CHAPTER V
RESULTS, DISCUSSIONS, AND RECOMMENDATIONS

5.1 General

This chapter is significant in that all the results and discussions of this research from data analysis are illustrated in this chapter. The collected data obtained from questionnaire and interviews in three countries; Cambodia, Lao PDR, and Thailand, were separately analyzed. Basically, the analysis is divided into two types in this study. First, Analytic Hierarchy Process was applied to find the rank of important knowledge of project managers. It is then to find how effective and efficient is the knowledge that local project managers apply for performing construction projects. Thus, the level of competencies of project manager to apply these knowledge areas in construction field was explored.

It is crucial that the results needed to discuss in detail for each country in order to dig out the critical weakness of local project managers and then to set up a significant guideline for upgrading their competencies in implementing the tasks construction projects. In particular, in order to validate the result of analysis of levels of competency, some evidence of competencies of local project managers would be explored in term of components of each knowledge areas. The values of all evidence are presented as the percentage obtaining from quantitative analysis of number of contractors in each country.

The recommendations, on the other hand, were realized and written down in this chapter based on the results of research and opinions of respondents. These suggestions are to help project managers of contractors practically enhance their performance with various approaches and techniques.

5.2 Results in Cambodia

The results were analyzed based on the collected data from 14 contractors, 12 consultants, and 10 owners. The results are divided into two parts; ranking of knowledge areas of local project managers and levels of competency of local project managers.

5.2.1 Ranking of Critical Knowledge of Project Managers in Cambodia

The full results of ranking of knowledge areas of local project managers from contractor, consultant, and owner, are shown in Appendix C. Figure 5.1 describes the ranking of important areas of project managers from overall perceptions by dividing into 3 groups of importance; high importance, medium importance, and low importance.

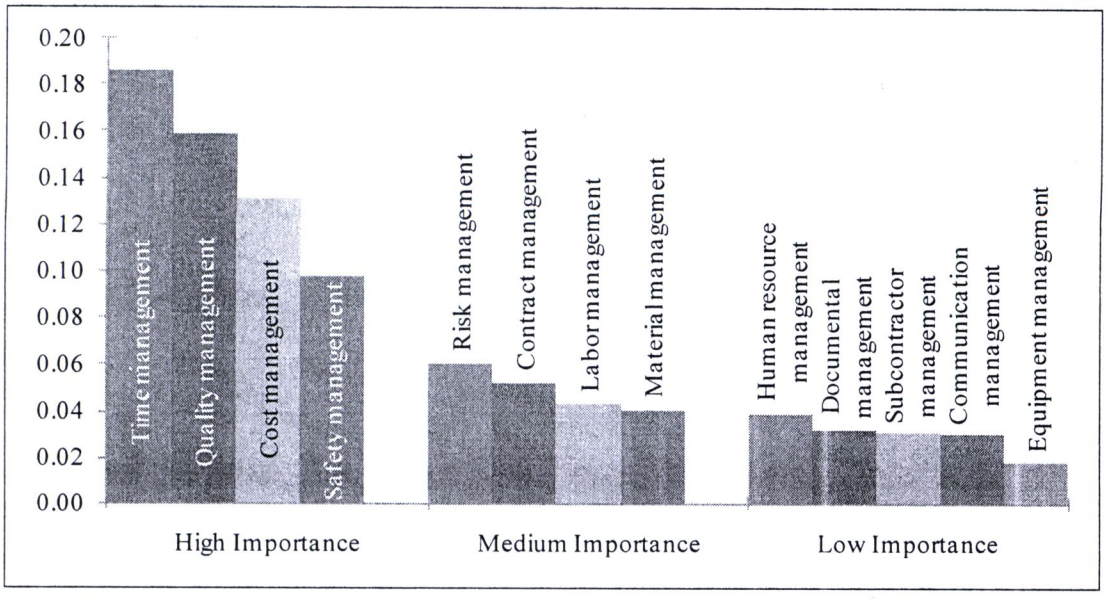

Figure 5.1 Ranking of critical knowledge from overall perceptions in Cambodia

5.2.2 Levels of Competency of Project Managers in Cambodia

Figure 5.2 demonstrates the levels of competency of local project managers obtained from perceptions of contractors, consultants, and owners, in Cambodia.

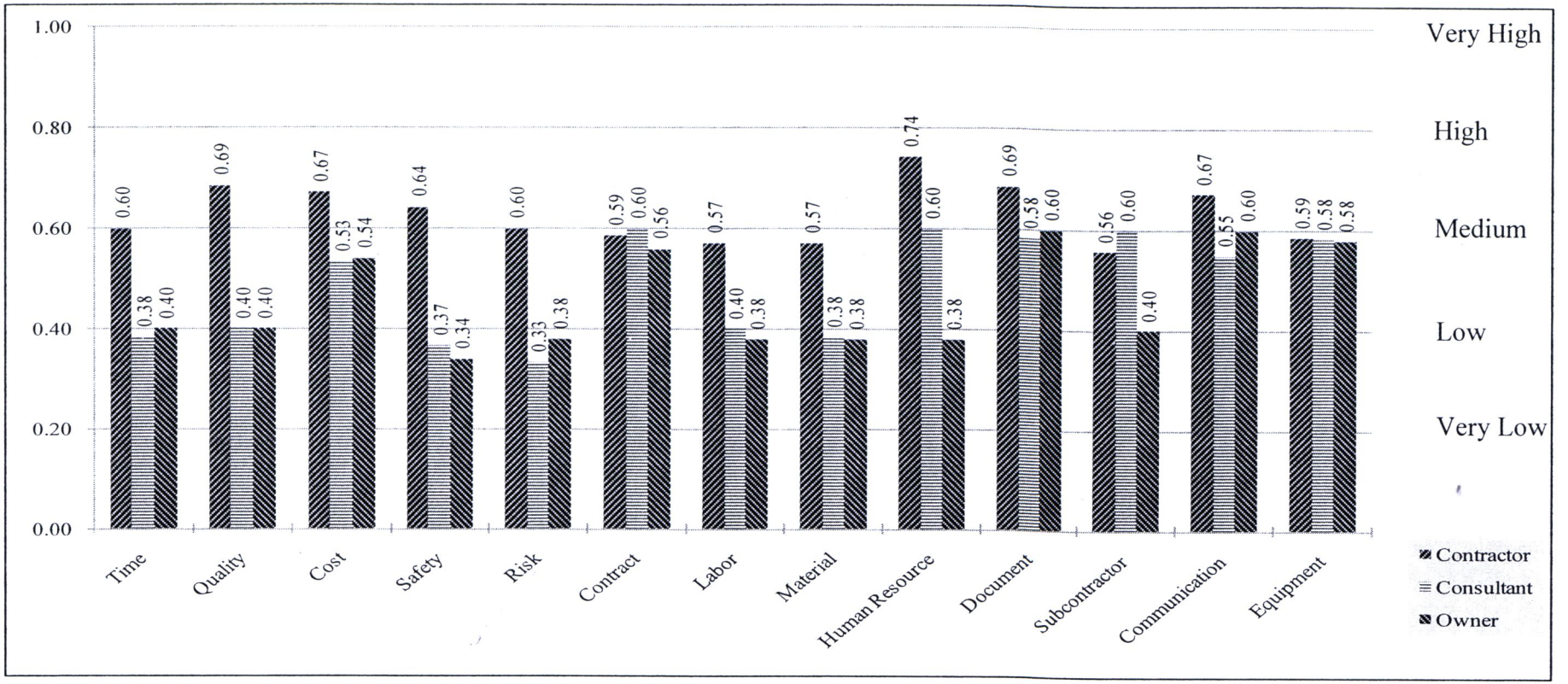

Figure 5.2 Levels of competency of project managers in Cambodia

As stated by overall perceptions, the levels of competency of local project managers in Cambodia are in medium level for all knowledge areas as illustrated in Figure 5.3:

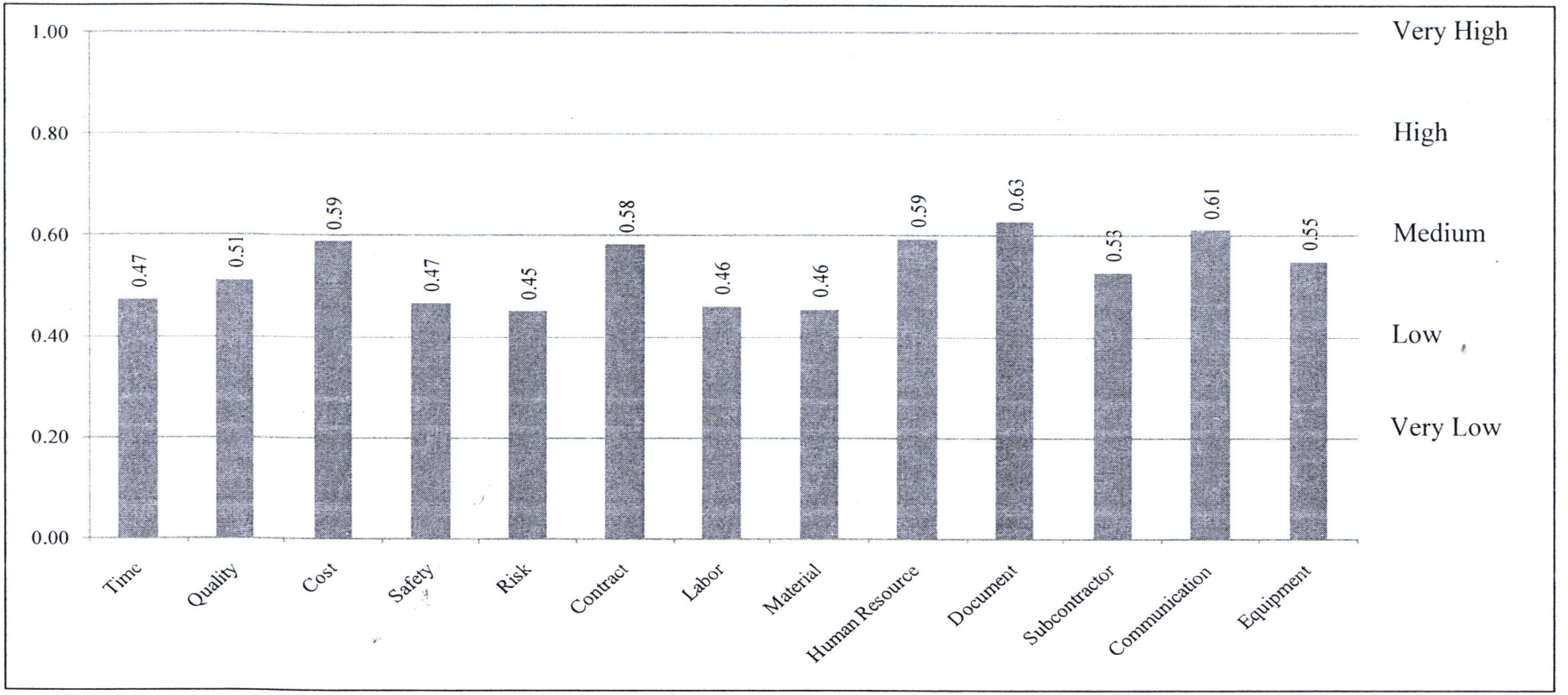

Figure 5.3 Levels of competency from overall perceptions in Cambodia

5.3 Results in Lao PDR

The results were analyzed based on the collected data from 9 contractors, 8 consultants, and 7 owners. The results are divided into two parts; ranking of knowledge areas of local project managers and levels of competency of local project managers.

5.3.1 Ranking of Critical Knowledge of Project Managers in Lao PDR

The full results of ranking of knowledge areas of local project managers from contractor, consultant, and owner, are shown in Appendix D. Figure 5.4 describes the ranking of important areas of project managers from overall perceptions by dividing into 3 groups of importance; high importance, medium importance, and low importance.

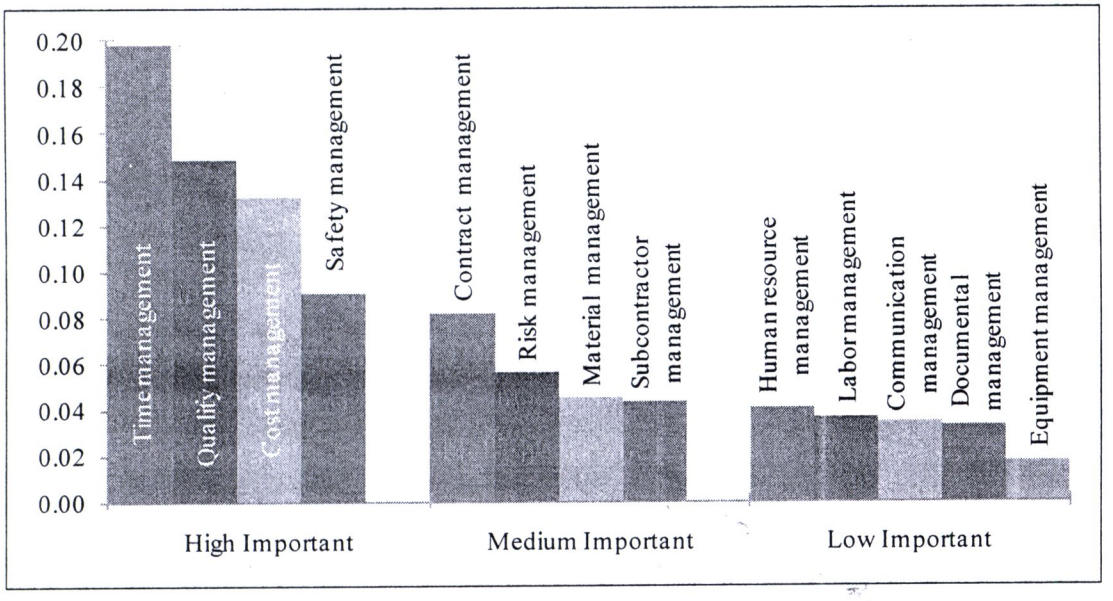

Figure 5.4 Ranking of critical knowledge from overall perceptions in Lao PDR

5.3.2 Levels of Competency of Project Managers in Lao PDR

Figure 5.5 demonstrates the levels of competency of local project managers obtained from perceptions of contractors, consultants, and owners, in Lao PDR.

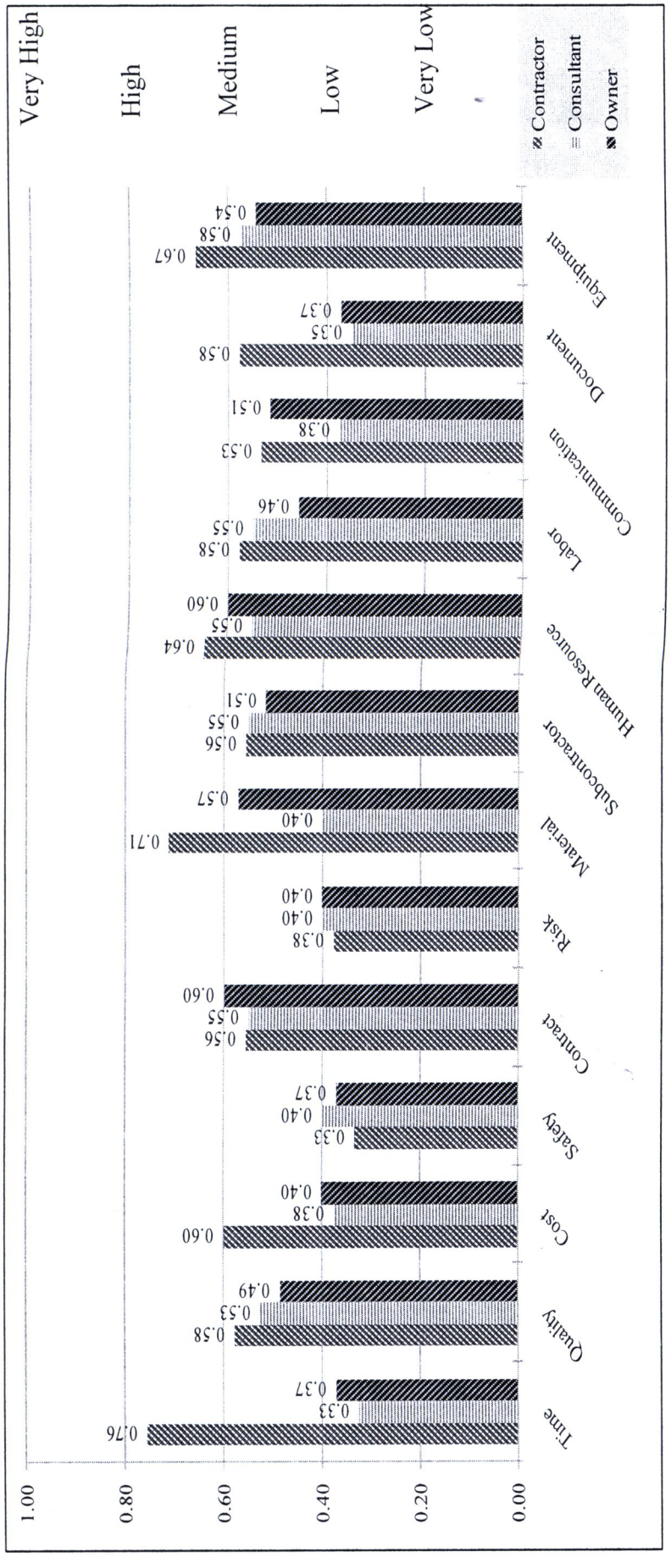

Figure 5.5 Levels of competency of project managers in Lao PDR

As stated by overall perceptions, the levels of competency of local project managers in Lao PDR are mostly in medium level for all knowledge areas as illustrated in Figure 5.6:

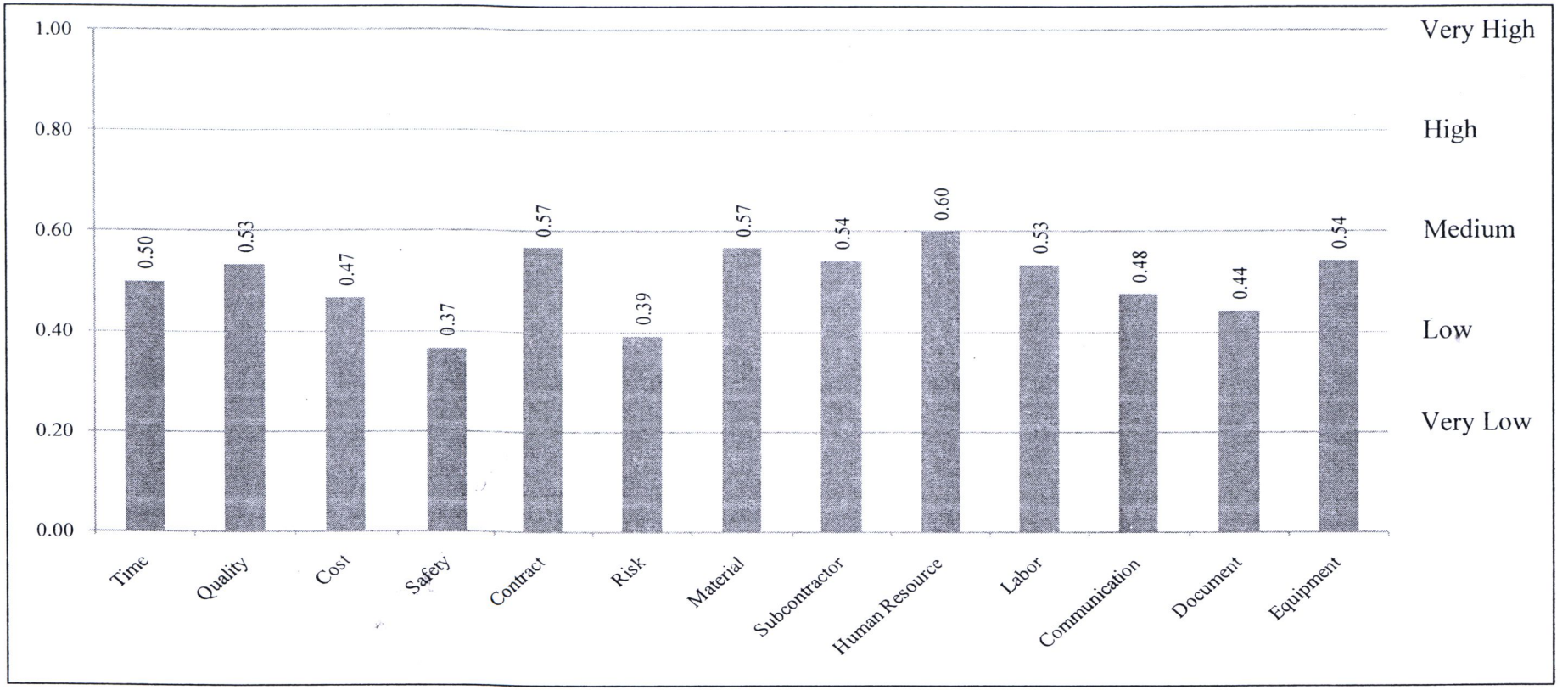

Figure 5.6 Levels of competency from overall perceptions in Lao PDR

5.4 Results in Thailand

The results were analyzed based on the collected data from 12 contractors, 10 consultants, and 9 owners. The results are divided into two parts; ranking of knowledge areas of local project managers and levels of competency of local project managers.

5.4.1 Ranking of Critical Knowledge of Project Managers in Thailand

The full results of ranking of knowledge areas of local project managers from contractor, consultant, and owner, are shown in Appendix E. Figure 5.7 describes the ranking of important areas of project managers from overall perceptions by dividing into 3 groups of importance; high importance, medium importance, and low importance.

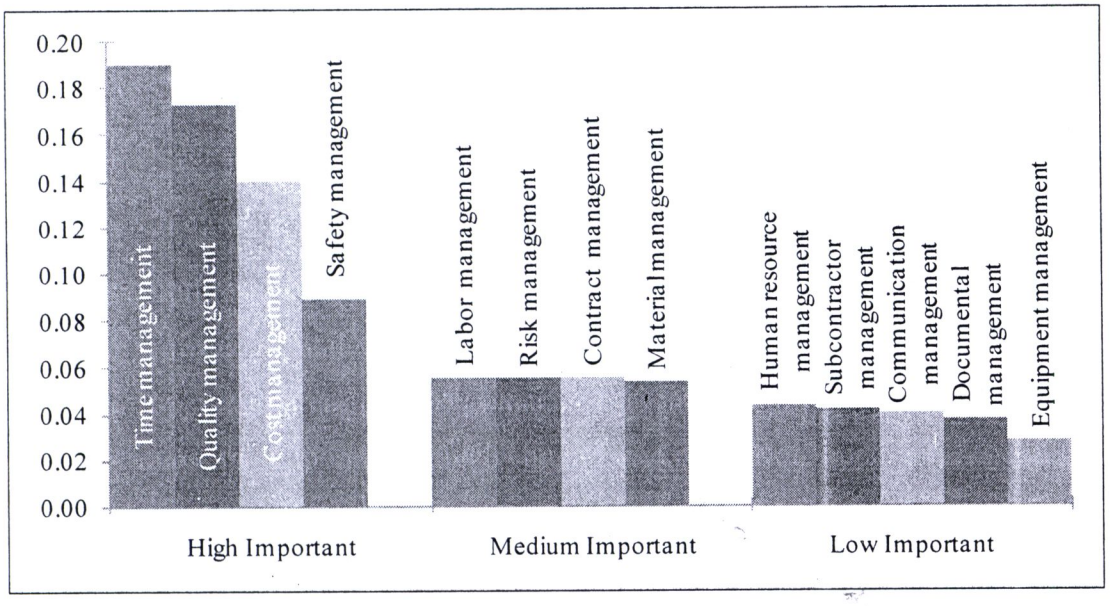

Figure 5.7 Ranking of critical knowledge from overall perceptions in Thailand

5.4.2 Levels of Competency of Project Managers in Thailand

Figure 5.8 demonstrates the levels of competency of local project managers obtained from perceptions of contractors, consultants, and owners, in Thailand.

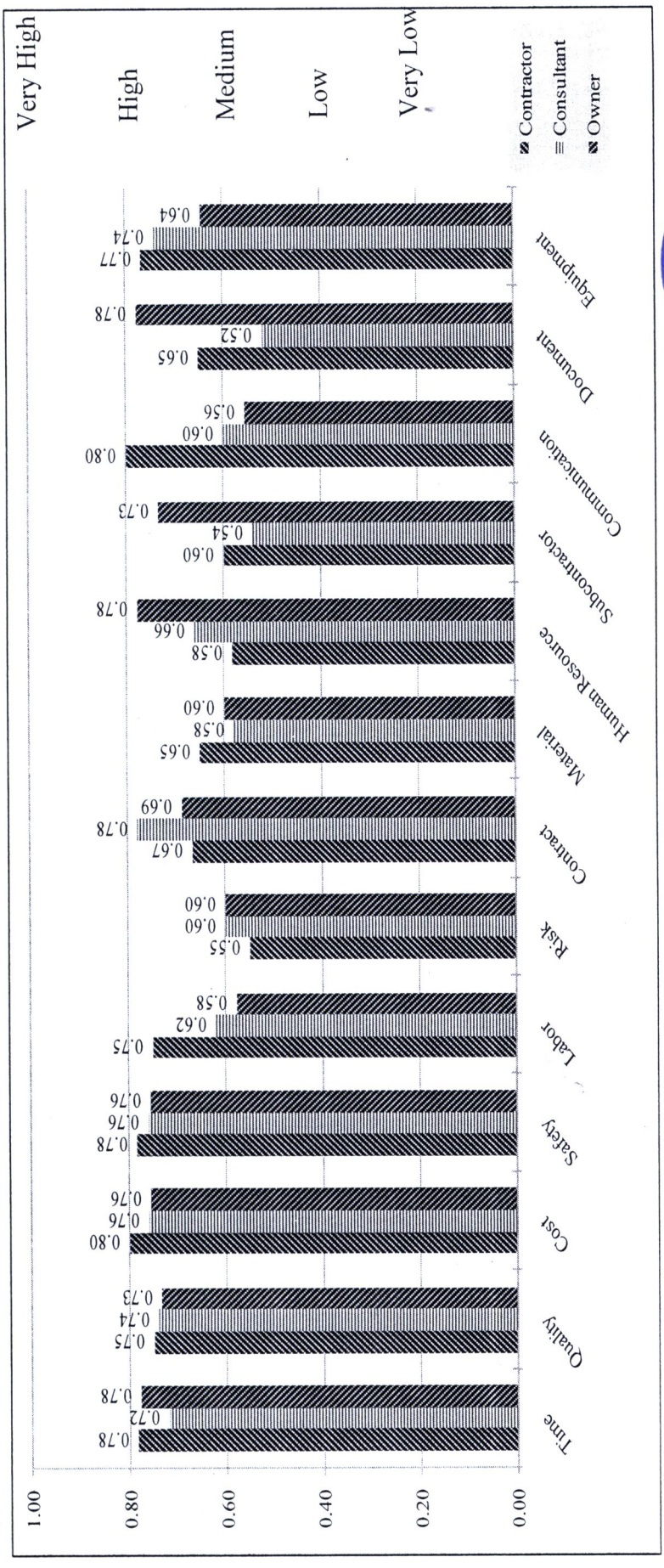

Figure 5.8 Levels of competency of project managers in Thailand

As stated by overall perceptions, the levels of competency of local project managers in Thailand are in high and medium level for all knowledge areas as illustrated in Figure 5.9:

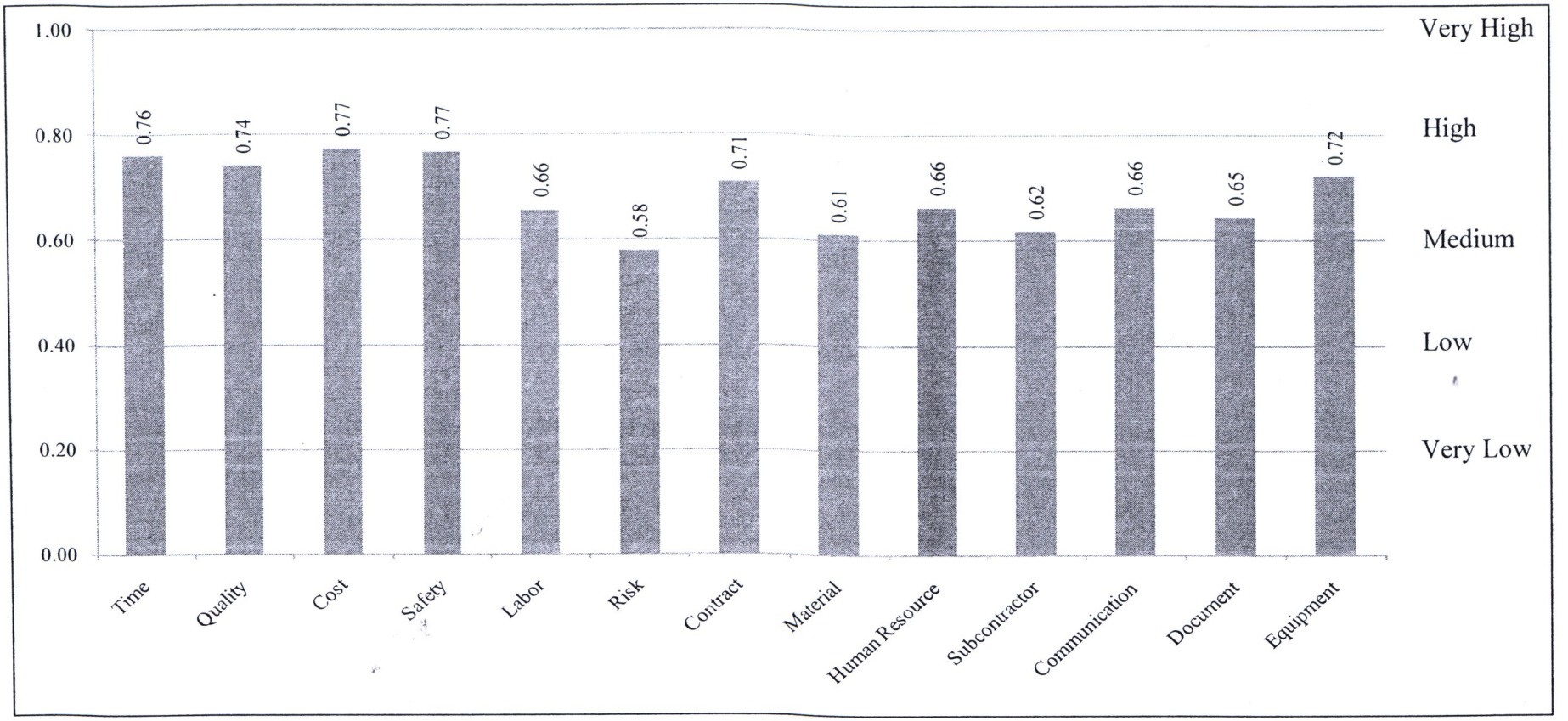

Figure 5.9 Levels of competency from overall's perceptions in Thailand

5.5 Result Validations

After obtaining the accurate results of competency levels of project managers, it is essential to validate the results in each country by using the evidence. Not all, some of knowledge areas were appropriately validated and discussed in detail as examples in accordance with the specialized and compulsory needs of each country.

The important knowledge ranking was accordingly divided into three levels. First, the high important knowledge areas are from the 1st rank to the 4th rank. Second, the medium important knowledge areas comprise of the 5th to the 8th rank. Third, the low medium important knowledge areas start from the 9th rank to 13th rank. Consequently, the high important knowledge areas were clearly validated and discussed in detail one by one involving the competencies of project managers to apply these knowledge areas.

5.5.1 Result Validations for Cambodia

The high important knowledge areas in Cambodia consist of time management, quality management, cost management, and safety management.

- ***Time Management***

The result indicated that time management is certainly one of the significant knowledge areas for project managers while their competency to apply this kind of knowledge is still in medium level because of many factors. Starting with schedule development, most local project managers only use M. Project to produce Bar Chart in order to represent the duration of each activity in the entire project. Using only Bar Chart is not effective enough for all projects since it has only a limited ability to show many detailed work activities and their associated interactions. It would become bulky and unwieldy on larger projects with complex activities. It also cannot show clearly the interaction between early start and late finish dates of activities and the resulting float of noncritical activities. Apart from Bar Chart, they are never aware of other techniques to yield and control the project schedule such as Critical Path Method (CPM), PERT, etc. because they gained the limited level of education from local universities. This reveals that local project managers lack some knowledge involving the components of time management, as shown in Figure 5.10. Subsequently, all

construction projects in Cambodia normally face delayed schedules due to lack of some useful techniques for controlling the time schedules.

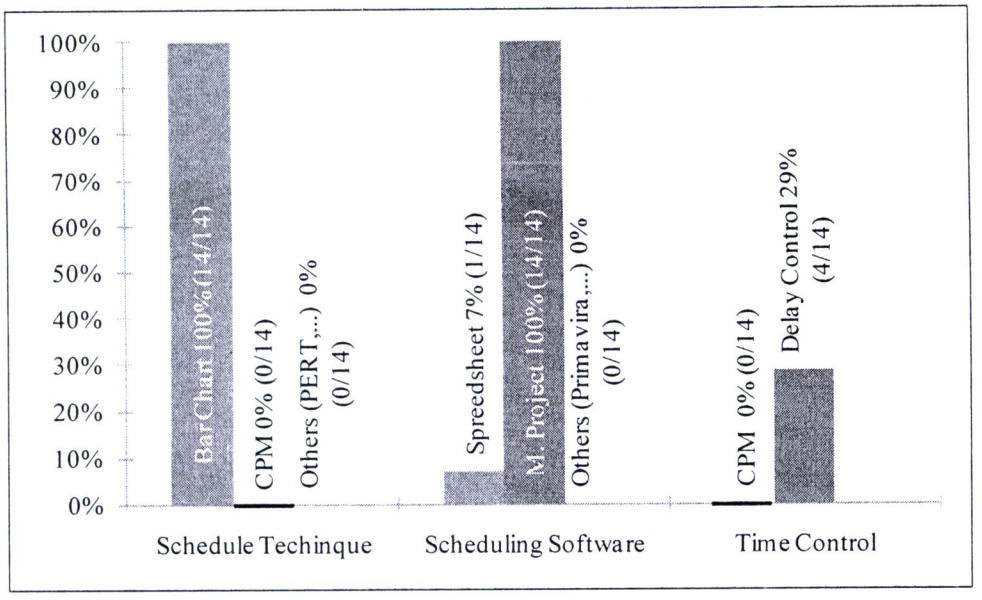

Figure 5.10 Percentage of Evidence for Time Management in Cambodia

- ***Quality Management***

According to the above result, it is found that the level of competency to apply the knowledge of quality management is in medium level. Regarding to quality assurance in Cambodia, construction projects do not have enough standards to perform the works with high quality because quality management in this developing country is not totally standardized, though, quality control is always available to be widely executed in construction projects in order to ensure the work quality corresponding to the identified specifications; such as reports of quality testing, as described in Figure 5.11. There are some quality control strategies, however, missing in some construction projects. For instance, the local project managers do not properly assign any engineer to inspect or keep up the work quality of workers in construction sites because they stated that it is consultant's job. In term of quality improvement, some local project managers enhance the quality by recording the problems and solutions related to the work quality as the historical data to use for the future works.

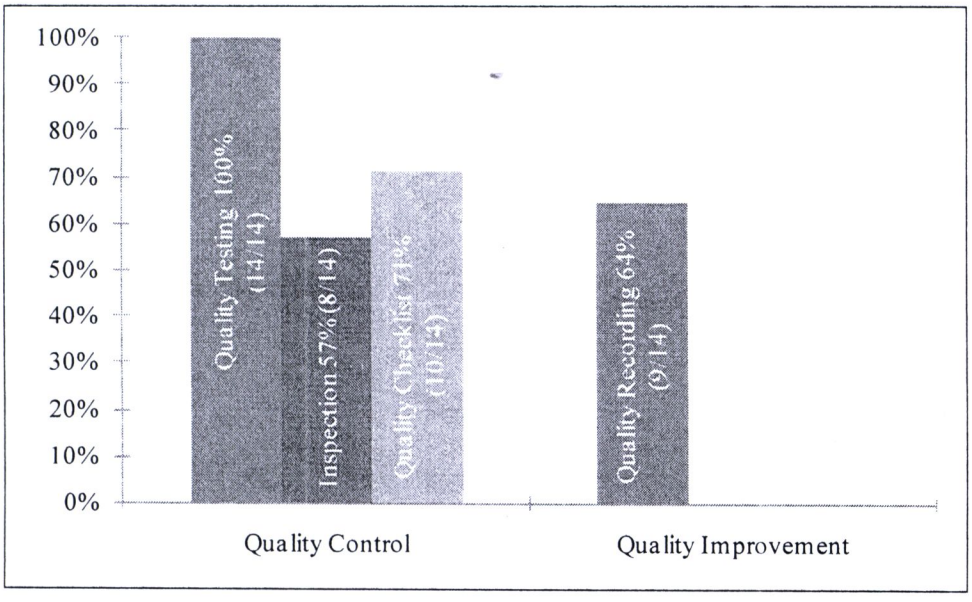

Figure 5.11 Percentage of Evidence for Quality Management in Cambodia

- ***Cost Management***

The results showed that the level of competency of local project managers to apply this important knowledge is in medium level. This is because cost management course is not available in any educational program in Cambodia due to lack of specific lecturers on this subject. Hence, the local project managers estimate and control the project cost by using their practical past experiences. Some of them also learn by jobs from working in foreign firms or international projects. For instance, local project managers use only spreadsheet as the main software to estimate the cost in the whole projects since they lack of knowledge in using up-to-date software. Moreover, they never use or even know the S-curve for controlling the project cost. Another technique they are missing is cost coding system. Few of them use cost coding system to control the project cost. That is to say, they are short of this important technique to make the project operation go smoothly without any serious trouble, as demonstrated in Figure 5.12.

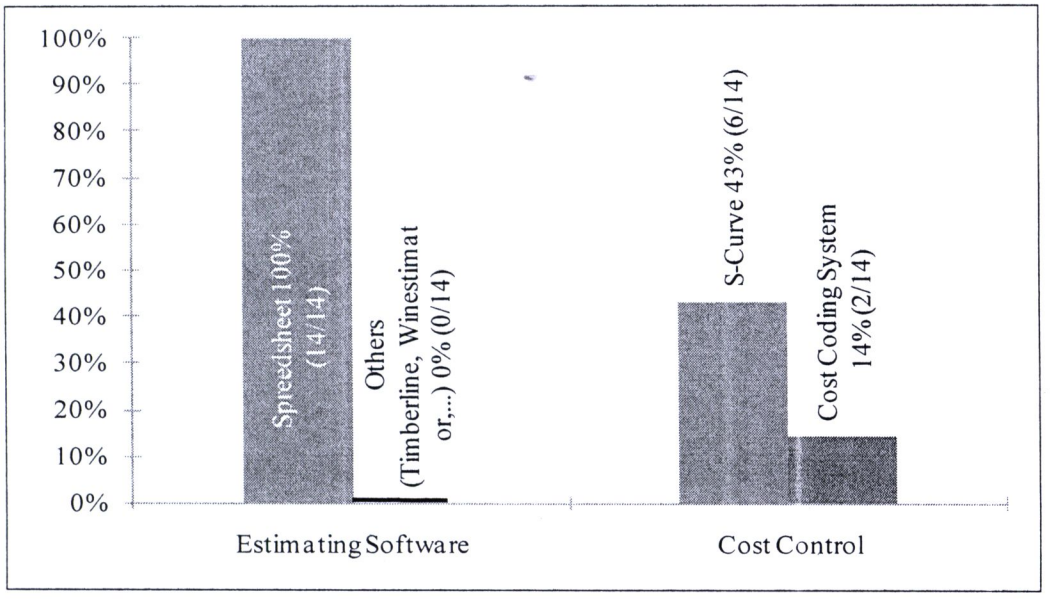

Figure 5.12 Percentage of Evidence for Cost Management in Cambodia

- ***Safety Management***

The level of competency of local project managers to apply the knowledge of safety management is also in medium level. The safety of construction sites in Cambodia is not standardized enough since there have been many workers injured and fatal during construction process. The main cause of job site accidents is the ignorance of local project managers. Although there is a number of personal protective equipment used by workers and safety signs installed in construction sites, the accidents to both neighboring public properties, people and construction workers always occur because local project managers are short of high attention and experiences of safety management. Furthermore, only some safety meetings are conducted in the sites when the site accidents particularly incurred. Safety engineers are assigned to control all safety issues in only some construction sites because the local project managers do not take serious on site safety for a reason of insufficient knowledge. Accident investigation and recording are, on the other hand, not appropriately conducted in construction sites. Some local project managers are lacking safety risk control which causes their construction works to encounter many troubles pertaining to the accident, as illustrated in Figure 5.13.

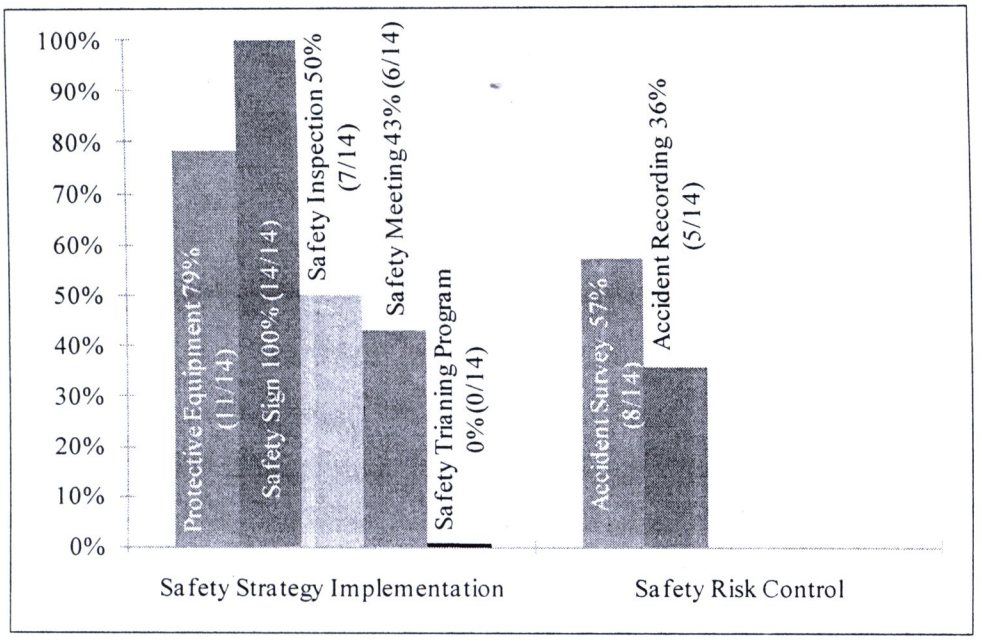

Figure 5.13 Percentage of Evidence for Safety Management in Cambodia

After thoroughly calculating and discussing the results and evidence in Cambodia, it is noticed that they are in the same direction of competency because the evidence of each knowledge areas represented the competencies of local project managers corresponding to the results as demonstrated in Table 5.1. Thus, the evidence of important knowledge is definitely able to validate the obtained results from overall perceptions.

Table 5.1 Validations of competency results in Cambodia

Knowledge Areas	**Results of Competency Levels**	***Level of Evidence***
Time management	Medium	*Low - Medium*
Quality management	Medium	*Low - Medium*
Cost management	Medium	*Medium*
Safety management	Medium	*Low - Medium*

5.5.2 Result Validations for Lao PDR

Time management, quality management, cost management, and safety management are accordingly the high important knowledge areas in Lao PDR.

- ***Time Management***

Time management is also the 1st rank of important knowledge areas in Lao PDR in accordance with the above result. Whereas, the competency of local project managers to apply this kind of knowledge is not efficient enough to achieve the construction projects within the limited time. This is because they are missing some effective techniques for applying in construction work. Nowadays, they only use Bar Chart developed by M. Excel and M. Project to show the entire project schedule, while there are some other techniques such as Critical Path Method (CPM), PERT and so on, which are more efficient than Bar Chart. The shortage of application of new techniques causes most of construction projects in Lao PDR always face delayed schedules, as stated in Figure 5.14.

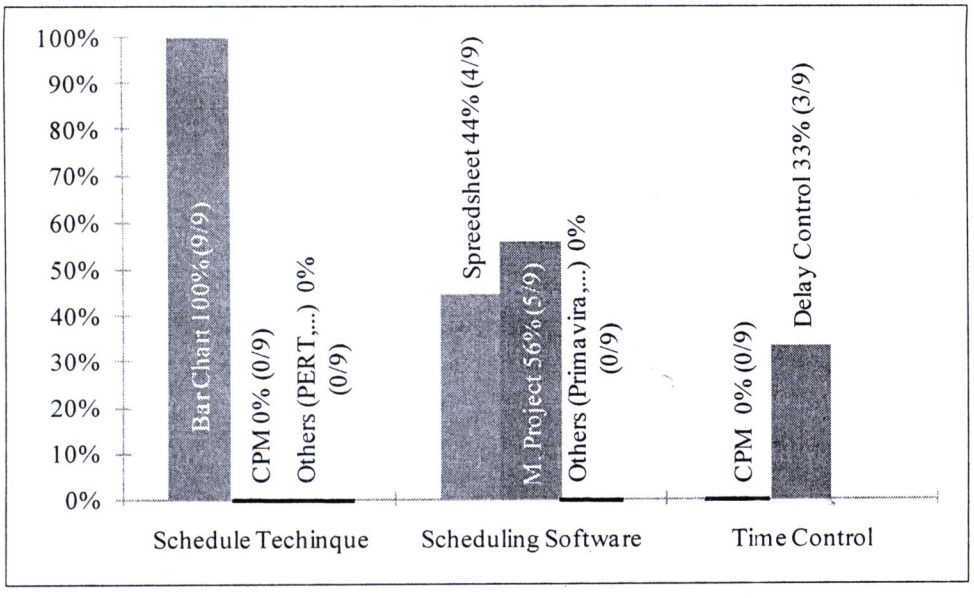

Figure 5.14 Percentage of Evidence for Time Management in Lao PDR

- ***Quality Management***

According to the above result, it is found that the level of competency to apply the knowledge of quality management is in medium level. There is no any quality assurance to apply in construction projects in Lao PDR for assuring the standard of

work quality because this country is under step by step development. Local project managers carry out the quality control by implementing some measures such as quality testing, quality inspection, quality document control. However, there are some limitations of these executions since local project managers do not pay much attention to work quality and care only about cost and their profit from the projects. For instance, during construction process, the work quality is not inspected by quality engineer because local project managers are short of knowledge and experiences to appropriately assign suitable quality engineers to perform the inspection in construction site. Regarding the quality improvement, some quality problems and solutions occurring in construction project are recorded by merely some local project managers. The evidence of this knowledge is shown in Figure 5.15.

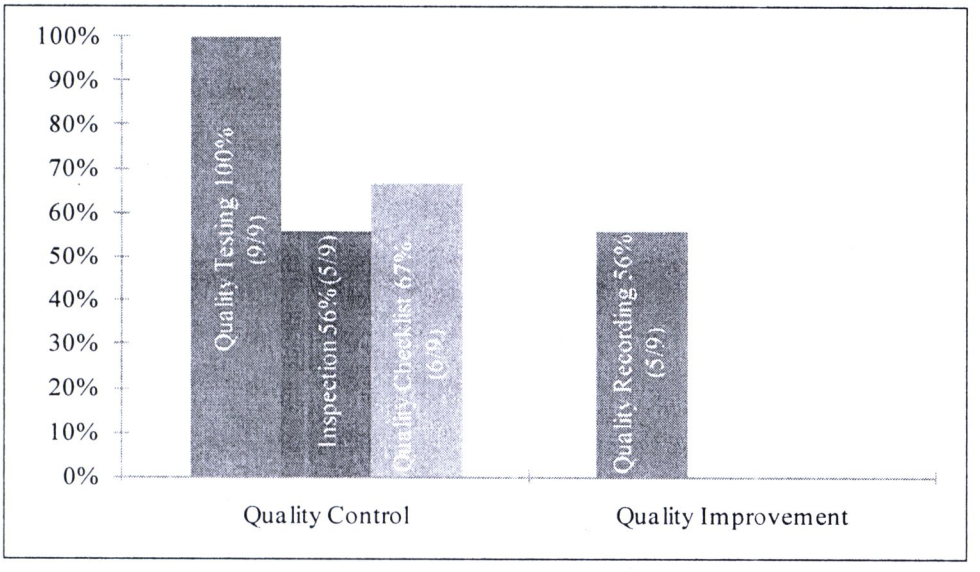

Figure 5.15 Percentage of Evidence for Quality Management in Lao PDR

- ***Cost Management***

The result showed that the level of competency of local project managers to apply this important knowledge is in medium level. Starting with cost estimating, local project managers practically use the past experiences and historical data for approximating the cost of project. They normally check the market price and historical information for material cost and labor cost. Simple software; spreadsheet, is widely used by Lao project managers for estimating the project cost. It is also used for calculating by putting the unit price and multiplying with the taken-off quantity of breakdown items. Using only spreadsheet is not effective enough to estimate the

project cost because there are presently many up-to-date software available in the market such as Win Estimate, Timberline, and the like. These software tools can organize the estimate, link it to resource database, provide reports, and possibly integrate with other systems. Furthermore, some local project managers are able to create S-curve analysis for modeling the cash flow which provides the link between the bar chart and the budget. Of course, they develop S curve to control the cost of project and particularly to claim the monthly payment from the owners. Regarding another technique for cost control; cost coding system, most of them do not use this technique to control the project cost because their knowledge and ability are in a certain limitation. The evidence of this knowledge is demonstrated in Figure 5.16.

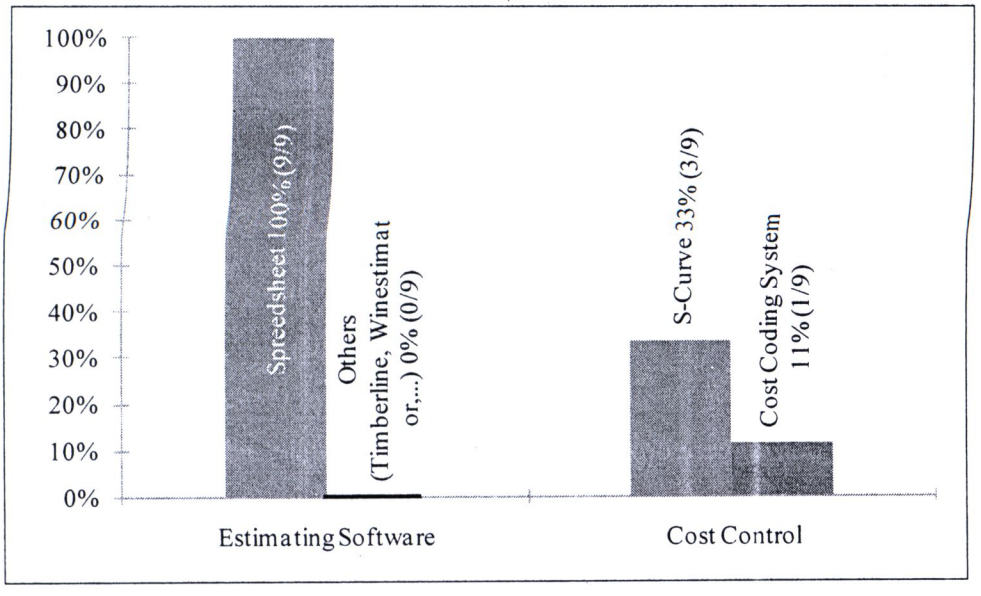

Figure 5.16 Percentage of Evidence for Cost Management in Lao PDR

- ***Safety Management***

The level of competency of local project managers to apply the knowledge of safety management is also in low level. There is no safety standard for construction sites in Lao PDR because the safety regulation has not been issued to execute yet in this country. That is why the risk of accident occurring in construction sites is very high both for the workers and for the public. Simultaneously, local project managers do not pay much attention to safety in construction sites which leads to problems on the project in terms of safety issue, as illustrated in Figure 5.17. Although protective equipment and safety signs are mostly implemented in some construction sites to

prevent any site accident, there are still many incidents causing both workers and public neighboring people to get injured and fatal due to lack of some safety strategies such as safety inspection and safety meeting. In other words, most local project managers do not seriously assign safety engineers for inspecting the site safety, and also safety meeting is not properly made among engineers, foreman, and subcontractors in construction sites. There is no local safety training program for engineers, foremen, and laborers in construction sites because project managers lack of knowledge and experiences as well. Moreover, accident investigation and recording are the deficient points of local project managers to be filled up.

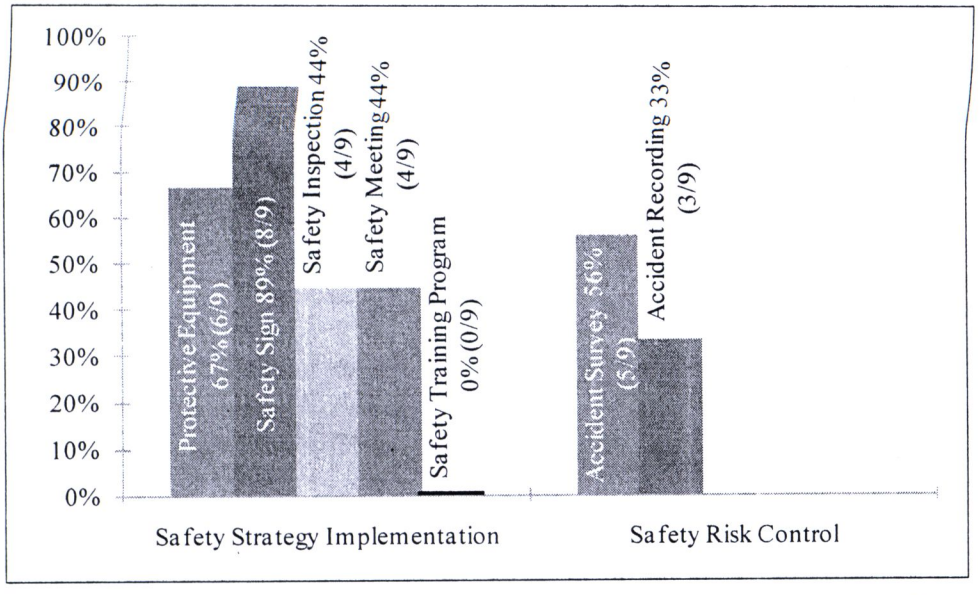

Figure 5.17 Percentage of Evidence for Safety Management in Lao PDR

After thoroughly calculating and discussing the results and evidence in Lao PDR, it is noticed that they are in the same direction of competency because the evidence of each knowledge areas represented the competencies of local project managers corresponding to the results as illustrated in Table 5.2. Thus, the evidence of important knowledge is definitely able to validate the obtained results from overall perceptions.

Table 5.2 Validations of competency results in Lao PDR

Knowledge Areas	Results of Competency Levels	*Level of Evidence*
Time management	Medium	*Low-Medium*
Quality management	Medium	*Low-Medium*
Cost management	Medium	*Low-Medium*
Safety management	Low	*Low*

5.5.3 Result Validations for Thailand

The high important knowledge areas in Thailand consist of time management, quality management, cost management, and safety management.

- ***Time Management***

The result indicated that time management is certainly one of significant knowledge areas for project managers while their competency to apply this kind of knowledge is still in high level. Beginning with schedule development, Thai project managers know what a CPM is but most of them are just not up with the current technology and its applications. Their preferred planning tool is that old favorite; Bar Chart developed by M. Project, because it provides an effective presentation which is not only easy to understand and assimilate by a wide range of people, but also conveys the planning and scheduling information accurately and precisely. Whereas, as projects became larger and more complex, the Bar Chart was found to be lacking as a planning and control tool because it could not indicate the logical relationships between activities. Similarly, most of them do not use CPM or PERT to control and monitor the project progress which causes the project fall into risk of delay due to schedule variance, as mentioned in Figure 5.18.

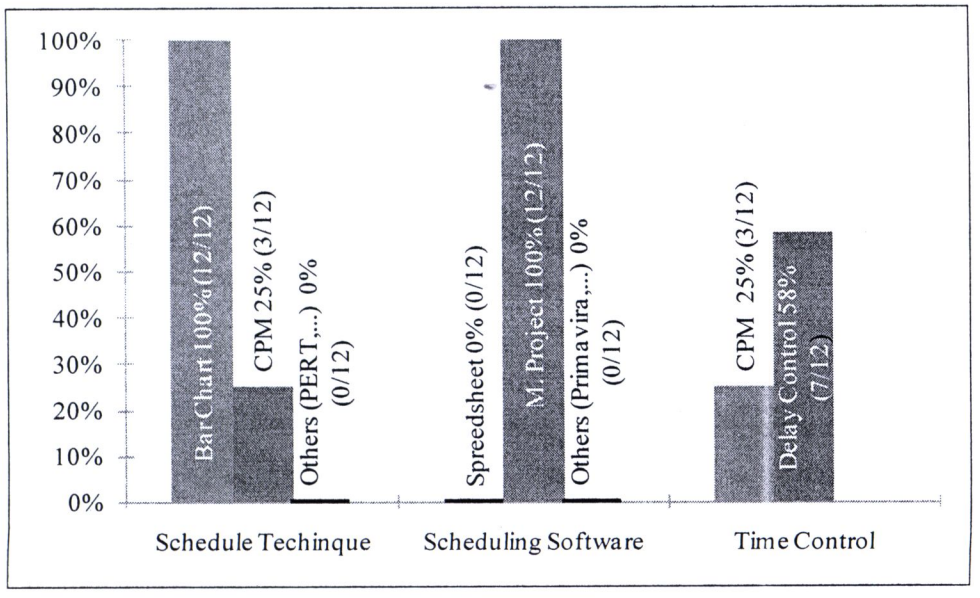

Figure 5.18 Percentage of Evidence for Time Management in Thailand

- ***Quality Management***

According to the above result, it is found that the level of competency to apply the knowledge of quality management is in high level. Regarding to the owner's demand, all surveyed construction projects in Thailand do not apply quality assurance for ensuring the quality standard of work. In principal, quality control is intensively conducted by local project managers in all construction sites to make sure all the construction works and materials following the requirements of quality in contract. To control the quality, they perform some strategies such as quality testing, quality inspection, and quality document or checklist control. Nevertheless, these methods are not definitely implemented by local project managers, as illustrated in Figure 5.19. For instance, some of them do not have construction team to inspect the work quality during construction process, which consultants criticize because of lack of proper inspector.

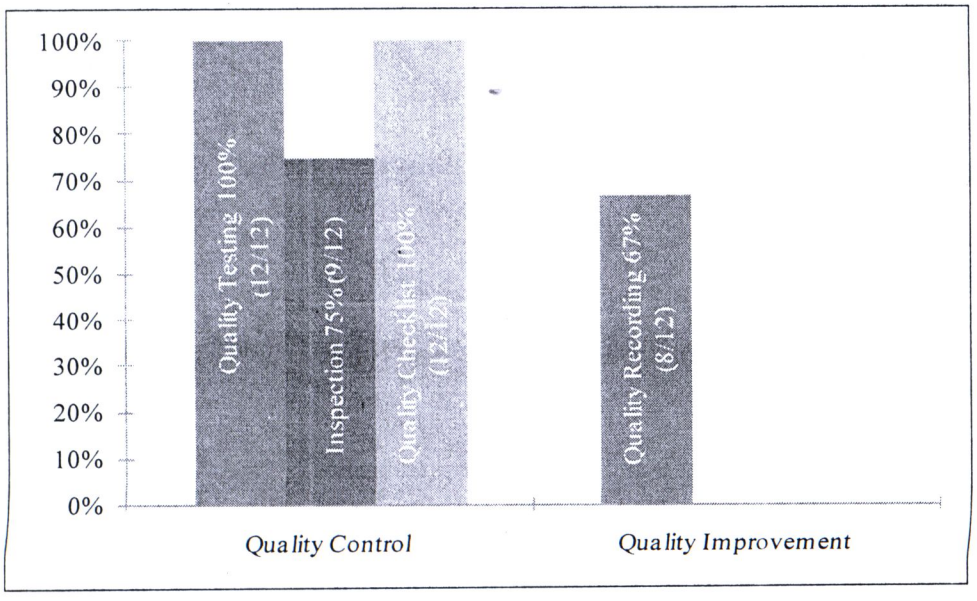

Figure 5.19 Percentage of Evidence for Quality Management in Thailand

- ***Cost Management***

The result showed that the level of competency of local project managers to apply this important knowledge is in high level. Like other project managers, Thai project managers stated that the obvious sources for estimating project costs are past experiences of individual project manager and historical information. The knowledge of the procedures for estimating is required by almost everyone involved in or associated with the field of construction such as construction teams, designers, drafters, subcontractors, material suppliers, and the like. All local project managers, on the other hand, are widely and only using computer programs in estimating building costs; especially spreadsheet programs. Using a computer to estimate makes the estimator's job easier in many ways. Employing computer calculation or formulas helps reduce calculation errors. To control the project cost, most of them develop S-Curve which enables them to plan ahead by knowing what budgets are required, when they are required and how much is required and to give timely warning of negative cash flows. In addition, some of them are able to use cost coding system to control the cost data which is important not only to project management in decision making process but also to the company's estimating and planning departments because these data provide feedback information essential for effective estimates and bids on new projects. The percentage of local project managers applying the evidence of this knowledge is shown in Figure 5.20.

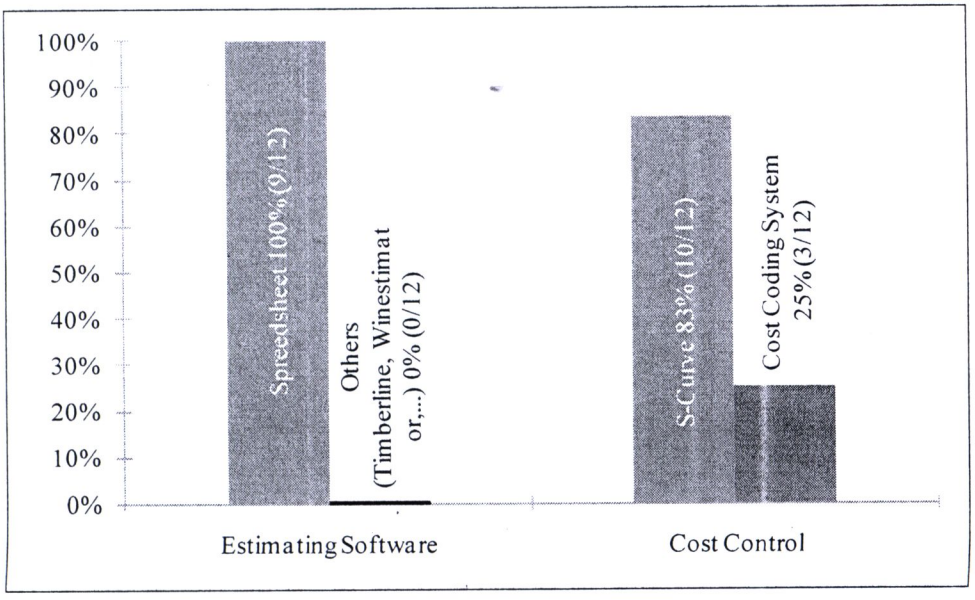

Figure 5.20 Percentage of Evidence for Cost Management in Thailand

- ***Safety Management***

The level of competency of local project managers to apply the knowledge of safety management is also in high level. Like other countries, Thailand unavoidably faces such problems of safety in construction sites due to inadequacy of safety strategies implementation and regular inspection although all construction projects have similar repeat requirements, such as hard hats and personal equipment for preventing job site accidents during construction process. Some of them sometime do not strictly consider safety matters in construction sites by ignoring the conducting of the regularly safety meeting in some manners. In other words, they are not that concerned about unforeseen job site accidents, and they also fail to yield effective regulations and practices for alleviating such safety problems in construction sites, as described in Figure 5.21.

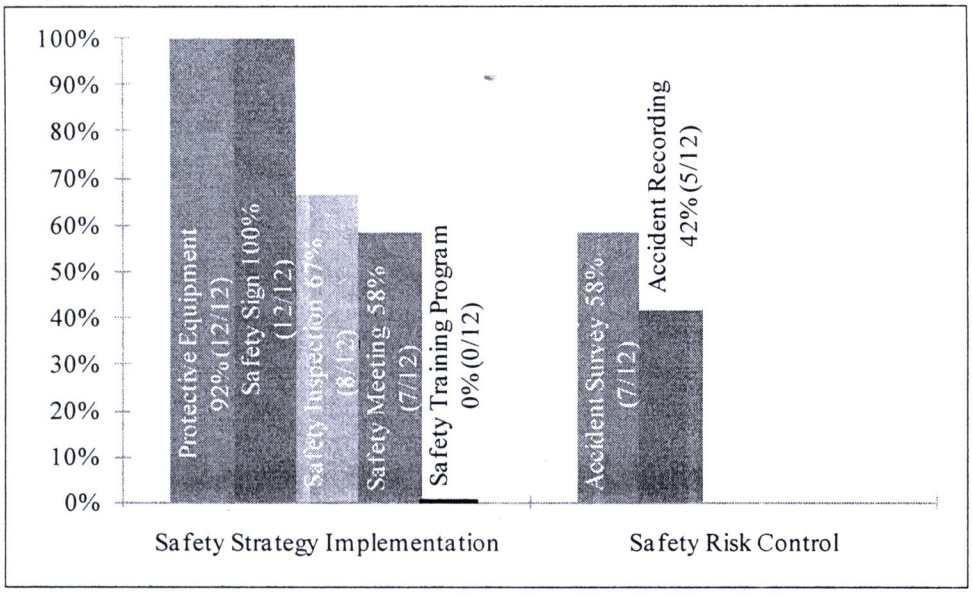

Figure 5.21 Percentage of Evidence for Safety Management in Thailand

After thoroughly calculating and discussing the results and evidence in Thailand, it is noticed that they are in the same direction of competency because the evidence of each knowledge areas represented the competencies of local project managers corresponding to the results. Thus, the evidence of important knowledge is definitely able to validate the obtained results from overall perceptions.

Table 5.3 Validations of competency results in Thailand

Knowledge Areas	**Results of Competency Levels**	***Level of Evidence***
Time management	High	*High*
Quality management	High	*Medium-High*
Cost management	High	*High*
Safety management	High	*Medium-High*

5.6 Recommendations

The recommendations were obtained from suggestions of main actors in construction projects; contractors, consultants, and owners, in Cambodia, Lao PDR, and Thailand, which are demonstrated in Appendix F as quantitative percentage. Summarily, to enhance the performance of project, the knowledge and competencies of local project managers should be upgraded by providing training programs so that they could learn how to manage their construction projects effectively and efficiently.

5.6.1 Recommendations for Cambodia

According to the result, time management is urgently needed as the crucial tool in construction project. That is why Cambodian project managers should learn more about time management from other sources not only to develop their own knowledge but also to make the projects finish within the limited time. In particular, new scheduling techniques should be widely offered to local project managers for enhancing their ability in estimating and controlling the project time.

The principle actors in construction projects cited that local project managers should regularly control the work quality to ensure that all materials used and all works performed on a project conform to the requirements of the contract plans of specifications.

It is recommended that, regarding the estimating software, additional workshops or trainings should be increasingly conducted in Cambodia in order to show local project managers new techniques or software for estimating the project cost with more accuracy. More especially, new cost control technique which can show the cash flow process, cash flow overrun, and cash flow shortage, should be provided for local project managers by capable outsource lecturers or experts in an attempt to expand and develop their knowledge and capability to estimate and control the total project cost.

The only critical approaches to improve safety management in Cambodia is to expand the knowledge of local project managers by providing some training courses, seminars, and workshops, which let them be aware of how to manage an effective safety program in their sites. Another key to a good safety program is to prevent such accidents violently occurring in construction sites in Cambodia. The local project managers should learn more how to effectively implement safety strategies or plans for eliminating, reducing, or responding to the hazards. All accidents, eventually, should be investigated promptly, whether or not injuries and damage occurred. The results of the investigation should be also recorded what happened, why the incident happened, and what procedures or policies should be adopted to minimize the safety risk for future occurrence of similar accidents or incidents. Furthermore, it is suggested that the Cambodian project managers of contractor should learn how to identify the risk sources, and to provide efficient strategies to control the project risk.

Another competency of local project managers is contract management, which is needed to be improved in construction projects in Cambodia. Local project managers should completely read and clearly identify the contract requirements and particularly determine any risk associated with contract because this knowledge is essential if they expect to satisfy all contractual requirements. After being aware of project risks and risk sources, they should take all measures to eliminate the anticipated risk which is the weak point of Cambodian project managers.

In terms of labor management, it is obvious that local project managers should learn how to basically select the laborers to ensure their acceptable qualifications. Especially, they ought to allocate or consider more about the labor variation which always occurs in construction sites. That is to say, they should better control the shortage of labor in order to avoid the delayed schedule because the number of laborers often varies due to many factors. They should also consider and keep up more on the work quality of workers, labor safety, and conflict among workers, to assure everything is going properly in terms of labor issue. Skill-enhancement training and development training, eventually, should be conducted in construction sites in Cambodia to develop the laborer's skills as these programs are presently not available.

Moreover, material procurement should be mainly conducted to ensure that construction activities are not delayed because of a lack of materials. Regarding the material stock management, they should use spreadsheet or other software to control the material flows in sites instead of manual by material keepers, in order to conveniently improve the stock management. Local project managers should learn from training how to effectively select all required staff based on their qualification. Moreover, they should control the working staffs by examining and managing their progress works in construction projects. In particular, the vital thing local project managers should perform is to develop the project team by providing fruitful training in an attempt to upgrade their skills.

After receiving award of the contract, the Cambodian project managers should clearly review each specification section and needed documents for submittal requirements. The only important task that local project managers should carry out is to develop suitable submittal schedule and also mention it in master schedule in order

to avoid project delay due to late submittal. Related to the subcontractor selection, local project managers should learn from training how to select subcontractors based on not only price but also other criteria such as good safety record, experienced craftspeople, good equipment, and are able to complete the project to the desired standards without experiencing financial problems. To ensure quality work, there must be mutual trust and respect between the local project manager and the subcontractors, because each can achieve success only by working cooperatively with the other. They also should not give up some control when working with subcontractors which often leads to problems on the project with quality and timely execution.

The competency of Cambodian project managers to apply communication knowledge in construction projects is acceptable because they are able to use English in terms of language to communicate for international projects.

Basically, the only way to improve the competency of local project managers in terms of equipment management is to provide some training for local project managers so that they can know more how to control the equipment safety and also how to take any action for equipment maintenance program, to ensure the construction works are not delayed due to problems involving equipment.

5.6.2 Recommendations for Lao PDR

First of all, the competency of local project managers should be improved in terms of time management in order to succeed in the estimated project schedule management. New software and new scheduling techniques should be particularly provided to local project managers through short course and training so that they could better learn what the advantages of these software and techniques are and how to apply these methods for construction project.

Of course, the necessary and essential methods to improve the competency of local project managers are training, short course and seminar, which will significantly get them to realize the importance of quality management in project, how to successfully control the work quality and how to efficiently improve the quality.

In principal, possible training or short course ought to be set up for Lao project managers to order to expand and enhance both their knowledge and competency by

showing more cost estimating software and techniques to efficiently develop the estimated cost and to control cost of the entire project.

It is proposed that the competency of Lao project managers should be improved in terms of knowledge of safety management. It is similar to other knowledge areas; the best way to enrich competency of local project managers is to greatly promote training program, fruitful seminar, and short course pertaining to the safety management. Local project managers should strictly conduct the safety strategy implementation and safety control.

Undoubtedly, the knowledge and competency of local project managers must be upgraded involving contract management knowledge. Training program and short course should be offered for local project managers. They would also, through, this training, understand the importance of contract and how to identify the contract risks and implement risk mitigation measures for the project with efficiency.

Continuing to risk management, local project managers should better learn how to clearly determine what risks seem to occur in the entire project, and then to identify at what sources those risks originated. After being aware of risk sources, they should also learn how to effectively reduce the whole project risks which would occur by any measure.

Another issue is material management; the only way to improve the competency of local project managers is to provide some training related to the method of how to develop the schedule of material order and delivery in order to avoid any project delay due to shortage of material on site. In other words, local project managers should initiate material procurement early in the construction process to ensure that materials are available on site when needed by the construction workers.

Local project managers should upgrade their ability in terms of knowledge of subcontractor management through training, seminar, or short course. Local project managers should look at all these conditions in selecting subcontractors to perform their construction works because subcontractor's works absolutely impinge on project schedule. Another important thing that local project managers should gain from training is about how to effectively control the subcontractor. Furthermore, local project managers should learn more from training how to select the qualified staffs or

engineers. Involving staff control, on the other hand, project managers ought to learn more and more in establishing the organizational chart and in directing staff in order to control their employees successfully. Regarding team development, they should enhance their ability by training in setting up the skill-enhancement training and development training for their staffs or engineers.

Labor management is similar to human resource management in terms of selection. Labor selection and labor control are the insufficient of local project managers. Thus, their inadequacy should be filled up by various training to improve their knowledge and competency in term of labor management.

Most Lao project managers of contractors are able to use foreign languages; especially English, to communicate and distribute information with international owners or consultants. This shows that the competency of local project managers to apply this kind of knowledge is positive response; but they still need some training to improve their knowledge and capability related to communication management.

In order to archive for documental management, training or short course should be offered to Lao project managers so that they can learn more how to primarily create and effectively manage the submittal program which is a necessary tool to achieve successful construction projects. Moreover, through training, they can be aware of how important submittal planning is and then develop schedule for document submittal in the entire project.

The knowledge and competency of equipment management of local project managers should be also improved by training to allow them to understand more critical features they are missing to manage the equipment. They should be taught how to allocate and control equipment which is a weakness of Lao project managers.

5.6.3 Recommendations for Thailand

It is recommended that Thai project managers better use new and advanced techniques in case of complex projects. When the projects fall in delay, they would be able to accelerate early finish in an attempt to reduce project risk and uncertainty by identifying the critical works. The best way to improve the ability of local project managers is that training should be conducted to encourage them to supportively use and practice other advanced techniques because those techniques enable them to

significantly contribute not only to the planning, control, and on-time completion of construction projects, but also to define and plan the work in detail from start to finish, thus permitting early identification of potential problem.

Of course, there is no significant problem pertaining to the competency of local project managers to apply the knowledge of quality management. However, advantageous training or short course should be conducted in Thailand in an attempt to provide new perceptions to fill up their inadequacy of knowledge and competency related to the quality management.

In particular, it is important that new and advanced cost estimating software and cost control should be introduced for Thai project managers to be aware and learn to apply these up-to-date computer programs and techniques in their current construction projects.

The local project managers should learn from training how to set the standard regarding safety on their projects and enforce safety standards at all times. Training is extremely required to enhance their knowledge and competency involving the safety management. For instance, local project managers should learn more how to train construction teams such as engineers, foremen, and laborers, to implement the safety strategies all the time. They should also learn how to attentively investigate and record the site accidents as historical data which will be beneficial for the future work.

The competency of local project managers should be enhanced by training or seminar in terms of knowledge of labor management. They should learn more how to select the skillful laborers to work in construction sites. In particular, they should also learn how to train laborers working in sites to update their skills which can increase their work productivity and then boost the construction project finish on limited time.

Even though Thai project managers have learned and are aware of what construction project risk is, they still confront complicated problems with unanticipated risks since they rely in their experience and judgment and rarely believe on systematic risk assessment which is widely used in commerce and economics. Thus, the risk identification should be properly set up in planning phase. They should undertake or propose actions which reduce or eliminate the effects of risk or uncertainty. Construction project risk mainly influences project cost, time, and quality which are the major constraints of construction projects. That is why Thai project

managers must understand the project risk in order to avoid any crucial issue which may occur in construction projects. Their insufficient knowledge and competency should be further improved by training, seminar, short course, or workshop.

It is similar to risk management that Thai local project managers should realize the importance of fully reading the contract for understanding in order to identify the contract risk and then to find out the measure to reduce the project risk regarding to the contract. Useful training should be provided to let them know how to effectively control the contract in project.

In terms of material management, the main weakness of local project manages is material delivery scheduling or material procurement. They should regularly develop the schedule of material order and delivery to ensure the materials are available in sites when required. Concerning material stock management, they usually use management manual for checking or recording material flows in sites and sometime they use simple software such as Spreadsheet to do these works. These kinds of approach are not efficient and appropriate enough to apply in large and complex construction sites. Therefore, training should demonstrate new or efficient software for controlling the material stock to them to be aware of and apply in complex construction projects.

Concerning human resource management, training should be offered to all Thai project managers so that they can learn how to select skillful staffs or engineers. They should regularly monitor and have a look at staffs' activities to control their staffs. Another important thing is team development which is rarely conducted by local project managers in Thailand. They ought to learn more how to train the construction team to develop their skills and then to improve the performance of the project. Another competency of local project managers needed to be developed is subcontractor management. They should not principally select subcontractors in accordance with only price or quotation. They should also learn from training how to efficiently control subcontractors for ensuring their work quality following the identified specifications.

Regarding the communication language, all Thai project managers are able to use English for communicating and sharing information with each other in case of foreign projects. There are also several formats and techniques that have been

developed to expedite the flow of information among members of the project team such as regularly meeting, electronic mail. However, training is still needed to provide new techniques and features related to communication management to local project managers.

In addition, Thai owners and consultants complained that there have often been late submittals in processing construction projects. Hence, local project managers should better learn how to appropriately set up an effective submittal planning at the starting of projects and mention in the master schedule to prevent any risk of delay due to late submittal.

Last but not least, equipment management training should be conducted to let local project managers know how to particularly choose and control equipment operating in construction projects.