

CHAPTER 5

DISCUSSIONS AND CONCLUSIONS

To solve problems occurring with companies (especially international companies) in the northern industrial estate (Lumphun) and human resources development, MMIT established a co-op model as a collaborative training system between the university and the industrial sector. This chapter presents an overview of this research through conceptual framework that shows the problems, solutions, and results. Discussion of the MMIT co-op model is also presented in this chapter. It will be separated into 3 perspectives including development, implementation, and advantages of the MMIT co-op model. Research limitations, novelties, generalizations, recommendations for further study, and conclusions are presented at the end.

5.1 A Refined Conceptual Framework of This Research

This section describes the refined conceptual framework that evolved from the initial one in chapter three (see part 3.1). The refined version involved three main stages: problems, solutions, and results. An overview of the process is illustrated in figure 5.1, and explanations follow.

5.1.1 Problems

The problems of this research came from 2 main entities, the northern industrial estate in Lumphun province and undergraduate students (especially from CMU). The industrial estate has to contend with many problems, but this research focuses only on those problems directly related to the research context.

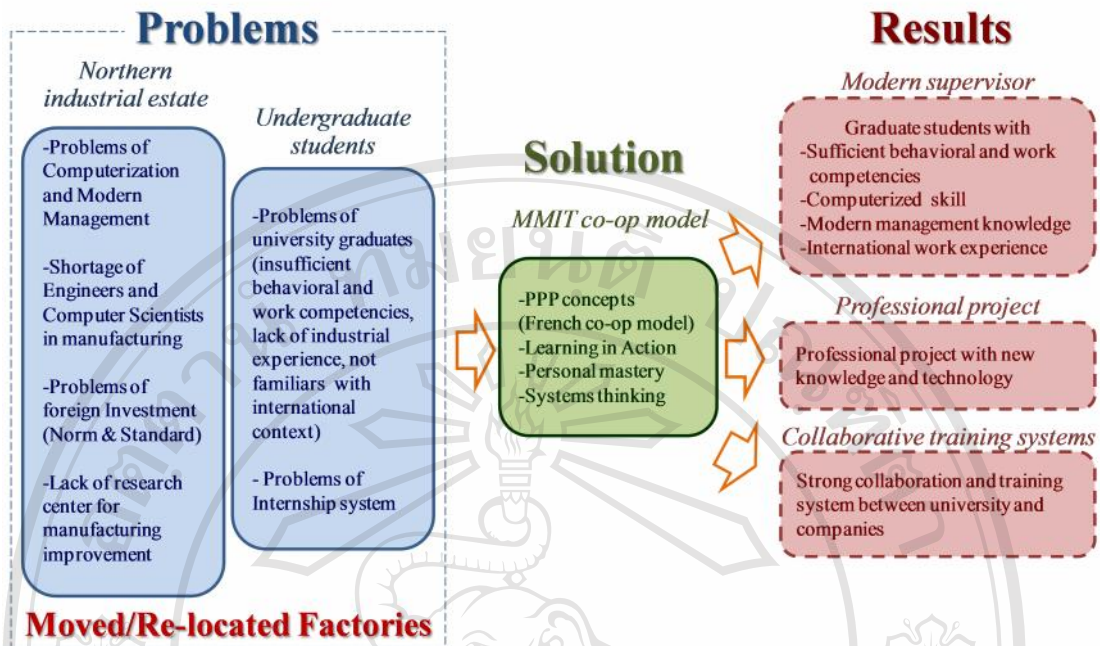


Figure 5.1 A refined conceptual framework of this research

1) Problems of the northern industrial estate and university graduates

1.1) Companies need more computerization and modern management to adapt rapidly to changes in globalization. Every company has to leverage their manufacturing to be more high-tech. Hence, computer systems and new modern knowledge such as Supply Chain Management (SCM), Customer Relationship Management (CRM) etc. are necessary for them. Consequently, they must develop their human resources to have sufficient potential to cope with this situation.

1.2) Shortages of engineers and computer scientists in manufacturing exist because most engineering graduates preferred to work in a large company located in the middle or eastern part of Thailand that pays a high salary and social welfare. Computer science graduates prefer to work in business companies because of the working environment. As a result, few graduates apply for work in the northern industrial estate.

1.3) Some critical problems relating to foreign investment were Thai employees were reserved, lacked leadership and had inadequate levels of knowledge and skills for international trade exchanges, especially with the EU. These included

knowledge/skills such as technical norms and standards, cultural practices, managerial habits, and specific expectations of EU companies. This is one important issue that impacted on increasing foreign investment.

1.4) Lumphun province did not have a research center for production improvement. This province had very few resources to provide them new tools/techniques or innovation to improve their potential. Most companies sent their key employees for training to Bangkok and this was expensive and time consuming.

2) According to the initial study and literature reviews of this research most new university graduates lacked sufficient work skills in cognitive, technical, and behavioral perspectives (refer to chapters 1 and 2). They were not ready to work, and their competencies still did not meet employer needs. Moreover, they were not familiar with the international context because they had studied in a Thai environment throughout their life and never had to deal with foreign cultures. Another issue was internship problems. Most university or educational institutes tried to encourage students to work in factories for practical experience, but students spent only 2 - 3 months in a real workplace to understand and absorb the working environment atmosphere. They still required some essential knowledge/skills development, such as problem solving and handling emergent problems. It normally takes a longer time working to gain this experience and the confidence to make decisions.

These problems were some of the reasons that influenced investor decision-making to increase investment and retain or move/re-locate their companies to other places.

5.1.2 Solution

After examining these problems, this research selected co-op education which focused on human resources development as a main approach to solve these problems. This kind of education and training was widely used in America and Europe for a long time because it helped students to have experience, adapt themselves into the community, and develop many necessary skills and competencies

(see in chapter 2). This research chose the French co-op of IUT Lumière as a prototype model. The reason was that MMIT needed to train students using an international approach (especially European). This would help students to become familiar and work within the international context after graduation. The French model included PPP activities as a key concept to initiate any activities for students both before and during their co-op apprenticeship. These concepts helped students to succeed in the school-to-work transition (see in chapter 2). Moreover, MMIT inserted Learning Organization (LO) theories (Learning in Action of Garvin, 2000, and The Fifth Discipline of Senge, 1990) into the co-op model to help students be well-prepared for their career. The main objectives included improving student ability to reflect on their experience, encourage them to decide career plans and future targets, and also trained them to have systemic thinking in industrial work.

5.1.3 Results

The MMIT co-op model provided 3 main essential results:

1) *Modern supervisors*: the MMIT co-op model produced graduate students with sufficient behavioral and work competencies. The process of continuous co-op training for a long period (more than one year) enhanced both their behavioral and work competencies (refer to chapter 4 part 4.2). In addition, during the apprenticeship students had opportunities to use their university knowledge related to computerization and new knowledge of management in their workplace. As a result, they knew and understood how to work on these in real situations. Moreover, most students apprenticed in international companies which provided real experience working within the international context. This helped students to understand different work cultures in-depth.

2) *Professional projects*: during the student apprenticeship they had to do a project to complete their program. These projects used new technology (techniques) and knowledge for solving problems or improving the work system in a company. This improved students' ability and helped the company to operate more efficiently.

Also, the new approach of doing research together with the university helped to improve company competitiveness. This was useful because there was no research center in Lumphun province.

3) *Collaborative training system*: the relationship between the university (MMIT) and companies strengthened after implementing the co-op framework. The long apprenticeship period and many co-op activities forced the companies and university to work together closely. As a result, the university knew what industry expected and provided graduate student training consistent with industry needs. A big advantage for companies is that they save money and get quality graduate students ready to work. This helped to establish a strong collaborative training system for preparing students to be suitable for companies in the long run. An important side-benefit was the reduction of factory re-locations.

5.2 Discussion of the MMIT Co-op Model

Discussion of the MMIT co-op models is separated into 3 main parts: co-op model development, implementation and advantages.

5.2.1 Discussion of Co-op Model Development

Three main aspects will be discussed.

1) *Co-op model development objectives*

In the USA they started creating co-op model at the university level to bridge the gap between theory in the classroom and practice in the field (Fifolt, 2006). In Europe (especially France and Germany) this was done for social and economic reasons because they needed to train mid-level engineers and managers to support business and industry (Veillard, 2009, Mann, 2009a). In Thailand universities introduced this system because many graduate students were inadequately prepared for work and lacked some of the necessary skills. Although the initial reasons of these

countries differed, they had the same target, that is, to develop students to meet industrial demands.

The MMIT co-op model was also established because many graduate students lacked work competencies. Another goal was to retain and prevent the relocation of factories of foreign investors in the northern industrial estate, hence the issue of how to train students to work within the international environment and transfer new knowledge technology for company work improvement was essential. As a result, the methodology used to construct the MMIT co-op model was adapted from foreign countries, especially the EU (France and Germany) to help meet the needs of international investors.

2) Target areas of co-op students' placement

Most of the co-op model was used to give students the opportunity to get practical skills in a real workplace. Hence, most co-op programs aimed at producing engineers and employees to work in industry. These students had specific fields/areas they studied. In France (in the case of IUT Lumière) the 5 main departments (Veillard, 2009) included: 1) Human resources management/accounts/administrative and financial operations, 2) Logistics, goods and passenger transportation, 3) Quality and production management / industrial project management, 4) Statistics studies and database management, and 5) Hygiene and safety at work / environmental management. Students who studied logistics did their apprenticeship in the logistics department and those who studied quality and production management apprenticed in the Quality Assurance or Quality Control department, and so on. In Germany (in the case of Berufsakademie (BA) Baden-Württemberg), they had 3 main kinds of curriculum: administration, engineering, and social work (Gohringer, 2002). Students who studied engineering such as industrial engineering worked in the engineering or production department to manage processes and improve productivity. This was clear to students and allowed a company to fit students into many positions/departments for work.

Although the MMIT curriculum produced students who could work in the industrial sector as did other models, the curriculum was slightly different. Many varied positions were open to MMIT students. They could work in Human Resources, Quality Assurance/Quality Control, Production, Purchasing, IT support, and Production Planning departments. This was because their studies were integrated and included business administration, industrial engineering, and information technology (see in chapter 2). This evolved because the main objective of the MMIT curriculum was to produce graduate students who had IT skills with modern management to improve jobs/tasks in industrial companies at mid-level management (no specific department). Thus they needed to have a variety of knowledge in industrial fields with emphasis on IT. The ultimate goal was to upgrade the company to be more high-tech and continually improve to prevent factory relocation in the northern industrial estate.

3) *The core concept for the constructed co-op model*

The French (IUT Lumière) used the concepts of ADVP transferred from Canada to initiate all activities in their co-op model (Veillard, 2009), including a “Personal and Professional Project: PPP”. The main objective of PPP was to develop an individual’s intellectual abilities and cognitive attitudes through vocational “developmental tasks” (Bujold, 1974). There were four main steps to help students develop themselves: *Exploration* - the procedure of active search for novelty and change, observation and curiosity, the process of trial and error, the elaboration of hypothesis, and risk taking. *Crystallization* - the clarifying and organizing their perceptions in relation to professional roles. *Specification* - specify their preferences, and *Implementation* - refers to committing themselves by enrolling in a program (see more detail in chapter 2). These concepts helped to train students to have reflective skills and work autonomously both before and during apprenticeship, because students still needed some preparation before going to work in a company.

The German co-op model (university level) used the concepts of “dual system” derived from the training system in the secondary level. The aim was to

integrate technical knowledge and professional experience (Wehrich et al., 1996). The functions and objectives of the dual system were: to acquire a defined level of technical knowledge and practical experience, to slightly develop students to be professional, and to ensure they were qualified in a particular field. This concept trained German students to be professionals only when they had gained work experience at a company.

To establish a co-op model MMIT used concepts that could respond to the requirements of international investors and leverage the quality of undergraduate students to have sufficient competencies. The IUT Lumière model was the first choice for a prototype because it not only trained students to be professional during the apprenticeship but also provided the preparation process to prepare them before going to a real workplace. The reason was that many students still lacked some competencies when starting work. Moreover, according to the requirements of the industrial sector (especially international companies), students needed to improve some specific abilities. It was important for them to understand the whole work system and be able to specify their future plans and career goals. Hence, MMIT added extra-activities to the co-op model to train students to increase these abilities. LO theory was the main concept used to create these activities, including defining a students' personal vision and drawing a systems thinking diagram of their job.

5.2.2 Discussion on Implementation of the Co-op Model

There are 4 main issues.

1) Starting time of the apprenticeship

Co-op models from many countries started the apprenticeship at the beginning. In the USA (University of Cincinnati) the apprenticeship began when students were in the 2nd year of a 5 year study plan, in Canada (University of Waterloo) in the 1st year of a 5 year plan, and in Germany (BA) in the 1st year of a 3 year plan. Most of these models did not have a preparation process. One exception

was IUT Lumière where they started the apprenticeship in the 2nd year of a 3 year plan and also had many preparation activities (PPP) for students in the 1st year. This is similar to Thailand where the normal format is starting an apprenticeship in the 3rd or 4th year of a 4 year plan, and also has a preparation process for students. At MMIT, the student apprenticeship started later (3rd year of a 4 year plan) and had a thorough preparation process (refer to chapter 4, part 4.1). At MMIT, 1st and 2nd year study is mainly general education courses (languages, mathematics, etc.) and some core courses (basic information technology). Therefore, they lacked some industrial specific knowledge for industrial jobs/tasks such as quality systems, HR management, and production planning and control (these occurred only in 3rd and 4th year). Moreover, they still needed to prepare themselves to be more confident to work in a real situation (understand the industrial environment and real work life).

2) Length of apprenticeship

Most co-op models have several month apprenticeships in a company alternating with study at university (more in the next sub-issue). In the USA (University of Cincinnati) students take 18 months, in Canada (University of Waterloo) 20-24 months, in France (IUT Lumière) 9 months, and in Germany (BA) 18 months. This guarantees that students will get a real in-depth experience in their career from the workplace. In Thailand most universities have 4 months of co-op apprenticeship without alternating (continuous work in a company with no study). One exception is the co-op model of KMUTNB (with a 5 year study plan) that had an accumulated apprenticeship of ten months and has alternations influenced by the German approach (see in chapter 2). However, MMIT has a long apprenticeship for co-op students with an accumulated apprenticeship of 10 months alternating with study at the university. This is to ensure that students get real in-depth experience from the workplace and learn to transfer their modern knowledge of IT to the industrial sector (especially international companies) through professional projects.

3) Alternating periods of the apprenticeship

All foreign co-op models alternate between periods of work and university. The USA model alternates generally every 3 months after the 2nd year, Canada every 4 months from the 1st year, France every 15 days during the 2nd year, and Germany every 3 months from the 1st year. The main reason for alternating is for students to have opportunities to return to university and enhance their knowledge and some skills to use in their work. Though most universities in Thailand don't have this type alternating (except KMUTNB), MMIT includes it because students have more courses to complete for graduation and also need more specific knowledge (especially advanced IT) to continually improve their company work and finish their project.

4) The student assessment process

The IUT Lumière co-op system includes 5 company assessments. Each time they assess oral presentation, work achievements, and student behavior (Veillard, 2009). This motivates students to develop themselves according to their assessment result and also encourages the company to be interested in the co-op program. MMIT also uses this method. As a result, most students tried to improve themselves continuously both in behavior and work performance. The assessment process encouraged companies to focus on the co-op program and give opportunities for students to ask university advisors for some advice about their jobs/tasks improvement. This contrasts with Germany, where they don't assess students in a company, and instead students must send a report on work-related topics at the end of each semester and participate in a seminar between students, companies, and BA to discuss students' experiences (Wehrich et al., 1996). In Thailand, TACE set the regulation that every co-op program must include visiting students in a company at least once. However, the details and criteria for assessing students depends on the co-op model of each university.

5.2.3 Discussion on the Advantages of the Co-op Model

The advantages resulting from implementing the co-op program of MMIT can be separated into 3 main perspectives, including students' competencies, professional projects, and a collaboration training system.

1) *Students' competencies*

In the USA co-ops bridge the gap between theory in the classroom and practice in the field and encourage students to develop their skills and abilities. In France co-ops helped students find themselves, work autonomously, and also improve their behavior. For Germany, co-ops gradually change students to be a professional with high practical skills. Moreover, much research about co-op education has shown it is effective for students' competencies development, such as Wehrich et al. (1996) whose research revealed that cooperative education encourages students to develop quality consciousness, professional characteristics, responsibility, creativity, work as a team, and overall thinking. Garvan and Murphy (2001) also showed that co-op allows students to acquire practical skills and helps students to improve themselves in many aspects such as self-confidence, self-concept, and social skills.

The MMIT co-op model is also advantageous to students because they can improve their competencies both behavioral and work performance (refer to chapter 4, part 4.2). Behavioral competencies include: enthusiasm, responsibilities, adaptability, manner, communication, leadership, and patience. Work performance competencies include: learning and understanding, planning and managing, knowledge applying, creativity, problem solving, following work instructions, and handling emergent problems. The main objective of the MMIT curriculum was to produce mid-level managers who used IT and modern management concepts to work in an industrial environment (especially foreign companies). Hence MMIT required students to apply IT and modern management concepts in their jobs/tasks and professional project, therefore most students developed computerized skills and also used knowledge of

modern management during their apprenticeship time. Moreover, as a result of MMIT targeting international companies in the northern industrial estate, there were numerous opportunities for MMIT co-op students to work within a real international environment (more than 90% of MMIT students apprenticed in international companies). As a consequence they knew, understood, and were able to work within difference cultures, norms, and standards.

2) *Professional projects*

Most co-op models including France (IUT Lumière), German (BA), and Thailand (most universities) required at least one professional project. Students had to use their university knowledge to initiate, implement, and assess/follow-up their project work. This was the real process of knowledge transfer from university to the workplace. Both students and companies benefited from the professional projects.

For MMIT, the professional project was an essential requirement to finish the co-op program. MMIT used the professional project not only to improve students' competencies but as a major methodology to improve industrial potential and to respond to international companies needs. Students and university lecturers were university representatives helping to transfer new knowledge and technology to industrial sectors and leverage their work performance by using more computer technology. This helped to compensate for the lack of a research center to develop the northern industrial estate.

3) *Collaborative training system*

Relationships formed between industrial companies and universities vary in each country, and depended on the fundamentals and context. In Germany, the education and employer sectors work together with support from the federal government since the beginning of co-op programs. Employers and the educational sector have equal responsibility in training students. This is because in Germany it is not the state's role to provide supervision for vocational training, it is the

responsibility of the self-governing bodies of industry (Wehrich et al., 1996). Consequently, there is a very strong collaboration between the two sectors. In France, IUT Lumière started by establishing their own co-op model according to rules/regulations for apprenticeship set by the government. To collaborate with industrial sectors, they started their own relationships and extended from this gradually. However, now, IUT Lumière has various employers interested in joining their co-op program each year. For MMIT (and in Thailand), similar to France, at the beginning the industrial sector had little interest in the co-op idea. It was very difficult to convince them to join in the co-op program.

Some countries had difficulties building up a good relationship between the education and employer sectors when co-op programs first began, but after implementing co-op programs it was obvious that co-op education promoted a strong relationship between the education and industrial sectors. This provided an efficient method of producing graduates of value for employers in high technology areas, and helped companies to recruit new graduates who were already familiar with the company and able to hold responsible positions without a settling-in period (Gohringer, 2002). It also reduced the skills shortage and skill gaps in industry to the satisfaction of the industrial sectors (Lee, 2009). The MMIT co-op encouraged the universities and industries to work together for a long period. Information, knowledge, and experience were exchanged between the two sides throughout this time. This generated a good relationship and a strong collaborative training system between the education and industrial sectors.

5.3 Conclusions

Implementation of the MMIT co-op framework resulted in student competencies both behavioral and work performance gradually increasing. Five main factor perspectives impacted on this result: the student, company mentor, university

advisor, company, and university (MMIT). The following were all integral to the success of the program:

- Students' characteristics consistent with company' cultures and work environment
- Students having sufficient basic and specific knowledge/skills
- Company mentor understanding of the MMIT curriculum and the co-op program
- Suitable planning and coaching by company mentors
- University advisor understanding of the co-op and curriculum as well as planning and coaching of students
- Participation and understanding of the co-op program by the company executive level
- Good company co-op coordinators
- Appropriate process of company selection by MMIT
- Suitable process of planning, operating, following, as well as good communication and coordination with companies associated with MMIT

In addition, this research found that there were three main phases of students' competencies development: adaptation, autonomous and proactive development. In the adaptation phase, students built various competencies to change from "student" to "employee". The behavioral competencies most required were manner, adaptability, patience, enthusiasm, responsibility, and communication. Work competencies necessary were learning and understanding, and following work instructions. Required general knowledge and skills were basic IT, basic math and statistics, and basic knowledge of job positions. Special knowledge/skills needed were basic languages for daily work, office jobs/tasks, and systemic thinking. In the autonomous development phase, students could work autonomously without close-coaching by mentors. Leadership competencies were most necessary to develop them to present their thoughts/ideas and provide some feedback to improve company work. Planning and managing, knowledge applying, and creativity competencies were also

required. The necessary knowledge and skills were advanced IT, and in-depth specific knowledge in their job positions. Necessary skills were advanced languages, especially English. In the proactive development phase, students developed themselves to become real employees. Most students were able to sufficiently develop all behavioral competencies at this phase. Necessary work competencies were problem solving and handling emergent problems. Knowledge/skills needed to finish their jobs/tasks and complete their professional projects were advanced IT and modern management.

From these results one can see that there were many key factors that affected the success of the MMIT co-op program. It took time and required many resources of knowledge/skills and experiences to produce and run the program. MMIT attempted to construct and operate the co-op framework as appropriately as possible. This was accomplished by adapting the IUT Lumière co-op model combined with LO theories to be a core strategy to develop students. The co-op benefits are considered from three perspectives.

1) *Student*; the co-op framework helps students to develop themselves in three main ways. First, they can improve their behavioral and work competencies through the intensive co-op apprenticeship program. Secondly, they can develop mastery in their career by using IT and modern management knowledge/skills to improve/develop work systems through co-op jobs/tasks and do a professional project. Thirdly, they get experience working in an international environment. All of these gradually adjusted students' mastery, mental attitude, and encouraged them to continually clarify their future.

2) *Company*; the co-op program is also advantageous for a company in three main ways. First, co-op students can support a company in establishing computerized work systems, especially through their professional project. This professional project can also be used as a starting point to do research in a company. Secondly, MMIT students that expected to work as mid-level managers in a manufacturing organization after graduation had knowledge/skills in IT and modern

management. Even though these students cannot replace engineers or computer scientists (shortage), they could work in various positions to improve the companies work. Thirdly, these students spent a long apprenticeship period gaining international environment experience. They were familiar with companies that deal with the international market and understood how to work within those cultures. This gave them time to develop sufficient work competencies and gain experience to meet employer demands.

3) *University*; the main issue of this perspective is the strong collaboration between the university and industrial sectors. The co-op program helped to build tighter relationships between the two parties. This made the university understand the industrial context and their requirements in-depth. As a result, the university had enough information to consider adjusting the curriculum and co-op program in order to respond to those requirements. In the long run, the university can produce graduate students consistent with company needs, and have an appropriate curriculum and learning strategy for teaching students.

These conclusions show the potential of the MMIT co-op framework to bring together related persons/organizations to help solve problems that occurred in the northern industrial estate. Although the co-op program cannot solve all the problems, it is a good starting point for developing graduate students to be future quality employees at the international level. This group of students will be a key force to develop the industrial sectors and also prevent factory relocation in the long run.

5.4 Research Novelty

Problems that occurred with international companies in the northern industrial estate required rapidly improving human resources. One solution is to develop a better human resources training system. This research provided a new co-op framework to train students to be future quality employees. Co-op models from European countries especially IUT Lumière in France was used as prototype. This

model was very useful in the French context for over 20 years. One challenge of this research was the adaptation of the European co-op model to the Thai context in the field of modern management and information technology. The PPP concept of the French model was adapted to be the main activities (i.e. job fair, site visit, matching process etc.) of the MMIT co-op model to prepare students to be more reflective and more motivated before they go to work. This can help students to become more familiar with their career demands and produce some necessary skills for work. Some tools and techniques of the IUT Lumière co-op system were also added brought to the MMIT curriculum to help conduct and control co-op systems, such as the method to manage with companies and mentors, the assessment system (student assessment book and assessment method), the students' follow up system etc. Moreover, learning organization theory was also adapted to integrate with the PPP concept. LO theory was used to generate many learning activities throughout the co-op program to help students improve their competencies, both behavioral and work. They were able to develop themselves to be proficient in their careers and gain a positive mental attitude which would influence their future work and life. The end result was a combining of two concepts/theories into one co-op pedagogical method. It not only improved Thai student quality but also leveraged the human resources training system in Thailand to meet international standards.

5.5 Research Generalization

The generalization of this research can be separated into two perspectives.

Other universities/institutes/faculties need to use co-op as a strategy to train/develop students. This research gives an example of a co-op model that was created through the collaboration of foreign educational institutes. The main goal was to construct a co-op framework which could be implemented in the international manufacturing context. This program can be used as guideline for other Thai universities who need to generate a co-op program in a similar context. The research

also provided generic competencies (both behavioral and work) of mid-level managers in an industrial context, and the specific knowledge/skills required (especially in the IT field). This is one resource of supporting information for other educational institutes who need to produce students in similar fields. Moreover, the research proposed new methodologies (PPP and LO theories) within the co-op framework to cope with Thai university graduates problems especially the case of lack of competencies. This can be applied to any curriculum that has similar problems.

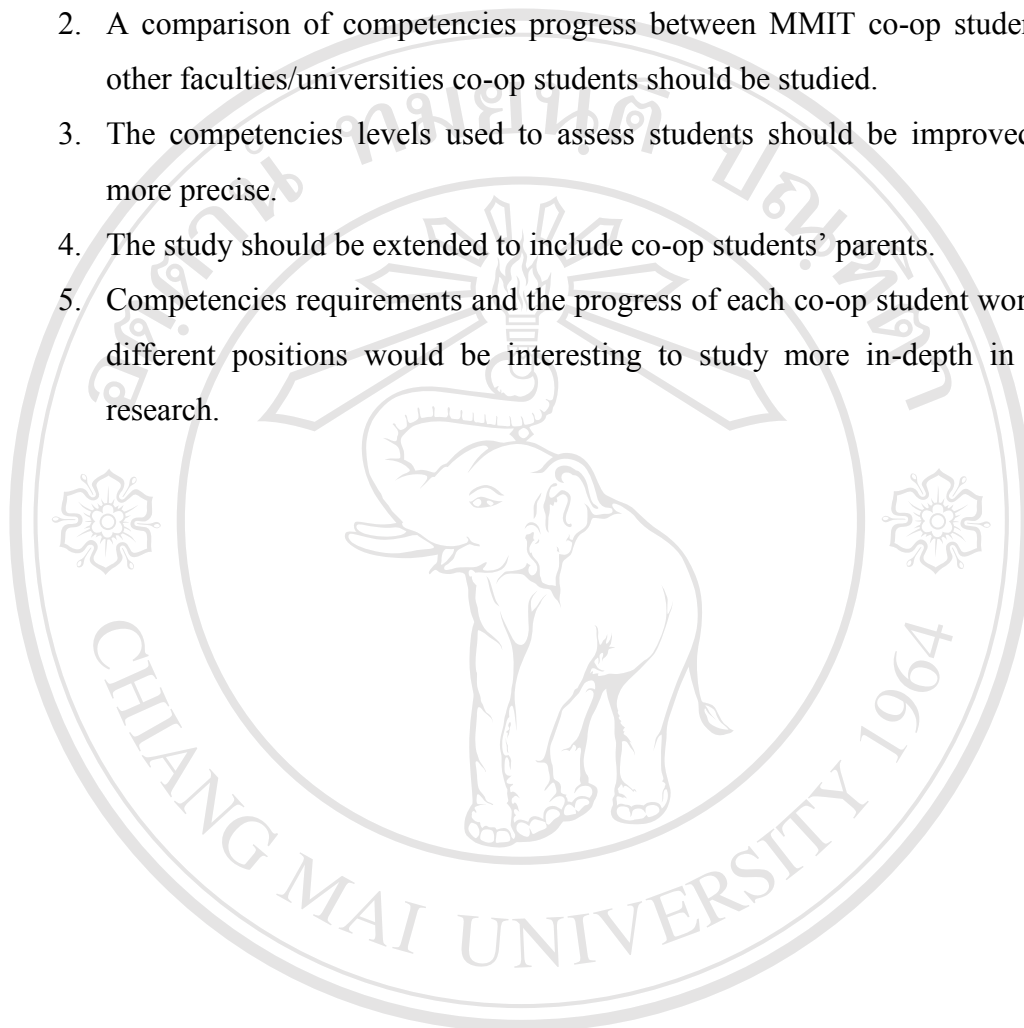
Secondly, the co-op training process is a new strategy for companies to recruit employees consistent with their demands using less time and money. In addition, the co-op professional project can also be used as an initial prototype to conduct company research. These are advantages for companies, but there still remains some misconception about co-op programs (especially in Thailand). This research provided in-depth details of all the co-op principles/processes to help any interested company understand and join a co-op program.

5.6 Limitations

The main sample groups of this research were students from MMIT, therefore, some competencies, knowledge, and skills that resulted from this research may not cover other curricula that do not have a similar context. Also, the main target place of this research is the northern industrial estate of Thailand which may have different problems, fundamental nature, and other constraints. Hence, the co-op model of this research may not be appropriate to use in other situations.

5.7 Further Study

1. A comparison of competencies progress between students in the MMIT co-op and non co-op (IS) program should be conducted.
2. A comparison of competencies progress between MMIT co-op students and other faculties/universities co-op students should be studied.
3. The competencies levels used to assess students should be improved to be more precise.
4. The study should be extended to include co-op students' parents.
5. Competencies requirements and the progress of each co-op student working in different positions would be interesting to study more in-depth in further research.



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