Project engineer, 8 years of experience

"Women engineers know better than men how to behave in front of their subordinates and know the appropriate distance between them and their subordinates. They don't hang out with their subordinates like men do so their subordinates pay more respect to them."

Site engineer, 4 years of experience

"Women engineers always choose to do office work. This characteristic is shown since they are students in surveying courses. Women students always write down information and calculate figures while men students move things around, install equipment and read surveying results. This happens in many other lab courses as well. That's why when women students become women engineers; they don't choose fieldwork, leaving work that requires strength and physical endurance to the men. Moreover, women are more tolerant of routine jobs and more detailed with documentation work than men."

Site engineer, 7 years of experience

"Distinctive traits of women engineers are their communication, coordination and English skills which are better than men engineers"

Site engineer, 3 years of experience

"Women are more detailed so they can handle documentation work better such as price estimation and designing. Also, they are more flexible and more open to other people's ideas than men."

Estimator, 4 years of experience

"Distinctive traits of women are that they are more detailed, honest and better at documentation work. Work that requires honesty should be assigned to women such as inspection and procurement-recruitment."

Planner, 6 years of experience

"Women have better skills of negotiation and bargaining. They are more suitable for detailed work and coordination and documentation work such as price estimation, procurement-recruitment, and negotiating with suppliers to get materials at cheaper prices."

Estimator, 6 years of experience

"Women are more detailed and more tolerant of routine work such as office work like designing. Women engineers with no fieldwork experience should be complemented or provided with mentors so the company they work for can get better performance from their staff."

Designer, 6 years of experience

"Women are highly flexible and more open to other people's ideas than men."

Site engineer, 6 years of experience

"Women are more careful, patient, better at documentation work and more open to other people's ideas than men."

Designer, 3 years of experience

"Women have better communication, negotiation and compromising skills than men making them more suitable for coordination work. Negative traits of women which make them unsuitable for construction sites are indecisiveness, intolerance of physically strenuous work, knowing few subcontractors/bad connections, fragile physical conditions that are unsuitable for the weather, pollution at construction sites, mental conditions that are not suitable for construction sites filled with low-class people using strong words all the time and workers who cannot accept women superiors."

Site engineer, 3 years of experience

"Women are honest, careful, responsible and suitable for documentation work."

Estimator, 5 years of experience

It can be seen from peers' perspectives that women engineers were more detailed and more patient, making them more suitable for documentation work and other routine work. This can be seen from behaviors of female and male students in laboratory classes: women wrote down information and calculations while men read results. In surveying classes, men used their strength and women used their brains. The fact that they were careful and detailed made them suitable for price estimation and designing work. Also, they possessed negotiation and coordination skills. Their communication and English skills put them in a better position to coordinate with other people than men. Another trait was that women engineers knew how to keep a proper distance and did not mingle with their subordinates to the point that it affected their work. Subordinates paid more respect to their superiors if the latter knew how to behave in the former's presence. Women engineers were highly flexible, open to other people's ideas, honest, more careful with procurement-recruitment, and knew how to bargain prices with suppliers. As a result, companies they worked for could keep the costs down. In addition, they had 'housewife' habits, meaning any construction site with woman engineers were usually

tidy and clean. Most women chose to work in offices, which were more suitable for office work, supportive work that was as important as production work.

Moreover, negative traits of women include indecisiveness, intolerance to physically strenuous work, and knowing few subcontractors/bad connections. Fragile physical conditions were unsuitable for the weather and pollution at construction sites. Mental conditions were not suitable for construction sites where lots of people using strong words all the time and workers who could not accept women superiors.

7.3.1.3 Subordinates' perspectives

The statements of subordinates are explained as follows.

"Female engineers listen to their subordinates more than men engineers. One example can be seen in the following statement of a worker: "I used to work in a housing project. I was not supervising the project carefully enough. The workers were applying more concrete than required and some part of the metal was missing. At first I was afraid to report that to my superior, but we were in dire need of more concrete, so I had to report that. I thought I would have been in big trouble and my one-day wage would have been cut. Instead, the woman superior tried to find solutions rather than finding somebody to blame. My experience with men engineers was worse. After that day, whenever small problems occur, I report them early enough to my superior so that construction work won't have to come to a stop."

Foreman, 3 years of experience

"Women engineers are more flexible and listen to their subordinates more than men engineers so the subordinates are not afraid to express their opinions."

Foreman, 2 years of experience

"Women engineers are more careful when inspecting work especially price inspection. Women engineers have better negotiation and coordination skills and they are consistent with their work."

Estimator, 3 years of experience

"Women engineers are more detailed than men engineers especially when estimating prices and they follow the rules when inspecting work. They also know how to negotiate and have good English skills"

Site engineer, 2 years of experience

"Women engineers are better at negotiating and communicating, careful and more open minded than men."

Estimator, 2 years of experience

The above statements show that two foremen felt that female engineers listened to their subordinates more than men engineers and helped find solutions rather than finding fault. Other views from men engineers' were that women engineers inspected work carefully and were highly flexible, good at negotiating and communicating, careful and calm.

The three views were analyzed and themes that emerged are shown in Table 7.2.

Table 7.2 Outstanding characteristics of women engineers

Outstanding Characteristics	**Views**		
	Upper	**Peer**	**Lower**
Detail Orientation	√	√	√
Communicating and Negotiating Skills	√	√	√
English Language Skills	√	√	√
Open-mindedness	√	√	√
Honesty	√	√	-
Following Up on Work	√	-	-
Knowing How to Conduct Oneself	√	√	√
Risk Averseness	√	-	-
Discipline and Cleanliness	-	√	√
High tolerance for Routine Work	√	-	-
Flexibility	-	√	√

Table 7.2 shows the results of outstanding characteristics of women engineers. The three views were linked to analyze congruence of opinions. It was found that women engineers had good characteristics, which were communicating and negotiating skills, detail orientation, English language skills and receptiveness to other's opinions. Superiors and peers of women engineers stated that they were honest. Superiors thought that women engineers followed up on work more than men engineers. Peers and subordinates felt that women engineers knew how to conduct themselves more than men engineers. Superiors felt that women were more risk averse, disciplined, clean and tolerant for routine work than men engineers. Lastly, high flexibility was thought by peers and subordinates of women engineers to be an outstanding characteristic of women engineers.

7.3.2 Personality of Women Engineers for Being Construction Supervisors

Interview sessions were conducted with three men engineers who were women engineers' superiors, 13 peers and five subordinates of women engineers. The

following table shows details of characteristics of women engineers that are suitable for construction supervision. One answer from a respondent is counted as one score. All scores were added up and ranked in descending order.

Table 7.3 Characteristics of women engineers suitable for construction supervision

No.	Characteristics	Score	Ranking
1.	Self-confidence	6	4
2.	Patience and effort taking	8	3
3.	Unafraidness of outdoor work, sunlight and rain	12	2
4.	Unafraidness of risks	12	2
5.	Leadership	17	1
6.	Man-like acting	4	5
7.	Strength and decisiveness	2	7
8.	High responsibility	4	5
9.	Wittiness and ability to solve problems at hand	3	6
10.	Long-term vision	2	7
11.	Eagerness of acquiring new knowledge	1	8
12.	Flexibility and listening to other people's opinions	1	8
13.	Unafraidness of hard and dirty work and ability to control subordinates	2	7
14.	Unafraidness, hot temper and indecisiveness	1	8
15.	Physical fitness	1	8
16.	High determination	1	8

As seen in Table 4.6, the first five characteristics were 1) leadership; 2) unafraidness of outdoor work, sunlight, rain and taking risks; 3) patience and effort taking; 4) self-confidence; and 5) men-like acting and high responsibilities. These characteristics seem to be strong notions from with three men engineers who were women engineers' superiors, 13 peers and five subordinates of women engineers.

7.4 Discussion

This chapter presents an analysis of data derived from three male and three female engineers' superiors, 13 male engineer colleagues, and five male engineer subordinates. The focus of this chapter is on outstanding characteristics of women engineers working in the construction industry that were different from male engineers. This chapter also discusses reasons of women's unsuitability for construction fieldwork and characteristics of women engineers suitable for contractor supervision.

Perceptions of male superiors, colleagues and subordinates about outstanding characteristics of women engineers that were different from those of men were also revealed. It was found that the three groups had similar perceptions: women engineers

were delicate, had negotiating and communicating skills, which helped reduce tension and handle conflicts. Women engineers were also found having better negotiating and English skills compared to men engineers and were receptive to other people's opinions. They were also found more honest than men engineers and, as a result, more reliable and suitable for money-related jobs such as procurement, recruitment, etc. The opinions of the three groups of people showed that outstanding characteristics of women engineers were different from men engineers and beneficial to the construction industry.

Women engineers' superiors thought of them as being detail-oriented, honest and good followers, having good coordinating and English skills, knowing the proper distance between them and their subordinates, knowing how to behave in subordinates' presence, not taking risks and causing negative consequences, being tolerant of routine work, and listening to other people's opinions. Ivancevich (2008) reported that people who were honest contributed highly to teamwork. Good teamwork is a key factor of projects' success or failure, for which project managers take responsibility (Angus et al, 2000).

Women engineers' peers thought of them as being more detailed so they were more suitable for documentation work. Women engineers were also considered to possess negotiating and coordinating skills. They are also highly flexible, open to other people's ideas, honest and more careful with procurement. They knew how to bargain prices with suppliers helping the companies they worked for keep the costs down. In addition, women engineers were more disciplined, clean and more suitable for office work and supportive work, which are as important as production work.

Women engineers' subordinates found that women engineers listened to their subordinates more than men engineers, helped find solutions rather than fault, inspected work carefully, highly flexible, good at negotiating, disciplined, clean, careful and calm.

Interestingly, contractor companies reaped various benefits from outstanding characteristics of women engineers. Particularly, male superiors of women engineers found that, unlike men engineers, women engineers did not like taking unnecessary risks, so they usually consulted with experts or their superiors before making a decision or taking action. This positively affected the company they worked for because it prevented problems and accidents. Furthermore, female superiors of women engineers found that they had better communicating and negotiating skills and are better at reducing conflicts in workplaces. Moreover, male colleagues found that women engineers carried themselves better in their subordinates' presence and keeping a proper distance so their subordinates paid respect to them. Male subordinates found that women engineers tended to listen to them more than men engineers did, and when a problem occurred, rather than finding who was responsible, they tried to find a solution to the problem before it got out of control.

Therefore, the linked statements of three perceptions were analyzed to find their congruence. According to the analysis, it was found that women engineers had the

following outstanding characteristics: detail orientation, communicating, negotiating and English language skills and receptiveness to other's opinions.

Furthermore, men engineers who were superiors of women engineers opined about the negative traits of women that made them unsuitable for construction supervision, which were their lack of leadership, their fear of sexual harassment, and their lack of knowledge and skills to work with machines. According to women engineers' peers, women engineers' negative traits included indecisiveness, intolerance to physically strenuous work, and having weak connections (because they did not know many subcontractors), and vulnerable physical and mental conditions.

Finally, characteristics of women engineers that were considered suitable for construction site inspection were leadership, unafraidness of sunlight and rain, hardiness and risk-taking, patience, high effort, self-confidence, man-like acting and highresponsibility.

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Chapter VIII
Suitable Roles of Women Civil Engineers in Thai Contractor Companies

8.1 Introduction

In Chapter 4, Section 4.4 presented a data analysis, the results of which pointed out nine roles of civil engineers in contractor companies: estimating, purchasing, planning and monitoring, designing, coordinating, contract administration, site supervision, site office engineer, and quantity surveying. In the following sections of this research, the above data will be developed into questionnaires and interviews to determine the most successful and suitable roles of women engineers.

To identify research results about suitable roles of women in Thai contractor companies consistent with real roles of women engineers in contractor companies, it is necessary to analyze the organizational behavior of contractor companies of different sizes in terms of civil engineer assignment of roles and responsibilities of civil engineers and career advancement of civil engineers in contractor companies of different sizes. This is to find out how they affect career advancement. Then suitable roles of women engineers that are closest to real-life work of women engineers in Thai contractor companies will be identified.

An analysis of the organizational chart of Thai contractor companies revealed information about working civil engineers or those who had work experience in Thai contractor companies as follows.

1). Ten senior women engineers working in contractor companies including one with 22 years of work experience, three with 17 years of work experience, one with 16 years of work experience, two with 15 years of work experience, one with 13 years of work experience and two with 11 years of work experience.

2) Ten male owners and superiors of women engineers including one with 34 years of work experience, two with 19 years of work experience, one with 18 years of work experience, one with 17 years of work experience, two with 15 years of work experience, one with 14 years of work experience, one with 13 years of work experience and one with 11 years of work experience

3) Ten female owners and superiors of women engineers including two with 18 years of work experience, two with 16 years of work experience, one with 13 years of work experience, one with 12 years of work experience, one with 11 years of work experience and three with 10 years of work experience.

8.2 Analysis of the Roles and Responsibilities of Civil Engineers in the Thai Contractor Companies

Generally contractor companies, civil engineer's work are divided into two parts: head office work and site office work. Since contractor companies deal with projects,

civil engineers working in contractor companies have explicit roles and responsibilities as follows.

Main responsibilities can be explained based regarding roles as follows.

1) Estimating: estimating prices and bidding for construction projects.

2) Designing: rechecking, verifying, and coordinating with designers in consulting companies.

3) Purchasing: finding different sources and compare prices of their materials and equipment needed for construction projects, negotiating and preparing reports.

4) Coordinating: coordinating with people in their offices, head offices and site offices, project owners, consulting companies to follow up on progress of projects, update progress and report problems happening with projects.

5) Contract administration: preparing, revising and correcting conditions in contracts, analyzing potential problems, and setting working conditions.

6) Planning and monitoring: preparing, updating and correcting plans, preparing reports for concerned parties so they complete construction projects in accordance with the plans.

7) Site engineers: controlling construction projects in accordance with the plans and projects' objectives.

8) Site office engineers: designing, preparing shop drawings, planning jobs for construction sites based on master plans, procurement and recruitment, comparing prices of materials and equipment from different sources and coordinating with internal and external work units related to construction projects.

9) Quantity surveyors: inspecting workloads, preparing installment payment reports, controlling and checking use of materials and equipment in construction projects.

It was found that there were nine suitable roles for women engineers. The roles and responsibilities of civil engineers may more than above statement depend on the size of contractor companies. The next section will discuss career paths of civil engineers of different size of contractor companies in each role.

8.3 Analysis of Career Path of Civil Engineers in the Contractor Organization of Different Sizes

Data from interviews with 20 male and female company owners and superiors of women engineers were employed to develop an organizational chart of Thai contractor companies. Latest information from the NSO reported that there were 29,023 contractor companies in Thailand, which can be categorized by projects' cost into three groups: 1) large-sized contractor companies (Figure 8.1), there are 3.5 per cent of the total number of contractor companies in Thailand and over; 2) medium-sized contractor companies (Figure 8.3), that are 35 per cent of the total number of contractor companies in Thailand; and small-sized contractor companies (Figure 8.5), there are 61.5 per cent of the total number of contractor companies in Thailand. There

are two kinds of work for civil engineers: head office work and site office work. The sizes of companies and career paths of contractor companies where civil engineers worked are addressed as follows.

8.3.1 Analysis of Civil Engineers' Career Paths in Large-Sized Contractor Companies

Career paths of civil engineers in each role at head offices based-work and site based-work are elaborated in Figure 8.2. The detailed are as follow.

1) Head office:

Normally, career path of civil engineers in large-sized contractor companies are discussed follow the roles. The details are described below.

Estimating: generally, large-sized Thai contractor companies accept both women and men engineers with no experience because the price estimating section in these companies requires many civil engineers to prepare bids for construction projects. In these companies, there are teams teaching work processes to new engineers. However, new inexperienced engineers get lower paid due to their lack of experience.

Career paths of estimating role begins as junior engineers, progressing to senior engineers, then assistant department heads, and finally, department heads, depending on engineers' competencies.

Designing: companies accept both women and men with no experience because they have mentors to teach new employee but they prefer people with some experiences because designing jobs in contractor companies mostly involve rechecking drawings applied to construction projects or project bidding.

Career paths of designing role starts as junior engineers, progressing to senior engineers, then assistant department heads, and finally to department heads, depending on engineers' competencies.

Purchasing: generally, large-sized construction companies accept people who do not hold a degree in civil engineering. However, they prefer civil engineering graduates. Foreign companies recruit more women engineers to do procurement and recruitment work more than men engineers because they want people with good negotiating and English skills to communicate with foreign companies and women tend to be better at English than men.

Career paths of purchasing role begins as junior engineers, progressing to senior engineers, then assistant department heads, and finally, department heads, depending on their competencies.

Coordinating: generally, large-sized contractor companies accept newly graduated civil engineers, both women and men, whose jobs are to coordinate with people inside and outside their offices such as project owners, consulting companies, people at construction sites and concerned external agencies and follow up on

projects' progress and prepare reports for concerned parties. Most coordinating work is done by women engineers in many companies.

Career path of coordinating role begins as coordinating engineers and then, they can be assigned to do planning and monitoring and contract administrative roles depending on conditions of the companies they work for, their competencies, basic knowledge and responsibilities. After that, they can be promoted to senior engineers, assistant department heads and finally department heads.

Planning and monitoring: generally, large-sized contractor companies do not accept inexperienced engineers and they provide mentors for new engineers. This role involves a lot of teamwork because realistic planning requires people with experience.

Career path of planning and monitoring role starts as junior engineers, continuing to senior engineers, then assistant department heads, and finally, department heads, depending on engineers' competencies.

Contract administration: generally, large-sized contractor companies do not accept inexperienced or newly-graduated engineers because this role requires people with some experience who can anticipate situations and plan activities that resolve those situations.

Career path of contract administration begins as junior engineers, continuing to senior engineers, then assistant department heads, and finally, department heads, depending on their competencies.

From these nine roles of civil engineers, it can be seen that large-sized construction companies accept both women and men to work in their head offices. The role of procurement, in particular, this role tends to employ women because of their outstanding characteristics. In addition, the coordinating role is mostly assigned to women because of their outstanding characteristics.

Project managers in large-sized companies are mostly responsible for construction sites, which are separated from head offices.

Furthermore, the gray block on the lower part of Figure 8.2 shows roles that may not require experience. However, planning and monitoring and contract administration are two roles in head offices that require people with experience, not newly-graduated women engineers.

2) Construction Site:

Normally, career path of civil engineers in large-sized contractor companies are discussed follow the roles. The details are described below.

Estimating: large-sized construction companies accept both women and men. Their main responsibilities are estimating, calculating quantity of several work items and materials, preparing reports of needed materials for construction projects and calculating workloads and materials of increased and decreased work. Generally,

in large-sized construction companies there are estimating sections in site offices that require many female and men engineers with or without experience.

Career path of estimating role begins as junior engineers, progressing to senior engineers, then project engineers, and finally, project managers, depending on engineers' competencies.

Designing: both female and men engineers are accepted. Their jobs include layout rechecking, shop drawing preparation and increased and decreased work planning. In large-sized companies, there are designing sections in site offices that require people with direct experience so they rarely accept women engineers with no experience or newly graduated women engineers. If they do, they always provide mentors for new engineers.

Career paths of designing role starts as junior engineers, progressing to senior engineers, then project engineers, and finally, project managers, depending on their competencies.

Purchasing: most large-sized construction companies accept civil engineering graduates, especially women because they have good negotiating and English skills which will allow them to have good communication with foreign customers.

Career paths of purchasing role of purchasing starts as junior engineers, continuing to senior engineers, then project engineers, and finally, project managers, depending on their competencies.

Planning and monitoring: most companies accept both female and men engineers with some experience to work as planners of site work. Planners' work involves planning small projects in each section in accordance with the master plan of big projects making the layouts as realistic as possible.

Career paths of planning and monitoring role begins as junior engineers, progressing to senior engineers, then project engineers, and finally, project managers, depending on their competencies.

Quantity surveying: generally, female and men engineers are accepted as quantity surveyors at site offices. Their jobs are to follow up on projects' progress, control use of materials at construction sites and prepare documents for installment payment.

Career path of quantity surveying role starts as junior engineers, progressing to senior engineers, then project engineers, and finally, project managers, depending on their competencies.

Site engineer: site engineers' work involves controlling construction projects according to plans so they meet specified quality and budget constraints. Most companies accept men engineers because the jobs are dangerous and risky, for example supervising male workers at construction sites.

Career path of site engineer role begins as junior engineers, continuing to senior engineers, then project engineers, and finally, project managers, depending on their competencies.

To become department heads in head offices based-work is considered the highest achievement. Most department heads work until they retire due to security and benefits offered by the companies. The highest position civil engineers can attain is senior engineers. However, their salaries and bonuses increase every year based on their performance. In site offices, there are many project engineers and project managers because the companies have a lot of big projects. In addition, project engineers and project managers in large-sized companies usually work until they retire due to security and benefits offered by the companies.

Based on the above information, there are little chances of promotion for engineers working at construction sites. Similar to work in head offices based-work, most people's highest position is senior engineer. However, their salaries are increased every year depending on their performance.

Thus, in general, women engineers working in large-sized contractor companies fit a variety of roles except site supervision due to safety reasons. Outstanding roles of women engineers in large-sized construction companies are coordinating and procurement because of their good negotiating skills as mentioned above.

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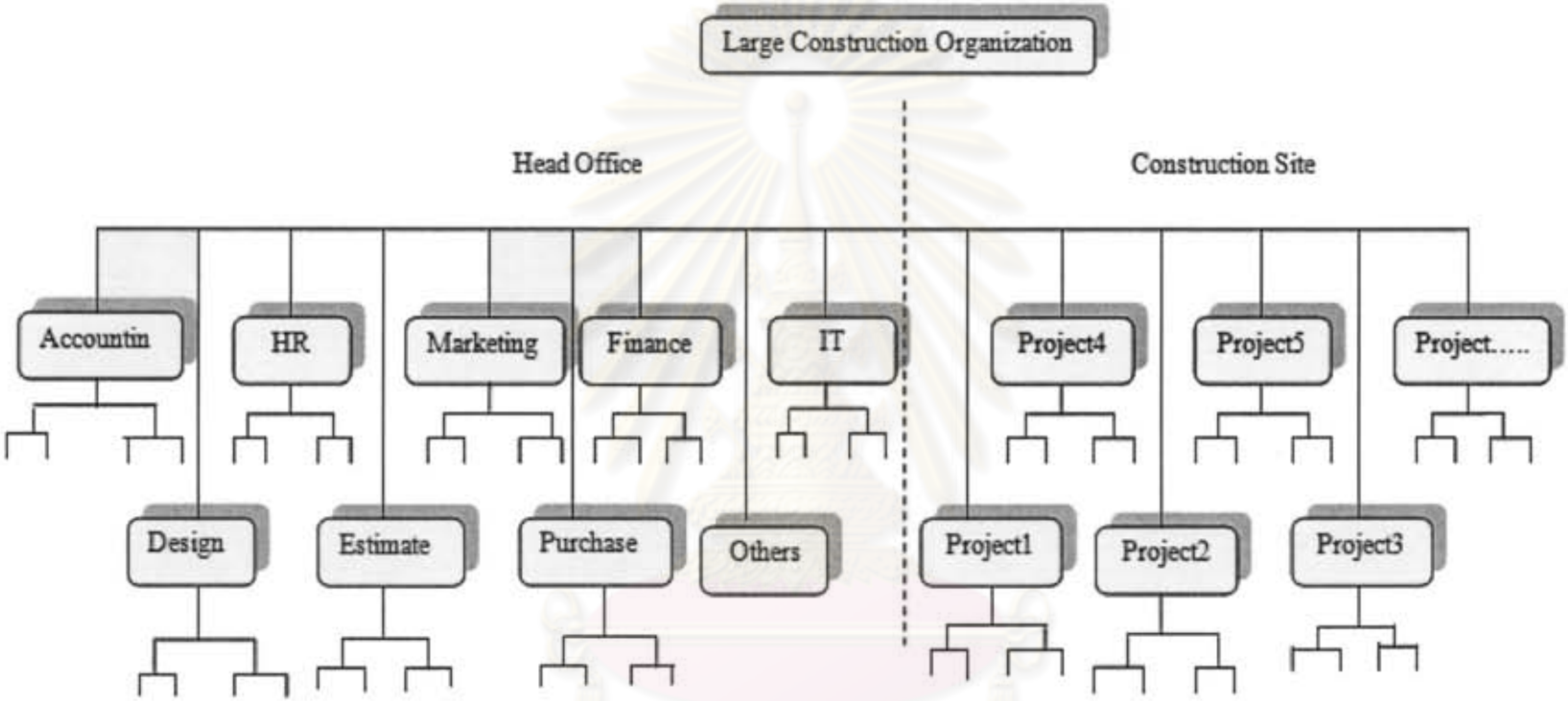

Figure 8.1 A sample of organization chart of large-sized contractor companies.

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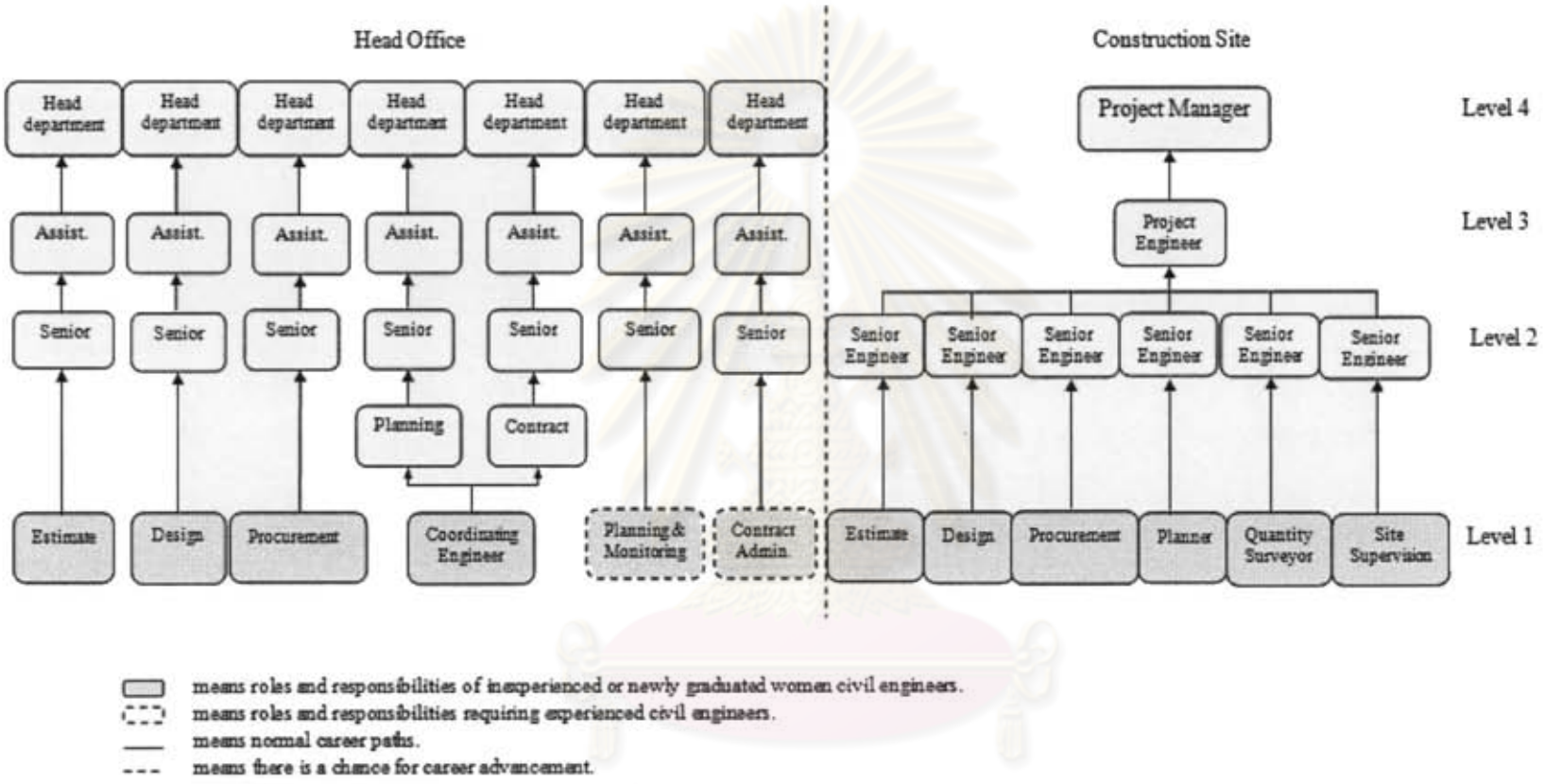

Figure 8.2 A sample of career path of civil engineers in large-sized constractor companies

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8.3.2 Analysis of Civil Engineers' Career Paths in Medium-Sized Contractor Companies

In medium-sized contractor companies, similar to large-sized companies, work is divided into two parts: head office work and site office work. Due to their project cost, medium-sized contractors do not have as many employees as large-sized companies and roles and responsibilities of civil engineers are not as clear as those in large-sized companies. In addition, roles of contract administration and procurement in medium-sized companies do not require civil engineers but rather people graduating with other degrees. Roles of civil engineers in medium-sized construction companies are as follows. (See Figure 8.3)

According to Figure 8.4, it can be seen that in each role, career paths of civil engineers working at head offices based-work and site based-work are as follows.

1) Head office:

Normally, career path of civil engineers in medium-sized contractor companies are discussed follow the roles. The details are described below.

Estimating: generally, medium-sized construction companies accept inexperienced or newly-graduated engineers, both women and men, because they have an estimating section that needs many people to estimate prices of construction projects for bidding and calculating increased and decreased work. It is normal to recruit inexperienced engineers to work in this section because companies have a mentoring team to teach new engineers. However, salaries of inexperienced engineers are lower than those with experience.Career path of estimating role begins as junior engineers, then senior engineers, and finally project managers (See Figure 8.4). Information regarding promotion of a person to a project manager is in a dashed line because in reality, project engineers are usually promoted to project managers depending on their competencies.

Designing: both women and men with no experience are accepted to work in this position because most jobs involve rechecking drawings used in construction projects or for bidding. Some companies accept inexperienced people because they have mentors to teach them.

Career path of designing role begins as junior engineers, then senior engineers, and finally, project managers (See Figure 8.4). Information regarding promotion of a person to a project manager is in a dashed line because in reality, project engineers are usually promoted to project managers depending on their competencies.

Coordinating: generally, both female and men engineers who had no experience or are newly graduated are accepted. Their jobs are to work in head offices and coordinate with people from inside and outside their offices such as project owners, consulting companies, site offices and concerned external work units. In addition, they have to follow up on projects' progress and prepare reports for involved parties. In many companies, women are seen in this role.

Career path of coordinating role begins as coordinating engineers, then they can be assign to do planning and monitoring and contract administration work depending on conditions of the companies they work for, and their competencies, skills, basic knowledge and responsibilities. They can also be promoted to senior engineers and finally to project managers.

Planning and monitoring: generally, medium-sized contractor companies do not accept inexperienced and newly graduated civil engineers. However, in some companies, mentors are provided to teach new engineers in the beginning teamwork is encouraged because planning needs experienced people to make the plans more realistic.

Career paths of planning and monitoring role begins as junior engineers, then senior engineers, and finally, project manager depending on their competencies.

Contract administration: generally, medium-sized contractor companies do not accept inexperienced or newly graduated engineers because contract administration requires experienced people who can anticipate situations and plan activities that resolve those situations.

Career path of contract administrative role starts as junior engineers, then senior engineers, and finally, project manager depending on their competencies.

According to the above description of the five roles of civil engineers, medium-sized contractor companies are different from large-sized contractor companies. Actually, most project managers in medium-sized contractor companies have to supervise the construction section in head offices. Additionally, contractor companies do not assign procurement jobs to civil engineers because it is more cost effective to hire people graduating with degrees in different fields. As for other roles in head offices, the construction department accepts both female and male engineers. Additionally, coordinating is usually the role occupied by women due to their outstanding characteristics.

It was also found that in Thai medium-sized contractor companies, there are usually a few project managers (1-2). Figure 8.4 shows the five roles of civil engineers in head offices based-work. The dashed line shows fewer chances of senior engineers being promoted to project managers. Project engineers are usually the first to be taken into consideration.

Furthermore, the block of coulor at the bottom of Figure 8.4 shows roles that inexperienced or newly graduated engineers can do with the exception of three roles: designing, planning and monitoring, and contract administration done in head offices and requiring some level of experience.

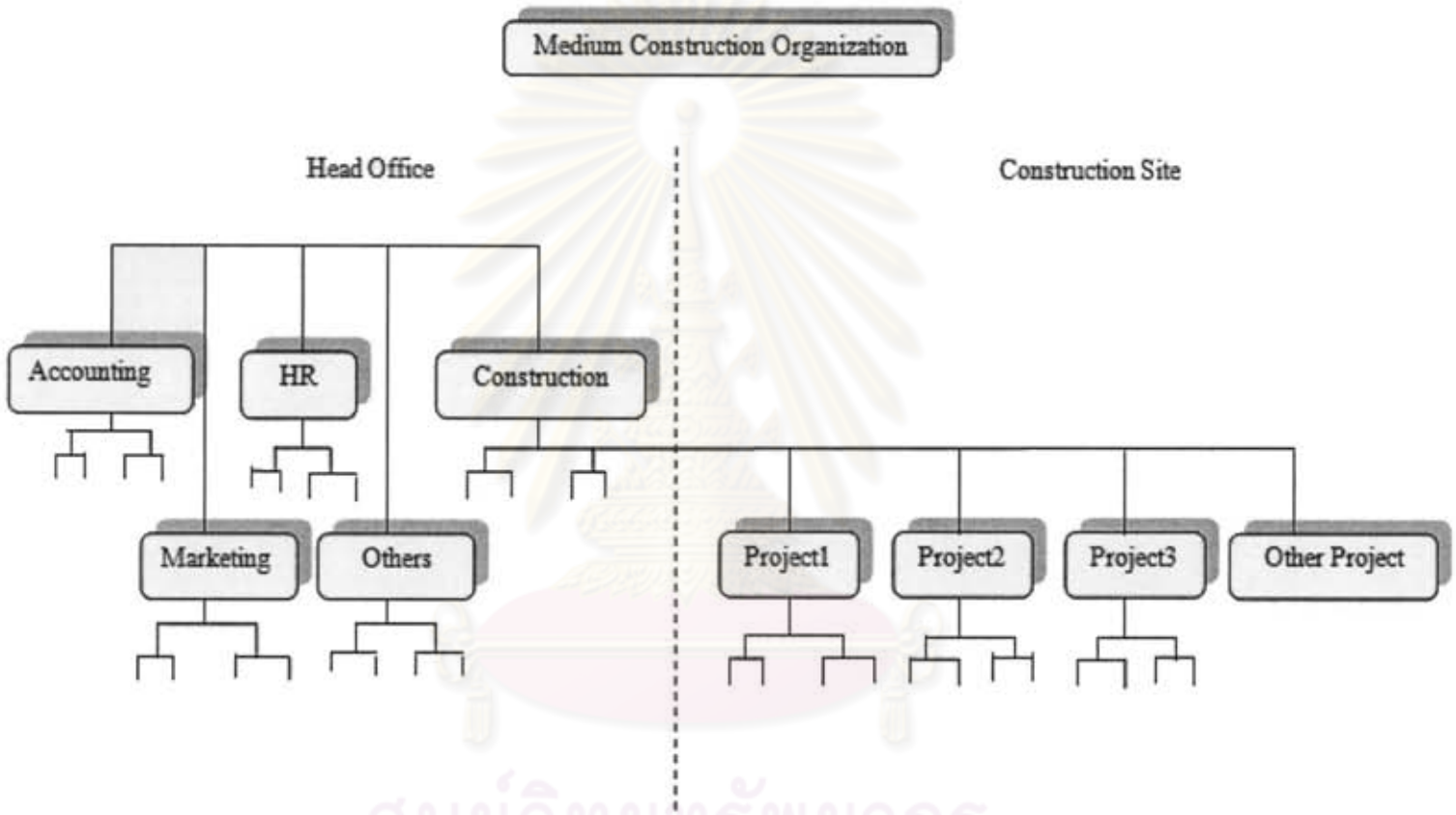

Figure 8.3 A sample of organization chart of medium-sized constractor companies.

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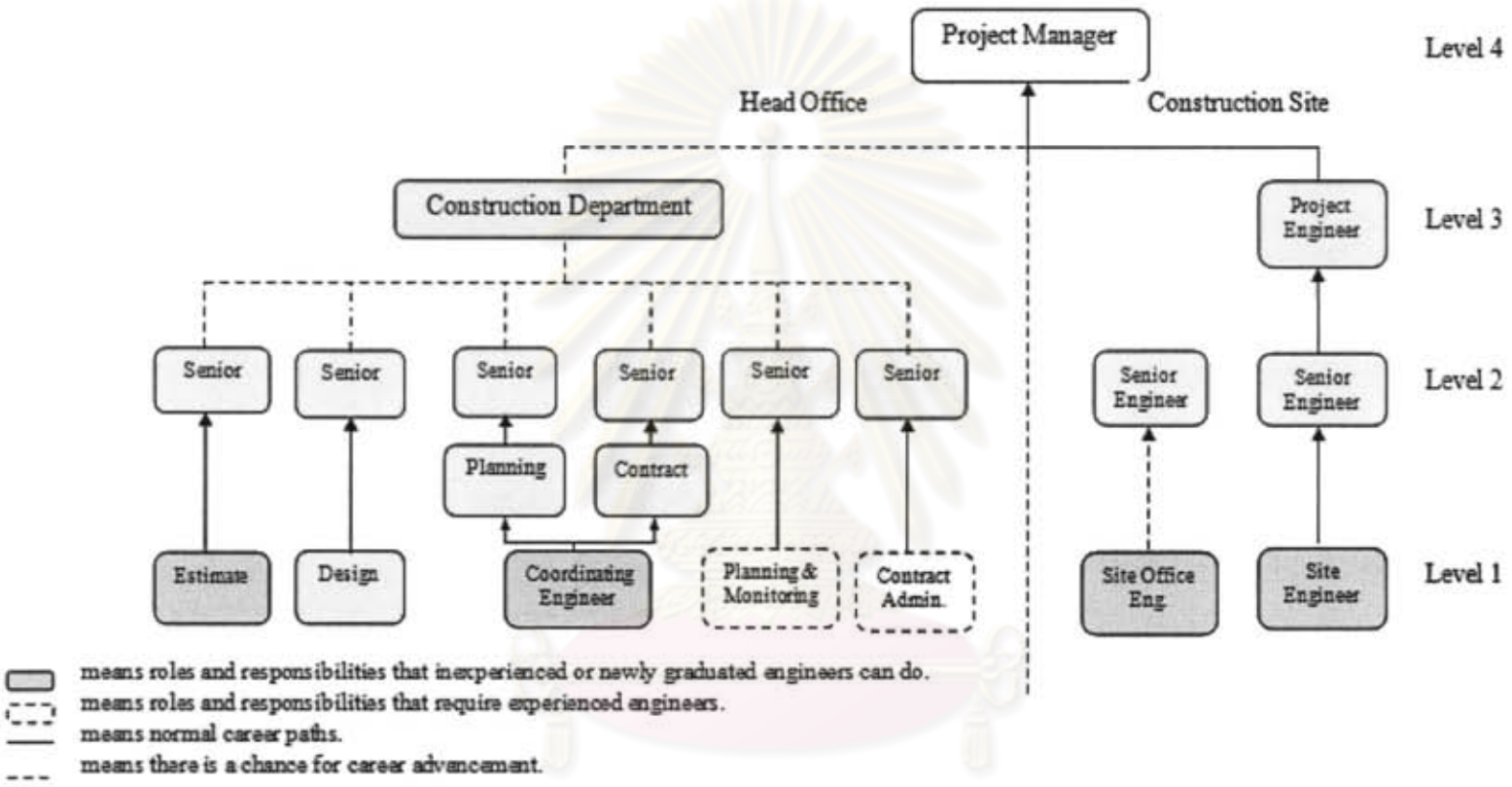

Figure 8.4 A sample of career path of civil engineers in different roles in medium-sized contractor companies.

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2) Construction Site:

Normally, career path of civil engineers in medium-sized contractor companies are discussed follow the roles. The details are described below.

Site office engineer: both female and male engineers are accepted. When female engineers work at site offices, their roles usually include documentation, coordination with people inside and outside construction sites, checking and ordering materials and preparing installment payment reports.

Career path of site office engineer role starts as junior engineers, progressing to senior engineers, then project engineers, and finally, project managers. In Figure 8.4, the dashed line drawn from senior engineer to project engineer shows a slim chance of senior engineers being promoted to project engineer because responsibilities of site office engineers in medium-sized construction companies are mostly concerned with administration work and not as many as those of site engineers.

Site engineer: only men engineers are accepted. The role involves supervising construction projects in accordance with plans so they meet specified quality and budget constraints. This role involves risks and hazards and supervising male workers at construction sites, so men engineers are preferred.

Career path of site engineer role begins as junior engineers, progressing to senior engineers, then project engineer, and finally, project manager depending on their competencies.

Generally, in head offices of Thai medium-sized companies, being promoted to senior engineer is considered a high achievement because most companies do not have many project managers. In some companies, there is only one project manager. Consequently, the chance of an engineer being promoted to a project manager is almost none at all. Project engineers are most of the time the first to be considered. Despite low promotion rates, engineers' salaries and bonuses are increased every year depending on their performance. On construction sites, responsibilities of site office engineers, which are usually occupied by women engineers, are less important than those of site engineers. Subsequently, the chance of a site office engineer being promoted to project engineer and project manager is less than that of a site engineer. In regard to salaries and bonuses of site engineers and site office engineers, they are increased every year depending on their performance. Nonetheless, performance of site office engineers is not as outstanding as that of site engineers so the former's salaries and bonuses are not increased as much as the latter's.

8.3.3 Analysis of Civil Engineers' Career Paths in Small-Sized Contractor Companies

In small-sized contractor companies, there are mainly two types of work: head office work and site-based work. In small-sized contractor companies, there are not as many employees as in large-sized and medium-sized companies. Therefore, roles of civil engineers are not clear because they have to be responsible for many things. For example, in a construction project there may be one site office engineer who takes care of all site work. On the other hand, in large-sized or medium-sized companies, there may be many site office engineers with clear roles and responsibilities. Additionally, departments of price estimation, designing and procurement and recruitment do not exist in small-sized companies but they are all merged into the construction department at head offices. Moreover, most small-sized contractor companies do not have the function of contract administration. They employ lawyers to prepare contracts for them because construction project are not big or complex and usually there are standard forms for those contracts. Figure 8.6 describes responsibilities of civil engineers in each role and shows a typical career path of head office based-work and site-base work. Roles of civil engineers in small-sized construction companies can be described as follows.

1) Head office:

Normally, career path of civil engineers in small-sized contractor companies are discussed follow the roles. The details are described below.

Estimating: generally, small-sized contractor companies accept female and men engineers who have no work experience or are newly graduated because their estimating department, covering many functions such as estimating projects' price for bidding, calculating increased and decreased jobs and rechecking construction plans, requires a lot more personnel than other departments. The estimating department is the key to the company's acquiring new projects via bidding. Inexperienced engineers are usually accepted in this department because the companies have a team coaching new engineers in the beginning. However, their salaries may be different from experienced engineers.

Career path of estimating role begins from junior engineers to senior engineers to project engineer. In the command chain, senior engineers can be promoted to project managers (See Figure 8.6) but in reality, this rarely happens, as demonstrated by a dashed line in Figure 8.6, because project managers are usually company owners.

Office engineer: in general, office engineers coordinate with people inside and outside their companies and people at site offices. They also make plans and follow up on projects' progress.

Career path of office engineer role begins from junior engineers to senior engineers to project engineer. In the command chain, senior engineers can be

promoted to project managers (See Figure 8.6) but in reality, this rarely happens, as demonstrated by a dashed line in Figure 8.6, because project managers are usually company owners.

The description of the two roles of civil engineers in small-sized construction companies indicates that small-sized construction companies are different from large-sized and medium-sized construction companies. In small-sized construction companies, engineers have more responsibilities. For example, even if they are in charge of estimating projects' prices, they have to do designing jobs as well.

In addition, small-sized construction companies usually accept newly graduated engineers because they do not have to offer them high salaries right away. Women engineers are usually not accepted because the companies want somebody who can work in offices and on sites or sometimes even upcountry. In some companies, women engineers are assigned to be office engineers and do administrative work, so they have fewer chances to progress in their careers. These problems confronted by women engineers in small-sized companies are similar to those of women engineers in medium-sized companies.

In small-sized construction companies, project managers are in charge of the construction department in head offices and work on construction sites. Procurement is usually done by the accounting department, not civil engineers.

2) Construction Site:

Normally, career path of civil engineers in small-sized contractor companies are discussed follow the roles. The details are described below.

Site engineer: only men engineers are assigned to do this role. Their responsibilities are supervising construction projects in accordance with plans so they meet specified quality and budget constraints, taking care of documentation work, coordinating with people inside and outside construction projects, checking incoming materials and preparing installment payment reports. Most companies accept men engineers because the jobs are dangerous and risky, for example supervising male workers at construction sites.

Career path of site engineer role starts from junior engineers to senior engineers/project engineers. Their chance of becoming project managers depends on whether the company owners are project managers. Generally, in small-sized companies, company owners are engineers or architects and project managers themselves.

Therefore, generally in small-sized contractor companies, there are not site office engineer and site engineers are also site office engineers assisted by secretaries who do not hold degrees in civil engineering for budget-saving reasons.

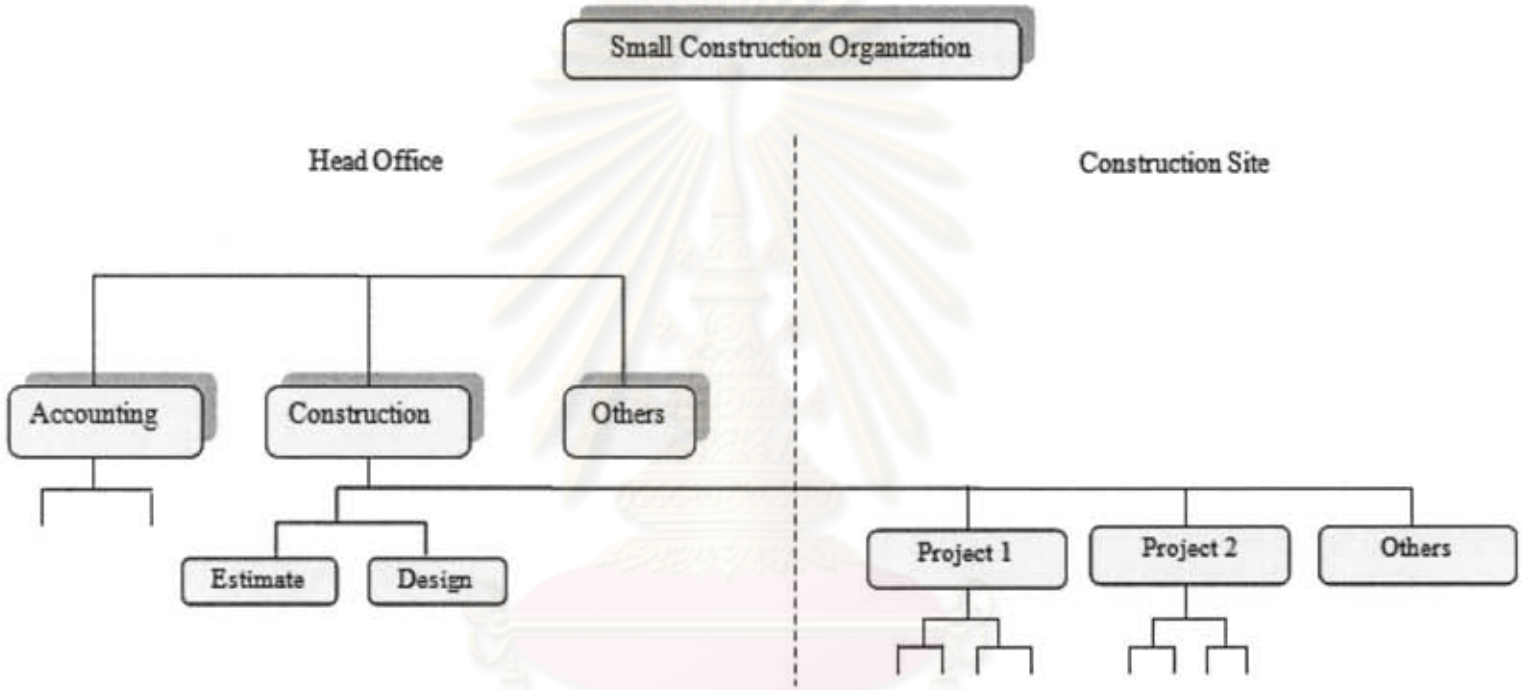

Figure 8.5 A sample organization chart of small-sized contractor companies.

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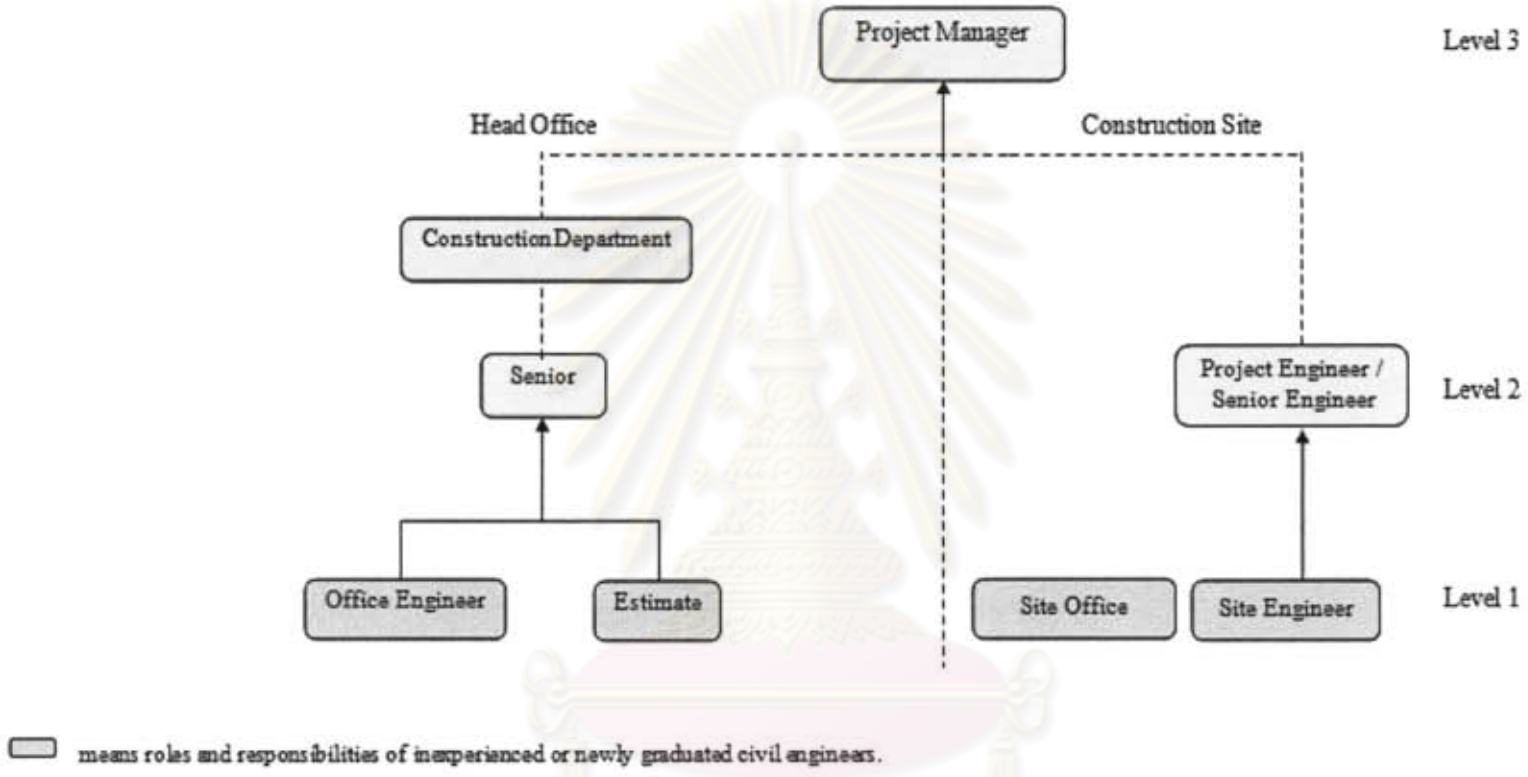

Figure 8.6 A sample of career path of civil engineers in different roles in small-sized constractor companies

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8.4 Analysis of Suitable Roles of Women Engineers in Contractor Companies in Thailand

Data analysis in Chapter 4 reveals most causes of women engineers' turnover from in contractor companies (See Table 4.1). Data analysis in Chapter 5 shows women engineers' turnover rates and causes of their turnover from contractor companies (See Figure 5.1). Data analysis in Chapter 6 indicates problems leading to women engineers' turnover from construction companies (See Figure 6.7). Women engineers in the Thai construction industry, especially in contractor companies, face problems of poor career advancement prospect compared to men engineers resulting in their higher turnover. To solve this problem, the researcher has determined suitable roles for women engineers that can make them progress in their careers as fast as men engineers. However, companies and superiors have to give women engineers the chances to show their abilities and women engineers have to adjust themselves to make up for their inferior characteristics so that they can work and make progress in contractor in a sustainable way.

To clarify suitable roles of women engineers in Thai contractor companies, this chapter contains data analysis of a number of aspects as follows (See Figure 8.7 also). They are classified into three phase as follow.

Phase1: Fact finding of role, responsibilities and career path of civil engineers in contractor organization.

An analysis of roles and responsibilities and career advancement of civil engineers (Career path) working in different sizes of contractor companies are demonstrated in Section 8.2-8.3. Next, an analysis of the most successful roles of women engineers was conducted from the viewpoints of ten senior women engineers working in contractor companies comprising of one with 22 years of work experience, three with 17 years of work experience, one with 16 years of work experience, two with 15 years of work experience, one with 13 years of work experience and two with 11 years of work experience. In this data gathering process, there are definitions of career advancement namely promotion opportunities, remuneration and knowledge. This data analysis suggests roles that women engineers working in contractor companies could do best in and make the most progress in their careers.

Phase2: Analysis of suitable roles in contractor companies

An analyzes suitable roles of women engineers in contractor companies viewed from the perspective of male and female company owners or superiors of women engineers. Thus, roles that company owners and superiors of women engineers found suitable for women engineers and are able to make them progress in their careers are presented in section 8.4. Data are categorized as follow.

2.1) Data were derived from from ten men company owners or superiors of women engineers comprising of one with 34 years of work experience, two with 19 years of work experience, one with 18 years of work experience, one with 17 years of work experience, two with 15 years of work experience, one with 14 years of work

experience, one with 13 years of work experience and one with 11 years of work experience.

2.2) It includes ten women company owners or superiors of women engineers comprising of two with 18 years of work experience, two with 16 years of work experience, one with 13 years of work experience, one with 12 years of work experience, one with 11 years of work experience and three with 10 years of work experience.

2.3) Data analysis results of outstanding characteristics presented in Table 7.2, Chapter 7 indicated congruence of opinions of superiors, colleagues and subordinates about women engineers. They found that women engineers' good characteristics included detail orientation, and good communication, negotiating and English skills. These data were compiled in an analysis of suitable roles of women engineers.

Phase3: Verifying of suitable role of women engineers in contractor companies

Suitable roles of women engineers were verified by women engineering experts.

The above data were analyzed and presented in the below diagram.

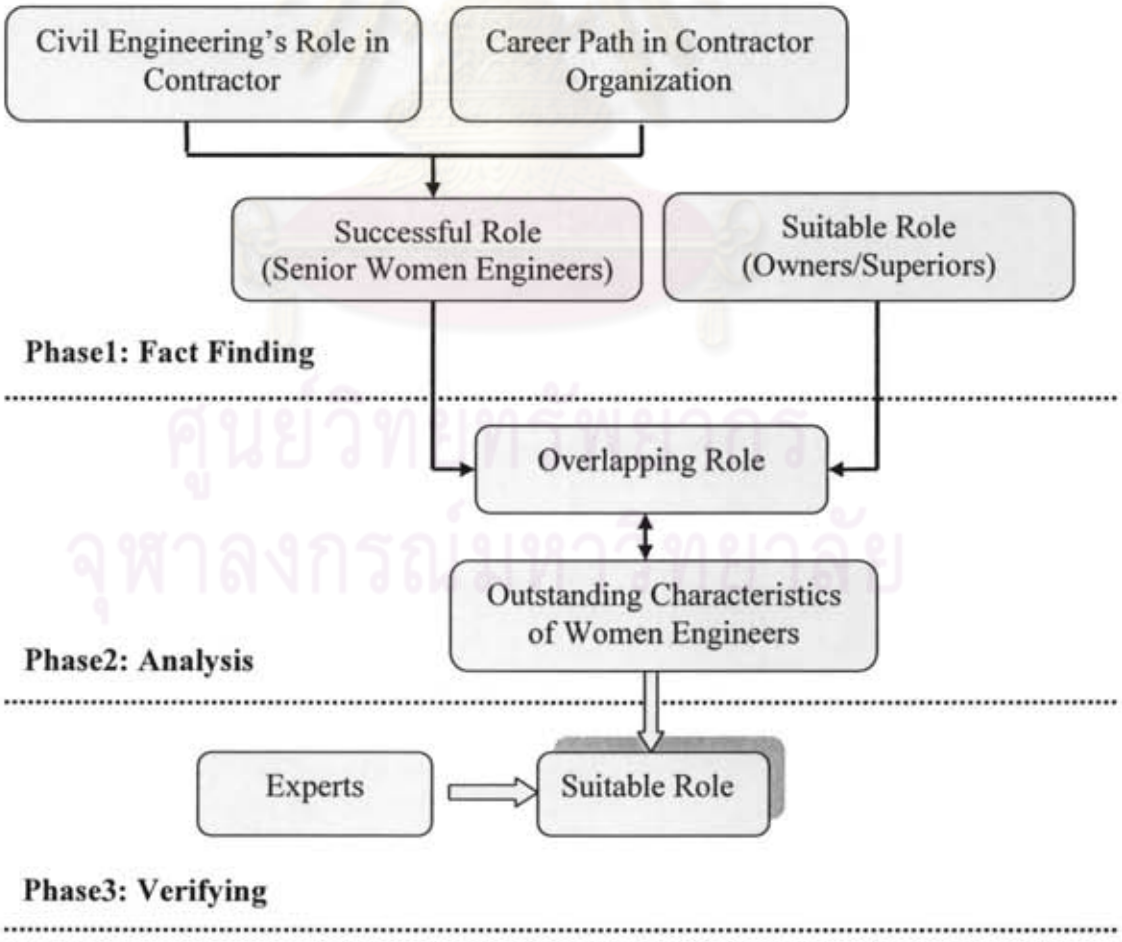

Figure 8.7 Overview of analysis model of suitable roles of women engineers

8.4.1 Analysis of Successful Roles of Women Engineers

Data about the most successful roles of women engineers were gathered from senior women engineers with more than ten years of work experience in contractor companies, as shown in Table 8.1 and Figure 8.8.

Table 8.1 Scores given to roles that make women engineers the most successful in their careers

	Role	Number	Percent	Mean	S.D.	Rank
1.	Estimating	6	60	0.60	0.516	3
2.	Procurement	3	30	0.30	0.483	5
3.	Coordinating	6	60	0.60	0.516	3
4.	Designing	5	50	0.50	0.527	4
5.	Quantity Surveyor	3	30	0.30	0.300	5
6.	Contract Administration	10	100	1.00	1.000	1
7.	Site Supervision	1	10	0.10	0.100	6
8.	Site Office Engineer	0	0	0.00	0.000	7
9.	Planning and Monitoring	8	80	0.80	0.422	2

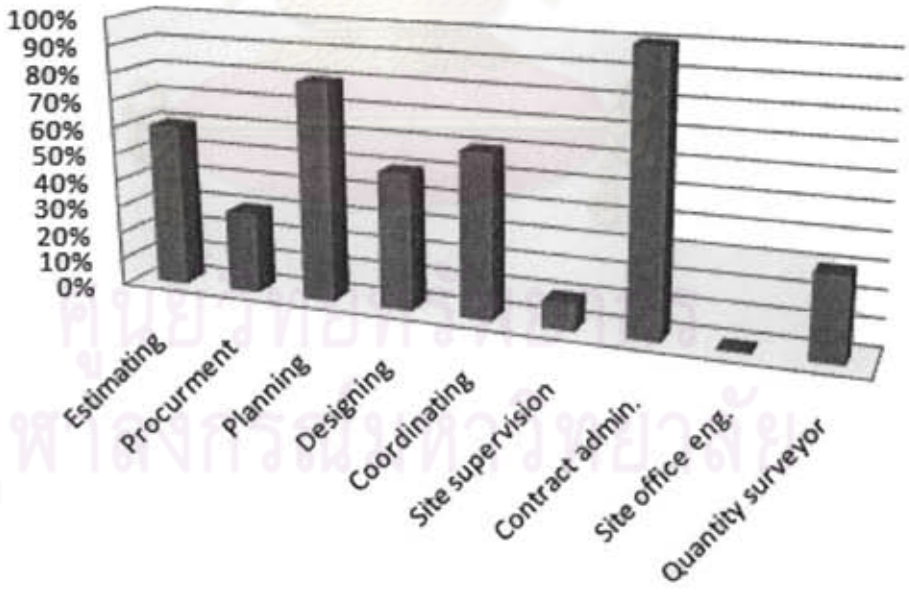

Figure 8.8 Comparative diagram showing roles that make women engineers the most successful in construction companies

Data from Table 8.1 and Figure 8.8 were analyzed. The roles chosen by over 50 per cent of all informants represented the most successful roles of women engineers working in Thai contractor companies and are shown in Figure 8.9.

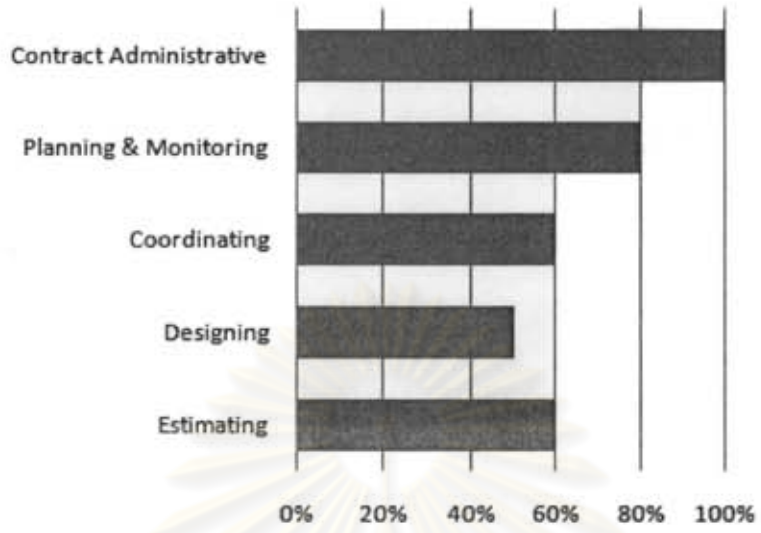

Figure 8.9 Successful roles of women engineers in contractor companies

Figure 8.9 shows viewpoints of women engineers with more than ten years of work experience in the construction industry. Successful roles of women engineers in contractor companies in descending order are contract administration, planning and monitoring, coordinating, estimating and designing.

The viewpoints of women engineers working in the construction industry for more than ten years show that the most successful role of women engineers is contract administration due to their outstanding characteristics, namely thoroughness, and good communicating and negotiating skills. Additionally, this role pays well compared to other roles. Planning and monitoring, coordinating, estimating and designing also require civil engineering knowledge. Women engineers have opportunities to improve their knowledge and skills all the time as new projects come along. Women engineers can perform these roles well because they require thoroughness and good communicating skills that reduce conflicts between concerned parties, which women possess. In reference to career opportunities, data analysis of the organizational layout of contractor companies revealed that women engineers performing these roles in large-sized and medium-sized contractor companies can progress in their careers. For instance, they can be promoted from senior engineers to department heads or project managers. Apart from that, their salaries and bonuses increase every year depending on their performance.

8.4.2 Data Analysis of Suitable Roles of Women Engineers in Contractor Companies from Perspectives of Male and Female Company Owners or Superiors of Women Engineers

Data of suitable roles of women engineers from viewpoints of company owners or superiors of women engineers were divided into two parts: 1) opinions of male company owners or superiors of women engineers; and 2) opinions of women company owners or superiors of women engineers. Details are shown below.

8.4.2 1 Data of suitable roles of women engineers from the viewpoints of two male company owners and eight male superiors of women engineers who had experience in construction are shown in Figure 8.10.

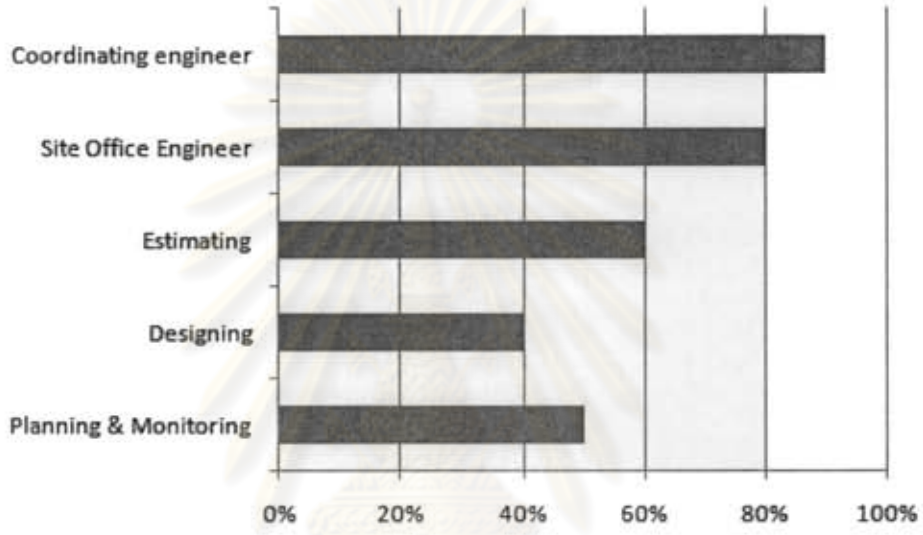

Figure 8.10 Suitable roles of women engineers in contractor companies from the perceptions of men company owners and superiors of women engineers

Figure 8.10 illustrates the most suitable and successful roles of women engineers in contractor companies from the viewpoints of male company owners or superiors of women engineers. This promotes optimization of women engineers' abilities and companies' benefits from women engineers' performance. The first five suitable roles of women engineers in descending order are coordinating, site office engineer, estimating, designing and planning and monitoring.

8.4.2 2 Data of women engineers' most suitable roles viewed from the perspectives of two female company owners and eight superiors of women engineers who had experience in construction are presented in Figure 8.11.

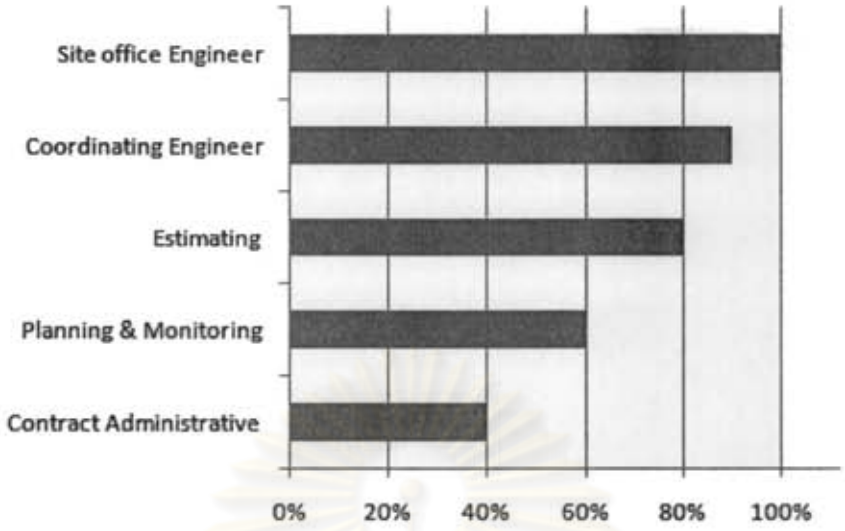

Figure 8.11 Suitable roles of women engineers in contractor companies from the perceptions of women company owners and superiors of women engineers

It can be seen from Figure 8.11 that the most suitable roles of women engineers in contractor companies from the viewpoints of female company owners or superiors of women engineers in the first five roles are site office engineer, coordinating, estimating, planning and monitoring and designing. These data will promote optimization of women engineers' abilities and companies' benefits from women engineers' performance.

According to the viewpoints of male and female company owners or superiors of women engineers, it can be seen that two most successful roles of women engineers are site office engineer and coordinating. These two roles most require outstanding characteristics of women engineers, which are thoroughness when dealing with document work, and good communicating and negotiating skills that reduce conflicts among concerned parties. Contractor companies in general assign women engineers to work in site offices as site office engineers because women engineers can perform this role better than their male counterparts. By the same token, if contractor companies want to hire engineers to do coordinating jobs, they usually recruit women engineers because they believe that women engineers are better at coordinating than men. As for other roles namely estimating, planning and monitoring and designing, even though women engineers are notably better than men, women can perform these roles very well because there are no constraints in these roles and women engineers can apply their thoroughness, one of their outstanding characteristics, to their work. In addition, they can utilize their civil engineering knowledge in their work while gaining new knowledge as new construction projects come along. When career opportunities were considered together with different sizes of contractor companies in Thailand, it was found that women engineers performing roles of site office engineer, coordinating, estimating, planning and monitoring and designing in large-sized and medium-sized contractor companies had the most

opportunities of career advancement. For instance, they can be promoted to senior engineers, department heads or project managers as long as their competencies allow. Even if they are not promoted, their salaries and bonuses still increase every year based on their performance.

8.5 Discussion

The research by Dainty et al. (2000a) revealed that women engineers in the UK had less opportunity for career progression than men engineers in large-sized contractor companies at every age range. Civil engineers were divided into seven levels in a contractor companies. This research in Thailand increased women engineers' career opportunities. At present, contractor companies are downsizing in order to cut costs and maintain profitability. Positions of young executives are omitted from the companies and positions that people can get promoted to in companies have decreased. This is a global trend of corporate adjustment (Gutteridge, Leibowitz, and Shore, 1993). Career success measurement has shifted from positions in the organizational hierarchy to psychological success (Miles and Snow, 1996; Hall, 1996). In Thailand, this corporate adjustment trend started in 1997 when the Thai economy collapsed. Contractor companies, such as Italian-Thai Development Public Company Limited and Sino-Thai Engineering & Construction Public Company Limited, reorganized to cut costs. That was a good chance for women to turn crisis into opportunity as limited positions in contractor companies could be filled by both men and women engineers. As seen from Figures 8.2, 8.4, 8.6, there are three to four levels of roles of engineers in Thai construction companies. Career advancement can no longer be measured by promotions in large-sized contractor companies, where the highest position for most civil engineers is senior engineer. Project engineer and project manager positions in large-sized contractor companies are occupied by experts with over 20 years of work experience who work until they reach retirement age because they are well provided with security and benefits. Considering remuneration packages, both male and female engineers enjoy the same salary raises based on their performance.

Additionally, there is equal representation of women and men engineers in large-sized contractor companies, where mentors are provided for new employees who have no work experience so that experienced and inexperienced people can join the companies. In large-sized contractor companies, civil engineers have clearer roles and responsibilities compared to medium-sized and small-sized companies with the exception of the site engineer position, which is reserved only for men engineers due to harshness, risks and danger involved.

In medium-sized contractor companies, there are fewer departments and roles compared to large-sized companies, but more departments and roles compared to small-sized companies. Both men and women engineers are welcome. Generally, newly graduated men and women start their engineering careers by gaining site-based

work experience. Women engineers in medium-sized contractor companies are sometimes assigned to be site office engineers, whose roles and responsibilities are not as important as those of site engineers. And consequently they are less likely to be promoted to be project engineers. In addition, site office engineers and site engineers start their careers at the same time without experience. By the same token, the pilot study in Chapter 4 reveals that women working at site offices are usually assigned to do unimportant jobs reducing their opportunities of career progression in many aspects such as professional knowledge, promotions and salary raises and bonus increases.

Small-sized contractor companies hire fewer civil engineers than medium-sized and large-sized contractor companies due to the number and size of projects they deal with. Small-sized contractor companies are generally family-run businesses and most cases the owners are project managers. Like most contractor companies, the work of small-sized contractor companies is divided into head office work and site-based work. Men engineers are considered able to do both kinds of work whilst women engineers are usually assigned to be estimators or office engineers. Analysis results disclosed that in small-sized contractor companies, there are not many opportunities for promotions and salary raises compared to medium-sized and large-sized contractor companies. In addition, site engineers are also site office engineers assisted by secretaries who do not hold degrees in civil engineering for budget-saving reasons.

According to the above analysis of the three sizes of contractor companies, it can be interpreted that women engineers working in large-sized companies are confronted with fewer problems than those working in small-sized and medium-sized companies. Women engineers who are site office engineers in medium-sized companies, in particular, are assigned to do tasks irrelevant to the civil engineering profession such as inspecting materials in warehouses, preparing documents for installment payments, administrative work such as answering phone calls, taking notes, making coffee, making photocopies, etc. In addition, in small-sized contractor companies, tasks of site office engineers are performed by people with no knowledge about civil engineering making it more difficult for women engineers to be promoted or use their knowledge and experience, and, thus, advance in their careers. Under-representation of women engineers in site-based work at high positions such as project engineers or project managers results in fewer opportunities for career progression compared to men engineers. This research also clarifies career problems in addition to research results in Chapter 5, which revealed that career under-achievement was the main cause of women engineers' turnover (See Table 5.5). Furthermore, in Chapter 6, data on problems affecting women engineers' turnover gathered from 57 women engineers working in contractor companies, 51% of which were site office engineers (See Table 6.1), showed that low levels of satisfaction of career progression led to women engineers' turnover intention. Hence, if women engineers are more satisfied with their career progression, their retention rates will increase.

Studying suitable roles of women engineers in the Thai construction industry is one way to increase their career opportunities. This research also aims to study suitable roles of women engineers that are beneficial for contractor companies and women engineers themselves.

According to the above-mentioned pilot study in Chapter 4, generally, there are nine roles of civil engineers in contractor companies are estimating, purchasing, planning and monitoring, designing, coordinating, contract administration, site supervision, site office engineer and quantity surveyor. In addition, suitable roles and outstanding characteristics of women engineers from the viewpoints of women engineers in contractor companies who had more than 10 years of work experience and male and female company owners or superiors of women engineers are also presented in Chapter 4. Finally, the roles of civil engineers in contractor companies and analysis results of their career paths in each role in contractor companies were featured in this chapter. Based on the above data, suitable roles of women engineers in contractor companies can be discussed as follows.

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The most successful roles of women engineers in descending order from the viewpoint of senior women engineers working in contractor companies and having over 10 years of work experience are contract administrating, planning and monitoring, coordinating, designing and estimating; from the viewpoint of male company owners or superiors of women engineers, they are coordinating, site office engineer, estimating, designing and planning and monitoring; and from the viewpoint of female company owners or superiors of women engineers, they are site office engineer, coordinating, estimating, planning and monitoring, and contract administration. Identifying outstanding characteristics of women engineers in Chapter 7 showed that women engineers' outstanding characteristics were good communicating and negotiating skills, thoroughness and better English skills compared to men engineers. When suitable roles of women engineers from the three viewpoints and roles of civil engineers in contractor companies and their career paths in each role in contractor companies were taken into account, it was found that coordinating was the most suitable role for women engineers in Thai contractor companies regarding to the outstanding characteirstics mentioned above. There was also found to be a great number of women engineers assuming this role in contractor companies. An analysis of career paths revealed that the knowledge and skills acquired from the coordinating role could be applied to the planning and monitoring and contract administrative roles which could help women engineers advance in their careers and become senior engineers and project managers. It can be concluded that outstanding characteristics such as negotiating and communicating skills and thoroughness of women engineers contribute to their coordinating role and if they try to gain more experience, they can also assume planning and monitoring or contract administrative roles, and even be promoted to senior engineers and project managers.

In regards to price estimating, women engineers are also suitable for this role due to their outstanding characteristics such as negotiating and communicating skills,

thoroughness and tolerance of redundant work. Sometimes they have to coordinate with people from different work units such as site designers and project owners. Thus, price estimating is a suitable role for women engineers. In addition, considering roles of civil engineers in contractor companies and their career paths, it is apparent that in contractor companies of different sizes, male and women civil engineers assume the price estimating role, which is considered the key to winning construction bids. As for career paths, women engineers doing estimating jobs can be promoted to project managers depending on their performance and companies' conditions.

Concerning planning and monitoring, thoroughness is an outstanding characteristic of women engineers that makes them suitable for this role. In addition, in large-sized and medium-sized companies, inexperienced civil engineers can also assume this role. Lastly, engineers who do planning and monitoring jobs can be promoted to senior engineers and project managers as well.

Thus, suitable roles of civil engineers that is beneficial to Thai contractor companies and women engineers are coordinating, estimating and planning and monitoring.

Moreover, senior women engineers, women company owners and superiors of women engineers found that contract administration was most successful and suitable role for women. In contrast, male company owners and superiors of women engineers did not find this role the most suitable for women. Along with financial gain, contractor companies can employ this role as a motivation for career advancement and organize a career path guideline for women engineers (See Figure 8.6) so they can visualize their career progression in contractor companies.

Finally, senior women engineers did not consider site office engineers a successful role for women engineers whilst both female and male company owners and superiors of women engineers found that this position was suitable for women engineers. According to this research, it was found that small-sized and medium-sized construction companies assigned this supportive position to women engineers. It is acknowledged that most people who have chosen a civil engineering career are capable and should be accepted in the field. In addition to the success of promotion, salary, knowledge and experience are important to them.

When roles of site office engineers in three sizes of contractor companies are considered, it was found that women engineers in medium-sized and small-sized companies, medium-sized companies in particular, had more problems of career development than those in large-sized companies or in other roles.

Site office engineers can not develop more knowledge and skills because they do not have the chance to use their civil engineering knowledge. In addition, this position seems to be inferior to site engineers even though who are site engineers do not have work experience. If contractor companies find site office engineers a suitable role for women engineers, they should try to add more responsibilities to this position. Furthermore, when career paths in medium-sized companies are considered, women engineers who are site office engineers seemed to have more problems of career

progression and less chance of promotion compared to women engineers in other roles.

Thus, a recommendation of this research to develop women engineers' careers is implementation of job rotation to decrease their dissatisfaction of career progression and increase their knowledge development and promotions. In addition, providing career development guidelines for employees is another responsibility of the project manager in project management (Pinto, 1998: 5-8) and another way to retain employees in the long run (Fisher, Schoenfeldt and Shaw, 2002: 744-765). In order to help women engineers who are site office engineers see their career opportunities in the companies they work for, apart from job rotation that allows them to go work in head offices from time to time, contractor companies can also give them career path guidelines so that they see themselves advancing in their careers. Figure 8.12 shows an example of the guidelines which largely depend on the conditions in each company. After collecting enough experience and knowledge as site office engineers, women engineers can go to work at the head offices in roles of estimating, designing and coordinating. Women engineers who have site-based experience can assume these roles even more effectively and get better faster than those without experience. As for roles of planning and monitoring and contract administration, most contractor companies want individuals with experience. Therefore, women engineers who used to be site office engineers can be very good at planning and monitoring and contract administration. As seen in Figure 8.12, senior site office engineers do not have a lot of career opportunities because most companies do not employ this position at senior level and usually people in this position do not stay there for a long time. In other words, they quit their jobs before they become senior site office engineers. Nonetheless, if a career path guideline of this position is provided, employees will be able to see opportunities of job rotation, promotions and salary raises and, thus, stay in this position for a longer period of time.

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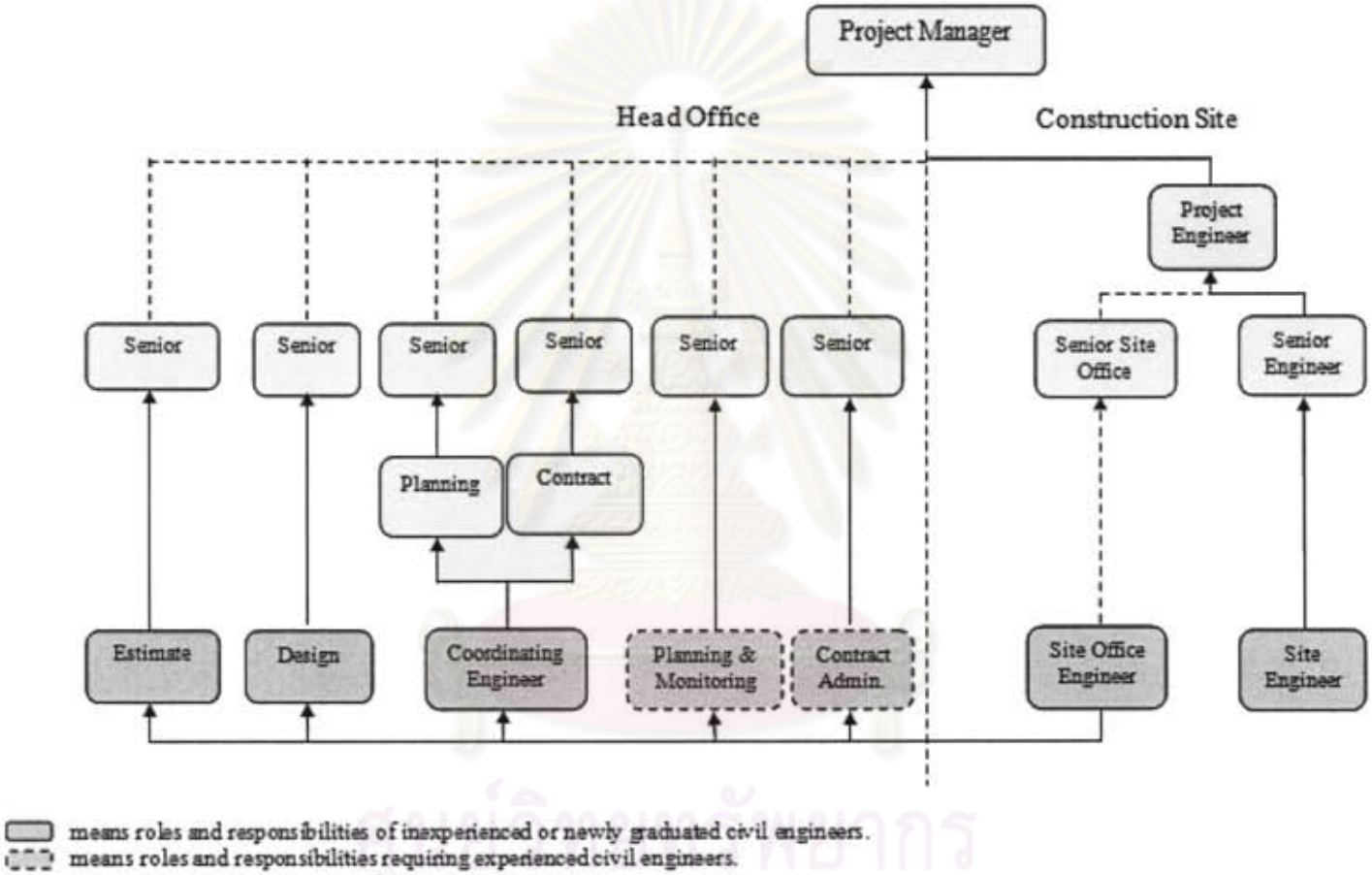

Figure 8.12 A sample career path in medium-sized contractor companies that allows site office engineers to make more progression in their careers and a job rotation.

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Chapter IX
Conclusions and Recommendations

9.1 Introduction

The topic of this dissertation is "A Study of Working Experiences, Outstanding Characteristics, and Suitable Roles of Female Engineers in Thailand Construction Industry: A Case Study of Female Civil Engineers." This research aims to suggest job allocation strategies and management of diverse workforces for project managers to improve women engineers' performance using their strengths to fulfill the work of men engineers in construction, as well as increase opportunities for women in the engineering field. Specifically, the purposes of this research are as follows: to explore women engineer's experiences in the Thai construction industry in order to identity women engineers' turnover problems, to identify advantages of women engineers' presence in the construction industry by identifying outstanding characteristics of women engineers compared to men engineers, and suggest suitable roles of women engineers in the Thai construction industry to increase their career opportunities.

The researcher gathered data in the Bangkok Metropolitan Region, where a wide range of contractor companies and construction companies are located and women engineers tend to work for. There were two data-gathering phases in this study. The first phase is a pilot survey which was a qualitative study. In-depth interview sessions were conducted of 12 women engineers. The second phase was data gathering which was a qualitative and quantitative study. Data were gathered from 151 engineers, consisting of 57 women engineers working in contractor companies, 47 women engineers working in non-contractor companies (4 working in construction management companies, 2 working in consulting firms, 19 working in design companies, 14 working in property developers, 8 working in suppliers of construction materials), and 47 men engineers working in contractor companies with no more than 10 years of work experience in construction. The methods of data gathering were semi-structured interviews and questionnaires. Furthermore, in-depth interviews were conducted with 21 males including 19 men civil engineers and two foremen who were superiors, colleagues and subordinates. Additionally, as a triangular method, in-depth interviews were conducted with ten senior women engineers with over ten years of experience, ten male company owners, superiors of women engineers, ten female company owners, and superiors of women engineers. Lastly, three successful female engineering experts in the Thai construction industry were interviewed. Research results were verified and conclusions of the research are presented in this chapter.

Semi-structured interviews and questionnaires from the sample group were examined in the data analysis process. Two types of statistical methods of data analysis were employed: 1) descriptive statistics, which explained data in terms of frequency, percentage, mean, and standard deviation; and 2) inferential statistics,

which determined the relationship between independent variables, namely individual characteristics, work characteristics and organizational factors, and dependent variables, namely problems of women engineers in contractor companies, such as discrimination, work-life conflicts, sexual harassment and factors of satisfaction of career progression. Statistical hypotheses were tested by way of One-Way ANOVA, Pearson's correlation coefficients and a model was created for prediction by way of multiple regression analysis, correlation coefficients and adjusted R^2 values. The research results are presented in the forms of tables, graphs and pictures. In reference to qualitative data analysis, NUDIST@ program was used to analyze data from interviews of outstanding characteristics of women engineers. Data were classified and analyzed in accordance with the predetermined issues.

9.2 Conclusions

9.2.1 Women Engineers's Experiences in the Thai Construction Industry

According to the pilot study, data gathered from 12 women engineers who had over five years of work experience showed that 11 or 91.6 per cent of all women engineers found that women engineers in contractor companies had less career advancement than men engineers because their roles were restricted and they could not do all the roles that men could; whilst women engineers working in other companies such as consulting companies or land developers could do all the roles of men engineers in the same kind of companies. Hence, the conclusions are grouped into three components.

9.2.1.1 Comparison of experience of women engineers working in contractor and non-contractor companies.

The comparison of work experience of women engineers included opinions about difficulties of working in the construction industry, problems in a contractor company career, career advancement, and career path guidelines. Details are elaborated as below.

1) Difficulties of working in construction: there are three periods of difficulty findings: (1) study period, (2) job application period, and (3) work period. The details are elaborated on as below:

1.1) Difficulties of studying civil engineering: women engineers working in contractor companies found that the first difficulty of studying civil engineering was outdoor practice such as in survey class where men could do better than women. Women engineers working in non-contractor companies found that the top difficulties were physical limit in carrying heavy materials such as reinforced concrete and also outdoor practice in survey my classes.

1.2) Difficulties of job application: women engineers working in contractor companies found that the first difficulty was preference for male

employees. Women engineers working in non-contractor companies found that the first difficulty was preference of graduates from public universities.

1.3) Difficulties of civil engineering work: women engineers working in contractor companies found that the first difficulty was women engineers having less knowledge of field work. Women engineers supervising projects in non-contractor companies found that the first difficulty was less recognition from contractors then men engineers.

2) Problems in contractor company careers;

Sexual harassment: The percentage of women engineers who experienced sexual harassment was higher for those working in contractor companies (23.0%) than in non-contractor companies (13.0%).

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Work-life conflicts: it can be seen that women engineers working in contractor companies (26.0%) had more work/family conflicts than their female peers in non-contractor companies (6.0%).

Equality of opportunity: women engineers working in contractor companies had different perceptions about equality in workplaces from those of women engineers in non-working contractor companies. There seemed to be more inequality for women engineers working in contractor companies (94.0%). On the other hand, the majority of women engineers working in non-contractor companies (77.0%) opined that there was equality in their workplaces.

3) Career advancement of women engineers in comparison with men engineers: 83 per cent of women civil engineers working in contractor companies found that women in civil engineering careers had less progression than their male counterparts. On the other hand, 53 per cent of women engineers working in non-contractor companies found that women in civil engineering careers had less career progression compared to male peers. Therefore, it can be concluded that women engineers working in contractor companies had different perceptions from engineers working in non-contractor companies on the matter of career progression of female and men engineers in the Thai construction industry. The majority of women engineers in contractor companies who found that they had less progress than men were higher than the number of women engineer in non-contractor companies who found that women engineers had less progress.

4) Career path guidelines for women engineers: 9 per cent of women engineers working in contractor companies were provided with career path guidelines by the companies they worked for while 38 per cent of women engineers working in non-contractor companies were provided with career path guidelines by the companies they worked for. Generally, Thai contractor companies provide career path guidelines to their employees because they envision the talent of their employee and want to retain them for a sustainable time. It can be concluded that the number of women engineers working in non-contractor companies who received career path guidelines was more than that of women engineers working in contractor companies.

This implies that non-contractor companies find women engineers more important compared with contractor companies.

9.2.1.2 Comparison of experiences of men and women engineers working in contractor companies and women engineers working in non-contractor companies

Three themes were addressed in this section: 1) study of the appropriateness of women in civil engineering careers, 2) study of perceptions about working for career progression in the construction industry, and 3) career satisfaction in the construction industry. The details are elaborated on below.

1) Appropriateness of women in civil engineering careers: there were different opinions among the three groups of people about the suitability of women in civil engineering careers. The first group was men engineers (85 %) working in contractor companies who highly agreed that women should not be civil engineers, followed by the majority of women engineers (66 %) in contractor companies. Most men engineers opined that women were unsuitable for construction work. In addition, one case study supported this notion expressed in section 5.4.1 On the other hand, in the third group, most women engineers (72 %) working in non-contractor companies, found that women should have civil engineering careers and a mere 28 per cent of them did not think women should be in civil engineering.

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2) Success in civil engineering careers in the Thai construction industry: perceptions about success in the Thai construction industry can be concluded as follows.

2.1) To be successful in civil engineering careers, one must have site work experience. Both men engineers and women engineers working in contractor companies agreed to the highest level with this statement whilst women engineers working in non-contractor companies agreed to an average level with this statement.

2.2) Having no site work experience in the long run can make one lose confidence in work. Both men engineers and women engineers working in contractor companies agreed to an average level with this statement whilst women engineers working in non-contractor companies agreed to a low level with this statement.

2.3) People with site work experience have more chance of promotions and salary raises compared to those without site work experience. Both men engineers and women engineers working in contractor companies agreed to the highest level with this statement whilst women engineers working in non-contractor companies agreed to a high level with this statement.

2.4) Companies gain equal benefit from women and men engineers. Among the three groups of people, men engineers and women engineers working in contractor and non-contractor companies agreed to the highest level with this statement.

2.5) Getting promoted to higher levels (from associate to professional and from professional to charter engineers) leads to career advancement. Women engineers working in contractor companies agreed to the same level as women engineers from non-contractor companies whilst men engineers working in contractor companies had a different idea about this statement.

2.6) Civil engineering is unsuitable for women because career advancement is limited to men. Both men engineers and women engineers working in contractor companies agreed to an average level with this statement whilst women engineers working in non-contractor companies agreed to a low level with this statement.

2.7) Civil engineering is unsuitable for women because women have restrictions in physical issues such as climbing to high places, etc. Both men engineers and women engineers working in contractor companies agreed to a high level with this statement whilst women engineers working in non-contractor companies agreed to an average level with this statement.

3) Overall career satisfaction in the Thai construction industry:

Women engineers working in non-contractor companies and men working in contractor companies agreed that overall work satisfaction in the construction industry was at a high level whilst women engineers working in contractor companies found that overall work satisfaction in the construction industry was at an average level.

9.2.1.3 Comparison of experience of women and men engineers working in contractor companies about turnover profiles

The experience of female and men engineers regarding turnover rates revealed that on average a female engineer worked in a contractor company. Women engineers had a higher tendency to have higher turnover rates compared to their male counterparts. The main reason for high turnover rates of women engineers was that they had poor advancement in their careers and for men engineers was that they wanted higher salaries. The calculations led to an initial finding that women engineers change their workplaces more often than men engineers or have turnover rates two times higher.

Furthermore, the first cause of women engineers' turnover was poor career advancement prospect/slow progression in their careers: 47 times or 31 per cent of overall turnover. Turnover causes of 47 men engineers were investigated and it was found that the main cause of men engineers' turnover was their desire for a higher salary. Therefore, it is clear that the main cause of turnover of women engineers and men engineers are different.

9.2.1.4 Women's problems/obstacles in contractor companies careers

Women faced many problems in contractor companies' careers that impact their turnover, which are divided into four groups: 1) discrimination; 2) work-

life conflicts; 3) sexual harassment; and 4) satisfaction of career progression. Furthermore, it was found that women engineers confronted the four groups of problems differently.

9.2.2 Factors Affecting Women Engineers' Careers in Contractor Companies

There are three main factors influencing problems of women engineers: 1) individual characteristics including age-range, work hours, family responsibility, site work experience, tenure, number of promotions and average number of salary raises; 2) work characteristics include fieldwork hours, going upcountry, uncertain work times, and male domination; and 3) organization characteristics including work value, training and development opportunities, support from superiors and gender diversity climate. According to the one-way Analysis of Variance (one-way ANOVA), it was found that uncertain work times in the second group of factors, namely work characteristics, was the only factor not consistent with the hypothesis, which means the difference of uncertain work times as perceived by women engineers does not affect differences of the four problems at the significance level 0.05. After that correlation analysis was employed to determine the correlation between three groups of dependent factors and four dimensions of problems in contractor company careers and multiple regression models. The results of correlation analysis yielded differences of the model. Therefore, uncertain work times were included in the correlation analysis.

1) Results of Pearson correlation analysis and stepwise multiple regression analysis of factors influencing problems of women engineers in contractor company careers are described below.

1.1) Discrimination model: there was 40 per cent variation of discrimination prediction (adjusted R^2 = 0.400). Significant predictors of discrimination are tenure, fieldwork hours and male domination.

1.2) Work-life conflicts model: there was 59 per cent variation of work-life conflicts prediction (adjusted R^2 = 0.592). Significant predictors of work-life conflicts are family responsibilities, and superiors' support.

1.3) Sexual harassment model: there was 49 per cent variation of sexual harassment prediction (adjusted R^2 = 0.491). Significant predictors of sexual harassment are male domination and age range.

1.4) Progression satisfaction model: there was 48 per cent variation of progression satisfaction prediction (adjusted R^2 = 0.482). Significant predictors of progression satisfaction are training and development, gender diversity climate, tenure and superiors' support.

2) Prediction Model of Women Engineer's Turnover Intention

Pearson correlation analysis and stepwise multiple regression analysis found that progression satisfaction was the only significant factor that predicted

women engineers' turnover intention and explains the 62 per cent variation of progression satisfaction prediction (adjust $R^2 = 0.620$).

9.2.3 Outstanding Characteristics of Women Engineers Presence in the Contractor Companies

Outstanding characteristics of women engineers that are beneficial for their work can be classified into three perspectives as follows:

9.2.3.1 Superiors' perceptions: most women engineers are thorough and polite and have good communication and negotiation skills, and better command of English than their male counterparts. Furthermore, women engineers tend to be honest, so they are suitable for positions that require reliability such as procurement-recruitment, quantity surveyor and specification determination and examination. Moreover, women engineers do not like risks so they consult with superiors or experts. This is considered a good characteristic of women engineers because chance of harm being caused to companies that women engineers work for can be reduced. Men engineers are sometimes too careless. Other good characteristics of women engineers are more tolerance of redundant work compared to men engineers and receptiveness to other people's opinions. Other details about a case study are in Section 7.3.1.1.

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9.2.3.2 Colleagues' perceptions: good characteristics of women engineers that are useful for their careers are good negotiation skills suitable for coordinating and procurement, and recruitment work. In addition, women engineers are thorough, so they are suitable for documentation work such as price estimation and designing. Men engineers accepted that women engineers knew how to carry themselves around their subordinates so they paid respect to them and were flexible, receptive to other people's opinions, clean and more honest than the men. Other details about a case study are in Section 7.3.1.2.

9.2.3.3 Subordinates' perceptions: women engineers have good communication and negotiation skills, are thorough, careful, flexible and receptive to their subordinates' opinions, so when problems occur, they try to find solutions rather than finding fault. Other details about a case study are in Section 7.3.1.3.

Therefore, from the three perceptions, it can be said that women engineers have the same outstanding characteristics, which are thoroughness, good negotiation skills, good English skill and receptiveness to other people's opinions.

9.2.4 Suitable Roles for Female Engineers

This research involves in-depth studies of problems of women engineers by analyzing roles of women engineers in construction companies of different sizes. Thai contractor companies can be categorized by project costs into three groups: large-sized, medium-sized and small-sized. Analyses of career paths of women

engineers in each role of three sizes of construction companies, nine roles suitable for women engineers from the perceptions of company owners, and superiors of women engineers working in contractor companies of different sizes yielded results consistent with the pilot study: women engineers' roles and responsibilities are limited, especially those of site engineers.

An analysis of career paths of site office engineers in three sizes of contractor companies showed that in large-sized companies, women engineers did not have more problems of slow career advancement whilst there are in medium-sized and small-sized companies, or 97 per cent of all contractor companies in Thailand, site office engineering roles, which favor women engineers, found women hardly advancing in their careers (NSO, 2010). When responsibilities and career paths of women engineers in each role are analyzed, it can be concluded that the majority of women engineers may have career problems when they are site office engineers due to low chance of knowledge development and career progression compared to site engineers or other positions in head offices.

Women engineers' work limitations are found in site-based work, supervising jobs and the site office engineer position, which negatively affect their career prospects. This research further clarifies career problems of women engineers. It was indicated in Chapter 5 that the main cause of women engineers' turnover was poor advancement prospects. In addition, data gathered from 57 women engineers working contractor companies in Chapter6, 51 per cent of whom were site office engineers, on problems affecting women engineers' turnover in Chapter 6, also revealed that low levels of satisfaction of career progression triggered women engineers' intention to resign. Therefore, problems of slow career advancement should be resolved by designating suitable roles for women engineers for the benefit of both contractor companies and women engineers.

Analysis results of women engineers' career paths in each role in contractor companies and perceptions of women engineering experts formed a conclusion that there were three suitable roles of civil engineers in Thai contractor companies, namely coordinating, estimating, and planning and monitoring engineers.

Coordinating engineers can be a suitable role for women engineers due to the nature of the job which requires communicating and negotiating skills and thoroughness for documentation work. In the analysis of roles of civil engineers in Thai contractor companies, this role was found mostly occupied by women engineers. An analysis of career paths also revealed that knowledge and skills from the coordinating role could be applied to planning and monitoring, and contract administrative roles possibly getting women engineers promoted to senior engineers and project managers. It can be concluded that outstanding characteristics such as good communicating and negotiating skills and thoroughness for documentation work make women engineers suitable for the coordinating role. If they try to gain more knowledge and experience in this role, they can also assume other roles such as

planning and monitoring and contract administration, and even be promoted to senior engineers and project managers.

The next role is estimating engineer. Women engineers' outstanding characteristics such as negotiating and communicating skills, thoroughness and tolerance of redundant work make them suitable for this role. Sometimes they have to coordinate with people from different work units such as site engineers, designers and project owners. Thus, estimating is a suitable role for women engineers. In addition, considering roles of civil engineers in contractor companies and their career paths, it is apparent that in contractor companies of different sizes, men and women civil engineers assume the estimating role, which is considered the key to winning construction bids. As for their career paths, women engineers doing estimating jobs can be promoted to project managers depending on their performance and companies' conditions.

As for planning and monitoring, thoroughness with documentation work is women engineers' outstanding characteristic that makes them suitable for the planning and monitoring role. In addition, in large-sized and medium-sized companies, inexperienced civil engineers can assume this role. Also, according to the career path, engineers in this role can be promoted to senior engineers and project managers.

9.3 Other Findings from this Study

Apart from the conclusions based on the research objectives, there are additional conclusions, which are listed below.

9.3.1 Women civil engineers were not suitable for construction site work because of their negative traits, namely indecisiveness, intolerance of physically strenuous work, knowing few subcontractors (poor connections), fragile physical conditions, unsuitable mental conditions. However, to work at construction sites, women were recommended to have leadership, high efforts, patience, self-confidence and responsibility. In addition, they should be hardy, able to take risks and act like men, and unafraid of sunlight and rain.

9.3.2 Men engineers admitted that some women engineers were able to work at construction sites. Most women engineers who were suitable for work at construction sites had leadership and high effort, and were unafraid of sunlight and rain, hardy, able to take risks, patient, self-confident, highly responsible, and man-like acting.

9.4 Contributions

9.4.1 Research Contributions

Contributions of this research are viewed at two levels.

9.4.1.1 Company level:

Contractor companies can learn women engineers' experiences and know that poor career advancement prospects are the most important problem leading to women engineers' turnover. It was also found that satisfaction of career progression was the problem that most influenced women engineers' turnover intentions.

Contractor companies can learn women engineers' outstanding characteristics that are different from those of men engineers and be able to design job allocation strategies to optimize their capacities, use their strengths to compensate for weaknesses of men engineers and enhance the company's overall productivity. Consequently, they can see the true value of women engineer's presence.

Suitable roles of women engineers are coordinating, estimating and planning, and monitoring. These outcomes contribute to the companies' proper job allocation, enhance women engineers' career progression and, thus, maximize the companies' advantage from women engineers' performance.

Contractor companies realize that being site office engineers makes women engineers feel the least satisfied with their career progression, and the contract administrative, planning and monitoring, coordinating, estimating and designing are the most successful roles of women engineers. This information can be useful for career management programs to create motivation and retain women engineers in a sustainable way.

9.4.1.2 Individual level

Women can learn from experiences of women engineers working in Thai contractor and non-contractor companies and be able to plan their career in the Thai construction industry.

An analysis of women engineers' progression in each role makes them envision their career paths in each role and understand the problems in these roles, helping them plan their career path in Thailand's construction industry accordingly.

Women engineers can learn that from the perceptions of male and female company owners and superiors of women engineers, coordinating, site office engineer, estimating, designing, planning and monitoring, and contract administration are their most suitable roles, and the reasons why the companies found those roles suitable for them. This can be applied to their careers in contractor companies.

Furthermore, knowledge of outstanding characteristics, suitable roles of women engineers, unsuitable roles of women engineers at construction sites, and personality characteristics of women engineers that are suitable for construction fieldwork are useful for women engineers working both at office-based work and site-

based work. This knowledge was presented in this research, so that women engineers can apply them to increase their career opportunities.

9.4.2. Implications for Practice

9.4.2.1 Outstanding characteristics of women engineers found in this research allow construction companies to see the advantages of women engineers' presence. In addition, they can design job allocation strategies for women engineers to benefit from their talents to the fullest and increase corporate efficiency.

9.4.2.2 Implementation of suitable roles, namely coordinating, estimating, and planning and monitoring to job allocation is one way to increase women engineers' career progression, reducing their turnover due to career dissatisfaction.

9.4.2.3 Work restrictions lead women engineers to feel less satisfied with their career progression in contractor companies compared to men. Construction companies should try to implement policies that encourage equality in workplaces so that women can assume every role available in contractor companies, especially the role of site engineer, which in this research, men engineers who have been working with women engineers admitted some women were able to assume.

9.4.2.4 Furthermore, the perceptions of senior women engineers, women company owners and superiors of women engineers show that contract administration was a suitable role for women engineers whilst male company owners and superiors of women engineers found otherwise. It is well known that contract administration is highly rewarding compared to other roles and any employee assuming this role must be highly skilled and recognized. If contractor companies employed this role to create motivation by introducing a career path guideline for this role for women engineers, the latter can improve their career prospects and feel more satisfied with it.

9.4.2.5 Lastly, the perceptions of senior women engineers was that site office engineer was not a successful role for women engineers whilst female and male company owners and superiors of women engineers found that this role was suitable for them. It was found that most small-sized and medium-sized construction companies assigned this role to women engineers because it supported site-based work. This research suggests that if contractor companies find site office engineer a suitable position for women engineers, they should expand the job or enrich it, subsequently increasing women engineers career prospects and satisfaction of career progression. Providing career path guidelines and job rotation also helps site office engineers see opportunities of their career prospects.

As a result, it is highly anticipated that the results of this research will help contractor companies allocate jobs to their employees more properly in order to enhance or make more complete the work of men engineers and increase opportunities of advancing and succeeding in construction company careers and career satisfaction in the Thai construction industry for women engineers. Eventually, retention of women engineers in the Thai construction industry will bring advantages

for the women engineers themselves, the construction companies, the Thai construction industry and the country as a whole.

9.5 Limitations of the Study

The limitations of this study in regard to data processing are listed below.

9.5.1 There is no updated list of contractor companies that women civil engineers had working for in Thailand. Thus, an exact sampling structure of women civil engineers in contractor companies is not available for random sampling. As a result, non-probability sampling incorporated with the snowball technique was applied in selecting qualified women engineers and others respondents.

9.5.2 Due to time and money constraints, limited data were collected for analysis. If there were more data, reliability would be increased.

9.6 Recommendations for Further Study

There can be further studies based on this research.

9.6.1. Studies on successful women engineers in the construction industry can be used to develop career guidelines for women engineers to increase their chance of career success.

9.6.2. In this study, data were gathered from women engineers working in Thai construction companies. Data should be gathered from the public or women civil engineers who changed their career paths to find the detailed causes of their departure from the construction industry.

9.6.3 The number of women engineers is currently growing. However, there is a lack of research in this field. An extension of this study should be done regarding various areas such as health and safety of women in construction, and differences in motivation between female and male engineers.

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ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Appendix

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Table A1 Men and women engineers' graduated from universities in Thailand (2003-2008)

	Women		Men	
	Number	Percent	Number	Percent
2003	179	100.0	2173	100.0
2004	233	130.0	2242	103.0
2005	268	150.0	2523	116.0
2006	312	174.0	2552	117.0
2007	341	191.0	2596	119.0
2008	378	211.0	2671	123.0

Sources; Office of the Higher Education Commission, 2009

Table A2 Men and women engineers' registered with the Council of Engineering in Thailand (2003-2008)

	Women		Men	
	Number	Percent	Number	Percent
2003	1,481	100.0	37,496	100.0
2004	1,760	119.0	39,172	105.0
2005	1,979	134.0	41,053	110.0
2006	2,188	148.0	43,394	116.0
2007	2,373	160.0	45,081	120.0
2008	2,652	179.0	48,018	128.0

Sources; Council of Engineering in Thailand, 2009

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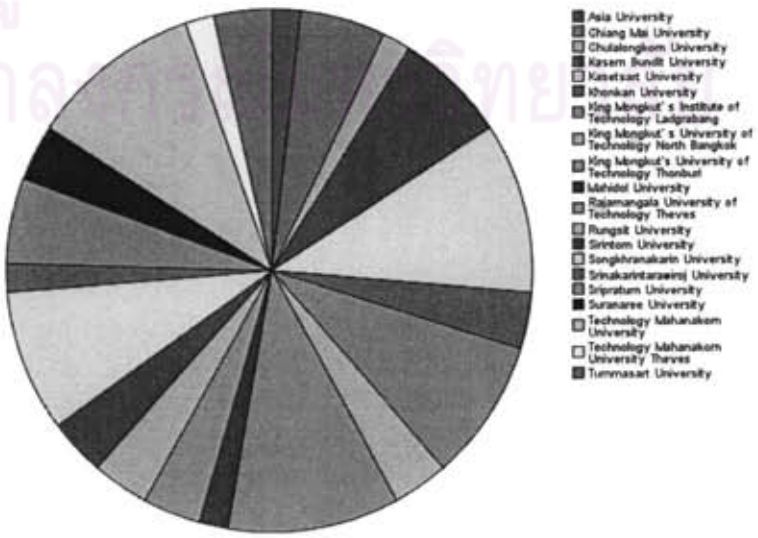
จุฬาลงกรณ์มหาวิทยาลัย

Women Engineers in Contractor Companies who Answer the Questionnaires Classified by Universities

University

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Asia University	1	1.8	1.8	1.8
	Chiang Mai University	3	5.3	5.3	7.0
	Chulalongkorn University	1	1.8	1.8	8.8
	Kasem Bundit University	4	7.0	7.0	15.8
	Kasetsart University	6	10.5	10.5	26.3
	Khonkan University	2	3.5	3.5	29.8
	King Mongkut's Institute of Technology Ladgrabang	5	8.8	8.8	38.6
	King Mongkut's University of Technology North Bangkok	2	3.5	3.5	42.1
	King Mongkut's University of Technology Thonburi	6	10.5	10.5	52.6
	Mahidol University	1	1.8	1.8	54.4
	Rajamangala University of Technology Theves	2	3.5	3.5	57.9
	Rungsit University	2	3.5	3.5	61.4
	Sirintorn University	2	3.5	3.5	64.9
	Songkhranakarin University	5	8.8	8.8	73.7
	Srinakarintarawiroj University	1	1.8	1.8	75.4
	Sripratum University	3	5.3	5.3	80.7
	Suranaree University	2	3.5	3.5	84.2
	Technology Mahanakorn University	6	10.5	10.5	94.7
	Technology Mahanakorn University Theves	1	1.8	1.8	96.5
	Tummasart University	2	3.5	3.5	100.0
	Total	57	100.0	100.0	

University

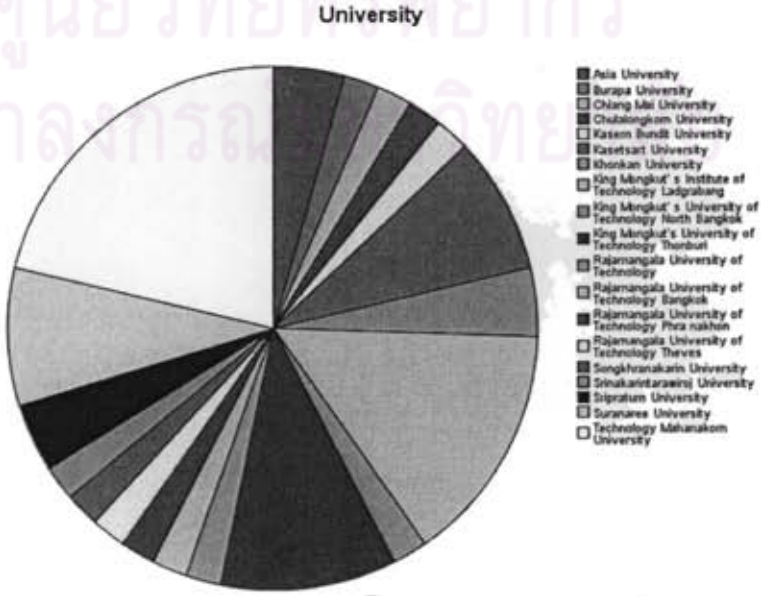


Women Engineers in Non-Contractor Companies Who Answer the Questionnaires Classified by Universities

University

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Asia University	2	4.3	4.3	4.3
	Burapa University	1	2.1	2.1	6.4
	Chiang Mai University	1	2.1	2.1	8.5
	Chulalongkorn University	1	2.1	2.1	10.6
	Kasem Bundit University	1	2.1	2.1	12.8
	Kasetsart University	4	8.5	8.5	21.3
	Khonkan University	2	4.3	4.3	25.5
	King Mongkut's Institute of Technology Ladgrabang	7	14.9	14.9	40.4
	King Mongkut's University of Technology North Bangkok	1	2.1	2.1	42.6
	King Mongkut's University of Technology Thonburi	5	10.6	10.6	53.2
	Rajamangala University of Technology	1	2.1	2.1	55.3
	Rajamangala University of Technology Bangkok	1	2.1	2.1	57.4
	Rajamangala University of Technology Phra nakhon	1	2.1	2.1	59.6
	Rajamangala University of Technology Theves	1	2.1	2.1	61.7
	Songkhranakarin University	1	2.1	2.1	63.8
	Srinakarintarawiroj University	1	2.1	2.1	66.0
	Sripratum University	2	4.3	4.3	70.2
	Suranaree University	4	8.5	8.5	78.7
	Technology Mahanakorn University	10	21.3	21.3	100.0
	Total	47	100.0	100.0	

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย



VITAE

Nuanthip Kaewsri was born on April 1, 1975 in Bangkok, Thailand. She graduated from Surasak Montri High School, Bangkok. She earned a Bachelor's degree in Civil Engineering from the Faculty of Engineering, Kasem Bundit University. Upon graduation in 1999, she worked as a cost engineer for a contractor company. From 2000 to the present, she works as a lecturer at Kasem Bundit University. During 2001-2003, while studying for her Master Degree in Construction Engineering and Management Division at King Mongkut University of Technology, Thonburi, she continued to give lectures and worked as a part-time consultant at a supply materials company. She presently works as a lecturer and consultant. In 2006, she enrolled in a Doctoral Program of Construction Engineering and Management (CEM) Division, Faculty of Engineering, Chulalongkorn University. She currently lives in Bangkok with her family.

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