ANALYSIS OF ROLES AND CAREER PATHS OF WOMEN CIVIL ENGINEERS IN THE THAI CONSTRUCTION COMPANIES

Nuanthip Kaewsri [1] and Tanit Tongthong [2]

[1] Lecturer, Department of Civil Engineering, Kasem Bundit University

[2] Associate Professor, Department of Civil Engineering, Chulalongkorn University

ABSTRACT

During the past two decade, there has been very little research concerning women engineers in the construction industry whilst the number of women engineers in Thai contractor companies keeps increasing. Recent research in Thailand revealed that women engineers changed their workplaces more often than their male counterparts because they had slow career progression in contractor companies. This article presents an analysis of roles of civil engineers in construction organizations of different sizes to suggest career paths and suitable roles of women engineers. A qualitative method including in-depth interviews with company owners and experts in construction companies was also conducted. The result showed suitable roles of women engineers with an aim to increase retention rates of women engineers in construction companies. Lastly, the highlight for project managers are advised to place more importance on women engineers so as to improve women engineers' career development in contractor companies.

KEYWORDS: Civil Engineers, Women Engineers, Career Paths, Construction Organization, Thailand

1. Introduction

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 invests a lot of money in developing civil engineering personnel [1]. 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 considering these 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 percent of the total workforce in the Thai labor market, slightly lower than the percentage of men [2]. The gender pattern of the Thai workforce has changed dramatically in the last 20 years: the male labor increased by 4 percent whereas the female labor skyrocketed by over 40 percent. Thai women employees predominate in certain occupational sectors such as manufacturing, education, health and services in the banking, insurance and retail trades [2]. On the other hand, women account for only 16 percent of the construction workforce, indicating that construction is a heavily male-dominated industry [2]. 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.

The objectives of the article are described as follows:

- To identify roles of women engineers in construction companies and career paths of each women engineer in different positions and analyze roles preventing women engineers from advancement in their careers.
- To identify roles of women engineers by analyzing suitable roles of women engineers useful for both construction companies and women engineers.

Results of a review of previous research concerning career of women engineers in construction companies are shown in the next section.

2. Women in Construction

In 1999, the UK studies found that the number of women engineers had significantly increased. However, according to the study by Dainty et al. [3-4], 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 [5], 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 [6] 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 [7].

Another study by Dainty et al. [3-4] 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 [8] 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 [8] 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 [9] 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 [3-4, 10-15].

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 [4, 16-17]. Additionally, the organizational style emphasizing teamwork in project development has attracted more women as well as men to work in the industry. The study in the UK and Thailand showed that teamwork or project-based work proved beneficial for women because teamwork involved cooperation, coordination and communication, which are women's strengths [4, 18]. Teamwork seems to give women more job opportunities at least at the junior and middle management levels [6, 19].

Previous research clearly shows that women engineers had to face many problems in the construction industry, especially problems of slow progression in their careers, because they are in the male-dominated culture even in Thailand [17]. There is a lack of research on ways to increase opportunities of women to progress in their career apart from teamwork. Research in Thailand revealed that women engineers do not progress in their careers as much as they should and this is the main problem of women engineers' leave from contractor companies [17]. In addition, there is a lack of in-depth analysis of suitable roles of women engineers to increase their opportunities of succeeding and, consequently, retain them in construction companies.

3. Methodology

3.1 Research Design

Owing to avoided biased results concerning suitable roles of women engineers by not collecting the data from women engineers, but instead from company owners or superiors of women engineers so that the latter can gain benefits from the study as much as possible. Specifically, the sample design to collecting data from samples is very important that bring about the reliable data. The purposive sample was used to identify the informants. They were at least 15 years experiences working in construction industry and have been working with women engineer in contractor companies. And the majority of informant had experiences in small-sized, medium-sized and large-sized construction companies. They included 20 people: two female company owners, eight female superiors of female engineers, two male company owners and eight male superiors of female engineers. Furthermore, the roles must benefit women engineers in the long run and contribute to their advancement in the Thai construction industry. Thus, we collected the data concerning the roles that made women engineers the most successful in their careers from ten senior women engineers with over ten years of experience. Details of the interviewees are presented in Table 1.

Table 1 Three group of interviewee profiles

Descriptions	Years of Experience (years)	Number (persons)
1. Senior Women Engineers	22	1
	17	3
	16	1
	15	2
	13	1
	11	2
Total		10
2. Women Owners / Women Superiors	18	2
	16	2
	13	1
	12	1
	11	1
	10	3
Total		10

Table 1 Three group of interviewee profiles (Cont.)

Descriptions	Years of Experience (years)	Number (persons)
3. Men Owners / Men Superiors	34	1
	19	2
	18	1
	17	1
	15	2
	14	1
	13	1
	11	1
Total		10

In-depth face-to-face interviews were held with the informants at their workplaces. A semi-structure interview was employed to collect data in workplaces of interviewees. Each interview session lasted 30-60 minutes. The researcher informed the interviewees that a voice recorder would be used during the interview. The researcher conducted in-depth interviews in person after calling the interviewees to make appointments. Three well-known experts who have more than 20 years of work experience in the Thai construction industry reviewed the results.

The data obtained were transcribed verbatim, and subsequently classified under general conceptual headings and coded under the themes exposed by the raw data, using the NU-DIST® software to explore and extract the obtained data. In this way, the data could be re-examined later when necessary to identify possible communication gaps or confusion in the notes taken. This study was also based on the grounded theory approach (Strauss and Corbin, 1998) to reveal the themes emerging from the content analysis over time. After roles and career paths of women civil engineers in the Thai construction companies were identified, next suitable roles of women engineers were identified by interviewees gave scores to the suitable roles and successful roles.

4. Findings

The findings could be explained in three sections including analysis of the roles and responsibilities of civil engineers in the Thai construction companies; analysis of career path of civil engineers in the contractor organization of different sizes (large, medium and small

sizes, this classified follow by National Statistic Office; NSO [2]) and analysis of suitable roles of women engineers in construction companies. These were explained as follow.

4.1 Analysis of the Roles and Responsibilities of Civil Engineers in the Thai Construction Companies

Generally construction companies, civil engineer's works are divided into two parts: head office based-work and site based-work. Since construction companies deal with projects, civil engineers working in construction companies have explicit roles from different size of construction companies as shown in Table 2.

Table 2 the roles of civil engineer from different size of construction companies

Large-size	Medium-size	Small-size
Head office based-work: 1. Estimating 2. Designing 3. Purchasing 4. Coordinating 5. Planning and Monitoring 6. Contract Administrating	**Head office based-work:** 1. Estimating 2. Designing 3. Coordinating 4. Planning and Monitoring 5. Contract Administrating	**Head office based-work:** 1. Estimating 2. Office Engineer
Site based-work: 1. Estimating 2. Designing 3. Purchasing 4. Planning and Monitoring 5. Quantity Surveying 6. Site Engineer	**Site based-work:** 1. Site Office Engineer 2. Site Engineer	**Site based-work:** 1. Site Engineer

In Table 2, main roles and responsibilities can be explained based regarding roles as in Table 3.

Table 3 **Roles and responsibilities of women civil engineers in the Thai construction companies**

Roles	Responsibilities
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 roles for women civil engineers in the Thai construction companies. The roles and responsibilities of civil engineers may more than above statement

depend on the size of construction companies. The next section will discuss career paths of civil engineers of different size of construction companies in each role.

4.2 Analysis of Career Path of Women Civil Engineers in the Construction Organization of Different Sizes

Career path of women civil engineers were described by sizes of construction organization are.

4.2.1 Analysis of women civil engineers' career paths in large-sized construction companies

Career paths of large-sized construction companies where women civil engineers worked are addressed in Figure1.

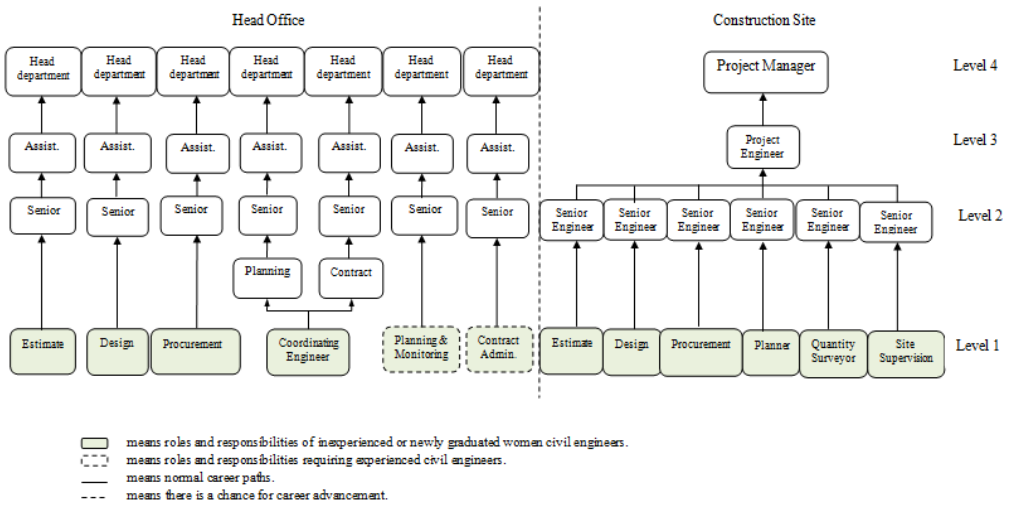

Figure 1 A sample of career paths of women civil engineers in large-sized construction companies

Figure1 presents career path of civil engineers in large-sized construction companies at head offices based-work are six roles namely; estimating, designing, purchasing, coordinating, planning and monitoring and contract administrating. Normally, these roles begin as junior engineers, progressing to senior engineers, then assistant department heads, and finally, department heads, depending on engineers' competencies. On construction site-

based work, there are six roles of civil engineers; estimating, designing, purchasing, planning and monitoring, quantity surveying, and site engineering role begin as junior engineers, progressing to senior engineers, then project engineers, and finally, project managers, depending on engineers' competencies.

From these six 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 good negotiation skill. In addition, the coordinating role is mostly assigned to women because of their good communication skill. Furthermore, the gray block on the lower part of Figure 1 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.

In addition, to become department heads in head offices 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, 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 construction 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 and communicating skills.

4.2.2 Analysis of women civil engineers' career paths in medium-sized construction companies

In medium-sized contractor companies, similar to large-sized construction 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 Figure2.

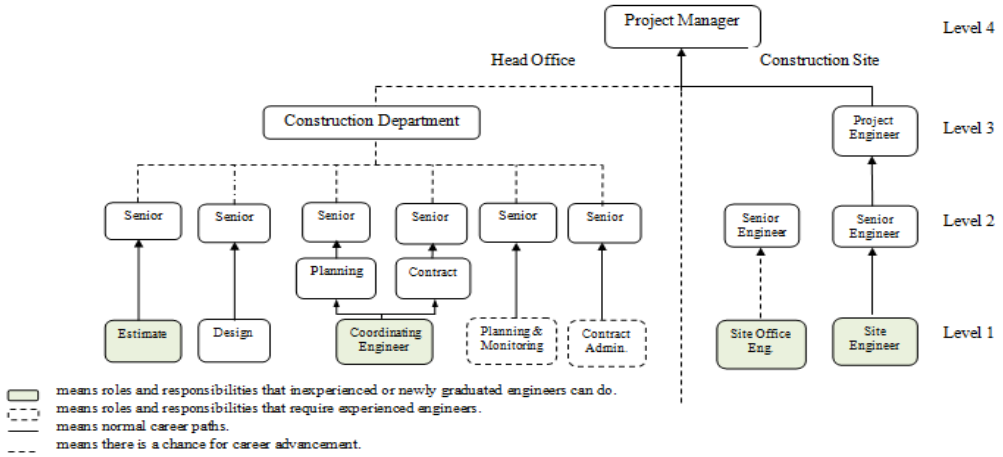

Figure 2 A sample of career paths of civil engineers in medium-sized construction companies

According to Figure 2, it can be explain that in each role, career paths of civil engineers working at head offices based-work. There are five roles namely; estimating and designing roles begins as junior engineers, then senior engineers, and finally project managers. 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. Next, 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. Further, career path of planning and monitoring and contract administrating roles are begins as junior engineers, then senior engineers, and finally, project manager depending on their competencies. Further, medium-sized construction companies are different from large-sized contractor companies. Actually, most project managers in medium-sized construction companies have to supervise the construction section in head offices. Additionally, construction 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. Coordinating is usually the role occupied by women due to their good communication skill.

It was also found that in Thai medium-sized construction companies, there are usually a few project managers (1-2). Figure 2 shows the five roles of civil engineers in head offices. 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. In addition, the gray block at the bottom of Figure 2 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.

On the contrary, site-based work has two roles site office engineer and site engineer. Career path of site engineer role starts as junior engineers, progressing to senior engineers, then project engineers, and finally, project managers. In Figure 2, 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. Another 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.

Furthermore, 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.

4.2.3 Analysis of civil engineers' career paths in small-sized construction companies

Career path of civil engineers in small-sized construction companies are presented and discussed below.

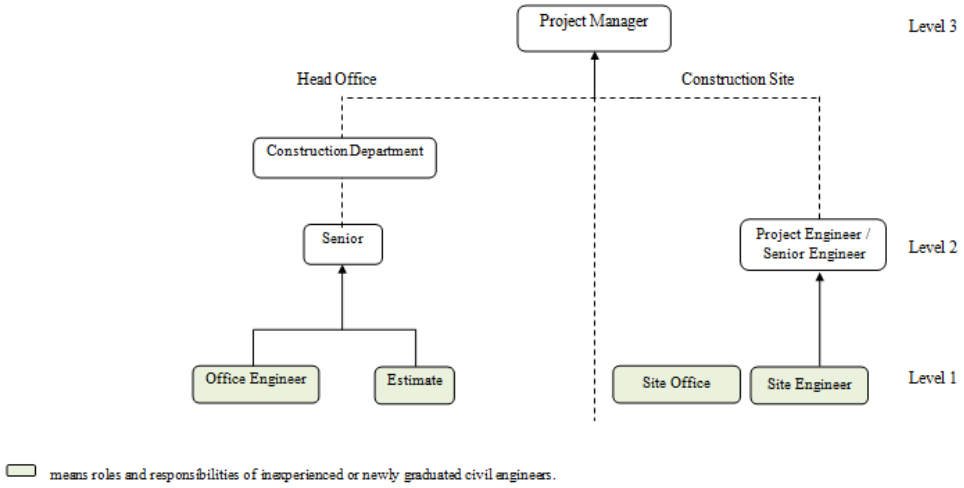

Figure 3 A sample of career paths of civil engineers in small-sized construction companies

From Figure 3, there are two roles in head office-based work namely estimating and office engineer roles. Career path of both begins from junior engineers to senior engineers to project engineer. In the command chain, senior engineers can be promoted to project managers but in reality, this rarely happens, as demonstrated by a dashed line in Figure 3, because project managers are usually company owners.

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. And 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.

On the contrary, site-based work, normally there is only one role of civil engineer that is site engineer. 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.

Furthermore, 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.

4.3 Analysis of Suitable Roles of Women Civil Engineers in Construction Companies

Data analysis of suitable roles which companies like to employ women engineer to take responsibilities was divided into two parts: 1) viewpoints of male company owners or superiors of women engineers; and 2) viewpoints of women company owners or superiors of women engineers. In addition, data of successful roles of ten senior women engineers in construction companies. The roles were chosen by score at least 5 score or fifty per cent of all informants. The highlight boxes show the role's scores that have at least 5 score and more as shown in Table 4.

Table 4 presents data of suitable roles of women engineers from viewpoints of company owners or superiors of women engineers. The interpretations of information were described into two sections as follow.

Table 4 Comparison of score of suitable roles and successful roles of women civil engineers in contractor companies

Roles	Score of Suitable Roles		Score of Successful Roles
	10 women company owners and superiors of women engineers	10 men company owners and superiors of women engineers	10 senior women engineers
Estimating	8	6	6
Procurement	2	3	3
Coordinating	9	9	6
Designing	2	4	5
Quantity Surveying	2	3	3
Contract Administrative	4	3	10
Site Supervision	0	0	1
Site Office Engineer	10	8	0
Planning & Monitoring	6	5	8
Others.....	0	0	0

4.3.1 Women engineers' most suitable roles

It can be seen from Table 4 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. On the contrary, the most suitable and successful roles of women engineers in construction companies from the viewpoints of men 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 site office engineer, coordinating, estimating, designing and planning and monitoring.

4.3.2 Most successful roles of women engineers

In Table 4, 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. In reference to career opportunities, data analysis of the organizational layout of construction companies revealed that women engineers performing these roles in large-sized and medium-sized construction companies (Figure1 and Figure2) 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.

5. Discussion

In Thailand, women and men engineers in large-sized construction companies are equally represented. Mentors are provided for new employees without work experience so 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 mostly for men engineers due to harshness, risks and danger involved.

There are fewer departments and roles in medium-sized construction companies than in large-sized companies but there are more departments and roles in medium-sized construction companies than in 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 construction companies are sometimes assigned to be site office engineers, whose roles and responsibilities are not as important as those of site engineers. Consequently they are less likely to be promoted to be project engineers even though site office engineers and site engineers start their careers at the same time without experience. By the same token, Kaewsri [23] found that women working at site offices are usually assigned to do unimportant jobs reducing their career opportunities in many aspects such as professional knowledge, promotions and salary raises and bonus increases.

In addition, small-sized construction companies hire fewer civil engineers than medium-sized and large sized construction companies due to the number and size of projects they deal with. Small-sized construction companies are generally family-run businesses and in most cases the owners are project managers. Like most contractor companies, the work of small-sized construction 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 there were fewer opportunities of promotions and salary raises in small-sized construction companies than in 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. In addition, it was found that slow or limited career progression was the main cause of women engineers' turnover in Thailand [17]. Hence, if women engineers are more satisfied with their career progression, their retention rates will increase. Identifying suitable roles of women engineers in the Thai construction industry is one way to increase their career opportunities.

The most successful roles of women engineers are contract administrating, planning and monitoring, coordinating, designing and estimating. From the viewpoint of male company owners or superiors of women engineers, the most successful roles of women engineers are coordinating, site office engineer, estimating, designing and planning and monitoring. From the viewpoint of female company owners or superiors of women engineers, the most successful roles of women engineers are site office engineer, coordinating, estimating, planning and monitoring, and contract administration. Thus, suitable roles of civil engineers that is beneficial to Thai construction 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 gains, construction companies can use this role as motivation for career advancement and organize a career path guideline for women engineers so they can visualize their career progression in construction companies.

Additionally, 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. When roles of site office engineers in three sizes of contractor companies were considered, it was found that women engineers in small-sized companies and medium-sized companies in particular had more career development problems than those in large-sized companies or in other roles. It was noted that most people who had opted for civil engineering careers were efficient and should be accepted in the field. In addition to promotions, salary, knowledge and

experience were important to them. Accordingly, small-sized and medium-sized construction companies assigned this supportive position to women engineers.

Thus, one of the recommendations of this research to develop women engineers' careers is implementation of job rotation to increase their job satisfaction and knowledge. Consequently, they will be promoted to higher positions. In addition, project managers should provide career development guidelines for employees [24] in order to retain employees in their company [25]. 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, construction companies should also give them career path guidelines so they see themselves advancing in their careers. Figure 4 shows rough career guidelines of construction companies. After collecting enough experience and knowledge as site office engineers, women engineers can start working in 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. Women engineers who used to be site office engineers can be very good at planning and monitoring and contract administration. As seen in Figure 4, senior site office engineers do not have a lot of career opportunities because most companies do not employ this position at a 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.

6. Conclusions

The number of women civil engineers in the Thai construction industry keeps increasing. However, research on their career paths and retention has been limited. This article presents analysis of roles and career paths of women civil engineers in construction companies in Thailand. This work can be useful for career management programs to create motivation and retain women engineers in the construction industry. Knowledge of suitable roles of women engineers and career paths can help them increase their career opportunities.

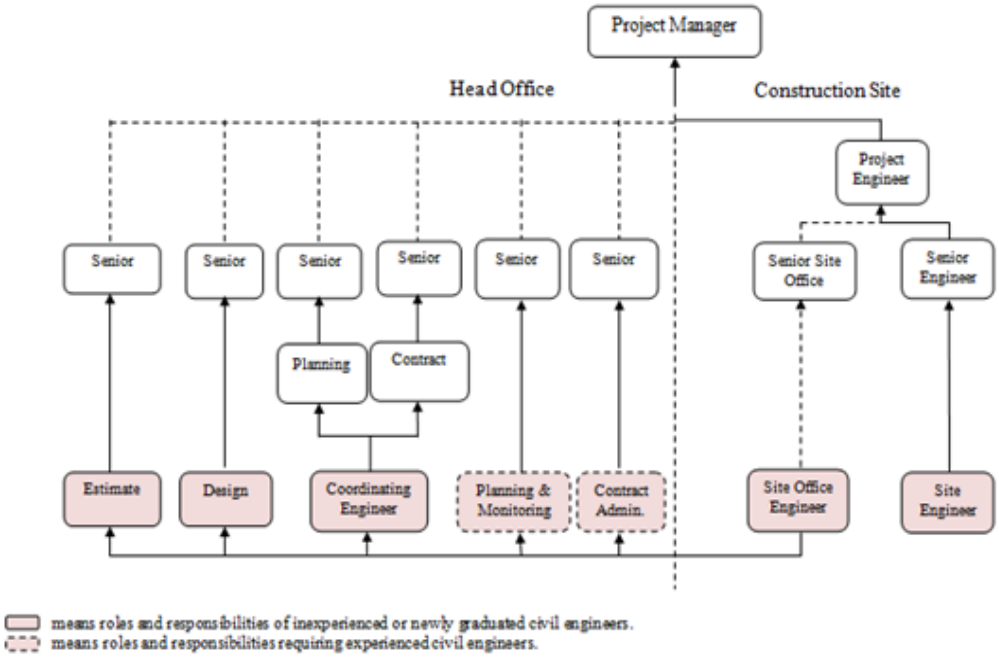

Figure 4 A sample career paths in medium-sized construction companies that allow site office engineers to make more progression in their career and job rotation.

It is highly anticipated that findings from this study will help construction companies allocate jobs to their employees more properly in order to enhance or complete men engineers' work and increase career opportunities and career satisfaction of women engineers in the Thai construction industry for women engineers. Retention of women engineers in the Thai construction industry benefits all involved parties including women engineers, construction companies, the Thai construction industry and the country as a whole.

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Author's Profile

Dr. Nuanthip Kaewsri has experienced of lecturer in Civil Engineering and Construction Management at Kasem Bundit University for 16 years. She investigated women engineer's careers in the Thai construction industry both contracting and consulting companies for her Ph.D. She is currently running a research project for sustainable development in Thailand about the cost of repairing dwelling after flood disaster.

Assoc. Prof. Dr. Tanit Tongthong was a lecturer in Civil Engineering and Construction Management at Chulalongkorn University since 1994. Significantly he had work for over ten years with consulting in construction project. Research interests include production of construction labors, computer application, IT in construction and quality system in construction. He is also running innovative research for developing the country.