

A MODEL OF RISK MANAGEMENT PLAN AND SYSTEM FOR THE CONSTRUCTION PHASE

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ABSTRACT : After the IMF shock, some major construction companies in Korea have been motivated to avoid and mitigate various risk factors which could be critical and catastrophic events to corporate revenue and organization internally or externally. It means that they are trying to introduce and set up a risk management plan and system suitable to their organization and culture. L construction co. ltd. is one of major construction companies that have been searching methodologies or technologies to manage various risk factors surrounding corporate marketing and project operation. This paper presents an unique approach to develop a model of risk management plan and system suitable to L construction itself focused on the construction phase.

Key words : Risk Management, Risk Management Plan, Risk Management System, Construction Phase

1. INTRODUCTION

1.1 Research Background

Recently, a construction industry tends to be more complex, diverse and huge because of various social and consumer's requirement following by economic growth. This tendency makes construction operation and management based on merely few project manager and engineer's experiences to be difficult or impossible any more. After the IMF, especially, as some top ranked construction companies have been experiencing corporate business deteriorations and project's instabilities coming from the construction inherent uncertainties and risks, they are trying to figure out reasonable and systematic approaches and methodologies in order to manage corporate and project uncertainties and risks efficiently.

L construction co. ltd.(L const) is one of the major construction companies, recognizes needs to prevent losses caused from inherent risks in the corporate and projects in advance, and has been making efforts to introduce or develop risk management system suitable to construction environment. This research presents development process of risk management plan and system suitable to L const corporate and project environment, and proposes a model of risk management plan for the construction phase.

1.2 Research Steps and Methodologies

A L const's risk management plan has been drawn up as the following steps and methodologies shown as Figure 1.

The first step is that a lot of the existing foreign risk management plans, systems, papers and other references had been collected or surveyed.

The second step is that after some domestic available risk management pilot or test practices, similar works, and judicial precedents had been collected, and then compared with information collected at first step.

The third step is that after L const's corporate and project environment had been surveyed and analyzed based on comparison results between foreign and domestic information from viewpoint of risk management, the objectives of L const's risk management were established, and risk management implementation system, organization and responsibilities to archive its objectives were defined.

The fourth step is that a risk breakdown structure and a risk checklist were setup and developed, and risk management process and techniques were defined, and a risk management plan was drafted.

The fifth step is that a drafted risk management plan was revised through several reviews and workshops, and then finally completed.



Figure 1. Research Steps

2. THE EXISTING RISK MANAGEMENT PLAN'S REVIEW AND ANALYSIS

2.1 A selection of the existing risk management plan

A lot of the existing risk management plans had been collected and reviewed, but it was impossible to compare and analysis all plans. Accordingly, major risk management plans were selected based on the multiple criteria such as its format, procedure, and contents whether or not they are reasonable, systematic and adaptable to formal risk management process and construction environment. Five risk management plans were finally selected, and its result is shown on table 1. Only three of them such as Risk Assessment in Fixed Guideway Transit System(RAFGTS), How to construct a public sector comparator(HCPSC), and Risk Analysis Procedure(RAP) are risk management plan for construction field, another one such as Bush Fire Risk Management Plan(BFRMP) is for fire disaster prevention field, the other one such as Risk Management Program Plan(RMPP) is for defense field. Although BFRMP and RMPP are not for construction field, which are determined to be symbolic models since those procedures and contents are so systematic and practical.

Table 1. A selection of the existing risk management plan

| No | Risk Management Plan | Authority | Field |
|----|---|-----------|-------|
| 1 | Risk Assessment in Guideway Transit System Construction | FTA | C |
| 2 | How to Construct a Public Sector Comparator | PFI | C |
| 3 | Risk Analysis Procedure | LG Const | C |
| 4 | Bush Fire Risk Management Plan | WPBFMC | F |
| 5 | Risk Management Program Plan | DOD | D |

*Field ; C(Construction), F(Fire Disaster Prevention), D(Defense)

2.2 A comparison and analysis of the existing risk management plan

The comparison items of the existing risk management plans are classified in way of including all contents of each risk management plan as the upper and low classes. The upper classes include generals, risk management process, and risk management system, and are classified to the detailed low classes. The low class of generals includes risk management definition and objective, work scope, risk management implementation system, risk factor and type, and the low class of risk management process includes risk management techniques and procedures, and evaluation, but the low class of risk management system is identical to the upper class. The result of a comparison and analysis of the existing risk management plan is shown on Table 2.

Table 2. The result of a comparison and analysis of the existing risk management plan

| Item | No. of Risk Management Plan | | | | |
|---|-----------------------------|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 |
| Generals | | | | | |
| -Risk Management Definition & Objective | ○ | △ | △ | ○ | ○ |
| -Work Scope | ○ | ○ | ○ | ○ | ○ |
| -Risk Management Organization | ○ | △ | ○ | ○ | ○ |
| -Risk Factor & Type | ○ | ○ | △ | ○ | ○ |
| Risk Management Process | | | | | |
| -Risk Identification Tech. & Procedure | ○ | △ | △ | ○ | ○ |
| -Risk Analysis Tech. & Procedure | ○ | ○ | ○ | ○ | ○ |
| -Risk Response Tech. & Procedure | ○ | △ | ○ | ○ | ○ |
| -Risk Management Eval. | X | X | X | △ | △ |
| Risk Management System | X | X | ○ | X | △ |

* Symbols; ○ (include), X (not include), △ (not obvious)

From the Table 2, it is easily confirmed that most portions of generals are included in all of the risk management plans. It means that generals such as risk management definition, objectives, background, etc., in risk management plan are too important to be omitted. And it is also understood that a definition of work scope, organization and responsibilities to implement risk management should be considered as essential factors.

It is easily recognized that the risk management techniques and procedures are described at most of risk management plan as similar manner, it means that risk management techniques and procedures could be clarified and defined to almost identical format even though risk management organizations and process would be differed. Because the risk management feedback process reflecting risk management results does not stipulate in most of risk management plan, however, it is not obvious whether the

post evaluation process of risk management is included or not.

Finally, it is almost impossible to confirm whether or not the risk management computer system or database exist except RAP. Since the risk management computer system and database are so important and essential in recent project management environment and trend, however, it could be assumed that most of authorities might have the risk management system and database interrelated with in-house project management computer system and database.

3. CONSIDERATION POINTS FOR A RISK MANAGEMENT PLAN

From results of the existing risk management plan's review and analysis, some consideration points for a risk management plan could be summarized as the followings;

The first point is that a definition and objectives of risk management must be clarified. Because a construction industry is exposed to so unique environment, it is very important to redefine a risk and a risk management as a limited scope within construction, which means that a risk management in construction should be clearly distinct from other industries such as manufacture, finance, or R&D, etc.

The second point is that a work scope and implementation system of risk management must be defined as suitable to construction operation, because they reflect the specific characters of construction organization and work process.

The third point is to rearrange the construction risks as a risk breakdown structure. The risk types could be differentiated depending on the characters of a corporate business and project management. So, it would make the corporate and project specific risks more efficiently managed through classified them into breakdown structure and coded for management information system.

The fourth point is to define the risk management process, and also techniques and procedures applied to each phase. The most important things at this point are that the risk management process, techniques and procedures must be simple and easily understood in order for project personnel to implement them efficiently at real practices.

The fifth point is to setup a risk evaluation procedure in order to feedback risk information results systematically, and also motivate project team to improve their performance.

The sixth point is to define risk management computer system and database. It is so common or essential to apply the risk management process to an integrated management information system because most recent construction management systems are based on the computer system and database, and integrated into in-house corporate management information system.

4. A MODEL OF RISK MANAGEMENT PLAN AND SYSTEM FOR CONSTRUCTION PHASE

4.1 A model of risk management plan for construction phase

An index of a risk management plan for L const is shown

on figure 2 reflecting some consideration points for a risk management plan. It consists of generals, organization and responsibilities, risk factors of L const, techniques and procedures, reports, and evaluation.

| | |
|-----------|--|
| 1. | GENERALS |
| 1.1 | Purpose and Background |
| 1.2 | Definition and Objectives |
| 1.3 | Scope |
| 2. | ORGANIZATION AND RESPONSIBILITIES |
| 2.1 | Organization |
| 2.2 | Responsibilities |
| 3. | RISK FACTORS OF L CONST |
| 3.1 | Corporate Common Risk |
| 3.2 | Project Risk |
| 4. | TECHNIQUES AND PROCEDURES |
| 4.1 | Risk Management Process |
| 4.2 | Risk Identification Phase |
| 4.3 | Risk Analysis Phase |
| 4.4 | Risk Response Phase |
| 5 | REPORTS |
| 6 | EVALUATION |

Figure 2. An index of a risk management plan

A chapter 1, generals, contains the purpose and background of a risk management plan, the objectives, and a work scope of risk management. The purpose and background of a risk management plan are to prevent losses and preserve business stability coming from uncertainties surrounding construction environment to be rapidly changed. The objectives of risk management are to prepare proactive plans for unexpected disadvantage events or status in order to minimize adverse impacts, and procure human and material resources to manage risks effectively, and own risks commonly within organizations or teams. A work scope of risk management is to be limited within corporate assets, project, and marketing of L const in time frame of 1 year.

A chapter 2, organization and responsibilities, contains an organization and key players' roles and responsibilities. An organization of risk management is composed of almost identical form of the existing L const organization in order to avoid unnecessary added works. Two key player's roles and responsibilities for risk management such as a risk manager who controls overall risk management process within a division, and a risk engineer who coordinates working-level risk management in a project or team level are specified. And also a risk evaluation committee that performs top-level risk related decision making and periodic or post evaluation, and a risk evaluation group, organized with 3-5 persons, that performs working-level risk identification, analysis, and response are defined.

A chapter 3, risk factors of L const, contains a risk breakdown structure and risk checklist. A risk breakdown structure consists of corporate common risks that are controlled by corporate level, in other words, home office level, and project risks that are controlled by a project and team level. Corporate common risks are classified to

marketing risks, estimating and budgeting risks, asset risks, legal and force majeure risks. Project risks are classified to mobilization risks, accounting risks, technical risks, construction risks, public related risks, and completion risks. A risk checklist that includes more detailed risk events based on a risk breakdown structure is used to identify working-level risks at the risk identification phase.

A chapter 4, techniques and procedures, contains the risk management process, risk management techniques and procedures. As previously mentioned at consideration points for a risk management plan, the most important points to establish a risk management process and define risk management techniques and procedures must be simple and easily understood. If project personnel feel uncomfortable to use and face a lot of difficulties to apply proposed process, techniques and procedures, a risk management at working level would be useless and ultimately failed.

A proposed risk management process is shown on figure 3 as simple as possible. It is composed of only three phases as a risk identification phase, a risk analysis phase, and a risk response phase.

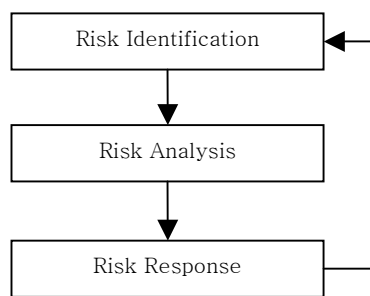


Figure 3. A risk management process

The tools and techniques applied to a risk identification phase consist of four methodologies such as a checklist method, a brainstorming method, an interview method, and a real-time method. A checklist method could be used as a main tool due to its simple and easily understandable format, and conveniently interrelated to the database. The others are to be used as making a checklist or a substitute in case of a checklist not prepared. The practical procedures to apply each methodology are described on a risk management plan.

The tools and techniques applied to a risk analysis phase are composed of two main categories as the qualitative methodology and the quantitative methodology. The qualitative methodologies such as a grade judgment method and matrix method are used to determine a probability and an impact of risk event as grades. The grade tables to be used in a grade judgment method are very simple and easily understandable to everyone in view of preparing and applying. On the other hand, the quantitative methodologies such as a sensitive analysis method, a monte-carlo simulation method, and a decision making tree method are considered as complicated and more difficult due to their statistical and mathematical characters, and so are not used

commonly at working level. Therefore, a grade judgment method is defined as a main tool at risk analysis phase, the other methodologies to be used as substitute at unusual situation.

The tools and techniques applied to a risk response phase consist of four main categories as a risk avoidance strategy, a risk acceptance strategy, a risk mitigation strategy, and a risk transfer strategy. At this phase, especially, a risk response repeated process considering a risk threshold and a residual risk is proposed as shown on figure 4.

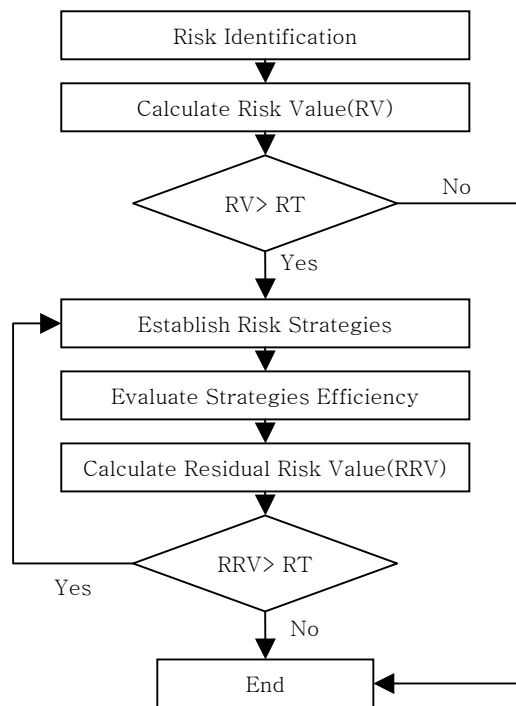


Figure 4. A risk response repeated process

A chapter 5, reports, contains the worksheet and report. The worksheet consists of three formats as a risk identification worksheet, a risk analysis worksheet, and a risk response worksheet, which are used as data input worksheets to a risk management process and database. The report consists of two formats as corporate risk management report and project risk management report, which show all of risk management status at corporate level and project level respectively.

A chapter 6, evaluation, contains periodic evaluation and post evaluation procedures, and evaluation tables. A periodic evaluation is performed by a risk evaluation committee in the middle of project operation periodically, about every 3 or 6 months. A post evaluation is performed by same committee only one time after project completion.

4.2 A Model of Risk Management System

A risk management system has been developed as one of subsystem integrated with the existing project management system of L const, so called PMS+. Because all menus, programs and databases in a risk management system are

identical to PMS+, anyone who is familiar to PMS+ can manipulate a risk management system and database very easily and conveniently. Some sample screen captures of a risk management system are shown on the following figures. A figure 5 shows a part of risk checklist, and a figure 6 shows one of risk identification screens, and a figure 7 shows one of risk analysis screens, and a figure 8 shows one of risk response screens respectively.



Figure 5. A part of risk checklist

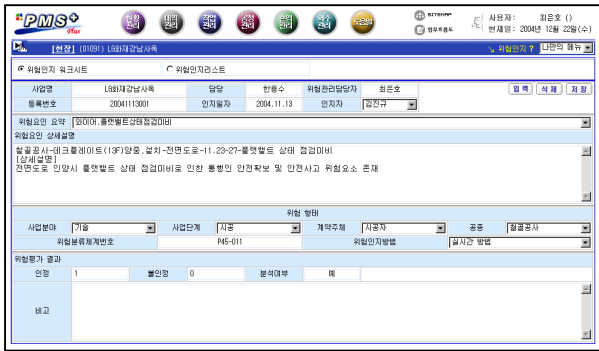


Figure 6. Risk identification screen



Figure 7. Risk analysis screen



Figure 8. Risk response screen

5. CONCLUSION

Some top ranked construction companies in Korea have recognized the needs of responding more systematically against inherent risks and uncertainties within their corporate business and projects, and tried to establish mechanisms, such as a plan or system, integrated with the existing in-house management system. This research has been performed to provide a basis of corporate level risk management system for L const to cope with rapidly changing construction environment, and proposed a risk management plan and system as research results. A risk management plan has been drafted and completed with numerous reviews and analysis, some creative ideas based on a lot of the existing risk management plans and in consideration of corporate business and project characters of L const. A risk management system has been developed to be able to use same database and menus within the existing project management system, so called PMS+. This research has been focused on the construction phase because most of construction companies still have had more interests on construction operation than planning, design, and procurement. The results of this research would be a model of risk management plan and system for the construction phase in Korea. However more research efforts should be required to upgrade its ability, efficiency, and adaptability to unique construction environment.

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