Risk Analysis for the Construction Industry in Jordan

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Dedication

To the soul of my late father, and to my mother,

to my elder brother Abdulla ,

to my wife, and my children,

to my brothers and sisters,

for all the love and support they gave me.

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ABSTRACT

The fundamental aim of this study was to investigate the risk factors that have the greatest influence on the construction industry in Jordan. This study concentrated on the major problems that affected the project progress due to the different risks. These have been categorized into five major categories: administrative, financial, resources, manpower, and technical .

A questionnaire was forwarded to companies ranked as first, second and third class, in order to measure and evaluate the major risks in the construction firms. Each risk was given a mark and a total score was derived. All risks were ranked according to the scores they achieved and a general description and discussion was carried out. After the assessments of the first questionnaire have been accomplished, another questionnaire was set up in order to suggest appropriate solutions for the major risks that have scored the highest ranks of each category. In addition to the results obtained by the second questionnaire, a meeting was held with a team of specialized engineers and contractors in order to discuss the most reasonable solutions suggested by the companies who filled in the questionnaire. Analysis were carried out using SPSS and more statistical results were obtained.

The results showed different issues that may be considered negligible, while they are really considered as the key factors to the success of the project. Financial support was the major awareness for all contractors and showed that the progress of the project was highly dependent on the financial payments that the contractor can get. The variation in the classification of the companies showed different understandings in ranking the risks. The study dealt with each company class in a different manner and each class has been analyzed individually and general discussion and comments have been given to each risk category. An internet model was provided to illustrate all details and results obtained in this study.

INTRODUCTION

Risk is inherent in all commercial transactions. The amount of risk accepted usually bears some relation to the profit expected. A decrease in the certainty of the conclusion will generally be balanced by an increase in the reward expected.

There are many risks associated with construction. The effect of any of eventuating these risks can be expressed in terms of monetary loss or property damage or personal injury or a combination. It is important to identify each risk, and to find its appropriate solution.

Some risks are peculiar to the geographical location of the project and can't be controlled, such as those due to political factors or the fluctuating rates of exchange. Other risks arise due to the size of a project; e.g. with very large projects, new risks emerge which are not merely scaled-up versions of the risks associated with conventional projects.

The liabilities need to be shared in order to encourage the proper implementation, and prompt an economic completion of construction projects, so as to best serve the interests of the parties and of the public in general. The contract, usually in its general conditions, will therefore define the basis upon which the risks are allocated. Some of these risks can't be insured, as they possess some characteristic apparent to the insurance industry- they must remain the responsibility of the party to which they are allocated.

1.1 Assessment of Risk

Risk assessment is an important task if decision-makers are to be provided with a reasonable method of assessing the potential gains and losses associated with any particular course of action. The risks may be unacceptable, in which case the course of action can either be rejected or a method can be found by which the risks are improved. On the other

hand, the risks may be acceptable and the course of action can be pursued with or without any further improvement in the risks.

When new technology is involved, there is often no information available on failure rates. Even when existing technology is to be applied, data may be inadequate or inconsistent. Moreover, useful information on a failure or potential failure may have been deliberately suppressed by those involved in the project.

When a method is devised to assess the probability and potential severity of perceived risks, the assessment can be compared with others for alternative courses of action. Cost-benefit analysis is the usual method, but it is difficult if not impossible to place monetary values on such factors as human lives and happiness.

1.2 Allocation of Risks

Traditionally, the allocation of risk depends on which party:

- can best control the risk,
- can best foresee the risk,
- can best bear the risk,
- most benefits or suffers if the risk materializes.

Basically, all risks should be those of the principal, unless transferred to or assumed by another party in return for fair compensation. However, the other party needs to have the competence to assess the risk, the opportunity and the expertise necessary to control or minimise it, and the financial resources to pay for damages if the risk materialises. Indeed, control is the essence of the allocation of risk. The party who has control should usually accept the risk. Thus, during construction, the contractor has control of the site and usually takes primary responsibility.

It may be appropriate in certain circumstances to allocate a specific risk on a different basis, such as the limited experience or resources or bargaining power of one of the parties. However, if the risks eventuate causing loss or damage, then a dispute may arise as to the liability for the resulting loss or repair costs. It may then be found that the legal interpretation of a clause of the contract differs from the meaning which had been expected.

1.3 Objectives

In Jordan there is still lack of knowledge regarding the risks that may occur in construction firms, particularly for new contracting companies or for those who transfer to higher classes and therefore face new risks.

The overall aim of this study is to identify and analyze the numerous factors affecting the construction industry in different aspects, such as, administrative, financial, resources, manpower, and technical factors. Each of these aspects is discussed individually, and results will be obtained. The main objectives of the work are to:

- Investigate factors that may cause a problem or may be classified as a construction risk, relying on the contractor judgment.
- Find out the appropriate solutions for the major construction risks.
- Carry out statistical analysis to investigate the influence of each risk on the construction industry.

1.4 Methodology

Risk in construction industry is a wide research area. This study will concentrate on a small part regarding the risks that occur in Jordan construction firms. The study was carried out after evaluating the major factors that affect the development of the project. Contractors

who really play major factor of speeding or delaying the performance of the project will be interviewed in order to evaluate, investigate, analyse risks affecting the project and propose appropriate solutions.

The following methodology was carried out in the present study:

- Literature review,
- Data survey and piloting,
- Problem evaluation using risk management definition and their functions.
- Evaluation of risks divided in five major categories,
- Questioning the entire risks,
- Analysis using SPSS software,
- Discussion of all risks in order to rank them,
- Investigating the appropriate solutions,
- An internet model to present all results achieved in this study,
- Conclusions of the study.

1.5 Project Strategy:

The present study investigates the risks in the construction industry in Jordan. Work in this study is divided into four main phases:

- Phase one: the data survey which consists of collecting data that are considered important risks in construction industry.
- Phase two: questioning the first three company classes in Jordan, in order to rank and declare the most important risks affecting the construction firm.
- Phase three: running statistical analysis using SPSS to give abetter description of the risks of the risks involvement.

- Phase four: is dedicated to the most appropriate solutions for the major risks. These solutions have also been discussed with specialists in the construction field.

1.6 Thesis Organization

The thesis was divided to five chapters as given in the following sequence:

- Chapter One gives a general introduction about the risk that usually occurs in construction firm. Objectives, methodology, and project strategy is illustrated in this chapter.
- Chapter Two was mainly dedicated to tell about the literature review that was carried out in this study. It also talks about the theoretical background and the assessment of the risk management.
- Chapter Three analyzes the results obtained by the first questionnaire using SPSS software.
- Chapter Four shows the data survey and the piloting methods that were implemented in order to construct the first and the second questionnaires. It also analyzes the data that were collected and emphasizes the ranks, scores, and some solutions for top ranks.
- Chapter Five presents the conclusions and recommendations obtained by this study and recommendations for future work.

LITERATURE REVIEW

The following literature review reveals time-cost relationship and risk management in construction projects, the papers presented discuss risk management with special emphasis on risk management in the construction industry.

2.1 Risk Management Definition and Systematic Approach

Abbasi examined different alternatives available to project managers before and during project implementation. His paper dealt with the project risk management environment. He proposed a systematic modeling approach to project risk management which consisted of five steps: project identification, risk element classification, quantifiable risk calculation, quantifiable risk evaluation, and risk calculation. The paper furthermore highlighted the significance of information system data base in the development of sound risk modeling. The paper handled risk management as a decision support tool, rather than as a meaningful substitute for managerial judgment. It introduced data flow diagrams (DFD) technique for structured documentation that enabled the description of an existing or proposed system. The paper explained how to implement risk management and discussed an example of the implementation process. It concluded that project management is a dynamic process, which consisted of various phases ranging from project conception to termination. The proposed system for managing project risks studied and evaluated both qualifiable and quantifiable project risks. The system "is considered as part of the organization, and required special data preparation and information gathering over all the project life cycle" (Abbasi, 1997).

Mills reviewed systematic management approaches to risk. He recommended that risk should be identified and managed early in the procurement process. He described the construction industry as one of the most dynamic, risky, and challenging business, and as a

one, which had a very poor reputation for managing risk, with many major projects failing to meet deadlines and cost targets. He explained that those facts are influenced greatly by variations in weather, productivity of labor and plant, and quality of material. He stated that all too often risks were "either ignored, or dealt with in a completely arbitrary way: simply adding 10 percent contingency onto estimated cost of a project". He then described his systematic approach to risk management as a management tool, which required practical experience and training in the use of the techniques. The paper explained how systematic risk management helped to focus on the project, make decisions based on information, minimize potential damage if the worst happens, control the uncertain aspects of construction projects, clarify and formalize the company's role, and identify the opportunities to enhance project performance. After defining risk and introducing the measurement of risk, the paper explained the ownership of risk-transfer and spreading of risk. The paper discussed answers to how to apply risk management, beginning from risk identification, through risk analysis, up to risk response. A case study was presented and finally the paper concluded that the burden of responsibility for identifying risks and dealing with them remains with the party that carries risk. Risk management will not remove all risk from a project; its principal aim is to ensure that risks are managed in the most efficient manner. The author underlined the fact that risk management should be viewed as a positive process, and can be one of the most creative tasks of the project manager (Mills, 2001).

2.2 Risk Perception

Akintoye and Macleod (1997) on the basis of a questionnaire survey of general contractors and project management practiced, described the construction industry's perception of risk associated with its activities and the extent in which the industry uses risk analysis and

management technique. The objective of their study was to obtain feedback from construction contractors and construction project management practitioners on some aspects of risk analysis and management: risk perception by the construction industry, organizational risk management, risk premium in construction projects, the management of risk, and finally the current usage of management techniques. The study discussed the research survey which concentrated on two categories of respondents: contractors and project management practitioners. The sample for the survey was a total of 100 top firms in the UK construction industry comprising 70 general contractors and 30 project management practitioners. The study described the questionnaires used and analyzed the results. It discussed risk perception according to the results of the survey. The authors concluded that the risk perception of construction by the project management practices are not markedly different from the general contractors. The study then discussed organizational risk management on the basis of the results of respondents' answers to the question: why risk management (identification, analysis, assessment and control) is important to their organizations' activities.

The research stated that project management practices and contractors have different reasons for using risk management. As to risk premium in construction, the research used a similar methodology to analyze the results. The authors discussed risk management from the perspective of risk reduction techniques, which included in terms of potential impact or probability of occurrence - the "use of alternative contract strategies, different methods of construction, project redesign, more detailed and further in depth site investigation, etc." Finally, the researchers concluded that risk elements associated with construction projects influence the time, cost and quality of performance of the project. They argued that "risk management therefore become a continuing activity in project development, from inception and throughout the life of the project". The research also concluded that the responses to the

strategies for dealing with risk in construction suggest that the industry is mostly risk averse. The contractors transfer risks to their domestic and specialist sub-contractors and through insurance premiums. Project managers resort to professional indemnity insurance to transfer risks associated with services provided to clients. An important conclusion the research underlined was that "although risk management techniques have been used in other industries for a long time, the construction industry has approached risk management in terms of individual intuition, judgment and experience gained from previous contracts", and that "one major drawback of risk analysis techniques is that the more powerful and sophisticated the technique, the more data and time is required" (Akintoye and Macleod, 1997).

2.3 Extending the Risk Process to Manage Opportunities

Hillson extended the scope of the risk process to include opportunity management explicitly, encompassing both negative and positive effects. He, then, proposed specific strategies for responding to identified opportunities. He explored new aspects of risk away from the traditional view of risk, which is, according to him "negative, representing loss, hazard, harm and adverse consequences". He introduced what he called possibility of "upside risk" or opportunity, i.e." uncertainties that could have a beneficial effect on achieving objectives". His paper extends the scope of the risk process to include opportunity management explicitly. He concluded that a single extended risk management process can effectively handle both opportunities and threats, and that there is, therefore, no need for a separate process focused exclusively on opportunities. His paper argued that the risk management process tended to focus on management of threats, "reflecting the common experience of risk practitioners who find it easier to identify potential pitfalls and problems than to look for hidden advantages or upsides". The paper recognized both

positive and negative risks, and used a particular risk management process as an illustration of how opportunity management can be integrated. It applied necessary modification on the process to achieve its goals. The paper discussed risk management planning, risk identification, the analysis of qualitative and quantitative risk analysis, risk response planning, and finally risk monitoring and control. The paper outlined a number of simple extensions to the standard risk management process. In particular, some new risk identification techniques are proposed to explicitly look for upside uncertainties (Hillson, 2002).

2.4 Risk Management in Construction Projects

In their work "Contractors' risks in Design, Novate and Construct contracts", Ng and Skitmore described the risks involved in contractors' risk in design, novate and construction contracts. The Design, Novate and Construct (DN&C) system has become an increasingly popular method of construction procurement. The authors described the DN&C system, and the contractual rights and liabilities of the design team, and how they are transferred to the contractor once appointed. The paper identified the results "of a series of interviews with construction projects managers experienced in DN&C work. These showed that the major risks to contractors in DN&C are concerned with the novated design team's ability to perform, the lack of design team fees allocated to the post-novation phase, the working relationship with the novated design team, and the timing of the novation" (Ng and Martin, 2002).

2.5 Time Factor in Construction Project

Albert Chan, presented time-cost relationship of public sector projects in Malaysia, found that the duration construction period can be modeled by a time cost formula. In his paper,

he tried to identify whether such time-cost can be extended to the building projects in Malaysia. He collected time and data cost data from 51 public sector projects to verify whether such a relationship holds using regression analysis. The author discussed the characteristics of the construction industry in terms of management, labor, contracts and construction development. He emphasized modeling construction time on the basis of a formula that represents the relation between the duration of construction period from date of site possession to practical completion in working days and the final cost of building adjusted to constant labor and material prices. He then formulated his research hypothesis and discusses examples of data analysis according to his findings. The paper suggested an equation representing time and cost relationship for public projects. Finally, the paper discussed the results using correlation and linear regression analysis. It concluded that the suggested equation can serve "as a convenient tool for project managers and clients to predict the average time required for the delivery of a building project". It furthermore concluded that the equation can serve "as an important benchmark for future research to study the time performance of building projects in Malaysia and facilitate international comparison of time performance (Chan, 1999).

Nkado found that factors influencing construction time can be prioritized. Those high on the priority list are generally identifiable from project information and directly quantifiable by the contractor. He explored "explanations for possible causative patterns and suggestions for strategies to compress the construction durations of various types of building projects, on the basis of the lessons learned from recent Hong Kong-based surveys and research findings". He presented a regression-based model developed from Hong Kong public housing construction project data "for predicting the durations of the primary work packages in the building process and the overall completion period. Finally, the principal survey results of three parallel investigations, which sought out the critical contributors to

faster construction in Hong Kong within each of three different building sub-sectors", were presented and analyzed (Nkado, 1995).

2.6 International Examples of Management (Hong Kong, Russia)

Shen Li Yen documented in 1996 the experience of Hong Kong in managing risks in the construction industry. His paper tried to identify what practitioners in Hong Kong consider to be the most serious project delay risks and the effective actions for managing these risks. It provided an indication of the limited application of various analytical techniques available for risk assessment in the Hong Kong construction industry. The data used in the study were based on an investigation on practical action of managing project delay risks in Hong Kong. The investigation was undertaken "by sending a questionnaire to the construction practitioners who were at or above project management level in various construction firms. The questionnaire was divided into two parts. The first part concerned the risks associated with project delays and their related importance in practice. The second part concerned the actions for managing delay risks. After discussing risks associated with project delays and their identification, the study stated the findings and results and their implications. Risk management actions were described as actions adopted by practitioners to respond to various risks. "In the survey, two kinds of risk management actions were presented to the respondents: preventive actions and remedial actions. Preventive actions are used to reduce, avoid, or transfer risks at the earlier stage of project construction, and remedial action is for minimizing the effects of risks when they happen or when they have to be taken. The respondents were required to indicate the relative effectiveness of each of the methods presented to them, for the actions to be taken on both of the two kinds of risk management actions.

After presenting the results of the survey, the author concluded that whilst the project delay

risk investigated in the study may not be unexpected in general construction business, the study examined those risks relative contributions to project delays within the Hong Kong construction industry. The study revealed, significantly, that methods where practitioners' experience and subjective judgment were used, proved to be the most effective and important risk management action; and that methods using quantitative analytical techniques had been rarely used due to limited understanding or experience (Shen, 1997).

Ahmad et. al. outlined risk management trends in Hong Kong construction industry. He compared between the perceptions of contractors to allocate greater portions of risks to themselves. Their paper reported a study carried out to compare the attitudes and perceptions of Hong Kong construction contractors and owners on the importance of various construction risks and also how the risks should be allocated between the parties to the contract. After stating that "different parties to a construction project face a variety of uncertain factors, which can be compiled under the category of risk, the paper discussed the objective of the study it presented. It defined the goal of the study as a "means to evaluate the present perceptions of Hong Kong construction contractors and owners regarding risk importance and allocation. The methodology of the study was explained. The research was conducted by means of a questionnaire survey. A total of 150 questionnaires were sent out. The questionnaire consisted of three sections: the first solicited general information about the respondent, the second carried an inventory of 26 project risks, and in the third section, the respondents were asked to give any comments or suggestions which they thought might be of further assistance to the study. The paper then gave the results of the survey and analyzed them.

One of the major results the study concluded revealed that "contractors have allocated six

risks onto themselves while the owners have allocated only five risks to contractors. Both the contractors and owners have similar views on the risks to be allocated to the contractors. They agree that the contractors should bear the risks of labor and equipment productivity, defective materials, and labor, equipment and material availability". Contractors contend that owners should bear the risks of change in work, deficiencies in specifications and drawings, and defective design. Contractors appear to be ready to accept the risks of quality of work, labor disputes, and suppliers /subcontractors' poor performance. The study ranked the most and least important risk categories (for Hong Kong contractors). The result showed that Hong Kong contractors consider delayed payments contracts to be the most important construction risk giving it an average score of 9.1 on a scale of 1-10. It is followed by risk of contract delay resolutions, with an average score of 8.7. The least important risk from the contractors' point of view was the risk of political uncertainty after the 1 July 1997 handover of Hong Kong to China (5.3/10), the risk of changes in government regulations (6.0/10). The Hong Kong owners' perceptions on the most and least important risks were different: site safety was considered the most important construction risk receiving average score of (9.0/10), followed by risk of quality of work (8.4/10). Similar to contractors, owners also gave an exceptionally low average score of (5.8/10) to political uncertainty after the 1 July 1997 handover of Hong Kong to China, followed by the risk of acts of God (6.3/10). The paper concluded that the results indicate positive trends where owners are ready to accept certain risks as mentioned above, and that there is a great similarity in the manner the contractors and owners have to the section on risk importance (Ahmad, Riaz and Saram, 1999).

Zarkada and Frazer reviewed the concept of risk management in a volatile socio-economic climate in Russia. They implemented the international marketing theory to identify political

risk in construction. Their paper examined the concept of political risk as perceived by UK practicing marketing managers involved in the Russian construction market. It presented their assessment of its impact on the decision making process, its constituency and its evolution through time, as the paper states. The paper's scope was empirical, since the chosen industry was "one of a distinct nature and culture, and the environment under study is volatile and largely uncharted". The authors of the paper reviewed the literature concerning the subject of the paper. They adopted a definition of political risk as being "the aggregate negative effect of governmental and social actions and / or inertia on a select group or all foreign concerns operating in or wishing to penetrate a country' market". They explained Russia's evolving market for construction firms and put the research questions: Is political risk the major determinant of new market entry, or are other factors more important? Does political risk hold a greater bearing when a volatile market is being considered than when a stable one is? The paper described the population of the empirical research defined as UK construction firms that are either involved already, or in the process of researching the Russian market. It then presented the empirical results in three categories: the impact of political risk estimates on market entry decisions, the aspects of political risk for foreign construction firms in Russia, and the perceptions of political risk by length of presence and degree of involvement in the Russian market. The paper finally concluded that " political risk is a major consideration at the stage of researching and penetrating a foreign market", and that "despite the multitude of inherent problems, construction firms from all over the world, and the UK in particular, are anything but indifferent towards it". The authors also conclude that "several factors are perceived as contributing to political risk including governmental and social actions and attitudes" (Zarkada and Fazer, 2000).

Aleshin developed a Risk Management Support System for construction industry in Russia.

He studied risks inherent to joint venture projects with foreign cooperation in Russia, and these were identified, classified, and assessed. Thus, cause –and-effect connections of risks among themselves, as well as with other project components, was established. His paper was based on the results of an empirical study of 16 completed projects of the Dwelling Construction Program for the Soviet troops withdrawn from East Germany. The author identifies, classified and assesses risks using a technique of risk analysis applicable to Russian conditions. The paper explained the approach and contents of the research in risk event identification, classification, assessing and ranking of risk event groups, and finally present detailed results of the study together with the decision support system (DSS) it suggests. The author concluded that "the introduction of investigation results and risk management support system in the practice of project management allows Russian and foreign participants to increase their competence in the area of risk management in Russia and to make the project implementation more Successful (Aleshin, 2001).

2.7 Theoretical Background

Risk is a concept that managers and engineers use to express their concerns about the probable effects of an uncertain environment. Because the future may not be predicted with certainty, managers and engineers have to consider a range of possible events that could happen. Any event of these could have significant effects on the project and its objectives. The negative effects are named, “risks” while the positive effects are named,”opportunities”.

Managers put assets at risk to achieve objectives; prudent managers take risk with assets, otherwise they can’t gain any goal. That is true for all kinds of sectors: private, public, and non- profit sectors. The assets at risk include:

- Financial assets, such as cash and investments,

- Human assets,
- Physical assets, such as buildings and tools,
- Intangible assets, such as reputation.

Risk is not something to be worried about, but something that needs to be managed. Risk management includes risk analysis plus the prudent processes that emerge from awareness of the results of managing projects in uncertainty (Appleby, 1984).

2.7.1. Risk Management Definition

Risk can be defined as "the possibility of loss, injury, disadvantage, or destruction". This definition may cover all types of risks such as technical, cost, and schedule risks. There is also the consideration that acquisition risks such as health, safety, weather, insurance, finance, environment, and policies, are part of and often mingled with other venues of risks. Risk is a conceptual notion used by managers and engineers to express concerns about the possible material effects of uncertain circumstances.

In general, risk management is a practice with processes and methods for managing risks in a project. Risk management provides a good environment for proactive decision making to

- assess what could go wrong, i.e. risk,
- determine which risks are of high priority and which are of medium, and of low priority,
- develop risk management strategies and plans,
- authorize the implementation of risk management plans.

One of the more useful constructs of risk management is that a risk as a possibility consists of a likelihood and of consequences. This definition is derived from the elementary mathematical concept of expectation of an event. Expectation for some event is defined as the product of its probability of occurrence and its value if it occurs.

The probability of occurrence depends on the managers' attitude towards risk, so “managers can take risk into account when selecting projects. The returns they receive will depend on their attitude towards risk (Appleby, 1984).

2.7.2 Functions of Risk Management

Risk normally goes through definite functions sequentially, but the activity in itself occurs continuously throughout the project life cycle. These functions may be summarized as follows:

- Identify : search for and locate risk before they become problems.
- Analyze : transform risk data into information, evaluate impact, classify, and prioritize risks.
- Plan : translate risk information into plans.
- Track : monitor risk indicators and actions.
- Control : correct any deviations from plans.
- Communication : provide information and feedback on risk activities.

It goes without saying that communication with others in this regard happens throughout all the functions of risk management. Also, it is necessary to mention and concentrate on the meaningfulness to rank the risks in assigning priorities of the task of prioritizing process.

The risks are performed usually at the senior staff level to assure that all political, business, and programmatic factors are weighted in the priority assessment. The purpose is to avoid the “successful operation, but the patient died” syndrome. The ranked risks are viewed in terms of combined likelihoods, consequences, and in terms of concerns with missions, functions, business objectives and political aspects.

As for developing risk management plan, the plan should encompass and approach risk management that commits the program to significant emphasis on all risks considered to be

from moderate to high. Such risks will have specific risk management plans that will have a flag indicating that a high or moderate risk is associated with the effort being exerted. Risks considered of a low ranking can be delegated to routine management, and such risks do not require specific risk management plans (Appleby, 1984).

2.8 General Concepts in Risk Management

There are a few key concepts in risk management, and these concepts can be understood and applied easily.

2.8.1. Principles in Risk Management

There are no fundamental scientific laws in risk management. Most of risk management is qualitative and subject to judgment colored by experience. However, any element of venture that entails a new aspect for the performing organization is a source of risk. Incompetence, negligence, and accidents are examples of newness in this connection. In the present context, inexperience is a synonym for newness.

The secret to risk management is to be creative in applying tests for newness to the activities, tools, people and products that constitute the venture. No two ventures will have the same risks and no two organizations will face the same consequences for a given set of risk.

As for SEI (Software Engineering Institute), there are seven principles which provide a framework for effective risk management:

1- Global perspective.

2- Forward- looking view.

3- Open communication.

4- Integrated management.

5- Continuous process.

6- Shared product vision.

7- Teamwork.

These principles address the need to establish and implement a continuous process for the effective management of risk (Software Engineering Institute, 2002)

2.8.2 Types of Risks

Risks may be classified into five types: programmatic, schedule, cost, technical, and supportability, as follows:

a. Programmatic risks: those risks that flow from or impose an impact on program governance, and those risks that impact program performance. The risks for governance may be

1) external, such as political, litigious, or contractual risks, or
2) internal, such as business priorities, staff limitations, rate on investment constraints, and learning curves.

In this context, risks that impute on program performance generally flow from issues of competence, experience, organizational culture, and skills of the management team.

b. Schedule risks: schedule risks imply that not enough time exists to do the required job within the limited resources allocated from people, material and money.

c. Cost risks: Cost risks mean that there is not enough money to do the job required in the time allocated. The causes of such risks can be attributed to errors, low bidding or business decisions. It appears that the procurement agencies understand what is reasonable in terms of accuracy of estimates. For example, in the construction industry in the United States, it is common practice for a contractor builder to add 25% or more to the quoted cost to construct any plan that the particular contractor has not built before.

d. Technical risks: Those risks that affect the performance level. From the viewpoint of the performing organization, the concern is that their performance will not meet the specifications required.

e. Supportability risks: The supportability risks mean that the job will cost too much to operate and maintain over its life cycle in terms of time, personnel, and material resources. It is a fact that some machinery may cost more to sustain than to develop (Melvin, 1982).

2.8.3 Risk Management Structure

The basic structure recommended for risk management consists of a risk manager who is in charge of the definition, structure, implementation, communication and coordination of a risk management approach. It is the risk manger's responsibility to coordinate the risk management activities in accordance with the organization's policy.

The risk manager schedules and oversees the production of all risk reviews, either as isolated events or as part of management reviews. This includes alerting risk board members of support requirements for such reviews. The risk manger is also in charge of preparing and distributing the minutes of meetings for risk board members.

One of the main risk situations facing the risk manager is forming teams and selecting team members. Such a situation requires additional staffing. When new people are hired, some of the negative aspects are that people will start making decisions with less than complete understanding of the organization and the customers. The most important solution is communicating, and communicating. Staff meetings are essential to the process (Appleby, 1984).

The purpose of such communications is to impart mission, functions, goals, priorities, and other guiding information to all team members at the right time. It is recommended that

each new employee gets a thorough introduction to the organizational climate, contracts, technical things, quality, safety, manufacturing, test laboratories, and shipping.

2.9 Risk Management in Construction Field:

Construction managers operate in a fast changing environment. There are a lot of threats to their ability to make profits for the organization they work for: suppliers tend to raise prices of material, employees like to have higher salaries, and the bad weather may cause delay in meeting the target date.

Being faced with such threats, construction managers should make decisions and solve problems. It goes without saying that construction problems are too complex, because the interrelationships of the elements of the problem are too complicated.

2.9.1 Decision making in the construction industry

There are many obstacles that hinder easy decision making and make decision making a difficult process. Complexity, uncertainty, and multidimensionality are examples of these obstacles.

The decision maker, controlled by the decision situation, has the authority and the responsibility to act in choosing the right course of action.

Construction managers with differing business experiences, education, and personal motivation can evaluate differently the identical project data. Some contractors, for example, may accept low profit margins and high risk rate in exchange for personal satisfaction and public recognition associated with prestige projects, such as the tallest building in the state, a high- arch bridge, or an enclosed stadium (Lifson and shaifer, 1982).

Of course, there are conditions that affect the results of the decision. These conditions are called states of nature. Depending on how much we know about the states of nature or the business environment, we can refer to decision making under:

a. Certainty: decision making under certainty occurs when the state of nature is a complete certainty, that is, a probability of 1.00 can be assigned to a specific state of nature.

b. Risk: decision making under risk refers to the condition in which there are many states of nature, and the decision maker knows the probability of occurrence for each state of nature in certain businesses, the probabilities of the respective states of nature are known since they are based problems for optimum stocking of machinery replacement parts. This is a good example of decision making under risk since historical data on parts replaced can be collected for a certain period of time.

c. Uncertainty: the third type of decision criteria relates to decision making under uncertainty. In this type, the probabilities of occurrence for the states of nature are not known. This may happen when there is no past experience.

For assessing the probabilities of occurrence for the states of nature, problems associated with new products, and increasing plant capacity are examples of decision making under uncertainty.

d. Competitive conditions: decision criterion under competitive conditions occurs when the strategies and the states of nature are determined, to some extent, by the actions of competitors. Under these competitive conditions, the field of decision theory expands into what is called, "game theory" (Melvin, 1982).

2.9.2 Models of a Decision:

We will introduce in this study two models: the decision tree and the pay off matrix.

1. **The Decision Tree**

The decision tree is basically a graphic representation of probability logic applied to decision alternatives; a decision tree is so named because it looks like a tree, although for convenience it is a horizontal one.

The base of the tree is the beginning decision point. Its branches begin at the first chance event. Each chance event produces two or more possible effects, some of which lead to other chance events and subsequent decision points.

Its branches begin at the first chance event. Each chance event produces two or more possible effects, some of which lead to other chance events and subsequent decision points. Figures on which the tree values are based come from research. These provide probabilities for certain chance events and predicted pay off or cash flow estimates of each possible outcome.

2. **The Payoff Matrix**

As we mentioned before, decision making under certainty occurs when the decision maker is sure of the state of nature that will occur with complete certainty. In a pay off matrix, there is only one column that applies.

The alternatives (strategies) are listed along one side of the matrix, and the states of nature are listed along the other side (Melvin, 1982).

In some cases, the payoff matrix cannot be written down since the number of strategies is large. This can be best illustrated by an example in a manufacturing plant where there are many machines of different sizes and for different purposes. Each machine of these requires various amounts of total time for each customer contract. The resulting cost difference makes the machine suited for a particular contract. The set for all the possible rows and columns would not be economically feasible.

2.9.3. Environment of a Decision: the Construction Project

A decision maker works in a decision environment which includes events, activities, and people around him. The decision environment in the construction industry must be considered when making a decision. A well-managed project follows a sequence of phases which are represented in the following construction project life cycle (Lifson and Shaifer, 1982):

(a) Concept selection

A project sponsor decides to initiate concept selection in response to a perceived need or opportunity. Four major decisions are made during this phase of life cycle:

1. To proceed with or drop the project: this decision is based on a facility study, an analysis and evaluation of the technical, economic, financial, legal, and sociological risks of continuing the project.

2. To select the best approach or concept for design and development: This decision is based on preliminary approach studies, the synthesis, analysis, and evaluation of various alternative candidate concepts for accomplishing project objectives. The choice of concept includes site selection, where appropriate.

3. To approve a set of design requirements for the facility to be constructed: This decision is also based on the preliminary approach studies that includes not only descriptions of alternative concepts, but also a comparative analysis of performance, cost, and schedule projections for each concept over the remaining phases of the life cycle.

4. To approve a project plan for the remaining phases of life cycle, the approved plan includes not only program and budget items but also financing milestones.

(b) Design and development

The design and development phase transforms design requirements into drawings, specifications, and instructions for producing, testing, constructing, installing, using,

supporting, and maintaining a facility. Many intermediate value engineering and management decisions are concerned with assuring component economy, contractibility, and occupancy, as well as with scheduling and coordination of available building resources that are made during this phase. The ultimate decision milestone is the approval of a set of drawings and specifications for production and construction, controlled to assure the budget parameters of the selected concept.

(c) Use

This phase represents the use of the installed system; myriads of decisions are made during the management, operation, maintenance, repair, and modification of the system.

The primary responsibility for major management decisions during concept selection design and development, and production/installation/ constructions lies with the construction project manager or sponsor.

Other major participants e.g. architect, engineer, contractor, users, are involved with the life cycles of their own projects, each comprising a sequence of decisions, that intersect the sponsor's activities and decision making (Lifson and Shaifer, 1982).

2.9.4 Estimation Techniques

During risk assessment, the risk analysis team gathers data, evaluates the current environment, and identifies areas of weakness. Risk assessment entails a careful inspection of applied systems. It provides the risk analysis team with the ability to assess the quality and completeness of the existing systems. This can be accomplished by focusing attention on and analyzing each stage of the information life cycle which begins with data origination and continues with data entry, processing, storage, and disposal.

Risk assessment requires identifying the risk or probable consequences and losses, and estimating the likelihood of undesirable events occurring. Risk analysis can be best

accomplished by a team of individuals representing a variety of disciplines. Management should demonstrate its support in this field by

- endorsing the selection of the risk analysis team members and delegating authority for the task,
- explaining the purpose and scope of risk analysis,
- expressing support for the risk analysis process,
- reviewing and supporting the team's findings.

The success of risk analysis program depends on how much the top management is involved in supporting the process. In general, risk analysis is often used to include two kinds of assessments (Smith, 1993):

(a) The frequency or probability of the event.

(b) The consequences of the event.

The analysis of consequences is a special area within each industry and may be based on chemical, electrical, gas or nuclear technology.

Various techniques to risk management are available to management. These techniques may be divided into four types: Judgment, historical data, hazard analysis, and mathematical techniques.

Judgment

Judgment approach is used under uncertainty circumstance. This means that the probabilities of occurrence for events are not known. The simplest way to obtain probabilities is to ask those who are involved in probabilities that quantify their estimates concerning risks associated with outcomes.

A manager may not be experienced in quantifying beliefs about uncertainties. Sometimes it is not easy to convert the works such as “good chance of getting a contract” to probability

numbers. In fact several techniques are used to help mangers estimate probabilities as greater than or less than. Sometimes, the manager may select a number at random from a set of numbers to be utilized to estimate probabilities. Always, we must make sure that the probability numbers resulting from judgments must satisfy fundamental probability concepts.

Historical Data

This method may be of best use for managers, since they are able to establish frequencies of events to guide their judgment regarding probabilities.

A good source of information is the records of organizations, e.g. cost records, profit or loss records. But one of the drawbacks of this method is the effect of external factors such as the political situation, economic threats, competitors, and the probability of industry influencing the construction of decision.

Care is to be exercised when using this method because conditions that are expected to happen are rarely duplicated exactly.

2.10 Concluding Remarks:

Based on the literature review and the theroical background carried out in this study, it was noticed that there is a lack of knowledge about the real factors that influence the progress of the work.

In the middle east, different understandings are implemented and the project is influenced by different aspects. Financially it is important for the contractor to get his payments at the same time he is funding the project. Administration wise, most of the contractors who are running the business are not sufficiently qualified to monitor all engineering tasks that may be presented in the project. Manpower is also important factor that most of the projects are

in deep concern.

Resources are very important in defining the project manner and it is always important to specify the required materials and to give alternatives. Technical issues may change the entire progress of the project depending on the correct understanding of the specifications required.

Therefore a comprehansive study was carried out in order to investingate stastically the major risks that influence the construction industry in Jordan. The following chapters illustrate in details the process adopted in collecting and anlysing the risks based on simillar stuides provided in the literature review.

STATISTICAL ANALYSIS

3.1 Introduction

Construction is a risky business under the best circumstances. The fact is that for many small and medium-sized companies, the next project is the one that could put them out of business. Even the big companies are not immune to this pressure.

An experienced claim professional recognizes the warning signs. More importantly, he or she knows how to avoid these pitfalls in the first place. Litigation is the last resort. The primary role of an experienced claim professional is risk management, starting at the beginning of the project, not the end.

Nevertheless, this attitude can also lead to trouble when tight contract clauses are involved. The motivations of other parties must also be considered. Chances are that someone is unhappy with their profit margin or has financial difficulties.

Every construction project is a compromise to some extent. The owner might have wanted a slightly lower price, the contractor may have wished for a little more time, a supplier might have preferred more favorable payment terms. With a little luck and considerable effort everyone can hopefully be satisfied with the finished project.

3.2 Data Survey

For the reasons mentioned above, an investigation was undertaken by sending a questionnaire to construction practitioners in three different classes in Jordan (these classes were considered according to the classification of the Ministry of Public Works and the classifications of the Contracting Associations which classified the contractors according to their budget, assets and employees). This questionnaire is designed to analyze the problems and the risks that may face the contracting companies in the construction industry firm. Depending on the company's ranks; first, second and third class companies (according to

the classification of Ministry of Public Works and the classifications of the Contracting Associations) were the only ones provided with the questionnaire in order to be filled by the specialized people working there.

The risks proposed in this questionnaire were chosen after deep argument and lots of meetings and discussions with the people involved in the construction area, project management, statistical analysis and computing works.

The questionnaire was divided to five major categories. These are: administrative aspects, financial aspects, resources, manpower, and technical aspects. In addition, four other problems were asked as shown in the questionnaire provided in Appendix A3. Numerous questions were adopted in each category in order to give a full description of the major factors that really influence the project behavior. The questionnaire was sent to all companies of the first class, second class, and the third class according to the records of the Ministry of Public Works and Contracting Association. Table 3.1 shows the total number of the companies and those who replied

Table 3.1: Number of companies that were contacted

No. of Companies	No. Sent	No. Replied
First Class	49	37
Second Class	50	40
Third Class	104	92

After the preliminary analysis of the survey results from the questionnaires were received, another questionnaire was sent to a number of companies to define the proposed solutions for each problem of the previous questionnaire (Appendix A5). This is meant to be a proposal suggested by some specialized companies in the construction firm who really know what are the most reasonable solutions for each case.

3.3 Setting up the First Questionnaire

The risks that were obtained by the piloting study were presented in a structural format and tied up in a questionnaire manner. Each category contained all relevant risks that were suggested by the contractors themselves.

An indication of the relative importance of these risks in the construction field is given by examining practitioners' observations and judgments. Each question was given 4 choices for answer depending on the degree of the importance of the case. Grade 4 indicates that the risk is very important and decreasing value indicates that the risk is less important. The minimum mark for each risk is 1 and it indicates that the risk is not important at all. A copy of the questionnaire and detailed discussion is presented in Appendix A4.

3.4 Data Analysis Using SPSS Software

All scores obtained by the first questionnaire were filled directly in the SPSS software in order to run the relevant statistics that explain and give more details of the important risks, and of the relationships between the company class : first, second, or third, and the problems that may occur.

Tables 3.2-3.5 discuss the descriptive statistics for the respondent answers for all company classes.

The grand mean score for the respondent answers in the first class companies is (3.2932) which is between fairly important and important. The largest mean in this category is for the respondent answers in the administrative problems (3.3884) with a standard deviation (0.3397), while the smallest mean is for the resources aspects (3.1662) with a standard deviation (0.4124).

Table 3.2 Means and standard deviations for the respondent answers in the first class companies.

No.	Category	Mean	Standard deviation
1-	Administrative	3.3884	0.3397
2-	Financial	3.2528	0.3448
3-	Resources	3.1662	0.4124
4-	Manpower	3.2998	0.3723
5-	Technical	3.3587	0.3514

Regarding the descriptive statistics for the respondents answers in the second class companies table 3.3 shows their means and standard deviation.

Table 3.3 Means and standard deviations for the respondent answers in the second class companies.

No.	Category	Mean	Standard deviation
1-	Administrative	3.1692	0.4225
2-	Financial	3.3639	0.3900
3-	Resources	3.2571	0.4833
4-	Manpower	3.3068	0.5648
5-	Technical	3.3432	0.4751

The grand mean score for the respondent answers in the above table is (3.2880) which is between fairly important and important. The largest mean in this category is for the respondents answers in the financial problems (3.3639) with a standard deviation (0.3900),

while the smallest mean is for the manpower problems (3.3068) with a standard deviating (0.5648).

As for the descriptive statistics for the respondents answers in the third class companies table 3.4 shows their means and standard deviation.

Table 3.4 Means and standard deviations for the respondent answers in the third class companies.

No.	Category	Mean	Standard deviation
1-	Administrative	2.8470	0.4202
2-	Financial	2.9809	0.3676
3-	Resources	2.8564	0.4392
4-	Manpower	3.1176	0.4333
5-	Technical	3.1196	0.4009

The grand mean score for the respondent answers in the above table is (2.9843) which is between somewhat important and fairly important. The largest mean in this category is for the respondent answers in the technical problems (3.1196) with a standard deviation (0.4009), while the smallest mean is for the administrative problems (2.8470) with a standard deviation (0.4202).

3.5 Hypothesis Investigation

The major hypothesis adopted in this study was based on the assumption that the company problems are increasing with the rising in the company classification. This was correctly approved by the SPSS as shown in Fig (3.1).

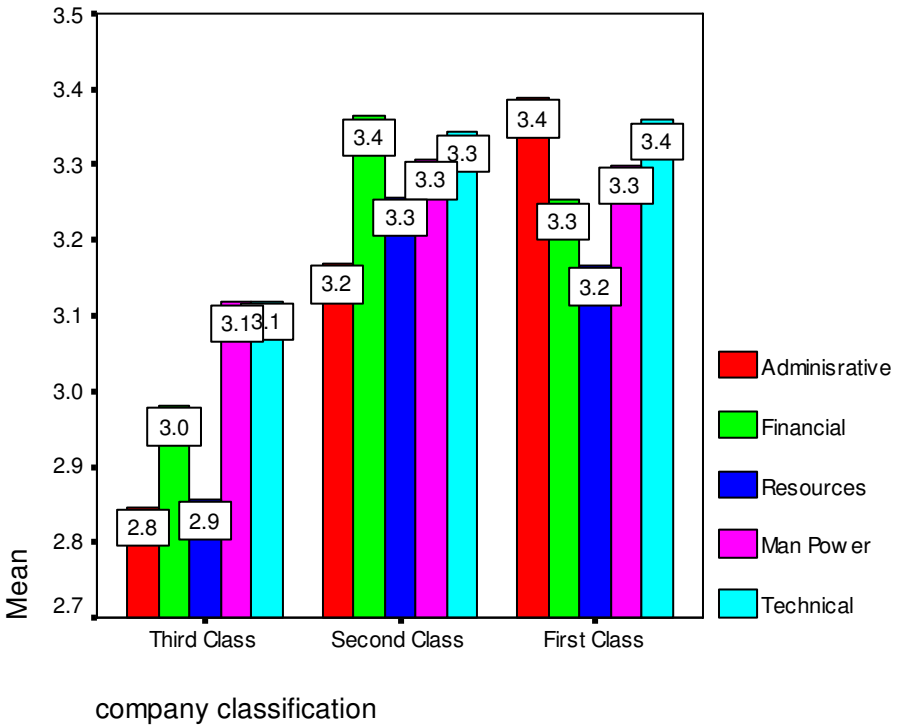

Figure 3.1 Hypothesis Investigation

The same figure shows a full distribution of each category. A Significance Level of 0.05 was used for this hypothesis. This major hypothesis was divided to five other minor hypothesis, these are:

Hypothesis No. One:

H_0: There is no difference in the mean value for the administrative aspects due to the company classification.

H_a: There is difference in the mean value for the administrative aspects due to the company classification

To test this hypothesis, an analysis of variance (ANOVA) was utilized. The results of the analysis (Table 3.5) show that F = 26.220. Since the F value of 26.22 is greater than the critical value of $F_{0.05}$ (2,166) which is equal 3.00, and P value in the table is 0.00 which is

smaller than 0.05, we can reject H_0 with 95% confidence interval and conclude that there is a difference in the administration aspects due to company classification

Hypothesis No. Two:

H_0: there is no difference in the mean value for the financial aspects due to the company classification.

H_a: there is difference in the mean value for the financial aspects due to the company classification.

To test this hypothesis, an analysis of variance (ANOVA) was utilized. The results of the analysis (Table 3.5) show that F = 17.63, Since the F value of 17.63 is greater than the critical value of 3.00, and the p value is 0.000which is smaller than 0.05, we can reject H_0 with 95% confidence level and conclude that there is a difference in the financial aspects due to company classification.

Hypothesis No. Three:

H_0: there is no difference in the mean value for the resources due to the company classification.

H_a: there is difference in the mean value for the resources due to the company classification.

To test this hypothesis, an analysis of variance (ANOVA) was utilized. The results of the analysis (Table 3.5) show that F = 13.931. Since the F value of 13.91 is greater than the critical value of $F_{0.05}$ (2,166) which is equal 3.00, and P value in the table is 0.00 which is smaller than 0.05, we can reject H_0 with 95% confidence level and conclude that there is a difference in the mean value for resources due to company classification.

Hypothesis No. Four :

H_0: there is no difference in the mean value for the manpower due to the company classification.

H_a: there is a difference in the mean value for the manpower due to the company classification

To test this hypothesis, an analysis of variance (ANOVA) was utilized. The results of the analysis (Table 3.5) show that F = 3.484. Since the F value of 3.484 is greater than the critical value of $F_{0.05}$ (2,166) which is equal 3.00, and P value in the table is 0.033 which is smaller than 0.05, we can reject H_0 with 95% confidence level and conclude that there is a difference in the mean value for the man power due to the company classification.

Hypothesis No. Five :

H_0: there is no difference in the mean value for the technical aspects due to the company classification.

H_a: there is a difference in the mean value for the technical aspects due to the company classification

To test this hypothesis, an analysis of variance (ANOVA) was utilized. The results of the analysis (Table 3.5) show that F = 6.679. Since the F value of 6.679 is greater than the critical value of $F_{0.05}$ (2,166) which is equal 3.00, and P value in the table is 0.002 which is smaller than 0.05, we can reject H_0 with 95% confidence level and conclude that there is a difference in the mean value for the technical aspects due to the company classification.

Table 3.5: Analysis of Variance (ANOVA) for the Differences in the Mean Value for all Aspects

		Sum of Squares	df	Mean Square	F	Sig.
AVG_ADMI	Between Groups	5366.618	2	2683.309	26.220	.000
	Within Groups	16988.385	166	102.340		
	Total	22355.003	168			
AVG_FIN	Between Groups	2995.166	2	1497.583	17.673	.000
	Within Groups	14066.456	166	84.738		
	Total	17061.622	168			
AVG_RES	Between Groups	3439.532	2	1719.766	13.931	.000
	Within Groups	20492.663	166	123.450		
	Total	23932.196	168			
AVG_MP	Between Groups	905.345	2	452.673	3.484	.033
	Within Groups	21571.182	166	129.947		
	Total	22476.527	168			
AVG_TECH	Between Groups	1401.883	2	700.942	6.679	.002
	Within Groups	17421.103	166	104.946		
	Total	18822.986	168			

Another main hypothesis in this study is that the five major categories presented in the questionnaire are Intercorelated with each others, and therefore ten minor hypothesis can be studied to understand the correlation between each category and the other four categories.

Hypothesis No. Six:

H_0: there is no correlation between administrative aspects with the financial aspects.

H_a: there is correlation between administrative aspect with the financial aspects.

From Table 3.6, note that the correlation between administration and financial is 0.610 which is quite positive, and since the p value of the relationship between the administration and financial aspects is 0.00 which is smaller than 0.05. We reject the null hypothesis with 99% confidence level and accept the alternative one.

This means that there is a significant relation ship between administrative aspects with financial aspects.

Hypothesis No. Seven:

H_0: there is no correlation between administrative aspect with the resources.

H_a: there is correlation between administrative aspect with the resources.

From Table 3.6, note that the correlation between administrative aspects with the resources equal 0.617which is good, and since the p value of the relationship between the administrative aspects with the resources is 0.00 which is smaller than 0.05. we reject the null hypothesis with 99% confidence level and accept the alternative one.

This means that there is a significant relation ship between administrative aspects with the resources

Hypothesis No. Eight:

H_0: there is no correlation between administrative aspects with the man power.

$H_{a:}$ there is correlation between administrative aspect with the man power.

From Table 3.6, we note with 99% confidence level, that the correlation between administrative aspects and man power is equal 0.437 which is not good. This means there is a weak relationship between administrative aspects with man power

Hypothesis No. Nine:

H_0: there is no correlation between administrative aspects with the technical aspect.

H_a: there is correlation between administrative aspects with the technical aspect.

From Table 3.6, note that the correlation between administration and technical is 0.501, which is good, and since the p value of the relationship between the administration and technical aspects is 0.00 which is smaller than 0.05. We reject the null hypothesis with 99% confidence level and accept the alternative one.

This means that there is a significant relation ship between administrative aspects with technical aspects.

Hypothesis No. Ten:

H_0: there is no correlation between financial aspects with resources.

H_a: there is correlation between financial aspects with resources.

From Table 3.6, note that the correlation between administration and resources is 0.635 which is good, and since the p value of the relationship between the administration and financial aspects is 0.00 which is smaller than 0.05. We reject the null hypothesis with 99% confidence level and accept the alternative one.

This means that there is a significant relation ship between financial aspects with resources.

Hypothesis No. Eleven:

H_0: there is no correlation between financial aspects with man power.

H_a: there is correlation between financial aspects with man power.

From Table 3.6, we note that the correlation between financial aspects with man power is 0.621 which is good, and since the p value of the relationship between the financial aspects with man power is 0.00 which is smaller than 0.05. We reject the null hypothesis with 99% confidence level and accept the alternative one.

This means that there is a significant relation ship between financial aspects with man power.

Hypothesis No. Twelve:

H_0: there is no correlation between financial aspects with technical aspects.

H_a: there is correlation between financial aspects with technical aspects.

From Table 3.6, we note that the correlation between financial aspects with technical aspects is 0.612 which is good, and since the p value of the relationship between the financial aspects and technical is 0.00 which is smaller than 0.05. We reject the null hypothesis with 99% confidence level and accept the alternative one.

This means that there is a significant relation ship between financial aspects with technical aspects.

Hypothesis No. Thirteen:

H_0: there is no correlation between resources with man power.

H_a: there is correlation between resources with man power.

From Table 3.6, we note that the correlation between resources and manpower is 0.544 which is good, and since the p value of the relationship between the resources and man power is 0.00 which is smaller than 0.05. We reject the null hypothesis with 99% confidence level and accept the alternative one.

This means that there is a significant relation ship between resources and manpower.

Hypothesis No. Fourteen:

H_0: there is no correlation between resources with technical aspects.

H_a: there is correlation between resources with technical aspects.

From Table 3.6, we note with 99% confidence level that the correlation between resources and technical aspects is equal 0.488 which is not good. This means there is a weak relationship between resources and technical aspects.

Hypothesis No. Fifteen:

H_0: there is no correlation between man powers with technical aspects.

H_a: there is correlation between man power with technical aspects.

From Table 3.6, we note that the correlation between man power and technical aspects is 0.692 which is good, and since the p value of the relationship between the manpower and technical aspects is 0.00 which is smaller than 0.05. We reject the null hypothesis with 99% confidence level and accept the alternative one.

This means that there is a significant relation ship between man power and technical aspects.

It is important to note that the value of Pearson correlation is considered weak if its absolute value is less than 0.5 and can be considered strong if its absolute value is more than 0.5.

Table 3.6: Correlation matrix between all aspects

		AVG_ADMI	AVG_FIN	AVG_RES	AVG_MP	AVG_TECH
AVG_ADMI	Pearson Correlation	1.000	.610**	.617**	.437**	.501**
	Sig. (2-tailed)	.	.000	.000	.000	.000
	N	169	169	169	169	169
AVG_FIN	Pearson Correlation	.610**	1.000	.635**	.621**	.612**
	Sig. (2-tailed)	.000	.	.000	.000	.000
	N	169	169	169	169	169
AVG_RES	Pearson Correlation	.617**	.635**	1.000	.544**	.489**
	Sig. (2-tailed)	.000	.000	.	.000	.000
	N	169	169	169	169	169
AVG_MP	Pearson Correlation	.437**	.621**	.544**	1.000	.692**
	Sig. (2-tailed)	.000	.000	.000	.	.000
	N	169	169	169	169	169
AVG_TECH	Pearson Correlation	.501**	.612**	.489**	.692**	1.000
	Sig. (2-tailed)	.000	.000	.000	.000	.
	N	169	169	169	169	169

**. Correlation is significant at the 0.01 level (2-tailed).

The strongest correlation occurred between the manpower and the technical aspects (0.692), while the weakest correlation occurred between the administrative aspects and the manpower (0.437).

These two results are very logical and indicate the strong relation ship between the technical implementation and the quality of the manpower. It also shows that there is a little connection between the administration and the selection of the manpower.

DATA COLLECTION AND DISCUSSION

4.1 Analysis and Ranks for the First Questionnaire

In order to quantitatively demonstrate the relative importance of the risks to the construction industry, a weighing approach is adopted. The principle is that the risk with higher contribution rank would be assigned the largest score, and the risk giving the lowest contribution will be given the smallest score. As risks have been ranked in four grades, four weights will be applied. For the purpose of simplicity, the four grades in the contribution rank are also used as four weights to indicate the importance of the contribution between the risks. The final score of each risk is equal to the summation of the grades times the number of the contractors who assigned the grade. The findings of the questionnaires were summarized in the Tables 4.1-4.12. The results were tabulated for each company class individually. This gives a better description of the performance of the companies depending on their ranks and on their class.

Bar-chart diagrams were produced in Figures 4.1-4.6 in order to present a clear behavior for all risks of each category. The risks were remarked using a grade system showing each grade for each risk. The score is out of 4 and it is equal to the score of each risk divided by the number of the companies belonging to each class. The bar charts show different heights and this makes it easier to compare between the lowest and the highest effect of each risk.

The three company classes were illustrated in the figures in order to make a quick comparison of each risk depending on the company class. Each company class was given a different bar color. It should be noticed that scores are also given depending on the process described before. All the results for the following problems were tabulated in Tables 4.1-4.12 which based on the first questionnaire results.

Administrative Aspect

1- Employer's direct supervision of managing the project
2- Lack of defining cadre structure in the company
3- Lack of employing computer programs in project management.
4- Absence of administrative experience in business administration
5- Overlap in cadre structure, whether administrative or technical.
6- The contractor's lack of scientific know-how.
7- Lack of applying all specifications agreed upon by the adviser and contractor.
8- Absence of licensed administrative bureaus for contractors.
9- Lack of sufficient administrative cadre for project management.
10- Absence of qualification courses for administrators.
11- Lack of distinguishing between technical and administrative aspects of the project
12- Continuous change in laws, particularly income tax law.
13- Contractor's rank is based on his company's capital.

Financial Aspect

1- The Company obtains large- sum loans
2- Inability to execute the project within specified timetable .
3- The owner lags behind in paying the contractor.
4- The contractor expands his work simultaneously in more than one project.
5- The contractor does not pay worker wages in due time.
6- Incompatibility of work progress (completed work) with cash payments.
7- Weak remitting.
8- Construction prices are low
9- Competition in pricing projects
10- Laws governing payment process and protecting contractor's rights are absent
11- Construction companies in Jordan are many
12- Deterioration of general economic conditions
13- Specialists in project financial analysis are not employed
14- Inability to control project financial affairs

15- Taxes and tax burdens
16- Absence of price standing strategy in the market
17- Reliance on personal relations in pricing
18- Absence of financial allowances with the contractor when the project tender is invited

Resources

1- There is no standing guideline of the numerous resources in Jordan
2- There are many fake and not original varieties of materials
3- Monopoly of some varieties of material
4- The long distance between the project and resources
5- There is no monitoring for high quality
6- There are no regular tests for materials used in projects
7- Absence of basic materials in the project
8- Scarcity of resources sometimes, especially basic resources
9- Some materials do not arrive in the site assigned for them
10- Agreed-upon technical specifications are not realized
11- The contractor takes into account the resource of lowest price
12- Heavy equipment are not maintained periodically
13- Fluctuating prices of materials
14- There are no guarantees on imported materials

Manpower

1- Absence of trained domestic manpower
2- Wages of domestic manpower are high
3- Laws of employing foreign manpower are rigid
4- Absence of training centers for domestic manpower
5- The worker does not abide by work- hours according to the a greed upon principles
6- Necessary technical skills are not available
7- Public safety rules are not abided by
8- Absence of health insurance
9- Low productive efficiency of the worker

10- There is no care for workmanship
11- Instability of cadre in the companies

Technical Aspect

1- Design bureaus are not monitored
2- There are many design bureaus
3- Providing special cadre is not abided by
4- The designer does not follow up designs and changes made on them
5- The owner's meddling with the design
6- Recurring design errors
7- Errors in the inventory of quantities
8- Supervising the project is not abided by
9- Plans of design are incompatible with execution
10- Survey processes are not precise
11- Many modifications on designs are made during execution

Other Problems

1- Absence of specialized contractors
2- No relation exists between the Contractor Union and Engineer Union
3- Small volume of projects and low prices
4- Not applying the ISO system in executing projects

The following discussion describes the first three major risks that really influence the behavior of each individual category.

4.1.1 Results Obtained for the Administrative Aspects

Table 4.1: Administrative Aspects

Problem No.	1 (Not Important)	2 (Some What Important)	3 (Fairly Important)	4 (Important)	Score	Rank
First Class						
1-	0	5	8	24	130	4
2-	0	0	15	22	133	2
3-	0	2	16	19	128	6
4-	0	4	5	28	135	1
5-	1	6	17	13	116	9
6-	0	2	9	26	135	1
7-	0	5	7	25	131	3
8-	1	6	4	26	129	5
9-	0	3	15	19	127	7
10-	4	9	11	13	107	12
11-	5	5	13	14	110	11
12-	2	9	9	17	115	10
13-	0	5	15	17	123	8
Second class						
1-	1	3	20	16	131	6
2-	2	11	16	11	116	10
3-	1	3	20	16	131	6
4-	2	8	11	19	127	8
5-	2	12	11	15	119	9
6-	1	6	9	24	136	5
7-	1	8	4	27	137	4
8-	3	2	5	30	142	1
9-	1	5	7	27	140	2
10-	1	18	13	8	108	11
11-	2	8	10	20	128	7
12-	1	2	15	22	138	3
13-	0	6	11	23	137	4
Third class						
1-	6	21	17	48	291	1
2-	23	10	28	31	251	8
3-	8	20	30	34	274	3
4-	20	17	18	37	256	6
5-	15	18	32	27	255	7
6-	14	7	21	50	291	1
7-	10	15	25	42	283	2
8-	12	18	31	31	265	5
9-	23	17	18	34	247	9
10-	22	24	27	19	227	12
11-	11	21	27	33	266	4

12-	11	21	16	44	237	10
13-	17	33	17	25	234	11

Table 4.2: Administrative Aspects for Three Classes.

				Grade out of 4		
Problem No.	**Score/cl1**	**Score/cl2**	**Score/cl3**	**Grad/cl1**	**Grad/cl2**	**Grad/cl3**
1	130	131	291	3.51	3.27	3.16
2	133	116	251	3.59	2.9	2.72
3	128	131	274	3.45	3.27	2.97
4	135	127	256	3.64	3.17	2.78
5	116	119	255	3.13	2.97	2.77
6	135	136	291	3.64	3.4	3.16
7	131	137	283	3.54	3.42	3.07
8	129	142	265	3.48	3.55	2.88
9	127	140	247	3.43	3.5	2.68
10	107	108	227	2.89	2.7	2.46
11	110	128	266	2.97	3.2	2.89
12	115	138	237	3.10	3.45	2.57
13	123	137	234	3.32	3.42	2.54
Total no. of companies	**37**	**40**	**92**			

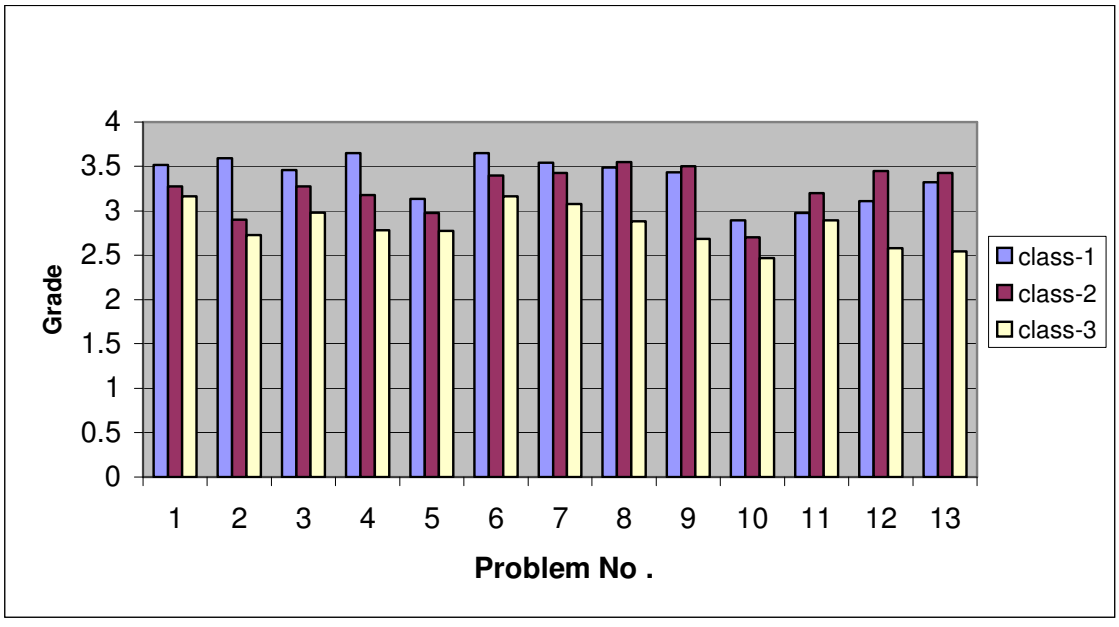

Figure 4.1 Final Results-Administrative Aspects for Three Classes

(1) Discussion for Administrative Aspects

For first-class companies, two major problems were ranked in the first place: the absence of administrative experience in business administration and the contractor's lack of scientific know-how. These two problems indicate the importance of having qualified people running the projects. People, who lack sufficient experience academically and administratively have less knowledge, will affect negatively the development of the project.

The second major risk was the lack of defining cadre structure in the company. This leads to many disputes and clashes between employees and therefore leads to a non-professional performance in running the project.

The third important risk was the lack of applying all specifications agreed upon between the advisor and the contractor. This really shows the importance of the well-organized connection between the two parties in order to accomplish a successful project with all the required specifications. Companies of the first class may have problems of the contact with the advisor because of the second risk mentioned above which restricts the task of each employee and leads to a confusion for each one authority.

The least important factor in this category was the absence of qualification courses in administration. This is a result of the fear of the worker in classifying the managers.

For second-class companies, different results were obtained. The major risk in this category was considered to be the absence of licensed administrative bureaus for contractors. The second risk was the lack of sufficient administrative cadre for project management, and these two risks highlighted the importance of the manager role in leading these companies of the second rank. Probably because of the big size of the projects undertake a second class company that may not be qualified enough in running big projects.

Surprisingly, continuous change in laws, particularly the in come tax law, was ranked in the third place and this again indicates that companies of the second class vary in the size of the projects that they may be undertake. Taxes on big projects are higher than those on small projects.

The second-class companies agree with the first-class companies in classifying the less important risk and this is the absence of qualification of the administrative courses.

For third-class companies, the first rank was occupied by two risks. These are the employer's direct supervision of managing the project, and again like the first–class companies, the contractor's lack of scientific know-how.

These two risks show the real appearance of the third-class companies. One can conclude the lower the class of the company the worse the company condition can be. Non-qualified people may run third-class companies and employers will not be satisfied with what the contractors do, and they start to interfere directly in the project.

The second place was also occupied as in the first-class companies by the lack of applying all specifications agreed upon by the advisor and contractor. This was also occupied in the fourth place for the second-class companies, which indicates that this is a real risk that faces all companies of all classes.

The least important risk was the absence of qualification courses for administrators and this again shows the importance of having qualified people to run the business. It is not a technical problem only, but it also affects decision-making and eventually affects the entire development of the project. All other factors are ranked in the tables and longer discussion can be built up.

4.1.2 Results Obtained for the Financial Aspects

Table 4.3: Financial Aspects

Problem No.	1 (Not Important)	2 (Some What Important)	3 (Fairly Important)	4 (Important)	Score	Rank
First Class						
1-	2	9	11	15	113	10
2-	1	4	10	22	127	5
3-	0	4	3	30	137	1
4-	1	10	14	12	111	12
5-	3	5	6	23	123	7
6-						
7-						
8-	8	0	9	20	115	9
9-	0	2	8	27	136	2
10-	3	4	5	25	126	6
11-	3	10	7	17	112	11
12-	5	6	6	20	115	9
13-	4	12	8	13	104	13
14-	1	2	11	23	130	3
15-	6	4	13	14	117	8
16-	3	2	18	14	117	8
17-	8	7	11	11	99	14
18-	2	2	9	24	129	4
Second Class						
1-	1	12	22	5	111	14
2-	0	7	5	28	141	5
3-	0	1	4	35	154	1
4-	3	1	18	18	131	9
5-	1	0	7	32	150	2
6-	1	1	16	22	139	7
7-	1	8	15	16	126	13
8-	1	4	5	30	144	4
9-	0	2	10	28	146	3
10-	3	5	11	21	130	10
11-	2	7	9	22	131	9
12-	1	4	10	25	139	7
13-	1	4	18	17	131	9
14-	0	2	12	26	144	4
15-	0	11	8	21	130	11
16-	0	5	10	25	140	6
17-	2	8	10	20	128	12
18-	0	6	10	24	138	8

Third Class						
1-	8	36	18	30	254	14
2-	12	15	11	54	291	2
3-	9	10	19	54	294	1
Problem No.	**1** (Not Important)	**2** (Some What Important)	**3** (Fairly Important)	**4** (Important)	**Score**	**Rank**
4-	9	18	39	26	266	12
5-	14	10	25	43	281	3
6-	16	11	26	39	272	8
7-	10	18	34	30	268	10
8-	15	12	20	45	279	5
9-	11	15	25	41	280	4
10-	16	10	27	39	273	7
11-	10	19	21	42	279	5
12-	12	18	29	33	267	11
13-	19	18	29	26	246	15
14-	11	17	32	32	269	9
15-	14	17	27	34	265	13
16-	10	18	25	39	277	6
17-	20	20	28	24	240	16
18-	8	23	26	35	272	8

Table 4.4: Financial Aspects for Three Classes**.**

				Grades out of 4		
Problem No.	Score/cl1	Score/cl2	Score/cl3	Grad/cl1	Grad/cl2	Grad/cl3
1	113	111	254	3.054	2.77	2.76
2	127	141	291	3.43	3.52	3.16
3	137	154	294	3.70	3.85	3.19
4	111	131	266	3	3.27	2.89
5	123	150	281	3.32	3.75	3.05
6	127	139	272	3.43	3.47	2.95
7	115	126	268	3.10	3.15	2.91
8	115	144	279	3.10	3.6	3.03
9	136	146	280	3.67	3.65	3.04
10	126	130	273	3.40	3.25	2.96
11	112	131	279	3.02	3.27	3.03
12	115	139	267	3.10	3.47	2.90
13	104	131	246	2.81	3.27	2.67
14	130	144	269	3.51	3.6	2.92
15	117	130	265	3.16	3.25	2.88
16	117	140	277	3.16	3.5	3.01
17	99	128	240	2.67	3.2	2.60
18	129	138	272	3.48	3.45	2.95
Total no of companies	37	40	92			

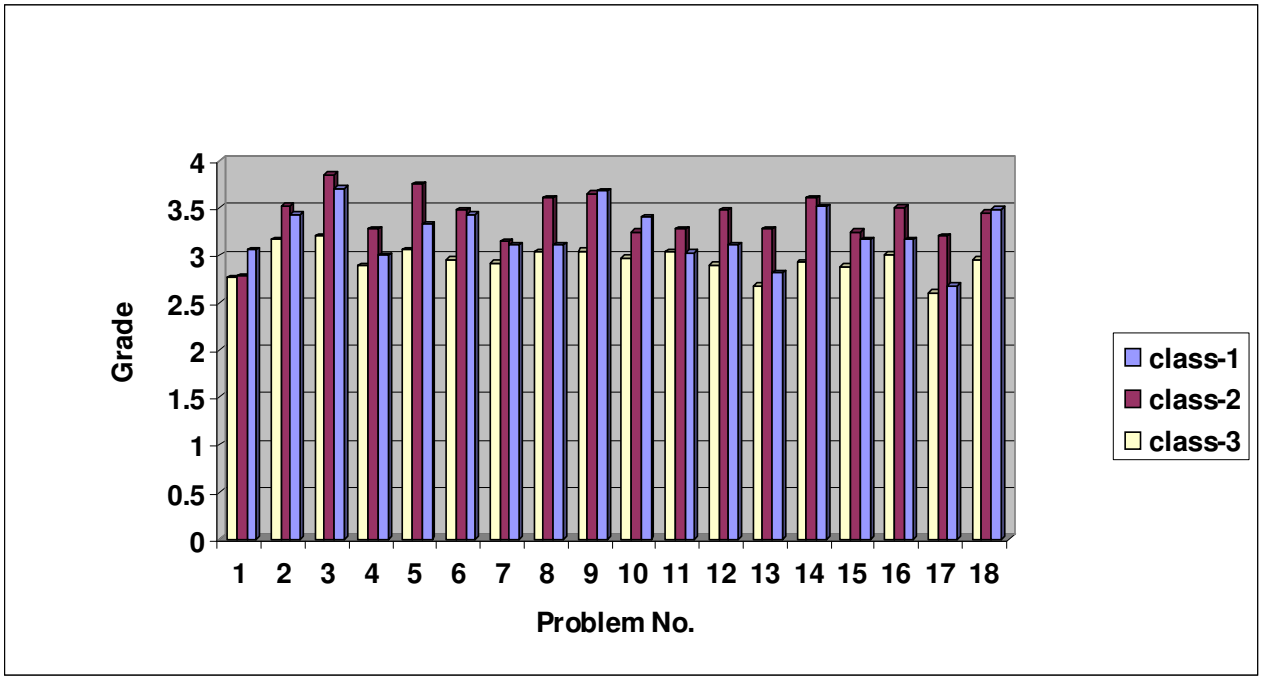

Fig 4.2 Final Results- Financial Aspects for Three Classes

2) *Discussion for Financial Aspects*

A very important result was achieved here which all companies agreed upon to be the most important risk. It was the owner lagging behind in paying the contractor. It is very important to notice that all companies of different classes think of financial issues in the first place. Most of the problems that occur in the construction firm in Jordan are based on financial issues and therefore it is highly recommended that schedule payments be allocated in a detailed contract between the owner and the contractor in order to calm the contractor's mind and to encourage him to finish his jobs in appropriate time.

The second and third important risks varied between the companies. For the first-class companies the second rank went to the competition in pricing the projects. The second-class companies think that non-paying the workers comes in the second place and this also shows that second-class companies is highly dependent on the size of the project and on the payments that are provided by the owner in order to run the project. Third-class companies response that the second risk is the inability to execute the project within the specified time table, and this also indicates again the previous conclusion that companies of the third-class are not dependent on the qualifications rather than on accomplishing the project in the shortest time to realize a better profit.

The third class varied a bit between the companies. First-class companies classified the inability to control project financial affairs as a third rank. Second-class companies think competition in pricing the projects comes in the third place, unlike the first-class companies, which classified it in the second place. The third-class companies think that the contractor does not pay worker wages in due time come in the third rank. This is similar to what the second-class companies think about paying the workers, which was classified in the second position due to their point of view.

The least important risk for the first-class companies was the reliance on personal relations in pricing the projects, which is logically understood, because companies of high classification are only depending on their good skills and performance and not on the personal relation that may affect the project price. The second-class and the third-class companies considered that obtaining large-sum loans to be the least important risk.

It is clearly observed that regarding the financial issues, all companies are having almost the same response and that all of their work is highly dependent on the payments they get.

4.1.3 Results Obtained for the Resources

Table 4.5: Resources

Problem No.	1 (Not Important)	2 (Some What Important)	3 (Fairly Important)	4 (Important)	Score	Rank
First Class						
1-	5	11	7	14	104	11
2-	5	13	13	6	94	13
3-	4	10	5	18	111	9
4-	5	11	10	11	101	12
5-	1	4	14	18	109	10
6-	3	3	7	24	126	2
7-	2	3	8	24	128	1
8-	2	5	7	23	125	3
9-	3	5	9	20	120	5
10-	3	4	10	20	121	4
11-	2	6	13	16	117	6
12-	0	5	13	19	125	3
13-	3	5	17	12	112	8
14-	2	7	13	15	115	7
Second class						
1-	4	4	12	20	128	8
2-	0	5	25	10	125	11
3-	1	7	17	15	126	10
4-	0	10	12	18	128	8
5-	3	5	12	20	129	7
6-	1	6	12	21	133	3
7-	0	5	14	21	136	1
8-	1	6	15	18	130	6
9-	1	7	12	20	131	5
10-	0	5	15	20	135	2
11-	1	7	13	19	130	6
12-	1	5	15	19	132	4
13-	1	10	9	20	128	8
14-	1	10	10	19	127	9
Third class						
1-	9	41	21	21	238	12
2-	4	21	32	35	282	1
3-	9	17	33	33	274	3
4-	14	19	33	26	255	9
5-	4	28	29	31	271	5
6-	10	18	30	34	272	4
7-	17	14	26	35	263	6
8-	13	15	28	36	271	5
9-	15	18	31	28	256	8
10-	18	15	23	36	261	7
11-	10	15	27	40	281	2

Problem No.	1 (Not Important)	2 (Some What Important)	3 (Fairly Important)	4 (Important)	Score	Rank
12-	14	14	35	29	263	6
13-	18	27	19	28	241	10
14-	17	30	18	27	239	11

Table 4.6: Resources for Three Classes

				Grades out of 4		
Problem No.	Score/cl1	Score/cl2	Score/cl3	Grad/cl1	Grad/cl2	Grad/cl3
1	104	128	238	2.81	3.2	2.58
2	94	125	282	2.54	3.125	3.06
3	111	126	274	0.29	3.15	2.97
4	101	128	255	2.72	3.2	2.77
5	109	129	271	2.94	3.225	2.94
6	126	133	272	3.40	3.325	2.95
7	128	136	263	3.45	3.4	2.85
8	125	130	271	3.37	3.25	2.94
9	120	131	256	3.24	3.275	2.78
10	121	135	261	3.27	3.375	2.83
11	117	130	281	3.16	3.25	3.05
12	125	132	263	3.37	3.3	2.85
13	112	128	241	3.02	3.2	2.61
14	115	127	239	3.10	3.17	2.59
Total no of companies	37	40	92			

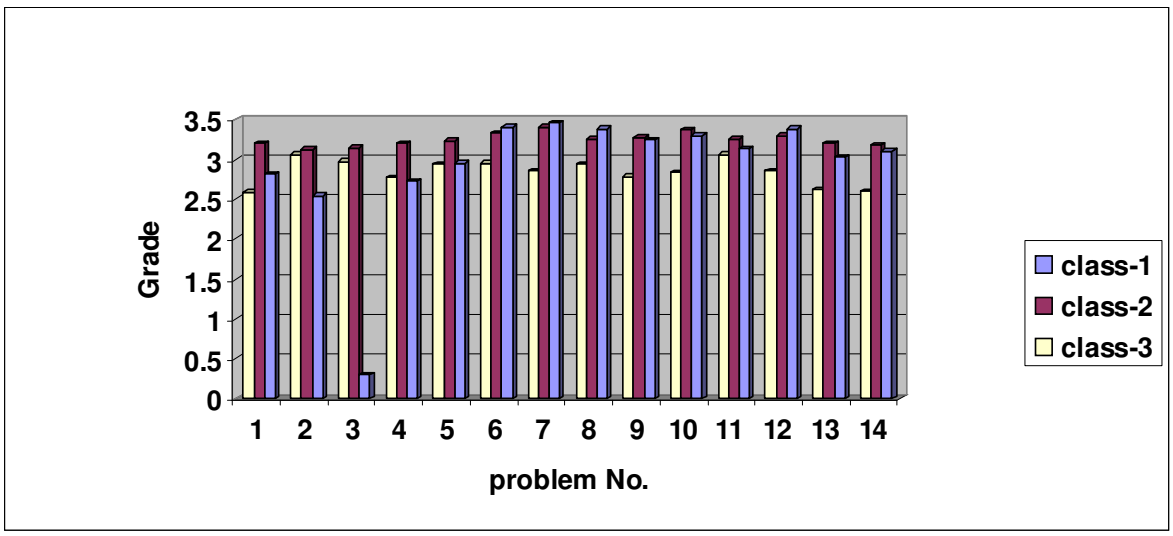

Figure 4.3 Final Results-Resources for Three Classes

3) Discussion for Resources

The first and the second-class companies agree that the absence of basic materials required in the project comes in the first highest risk. The third-class companies think that the existence of many fake and not-original varieties of materials comes in the first place. This actually may have the same meaning but as a conclusion we can say that the quality of the materials play the key factor in reducing or increasing the risks of the construction industry.

The first-class companies consider the testing of the materials as a very important risk factor and they think the non-existence of regular tests on the materials used in the project may be an important risk factor. The same factor is ranked in the third place for the second-class companies. The second risk factor for the second-class companies is considered to be the agreed-upon technical specifications which are not realized.

The third-class companies are very dependent on lowest material prices and consider this as a very important risk factor for them (second place), unlike the first and the second class-companies which rank it in the six place.

Surprisingly, the least important risk factor for the first and the second-class companies is the same but is ranked in the first place for the third-class companies and that is there are many fake and not original varieties of materials in the industry.

4.1.4 Results Obtained for the Manpower

Table 4.7: Manpower

Problem No.	1 (Not Important)	2 (Some What Important)	3 (Fairly Important)	4 (Important)	Score	Rank
First Class						
1-	2	8	6	21	120	6
2-	1	7	15	14	116	7
3-	1	6	17	13	116	7
4-	2	14	3	18	111	8
5-	1	4	10	22	127	3
6-	1	4	15	17	122	5
7-	1	3	16	17	123	4
8-	3	8	12	14	111	8
9-	0	4	13	20	127	3
10-	0	4	6	27	134	1
11-	0	5	10	22	128	2
Second Class						
1-	1	6	10	23	135	2
2-	2	6	12	20	130	6
3-	2	4	12	22	134	3
4-	2	6	17	15	125	7
5-	1	5	13	21	134	3
6-	1	4	12	23	137	1
7-	2	5	11	22	133	4
8-	2	5	13	20	131	5
9-	0	4	15	21	137	1
10-	1	3	17	19	134	3
11-	1	6	10	23	135	2
Third Class						
1-	9	15	25	43	286	6
2-	10	12	27	43	287	5
3-	0	11	23	58	323	1
4-	5	21	36	30	275	9
5-	4	23	32	33	278	7
6-	4	22	24	42	288	4
7-	6	27	24	35	272	10
8-	8	15	36	33	278	7
9-	13	9	16	54	295	3
10-	10	9	19	54	301	2
11-	7	23	24	38	277	8

Table 4.8: Man Power for Three Classes

				Grades out of 4		
Problem No.	**Score/cl1**	**Score/cl2**	**Score/cl3**	**Grad/cl1**	**Grad/cl2**	**Grad/cl3**
1	120	135	286	3.24	3.37	3.10
2	116	130	287	3.13	3.25	3.11
3	116	134	323	3.13	3.35	3.51
4	111	125	275	3	3.12	2.9
5	127	134	278	3.43	3.35	3.0
6	122	137	288	3.29	3.42	3.13
7	123	133	272	3.32	3.32	2.9
8	111	131	278	3	3.27	3.02
9	127	137	295	3.43	3.42	3.20
10	134	134	301	3.62	3.35	3.27
11	128	135	277	3.45	3.37	3.0
Total no of companies	37	40	92			

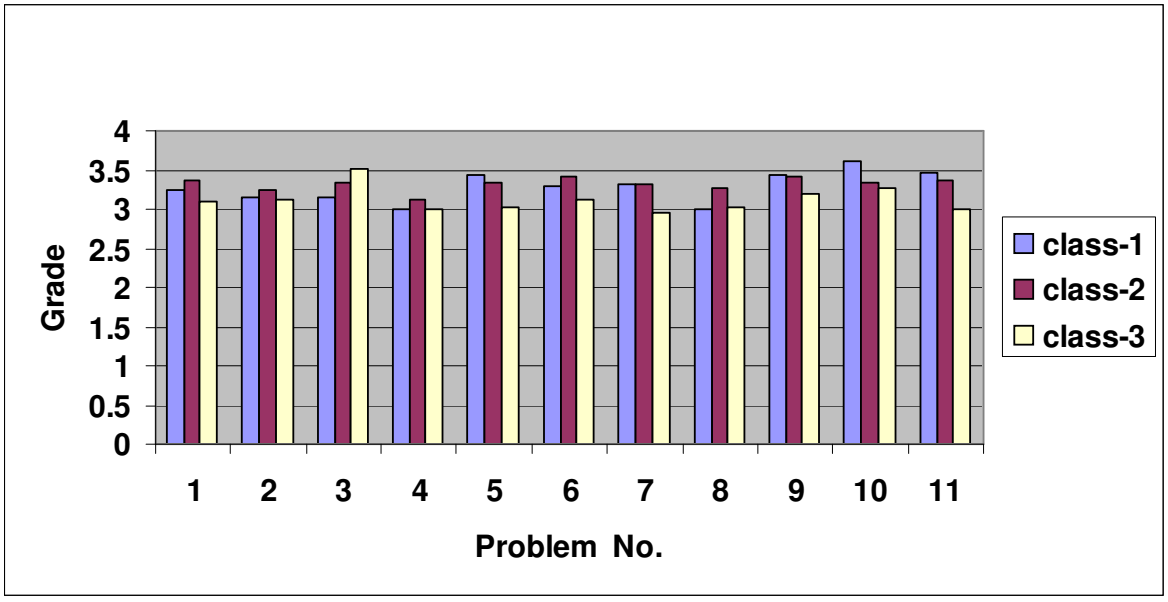

Figure 4.4 Final Results-Man Power for Three Classes

4) Discussion for Manpower

More or less the first and the second-class companies agree on the first three risk ranks, but in different orders. These are unavailability of necessary technical skills, low productive efficiency of the workers, and the instability of cadre in the companies. The third-class companies agreed on that but again they disagreed on the first rank and they classify the laws of employing foreign manpower as rigid to be in the first rank.

It is obvious that whenever the company rank drops down, it is more likely that the manpower cost will influence the total profit of the project. Therefore, companies of less ranks are always more determinant in reducing the manpower cost to the minimum.

4.1.5 Results Obtained for Technical Aspects

Table 4.9: Technical Aspects

Problem No.	1 (Not Important)	2 (Some What Important)	3 (Fairly Important)	4 (Important)	Score	Rank
First Class						
1-	0	3	9	25	133	1
2-	2	11	7	17	93	9
3-	5	5	11	16	112	8
4-	1	6	10	20	123	5
5-	0	5	15	17	123	5
6-	1	4	10	22	127	4
7-	0	5	7	25	131	2
8-	2	3	15	17	121	7
9-	1	6	11	19	122	6
10-	2	4	11	20	123	5
11-	1	3	10	23	129	3
Second Class						
1-	0	3	12	25	142	1
2-	2	4	20	14	126	7
3-	3	4	17	16	126	7
4-	1	4	10	25	139	4
5-	1	4	18	17	131	6
6-	0	3	14	23	140	3
7-	1	3	11	25	140	3
8-	3	5	15	17	126	7
9-	0	5	17	18	133	5
10-	1	4	16	19	133	5
11-	0	2	15	23	141	2
Third Class						
1-	12	14	16	50	288	7
2-	16	22	32	22	244	11
3-	14	25	21	32	255	10
4-	7	13	25	47	296	5
5-	9	25	15	43	276	9
6-	5	15	23	49	300	4
7-	6	10	25	51	305	1
8-	6	10	27	49	303	2
9-	8	15	32	37	282	8
10-	7	15	24	46	293	6
11-	5	10	32	45	301	3

Table 4.10: Technical Aspects for Three Classes

				Grades out of 4		
Problem No.	**Score/cl1**	**Score/cl2**	**Score/cl3**	**Grad/cl1**	**Grad/cl2**	**Grad/cl3**
1	133	142	288	3.59	3.55	3.13
2	93	126	244	2.51	3.15	2.65
3	112	126	255	3.02	3.15	2.77
4	123	139	296	3.32	3.47	3.21
5	123	131	276	3.32	3.27	3
6	127	140	300	3.43	3.5	3.26
7	131	140	305	3.54	3.5	3.31
8	121	126	303	3.27	3.15	3.29
9	122	133	282	3.29	3.32	3.06
10	123	133	293	3.32	3.32	3.18
11	129	141	301	3.48	3.52	3.27
Total no of companies	37	40	92			

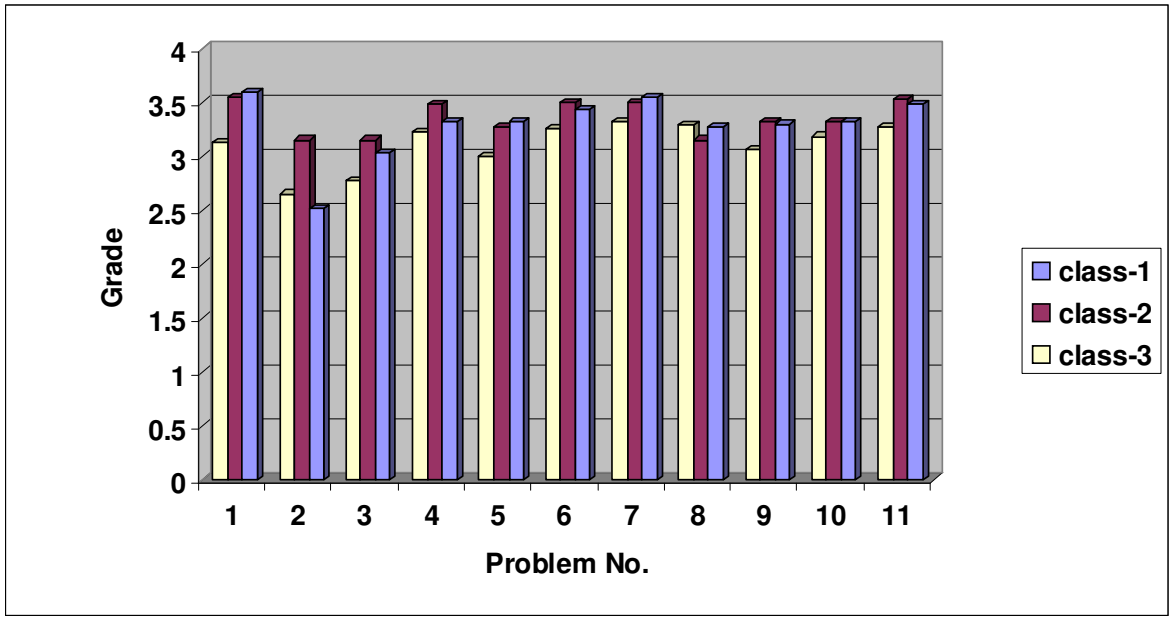

Figure 4.5 Final Results-Technical Aspects for Three Classes.

5) Discussion for Technical Aspects

The first and the second-class companies agree on the first risk factor which is that the design bureaus are not monitored. This lead to a fact that these companies believe that designer offices are not producing full details or accurate designs to be implemented in a proper way in the site. There are always some missed points in the design sketches and the time being spent until the accurate design is redone will consume more time and this will reduce the profit of the total project.

Third –class companies consider the errors presented in the inventory of the quantities to be the first risk factor. This is more or less leading to the same point which is that inadequate full-detailed sketches will lead to improper applications in the site and again the time needed for re-sketching the details or re-tabulating the quantities will reduce the total profit of the project. The same point was classified to be in the second rank for the first-class companies and to be in the third place for the third-class companies. This obviously indicates the importance of having full detailed sketches and proper tables of quantities. Many modifications on designs made during execution was also classified as a very important risk factor that affects the performance of the project, and this again emphasizes the importance of having accurate and proper design sketches by the designer before the beginning of the project.

All companies agree that having so many designer offices has very little effect on the project performance and they classify it as the least risk factor.

4.1.6 Results Obtained for the Other Problems

Table 4.11: Other Problems

Problem No.	1 (Not Important)	2 (Some What Important)	3 (Fairly Important)	4 (Important)	Score	Rank
First Class						
1-	1	5	16	15	119	2
2-	4	5	13	15	113	3
3-	1	1	8	27	135	1
4-	8	6	10	13	102	4
Second Class						
1-	0	7	20	13	126	2
2-	2	6	18	14	124	3
3-	0	2	13	25	143	1
4-	5	17	13	5	98	4
Third Class						
1-	25	15	20	32	243	2
2-	33	22	17	20	208	3
3-	15	16	16	45	275	1
4-	30	28	14	20	208	3

Table 4.12: Other Problems for Three Classes

				Grades out of 4		
Problem No.	**Score/cl1**	**Score/cl2**	**Score/cl3**	**Grad/cl1**	**Grad/cl2**	**Grad/cl3**
1	119	126	243	3.21	3.15	2.64
2	113	124	208	3.05	3.1	2.26
3	135	143	275	3.64	3.57	2.98
4	102	98	208	2.75	2.4	2.26

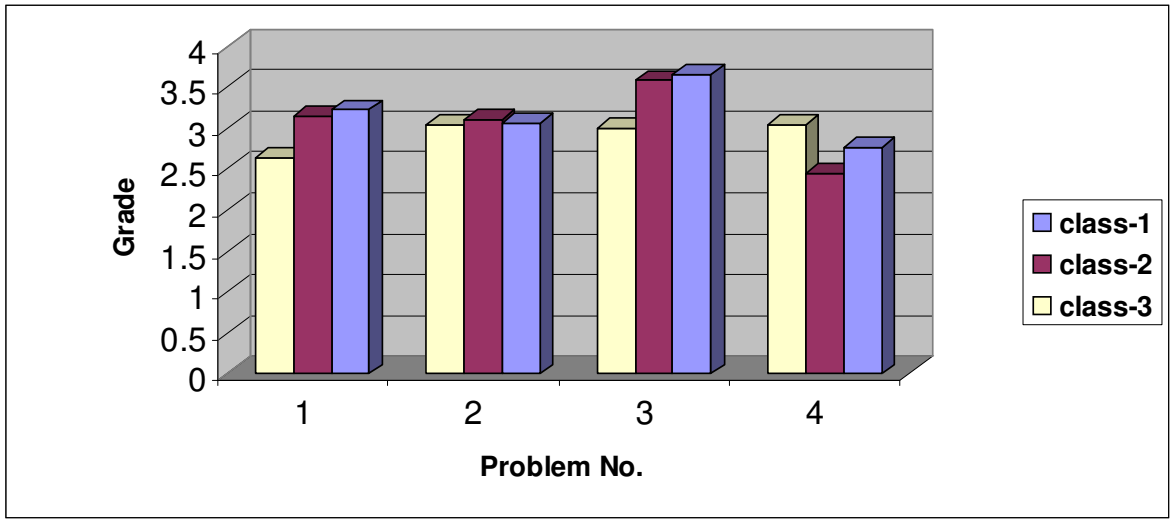

Figure 4.6 Final Results -Other Problems for Three Classes.

6) Discussion for Other Problems

Some other questions have been asked about the other risks that may occur in the construction industry and all companies agree on the same order of these risks which are as follows:

- First Rank, small volume of projects and low prices.
- Second Rank, the absence of specialized contractors.
- Third Rank, there is no relation existing between the contractor union and engineer union.
- Fourth rank, not applying the ISO (9000) system in executing projects.

It is clearly observed that these problems are not significantly varied between all classes. These problems were only suggested by some companies in the piloting study and they are not mainly considered as major risks.

4.2 Second Questionnaire

After the first questionnaire was accomplished and results were obtained, the first three highest rank risks for each category were constructed in another questionnaire (as shown in Appendix A5) to find out the appropriate solutions (except for the financial problems, the first four risks were included).

The questionnaire was sent to 20 companies of all classes to ask for their viewpoints about the best solutions they have. Later on, all data was collected and discussed with a team of qualified engineers and contractors in a meeting held in the Tendering Department at the Applied Science University. The meeting discussed all the proposed solutions. Each solution was given a mark, and solutions with higher marks were classified separately. The meeting was very positive and many fine solutions were agreed upon.

The following sections describe the most appropriate solutions that were suggested by the questionnaire and by the people who attended the meeting. Each category is discussed individually. Numbers before each risk description indicates the number of the risk in the questionnaire. The highest three-four risk ranks elected by the contracting companies in the first questionnaire are given the following solutions:

4.2.1 Second Questionnaire Solutions

(1) Administrative Aspects

1. Employer's direct supervision of managing the project:
    - Stating new private legislations that force the employer not to interfere unless he possesses the appropriate academic and technical qualifications.
    - Limiting authority only to the consultant who will work on behalf of the employer.
2. Lack of defining cadre structure in the company:
    - Separation of administrative cadres from technical cadres.
    - Having both cadres on location.
3. Lack of employing computer programs in project management:
    - Forcing the companies to use the computer in all their tasks, especially in project management and technical issues including the design.
4. Absence of administrative experience in business administration:
    - Requiring specific administrative qualifications for project managements
    - Employing more than one manager specific to his specialty.
6. The contractor's lack of scientific know-how
    - Stating private legislations to specify the academic qualification for the contractor depending on his company class.
    - Employing qualified employees and cadres.

7. Lack of applying all specifications agreed upon by the adviser and contractor:

- Stating financial penalties for technical mistakes in the contract.
- Referring to the technical specifications issued by the ministry of public works as being refereed and final specifications.
- Stating private legislations to give projects to specialized contractors only.

8. Absence of licensed administrative bureaus for contractors:

- Binding the contractors by the Contractor union to have administrative offices
- Inspecting the existence of these offices on a regular base.

9. Lack of sufficient administrative cadre for project management:

- Specifying the number of cadre according to the project size.
- Applying the required computer management software.
- Enriching the knowledge of the employers with the importance of having the enough number of the administrative cadre in the project.

12. Continuous change in laws, particularly income tax law:

- Appointing a special panel in the contractor union that review the income tax laws in cooperation with the Tax Office in order to participate in issuing an appropriate tax laws that suit the contractors.
- Stating clear strategies that last for a long period of time in the Tax Office, and notifying contractors with these laws.

(2) Financial Aspects

2. Inability to execute the project within specified timetable:

- Requiring a detailed timetable showing the task schedule to be submitted by the contractor at the beginning of the project.
- Awarding the project to the appropriate contractor according to the project cost.

3. The owner lags behind in paying the contractor:

- Stating special legislations to organize the contractor payments by the employer
- Issuing a clear schedule for organizing the payments between the contractor and the employer at the beginning of the project.

5. The contractor does not pay worker wages in due time:
   - Notifying the contractor and if the delay is repeated then the project will be withdrawn from him.

8. Construction prices are low:
   - Creating special panels in the contractor union to follow up with the market prices and modifying them when necessary.

9. Competition in pricing projects:
   - Creating special panels responsible for analyzing prices.
   - Binding the contractor to produce comprehensive analysis for the price of each of the contract jobs.

14. Inability to control project financial affairs:
   - Employing an administrative cadre at each project responsible for organizing the financial affairs.
   - Employing a specialized accountant to organize financial issues.

18. Absence of financial allowances with the contractor when the project tender is invited:
   - Studying the contractor's condition and his abilities before the project is awarded to the contractor.
   - Asking for sufficient financial guarantees as a condition to give the project for the contractor.

(3) Resources

2. There are many fake and not original varieties of materials:
   - Requiring a full description of specifications in the contract.

- Improving the role of the association of measurements and specifications.

6. There are no regular tests for materials used in projects:

- Assigning additional payments for material tests to guarantee the quality.

7. Bad quality of basic materials in the project:

- Providing a condition to make regular tests on the materials provided to the site.
- Specifying alternative materials for materials that may not exist in the markets.

8. Scarcity of resources sometimes, especially basic resources:

- Creating special joint panels between the contractor union and engineer union in order to find out the alternative materials.

10. Agreed-upon technical specifications are not realized:

- Forcing the contractor to implement the required design codes.
- Full technical supervision on the contractor from the outset of the project.

11. The contractor takes into account the resource of lowest price:

- Providing conditions that the quality must meet the specified requirements.
- A full supervision by the consultant on material supply.

12. Heavy equipment is not maintained periodically:

- Awarding the project according to the contractor's ability of having good maintained equipment.
- Considering the available equipment for the contractor when his company is classified.

(4) Manpower

3. Laws of employing foreign manpower are rigid:

- Easing legislations for foreign manpower.
- Allowing the companies to get licenses for their workers directly from the Ministry of Labor.

6- Necessary technical skills are not available:

- Running technical workshops to train workers in accordance with the technical training centers.
- Specifying special awards for professional technicians in order to attract them.

9. Low productive efficiency of the worker:

- Increasing the wages.
- Increasing the percentage of the workers per work.

10. There is no care for workmanship:

- Full supervision from the beginning.
- Employing qualified technicians to execute the required workmanship.

11. Instability of cadre in the companies:

- Creating a special panel in the contractor Union that supervises the distribution of tenders on a consequence order for all contractors.
- Supporting the idea of joining the small companies together to create bigger and stronger companies.

(5) Technical Aspect

1. Design bureaus are not monitored:

- Monitoring the design bureaus by the Engineer Union before they are given the authority to start their work.

6. Recurring design errors:

- Enhancing the role of the Engineer Union by monitoring the sketched designs before they are approved.

7. Errors in the inventory of quantities:

- Employing engineers specialized in calculating material quantities.
- Using computer programs that are specialized in calculating material quantities.

8. Supervising the project is not abided by:

- Binding the owner to specify a qualified supervising team for the whole period of the project, and to pay their expenses.
- Running regular inspection on the projects by the Engineer Union in order to check supervising engineers.

11. Many modifications on designs are made during execution:

- Requiring full detailed technical designs prior to the beginning of the project.
- Binding the designer to visit the site and take accurate sketches before the beginning of the designs in order to check all the obstacles that may affect the project development.

The other problems mentioned in the first questionnaire are not considered as essential issues to be solved. These problems are affected by the construction policies and strategies and need to be studied very well by private and public sectors.

4.3 Internet Model

An additional model is given in this study on the following home page address:

HTTP://www.asu.edu.jo/tenders.

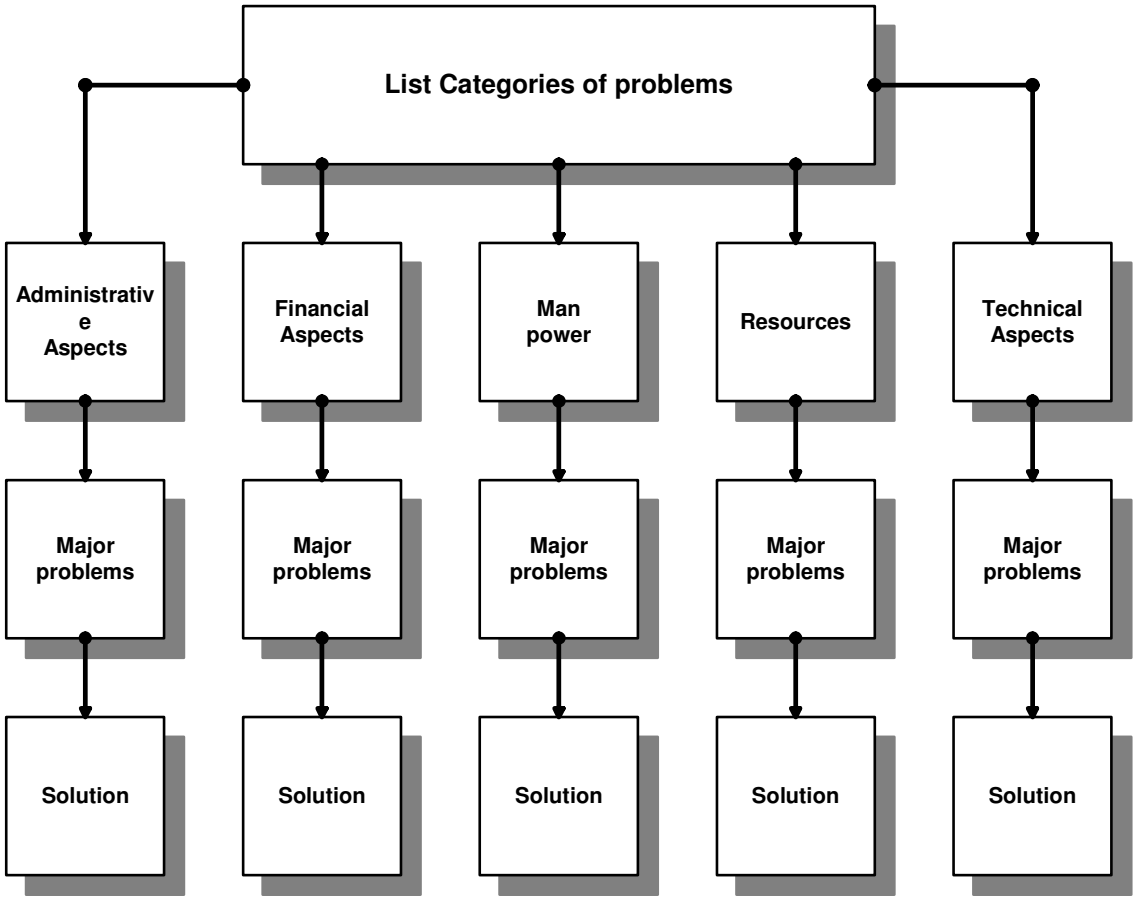

Fig. 4.7 Flow Chart of the Internet Model

- Editing to all functions can be authorized to substantial users with limited authorities.
- Editing includes adding new problems and will be defined and categorized under the user name which can be originally provided by the administrator.

The aim of this model is to give a brief description about the risks that were studied in this project and to give proposed solutions for each risk. The user can search for any risk by word entry and the model will check all the related probabilities and give choices for the user to check the risks and to obtain the solutions.

It is also possible for selected users to be provided by login numbers and passwords in order to be authorized to add or edit risks related to each category.

CONCLUSIONS AND RECOMMENDATIONS

The fundamental aim of this study was achieved by studying the influence of five major categories on the construction industry firms. The following conclusions and recommendations are derived.

5.1 Conclusions

- Financial support by the owner is a very important risk factor. All companies of the three different classes agree that the delay in payments supplied by the owner comes in the first place as the most important risk.
- It is clearly observed that regarding the financial issues, all companies are having almost the same opinion and that all of their work is highly dependent on the payments they get.
- Third-class companies are not dependent on qualified people. Rather, they are dependent on accomplishing the project in the shortest time to achieve a better profit.
- Second-class companies always fear the size of the project. Apparently they are able to get into big projects but actually financial support affects the whole action of the company. Duration, financial support and tax payments play the key factors of the performance of the company. Many second-class companies may end up transferring to lower class depending on the size of the project and on the success they achieve.
- The quality of the materials in the second-class companies plays the key factor in reducing or increasing the risks of the construction industry.

- Third-class companies are very dependent on less material prices (ranked in the second place), unlike the first and second class-companies which have ranked it in the six place.
- In the resource category part of the questionnaire, the least important risk factor for the first and the second-class companies is the same but it is ranked in the first place for the third-class companies. This is the existence of plenty of fake and unoriginal materials in the industry.
- Whenever the company rank drops down, it is more likely that the labor cost will influence the total profit of the project. Therefore companies of less ranks are always more determinant reducing the labor cost to the minimum.
- In a technical point of view, the first and the second-class companies agree on the first risk factor which is the absence of real supervision and monitoring on designer offices. This leads to a fact that these companies believe that designer offices are not producing full details or accurate designs to be implemented in a proper way in the site. There are always some missed points in the design sketches and the time being spent until the accurate design is redone will consume more time and this will reduce the total profit of the project.
- All companies agree on the importance of the mistakes presented in the tables of the quantities. This is more or less leading to the same points that inadequate full-detailed sketches will lead to improper applications in the site and again the time needed for re-sketching the details or re-tabulating the quantities will reduce the total profit of the project.
- In all cases, it was approved by SPSS, that there is always a difference in the mean values for the five categories due to the company classification. This means that the company classification has a big influence on the risks that it may face. Results had

shown that the company problems are increasing with the rising in the company classification.

- Another main hypothesis has been approved using SPSS software and that is there is always a correlation between each risks category and other categories. The correlation is varied between the categories but it was an indication, as was anticipated from the beginning, that each risk is linked to the others by a way or another.
- The strongest correlation occurred between the manpower and the technical aspects, while the weakest Correlation occurred between the administrative aspects and manpower.

5.2 Recommendations

The following recommendations can be summarized

- Most of the problems occur in the construction firm in Jordan are based on financial issues and therefore payments schedule be specified in a detailed contract between the owner and the contractor in order to facilitate implementation and encourage the contrator to finish his project timely.
- Establishment of new legislation is demanded by all parties involved in construction industry firm. New laws must be issued in cooperation with Ministry of public work, Engineer Union, contractor Association and all other parties who are affected by these laws.
- To construct an organized union between all parties involved for project sake. Running technical workshops to train workers in accordance with the technical training centres is one of the examples that can be given for such an organized

teamwork.

- To seek always for alterative materials to replace any lack of material in the market. Alternative replacements must be specified by the Specifications and Measurement Office.
- Merge small companies together to create bigger and stronger companies in order to get more benefit for all parties.

5.3 Recommendations for Future Work

- Further work is still required to discuss many other aspects that influence the construction industry, such as , political involvement, site allocation and position, availability of providing locally manufactured materials, and so many other things that may affect significantly and indirectly the project progress.
- Additional work is required using SPSS software or any other types of statistical software to carry out more work about the other aspects that may affect on the progress of the project.
- This work should be considered as a start to so many other works that are still needed in order to have further information about the risks that have not been considered elaborately in this study, such as the subcontractor effect, the availability of locally manufactured materials, the governmental projects, the political influence and so many other things that are really important for the construction industry.

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A –1 Piloting Study in Arabic

إستبانة حول المشاكل التي تواجه قطاع صناعة الإنشاءات في الأردن

الموضوع : معرفة المشاكل التي يواجهها قطاع صناعة الإنشاءات في الأردن
لأغراض رسالة الماجستير

الباحـــث : المهندس عبد اللطيف أبو خديجه

تلفون : 5237181 فرعي 1119
تلفاكس : 5239346
خلوي : 079666194

الناحيـــة الإدارية :-

الناحية المالية:-

المـوارد :-

العمالـــة :-

الناحية الفنية (التصميم والإشراف) :-

مشاكل أخــرى :-

A-2 Piloting Study in English

Questionnaire on the risks and problems faced by the construction industry sector in Jordan

Subject : Study the risks and problem faced by the construction industry sector in Jordan

Research :By Engineer Abdul- Lateef Abu Khadeejeh
Tel : 5237181 – 1119
Telfax : 5239346
Mobile :0795666194

Administrative aspects

Financial aspects

Resources

Manpower

Technical aspects (design and consulting)

Other problems

A – 3 First Questionnaire in Arabic

استبانة حول المخاطر والمشاكل التي تواجه قطاع صناعة الإنشاءات في الأردن

عزيزي المدير المحترم ،

تحية طيبة وبعد ،

نظرا لما يمثله قطاع الإنشاءات الوطني من أهمية في الاقتصادات الوطنية ولأهمية الوقوف على ما يعانيه هذا القطاع من تعثرات وعوامل مؤثرة في بنيته التنظيمية وبيئته ونشاطه ،

يسعدني أن أجعل محور بحثي في هذه الرسالة المقدمة للجامعة الأردنية، حول المخاطر والمشاكل التي تؤثر في صناعة الإنشاءات الوطنية ، "سلبا وإيجابا " وللوصول للأسلم من المؤشرات، سأكون شاكرا لكم إذا ما تكرمتم برفدي بمرئياتكم في هذا المجال، علما بأن كافة المعلومات ستكون سرية خصوصا إذا ما علمتم أنه ليس من الضروري ذكر اسم مؤسستكم في الاجابة .
في حال وجود أي ملاحظات او الرغبة بالاستفسار عن أي من بنود هذه الاستبانة فإننا نرجو منكم الاتصال مع

الباحث : المهندس عبد اللطيف ابو خديجه
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خلـــوي : 0795666194

شاكرين ومقدرين حسن تعاونكم ،

❖ ***أرجو وضع الرقم المناسب أمام كل مشكلة مع مراعاة مسميات كل رقم***

❖ ***1)غير مهمة 2) نوعا ما مهمة 3)متوسطة الأهمية 4) مهمة***

الناحية الإدارية :-

1-	إشراف صاحب العمل بشكل مباشر في إدارة المشروع	
2-	عدم تحديد الهيكل الوظيفي في الشركة	
3-	عدم استخدام برامج الكمبيوتر في إدارة المشاريع	
4-	عدم وجود الخبرة الإدارية لإدارة الأعمال	
5-	التداخل في الهيكل الوظيفي سواء كان الهيكل الإداري أو الفني	
6-	عدم وجود خبرة علمية لدى المتعهد	
7-	عدم تطبيق جميع المواصفات المتفق عليها من قبل الاستشاري والمتعهد	
8-	عدم وجود مكاتب ادارية مرخصة للمقاولين	
9-	عدم توفر الكادر الاداري الكافي لإدارة المشروع	
10-	عدم وجود دورات تأهيلية للإداريين	
11-	عدم الفصل بين النواحي الفنية والادارية للمشاريع	
12-	التغير المستمر في القوانين وخاصة في ضريبة الدخل	
13-	درجة المقاول مبنية على رأس مال شركته	

1)غير مهمة 2) نوعا ما مهمة 3)متوسطة الأهمية 4) مهمة

الناحية المالية :-

1-	حصول الشركة على قروض بمبالغ كبيرة	
2-	عدم قدرة تنفيذ المشروع في الوقت المحدد	
3-	تأخر المالك بسداد المقاول	
4-	توسع المقاول في أكثر من مشروع في نفس الوقت	
5-	عدم سداد رواتب العمال من قبل المقاول	
6-	عدم توافق سير العمل (الاعمال المنجزة) مع الدفعات النقدية	
7-	ضعف التحويل	
8-	رخص أسعار الانشاءات	
9-	المنافسة في تسعير المشاريع	
10-	عدم وجود قانون يحكم عملية الدفع وتحفظ حقوق المقاول	
11-	كثرة شركات الانشاءات في الاردن	
12-	تدني الوضع الاقتصادي العام	
13-	عدم استخدام المختصين للتحليل المالي للمشاريع	
14-	عدم القدرة على ضبط الامور المالية للمشاريع	
15-	الضرائب والاعباء الضريبية	
16-	عدم وجود استراتيجية ثابتة للاسعار في السوق	
17-	الاعتماد على العلاقات الشخصية عند التسعير	
18-	عدم وجود مخصصات مالية عند المقاول عند طرح المشروع	

الموارد :-

1-	عدم وجود دليل ثابت للموارد الكثيرة في الأردن	
2-	كثرة الاصناف المقلدة وغير الاصلية	
3-	الاحتكار لبعض الاصناف	
4-	بُعد المسافة بين المشروع والموارد	
5-	عدم وجود رقابة على الجودة	
6-	عدم وجود إختبارات فحص للمواد الموردة للمشاريع بشكل منتظم	
7-	عدم جودة بعض المواد الاساسية في المشروع	
8-	شح الموارد في بعض الاحيان وخصوصا الموارد الأساسية	
9-	عدم وصول بعض المواد في الموقع المحدد لها	
10-	عدم تحقق المواصفات الفنية المتفق عليها	
11-	مراعاة المقاول المورد الاقل سعرا	
12-	عدم صيانة المعدات الثقيلة بشكل دوري	
13-	تذبذب الاسعار للموارد	
14-	عدم وجود ضمانات على المواد الموردة	

❖ *1)غير مهمة 2) نوعا ما مهمة 3)متوسطة الأهمية 4) مهمة*

العمالــة : -

1-	عدم وجود عمالة محلية مدربة	
2-	غلاء أسعار العمالة المحلية	
3-	صعوبة القوانين الخاصة باستخدام العمالة الوافدة	
4-	عدم وجود مراكز تدريبية للأيدي العاملة المحلية	
5-	عدم التزام العامل بالدوام حسب الأصول المتفق عليها	
6-	عدم توفر المهارات الفنية اللازمة	
7-	عدم التقيد بقواعد السلامة العامة	
8-	عدم وجود التأمين الصحي	
9-	قلة الكفاءة الإنتاجية من قِبل العامل	
10-	عدم الاهتمام بالمصنعية	
11-	عدم الاستقرار الوظيفي في الشركات	

الناحية الفنية :-

1-	عدم وجود الرقابة على مكاتب التصميم	
2-	كثرة مكاتب التصميم	
3-	عدم الالتزام بالكوادر الخاصة	
4-	عدم متابعة المصمم للتصميم والتغيرات التي تجرى عليها	
5-	تدخل المالك في نواحي التصميم	
6-	الأخطاء التصميمية المتكررة	
7-	أخطاء في جدول الكميات	
8-	عدم التقيد بالإشراف على المشروع	
9-	عدم توافق مخططات التصميم مع التنفيذ	
10-	عدم وجود دقة في الأعمال المساحية	
11-	كثرة التعديلات على التصاميم أثناء العمل	

مشاكل أخرى :-

1-	عدم وجود تخصص في المقاولين	
2-	عدم وجود رابطة بين نقابة المقاولين ونقابة المهندسين	
3-	قلة حجم المشاريع وتدني الأسعار	
4-	عدم تطبيق نظام ISO في عمل المشاريع	

A –4 First Questionnaire in English

Questionnaire on the risks and problems faced by the construction industry sector in Jordan

Dear Director,

Due to the important role of the national construction sector in the national economies and the importance of recognizing the stumbling blocks and factors which influence the sector's organizational structure, environment and activity, I am pleased to study the risks and problems which influence the national construction industry positively or negatively in the present M.Sc thesis, which is submitted to the University of Jordan, in order to delineate the most reasonable factors which affect this industry.

I will be grateful if you kindly provide me with your viewpoints in this field of research All the information you offer will be confidential since you are not required to mention the name of your organization on the questionnaire.

Should there be any remarks or inquiries about any of the items in this questionnaire, please contact me on the following address:

Engineer Abdul- Lateef Abu Khadejeh
Tel : 5237181 – 1119
Telfax : 5239346
Mobile 1795666194

Thank you for your cooperation

- **Put the number of value you think appropriate against any problem. Please consider the values stated in each number**

- (1) not important (2) some what important (3) fairly important (4) important

ADMINISTRATIVE ASPECT

1	Employer's direct supervision of managing the project	
2	Lack of defining cadre structure in the company	
3	Lack of employing computer programs in project management.	
4	Absence of administrative experience in business administration	
5	Overlap in cadre structure, whether administrative or technical.	
6	The contractor's lack of scientific know-how.	
7	Lack of applying all specifications agreed upon by the adviser and contractor.	
8	Absence of licensed administrative bureaus for contractors.	
9	Lack of sufficient administrative cadre for project management.	
10	Absence of qualification courses for administrators.	
11	Lack of distinguishing between technical and administrative aspects of the project	
12	Continuous change in laws, particularly income tax law.	
13	Contractor's rank is based on his company's capital.	

FINANCIAL ASPECT

1	The Company obtains large- sum loans	
2	Inability to execute the project within specified timetable .	
3	The owner lags behind in paying the contractor.	
4	The contractor expands his work simultaneously in more than one project.	
5	The contractor does not pay worker wages in due time.	
6	Incompatibility of work progress (completed work) with cash payments.	
7	Weak remitting.	
8	Construction prices are low	
9	Competition in pricing projects	
10	Laws governing payment process and protecting contractor's rights are absent	
11	Construction companies in Jordan are many	
12	Deterioration of general economic conditions	
13	Specialists in project financial analysis are not employed	
14	Inability to control project financial affairs	
15	Taxes and tax burdens	
16	Absence of price standing strategy in the market	
17	Reliance on personal relations in pricing	
18	Absence of financial allowances with the contractor when the project tender is invited	

RESOURCES

1	There is no standing guideline of the numerous resources in Jordan	
2	There are many fake and not original varieties of materials	
3	Monopoly of some varieties of material	
4	The long distance between the project and resources	
5	There is no monitoring for high quality	
6	There are no regular tests for materials used in projects	
7	Absence of basic materials in the project	
8	Scarcity of resources sometimes, especially basic resources	
9	Some materials do not arrive in the site assigned for them	
10	Agreed-upon technical specifications are not realized	
11	The contractor takes into account the resource of lowest price	
12	Heavy equipment are not maintained periodically	
13	Fluctuating prices of materials	
14	There are no guarantees on imported materials	

MANPOWER

1	Absence of trained domestic manpower	
2	Wages of domestic manpower are high	
3	Laws of employing foreign manpower are rigid	
4	Absence of training centers for domestic manpower	
5	The worker does not abide by work- hours according to the a greedupon principles	
6	Necessary technical skills are not available	
7	Public safety rules are not abided by	
8	Absence of health insurance	
9	Low productive efficiency of the worker	
10	There is no care for workmanship	
11	Instability of cadre in the companies	

TECHNICAL ASPECT

1	Design bureaus are not monitored	
2	There are many design bureaus	
3	Providing special cadre is not abided by	
4	The designer does not follow up designs and changes made on them	
5	The owner's meddling with the design	
6	Recurring design errors	
7	Errors in the inventory of quantities	
8	Supervising the project is not abided by	
9	Plans of design are incompatible with execution	
10	Survey processes are not precise	
11	Many modifications on designs are made during execution	

OTHER PROBLEMS

1	Absence of specialized contractors	
2	No relation exists between the Contractor Union and Engineer Union	
3	Small volume of projects and low prices	
4	Not applying the ISO system in executing projects	

A – 5 Second Questionnire in Arabic

استبانة حول المخاطر والمشاكل التي تواجه قطاع صناعة الإنشاءات في الأردن

عزيزي المدير المحترم ،

تحية طيبة وبعد ،

نظرا لما يمثله قطاع الإنشاءات الوطني من أهمية في الاقتصادات الوطنية ولأهمية الوقوف على ما يعانيه هذا القطاع من تعثرات وعوامل مؤثرة في بنيته التنظيمية وبيئته ونشاطه ،

يسعدني أن أجعل محور بحثي في هذه الرسالة المقدمة للجامعة الأردنية، حول المخاطر والمشاكل التي تؤثر في صناعة الإنشاءات الوطنية ، "سلبا وإيجابا " وللوصول للأسلم من المؤشرات، سأكون شاكرا لكم إذا ما تكرمتم برفدي بمرئياتكم في هذا المجال، علما بأن كافة المعلومات ستكون سرية خصوصا إذا ما علمتم أنه ليس من الضروري ذكر اسم مؤسستكم في الإجابة .
في حال وجود أي ملاحظات او الرغبة بالاستفسار عن أي من بنود هذه الاستبانة فإننا نرجو منكم الاتصال مع

الباحث : المهندس عبد اللطيف ابو خديجه
تلفون : 5237181 فرعي 1119
تلفاكس : 5239346
خلـــوي : 0795666194

شاكرين ومقدرين حسن تعاونكم

ملاحظة : لقد تم حصر معظم المشاكل التي تواجه قطاع الإنشاءات في الأردن بالنواحي المبينة في هذه الاستبانة، سأكون شاكرا إذا ما تكرمتم برفدي بمرئياتكم واقتراحاتكم حول أفضل الحلول المناسبة لهذا المشاكل.

الناحية الإدارية :-

1- إشراف صاحب العمل بشكل مباشر في إدارة المشروع

2- عدم تحديد الهيكل الوظيفي في الشركة

3- عدم استخدام برامج الكمبيوتر في إدارة المشاريع

4- عدم وجود الخبرة الإدارية لإدارة الأعمال

5- عدم وجود خبرة علمية لدى المتعهد

6- عدم تطبيق جميع المواصفات المتفق عليها من قِبل الاستشاري والمتعهد

7- عدم وجود مكاتب ادارية مرخصة للمقاولين

8- عدم توفر الكادر الاداري الكافي لإدارة المشروع

9- التغير المستمر في القوانين وخاصة في ضريبة الدخل

الناحية المالية :-

1- عدم قدرة تنفيذ المشروع في الوقت المحدد

2- تأخر المالك بسداد المقاول

3- عدم سداد رواتب العمال من قِبل المقاول
_____
_____

4- رخص أسعار الانشاءات
_____
_____

5- المنافسة في تسعير المشاريع
_____
_____

6- عدم القدرة على ضبط الامور المالية للمشاريع
_____
_____

7- عدم وجود مخصصات مالية عند المقاول عند طرح المشروع
_____
_____

الموارد :-

1- كثرة الاصناف المقلدة وغير الاصلية
_____
_____

2- عدم وجود إختبارات فحص للمواد الموردة للمشاريع بشكل منتظم
_____
_____

3- عدم جودة بعض المواد الاساسية في المشروع
_____
_____

4- شح الموارد في بعض الاحيان وخصوصا الموارد الأساسية
_____
_____

5- عدم تحقق المواصفات الفنية المتفق عليها
_____
_____

6- مراعاة المقاول المورد الاقل سعرا
_____
_____

7- عدم صيانة المعدات الثقيلة بشكل دوري
_____
_____

العمالــة : -

1- صعوبة القوانين الخاصة باستخدام العمالة الوافدة
_____
_____

2- عدم التزام العامل بالدوام حسب الأصول المتفق عليها
_____
_____

3- عدم توفر المهارات الفنية اللازمة
_____
_____

4- قلة الكفاءة الإنتاجية من قِبل العامل
_____
_____

5- عدم الاهتمام بالمصنعية
_____
_____

6- عدم الاستقرار الوظيفي في الشركات
_____
_____

الناحية الفنية :-

1- عدم وجود الرقابة على مكاتب التصميم
_____
_____

2- الأخطاء التصميمية المتكررة
_____
_____

3- أخطاء في جدول الكميات
_____
_____

4- عدم التقيد بالإشراف على المشروع
_____
_____

5- كثرة التعديلات على التصاميم أثناء العمل
_____
_____

A – 6 Second Questionnaire in English

Questionnaire on the risks and problems faced by the construction industry sector in Jordan

Dear Director,

Due to the important role of the national construction sector in the national economies and the importance of recognizing the stumbling blocks and factors which influence the sector's organizational structure, environment and activity, I am pleased to study the risks and problems which influence the national construction industry positively or negatively in the present M.Sc thesis, which is submitted to the University of Jordan, in order to delineate the most reasonable factors which affect this industry.

I will be grateful if you kindly provide me with your viewpoints in this field of research All the information you offer will be confidential since you are not required to mention the name of your organization on the questionnaire.

Should there be any remarks or inquiries about any of the items in this questionnaire, please contact me on the following address:

Engineer Abdul- Lateef Abu Khadejeh
Tel : 5237181 – 1119
Telfax : 5239346
Mobile 1795666194

Thank you for your cooperation

Note : most problems faced by the construction industry sector in Jordan have been listed in the present questionnaire. I will be grateful if you provide me with your viewpoints and suggestions on the best appropriate solutions for these problems.

ADMINISTRATIVE ASPECT

1. Employer's direct supervision of managing the project.
2. Lack of defining cadre structure in the company
3. Lack of employing computer programs in project management.
4. Absence of administrative experience in business administration
5. The contractor's lack of scientific know-how.
6. Lack of applying all specifications agreed upon by the adviser and contractor.
7. Absence of licensed administrative bureaus for contractors.
8. Lack of sufficient administrative cadre for project management.
9. Continuous change in laws, particularly income tax law.

FINANCIAL ASPECT

1. Inability to execute the project within specified time – table .
2. The owner lags behind in paying the contractor.
3. The contractor does not pay worker wages in due time.
4. Construction prices are low
5. Competition in pricing projects.
6. Inability to control project financial affairs.
7. Absence of financial allowances with the contractor when the project tender is invited.

RESOURCES

1. There are many fake and not original varieties of materials
2. There are no regular tests for materials used in projects.
3. Absence of basic materials in the project.
4. Scarcity of resources sometimes, especially basic resources.
5. Agreed-upon technical specifications are not realized.
6. The contractor takes into account the resource of lowest price.
7. Heavy equipment are not maintained periodically.

MANPOWER

1. Laws of employing foreign manpower are rigid.
2. Necessary technical skills are not available.
3. Low productive efficiency of the worker.
4. There is no care for workmanship.
5. Instability of cadre in the companies.

TECHNICAL ASPECT

1. Design bureaus are not monitored
2. Recurring design errors.
3. Errors in the inventory of quantities.
4. Supervising the project is not abided by.
5. Many modifications on designs are made during execution.

تحليل المخاطر في صناعة الإنشاءات في الأردن

إعداد

عبد اللطيف أبو خديجه

إشراف

الدكتور غالب عباسي

الملخص

ينصّب الهدف الأساسي لهذه الدراسة للتحري عن عوامل المخاطر التي لها أبلغ الأثر على صناعة الإنشاءات في الأردن. وتركز الاهتمام على المشاكل الكبرى التي تؤثر في تقدم المشروع، ويعزى ذلك إلى عدة مخاطر صنفت في خمسة أبواب كبرى، وهي : النواحي الإدارية، النواحي المالية ، الموارد ، مشاكل القوى العاملة، والنواحي الفنية.

تم ارسال إستبانة إلى شركات مصنفة من الدرجة الأولى والثانية والثالثة للوقوف على آرائها ووجهات نظرها حول المخاطر الكبرى في مؤسسة الإنشاءات بناء على دراسة استبانات سابقة، ولقد تم إعطاء لكل حالة خطر درجة ثم استخلص المجموع الكلي. وتم ترتيب جميع المخاطر بحسب الدرجات التي حصلت عليها وتم وصفها ومناقشتها.

وبعد إتمام تقويم الاستبانة الأولى، تم وضعنا إستبانة ثانية من أجل اقتراح حلول مناسبة للمخاطر الكبرى التي حصلت على أعلى المراتب في كل فصيلة وتم عقد اجتماعا مع مهندسين مخصصين ومقاولين لمناقشة الحلول الأكثر عقلانية والتي اقترحتها الشركات التي ملأت الاستبانة. كذلك تم عمل تلخيص إحصائي إضافي وتم الحصول على نتائج إحصائية أخرى.

لقد أظهرت النتائج بعض النقاط المؤثرة حول مختلف القضايا التي يمكن النظر إليها على أنها ليست بذات أهمية، في الوقت الذي ينظر إليها على أنها عوامل أساسية لنجاح المشروع . ولقد كان الدعم المالي العامل الأكبر الذي عرفه جميع المقاولين وأظهر أن تقدم المشروع يعتمد اعتمادا كبيرا على المدفوعات المالية التي يستطيع أن يحصل عليها المقاول.

وأظهر التفاوت في تصنيف الشركات درجات فهم مختلفة في تحديد رتبة المخاطر. لذلك تعاملت الدراسة مع كل تصنيف شركة بأسلوب مختلف وحللت كل صنف تحليلا مستقلا. وجرت مناقشة عامة لكل فصيلة مخاطر تلتها تعقيبات. ولقد تم تصميم نموذج خاص عبر شبكة الانترنت ومزود بكافة التفاصيل التي تم اشتقاقها في هذه الرسالة.