ISSN: 1813-162X (Print) ; 2312-7589 (Online)

Tikrit Journal of Engineering Sciences

available online at: http://www.tj-es.com

TJES Tikrit Journal of Engineering Sciences

Cost and Time Risk Management in Construction Projects

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***Keywords*:**

Business risk
cost and time overruns
questionnaire
risk management

ARTICLE INFO

Article history:

Received 18 June 2017
Accepted 21 November 2017
Available online 11 March 2018

ABSTRACT

Identifying and evaluating the business risk (Cost and time overruns) management in construction projects to control and minimize such risk is the aim of this research. In diverse construction site, qualified professional workings are asked through an online questionnaire to collect tremendous diverse thoughts to compare between them. The questionnaire developed the research and collected more sensitive/accurate and reliable data about construction business risk management. The first step in this research is to attain worthy information about business risk management in term of cost and time overruns from previous related studies. A theoretical background about management of business risk is provided by the review of these studies that led to the design of the questionnaire questions. This paper concluded that poor business performance, such as time delays and cost overruns, are common in construction projects. Poor business performances can be significantly reduced by providing adequate construction planning at the beginning of the project, accurate in estimation, preventing changes in projects during construction, improving contract management and improving communication between construction parties.

DOI: http://dx.doi.org/10.25130/tjes.25.1.07

إدارة مخاطر التكلفة والوقت في المشاريع الإنشائية

الخلاصة

يهدف هذا البحث إلى تحديد وتقييم مخاطر العمل (إدارة التكلفة والوقت) في المشاريع الإنشائية للسيطرة على هذه المخاطر والحد منها. في مواقع إنشائية متنوعة، يتم سؤال المؤهلون مهنيا من خلال استبيان على الانترنت لجمع أفكار هائلة متنوعة للمقارنة فيما بينهما. قام الاستبيان بتطوير البحث وجمع بيانات أكثر حساسية / دقيقة وموثوق بها حول إدارة مخاطر أعمال البناء. وتتمثل الخطوة الأولى في هذا البحث في الحصول على معلومات جديرة بالاهتمام حول إدارة مخاطر الأعمال من حيث تجاوز التكاليف والوقت من دراسات سابقة ذات صلة. يتم تقديم خلفية نظرية عن إدارة مخاطر العمل من خلال مراجعة هذه الدراسات التي أدت إلى تصميم أسئلة الاستبيان. وخلصت هذا البحث إلى أن الأداء الأداري الضعيف للأعمال في المشاريع الإنشائية، تسبب التأخيرات الزمنية وتجاوز التكاليف، الشائعة في المشاريع الانشائية. ويمكن تقليل تأثير ذلك الأداء الضعيف للأعمال بشكل كبير من خلال توفير التخطيط المناسب للمشاريع الإنشائية في بداية المشروع، والدقة في التقدير، ومنع التغييرات في المشاريع أثناء الأنشاء، وتحسين إدارة العقود وتحسين التواصل بين أطراف المشتركة في المشروع الإنشائي.

1. INTRODUCTION

Business risk in general is the probability that an actual return of an investment will be less than the expected return. The continuing process to identify, analyze, evaluate and monitor risk control to alleviate the adverse effect of loss. Therefore, the survey process through an online questionnaire is applied to recognized risks and device actions to minimize the likelihood of a risk materializing and to eliminate or reduce the possible consequences of recognized project risks. This research focused on business risk (time delay and cost overrun). Poor business performance in the construction industry, such as construction time delays and cost overruns, are not uncommon and they have the greatest negative outcomes for the construction projects. Therefore, construction practitioners, consultant and researchers' attention have attracted due to these problems, which could be inevitable in most construction projects all around the world. Construction projects' economic case could overturn due to the cost and time overruns, particularly in extreme cases a conceivably profitable project turns into an unprofitable venture. Contractors may be tempted to cut corners to maximize profits, although this can backfire and result in inefficiencies and other expenses.

Therefore, this paper aimed to evaluate and identified this risk in construction projects to control and reduce

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business risk (construction time delay and cost overruns). This aim could be attained by:

- Identifying and realizing the most significant features in business risks (Cost/budget and time overruns).
- Providing the most appropriate solutions for the different identified problems.
- The most important features in time delays and cost/budget overruns, and provide solutions.
- Improving estimation of time and cost to complete the project within the specified time and budget to reduce business risk.

The construction industry is notorious for poor business act in relations of budget overruns and time delays, which have significant negative outcomes for projects [1,2]. Cost overrun is "additional cost above the estimate of the finance cost of the project", while time delay is "additional time beyond the completion date of the construction project" [3].

1.1. Factors Affecting Project Time Delay and Cost Overruns

The most important factors leading to time delays and cost/budget overruns are poor contract management, finance and payment problems, shortages of materials and changes in site conditions [2,4]. Moreover, Kaming et al. [5] reported that the most principal aspects leading to project time delays are inadequate planning, shortage of resources, poor labour productivity and design changes, while cost overrun is generally attributable to inaccurate material estimation, material cost increases and complexity of project. In addition, Budget overrun and time delay occur due to poor contractor management, payment difficulties, material shortages, escalation of material prices and poor technical ability as stated by Frimpong et al. [6]. The reasons which maximize project budget could be the same reason which cause the project time delay as reported by Chang [7]. Delaying the time of construction automatically increases the construction cost of the project, due to their inherent link. For example, when the project is delayed, the organisation generally must continue to pay salaries for construction teams.

Chartered Institute of Building (CIOB) carried out a survey and found that the UK complex construction projects are most probably to be completed within more half a year late [8](CIOB 2008). Regarding to the 332 the United States Air Force funded construction projects investigated by Hoffman et al. [9] it found that almost 72 percent of those construction projects were overdue within the quantified time of the project.

2. RESEARCH METHODOLOGY

The questionnaire was used for this research to analyse business risk management in construction projects, to collect a widespread of concepts from professionals who have experienced in the field of construction industry to compare their viewpoints. Many stakeholders in construction projects (project managers, site engineers, clients, contractors, designers, and others) were questioned through the survey questionnaire to develop the questioner. Reviewing the previous related studies have obtained a useful information was the first step, which provided the theoretical background about business risk management and were supportive in designing the questionnaire. A list questions structured was sent to construction-related professionals to collect an honest quantitative large information in a relatively short time. This could have considered as principal advantageous of the questionnaire process.

By analyzing and developing the respondent mind about cost/budget and time risks in construction projects, throughout the questionnaire this research has focused on the most business risk common problems in Iraq and the United Kingdom were under the scope of this questionnaire. Microsoft excel has used to more data analyzing after the collection of data have been completed.

2.1. Project Change Impact on Business Risk

According to Ming et al. [10] a project change is the common concern in construction projects. At any phase of a project and due to different reasons from different causes change frequently occurs and this change could have significant effects as stated by Motawa et al. [11]. Projects scope deletions or modifications could be considered as variations in the project with originally specified time. Construction process method that differ from the first construction plan or specification, and produce variances in quality. Quantity of the work condition different or produce an unstable project as clarified by Park [12] and also Yousif [13] reported that the state of the work changes due to changes in construction projects. The effect of project changes in different kinds of projects depend on the type of industrial, nature of the project, size of the project, project complexity, projects' participant experience level in addition to the method control of the construction projects.

Project changes have both negative and positive effects on the budgets of the project; quality and plan changes are divided into two principle types, ''detrimental and beneficial changes''[14]. Beneficial changes should result from practicing cost management. Though cost management itself results in projects incurring more costs, in generally this could be eventually helpful and useful to big projects, therefore such type of the change in the big project could be assisted by the running team as it has benefits to the project particularly in a large project. In contrast, the second type of the change the Detrimental variation could have adverse influences on projects, reducing the value of the owner (from a financial perspective). According to Arain and Low [15], project cost/budget could increase significantly due to any principal additional items to the scope of the original work therefore, in general such major change must be avoided. Also, Isaac and Navon [16] reported that changes such as project time delay, project cost/budget overrun and differences in quantities from first agreed requirements could produce negative impact on construction management in big projects.

2.2. Financial Risk

It is evident that financial risks are not uncommon to furthermost construction projects. As in some cases the diminished income generation and delay in construction projects occurrence influence significantly the financial risk, this type of risk is greatly affected by such risks (diminished avenue and time delay) and depend on the

occurrence of these risks. Smith et al. [17] stated that by considering the appropriate financial risk act, the construction financial risk could be significantly reduced. This success could be achieved due to successful management of the construction project after identifying the earlier mentioned risks connected with the project finance risk. Thus, the project's chance of achievement could increase significantly. Smith et al. [3] and Merna [18] stated that the most serious impacts of risks in construction projects are:

- Failure to meet cost estimate.
- Failure to complete project in specified time.
- Failure to achieve operational requirements calculated by the agreement.
- Failure to achieve estimated revenues.
- Failure to meet repayment.
- Failure by one of the construction parties to meet their obligations (as determined by the contract agreement).

However, although risks seem to inherently imply loss, they may also have beneficial impacts such as:

- Costs may be lower than estimated.
- Completion date may be sooner than expected.
- Quality may be achieved at a lower cost while still meeting operational requirements.
- Increases in demand increase the estimated revenue.
- Increased revenue benefit repayment.
- Obligation is met by each party to the agreement.

2.3. The Effect of Accidents on Time and Cost of Construction

Clearly construction accidents can cause time delay and cost overrun, particularly if they result in suspension of the construction process (e.g. due to investigations or on-going safety issues), which causes time delay. Moreover, the organisation generally pays some form of compensation to injured employees and must pay for repairs and damages to the project. Thus, according to Griffith and Howarth [19], site accidents cause time delays and cost overruns that can be divided into two categories: visible or 'insured costs' and hidden or 'uninsured costs'. Determining the proportion of insured costs to uninsured costs is difficult. The uninsured costs of the accidents are many times more than the insured costs.

Insured (visible) construction project organisation costs contain the legal responsibility of the employer; Property damage; Third party (public) liability. Uninsured (hidden) costs to both corporate organisations and construction projects include investigations; legal fees; fines; production schedule disruption and delays; reputation damage; loss of business and goodwill; sick pay and compensation; repairs and replacement; loss due to equipment, construction material and plant damage in addition to damaging of other resources.

2.4. Project Schedule and Cost Estimation

Schedule/time estimation is identified a strategy of project item implementation performance, displaying the guidelines of carrying out of each task and required quantity of expected period of each project items. Cost estimation quantities prediction. Resources prices or costs demanded by the scope of project. Cost estimation is determined by using experience, calculations and expecting future resources cost [20].

Construction projects time and cost are governing with the aim of delivery within a prearranged cost/budget and time. Defining these aims is the very significant initiating point for controlling projects. The main reason behind this it performs as benchmark/baseline to measure against. In the UK, a survey of consultant and contractors to ascertain the estimated time and cost of their construction projects [21].

2.5. Questionnaire

To collect information a list of questions was sent to professionals experienced in construction. Quick and large collected volume of quantitative information from the questionnaire is the main reason behind selecting this process. In addition, the respondents were express their honest opinions freely and when they like to respond due to availability of enough time of thinking before answering the questionnaire questions.

As unambiguous, simple, accurate and short questionnaire, were key points to get the highest rate of response. The survey questions were designed to be simple and easy to follow with many multiple choices yes/no, significant/insignificant and agree/disagree format questions.

This survey includes a total of 10 questions. The first two questions were related to the respondent's years of experience and their level of understanding of risk management, the other 8 questions were about their opinion regarding to the time and cost most affect factors. In this research, online questionnaire was used to send to more than 100 professional people working in construction industry in two countries: the UK and Iraq. Relatively high response of more than 80 percent were received from eligible identified professionals.

3. RESULTS AND DISCUSSION

In this section, the questionnaire respondent answers will be presented in addition to focusing on the key points arising from the results analysis.

3.1. Respondents Experience and Understanding of Business Risk

It is evident that the quality of any data, collected throughout a questionnaire is extremely depended on both knowledge and experience of the questionnaire respondent. Therefore, to ensure the the questionnaire respondent were most suitable qualified to participate in this questionnaire, the first two questions were about the years of experience and the level of understanding of risk management in construction projects.

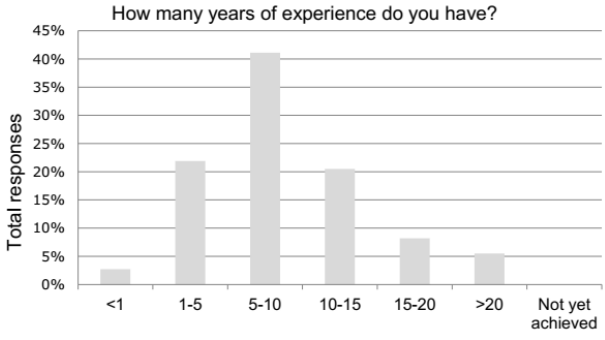

Fig. 1. Respondents experience.

Respondents experience is shown in Fig. 1. Years of experience group (5-10) years forms almost 40% of total respondents as the largest group, followed by (1-5) years group of 22%, (10-15) years group of 20%, (15-20) years group of 8%, while the experienced group with more than 20 year consists just 5% of the total respondents. Fig. 1 result confirms the sufficient knowledge and wide ranges of experience to take part in such research which might have good contribution to the research.

One of the survey questions inquired the respondent's levels of knowledge regarding to management of time delay and cost/budget overruns in a construction projects. According to the results shown in Fig. 2, most respondents (56%) indicated that their understanding is well, 25% of the professional response illustrated that they a very well understand of the business risk management, and about 17% of the respondents were just familiar with the risk management concept, whereas only 1% of the respondent were declared that they are unfamiliar with the business risk management concept as illustrated in (Fig. 2).

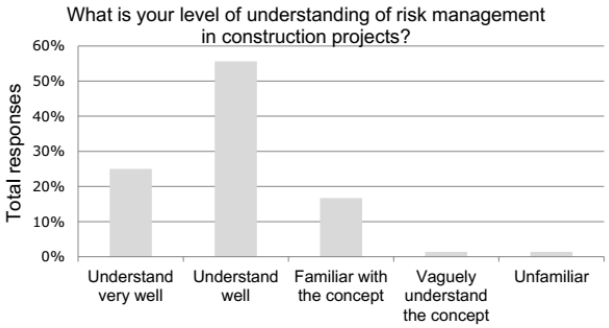

Fig. 2. Business risk management understanding levels of the respondents.

Accordingly, Fig. 2 results show that the respondents' wide ranges of understanding of business risk management, might add more valuable information to this research.

3.2. Construction Parties' Role factor

Most respondents (43%) thought that the contractor has a main role in avoiding time delay and cost overrun, one-fourth indicated project manager, and 14% indicated principal designer (Fig. 3). This indicates that the contractor and project manager have the main roles in minimizing business risk.

Fig. 4 shows the survey results when respondents were asked to show how strongly they agree or disagree with some factors causing project time delay, the majority (57%) of respondents strongly agreed with time delay due to inadequate construction planning, 46% agreed with time delay caused by project change during construction, 58% were neutral about poor labour productivity, 10% disagreed with finance and payment problems which cause of time delay.

The survey also asked the respondents to show how strongly they agree or disagree with some factors causing project cost overruns, as shown in Fig. 5. The majority (51%) of respondents strongly agreed with cost overruns due to inadequate construction planning, 55% agreed with cost overruns caused by poor contract management, 47% were neutral about construction accidents, 10% disagreed with poor labour productivity and 8% of respondents disagreed with shortage of materials as a cause of cost overrun.

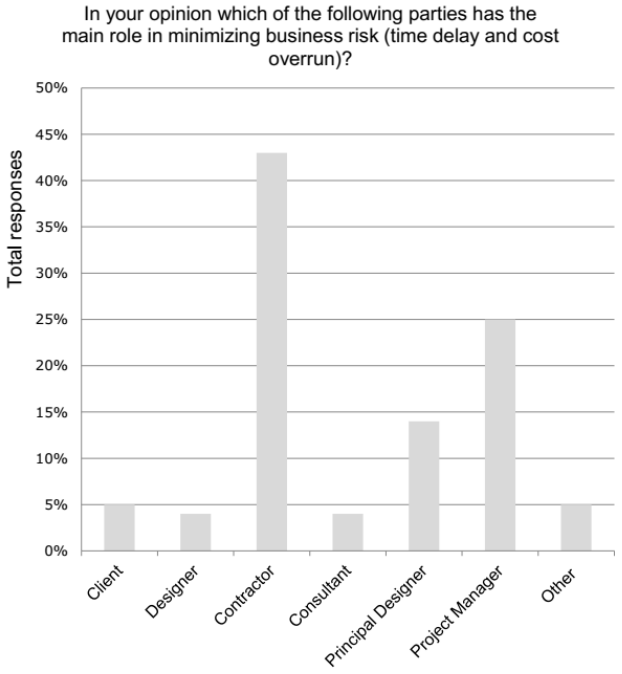

Fig. 3. Respondents' opinions about role of construction parties in minimizing business risk.

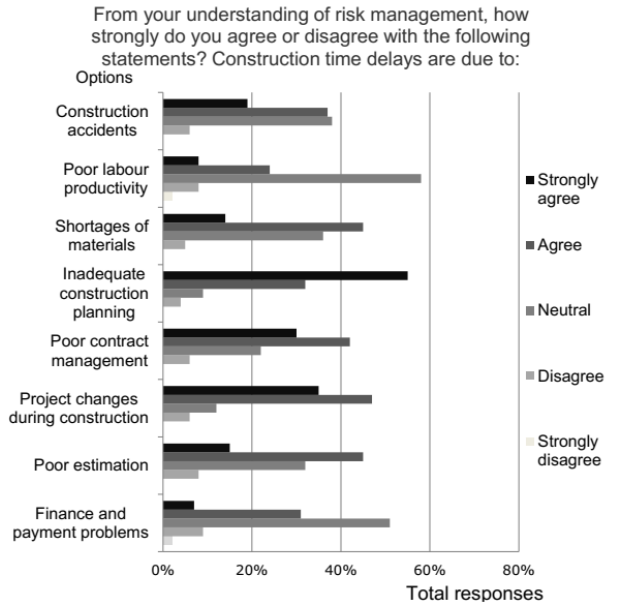

Fig. 4. Respondents' positions about construction time delays.

Based on the results shown in Figure 4 and Figure 5, it can be concluded that all the above factors cause time delays and cost overruns. Time delay and cost/budget overruns resulted in various significant factors which are namely: materials shortage, site conditions changes, poor management of the contract, payment, and finance problems. Similarly, most of the respondents emphasized time delay and cost overrun caused by inadequate construction planning, poor estimation, project changes during construction, poor contract management and finance and payment problems.

Delaying time of construction causes the cost of construction to increase, as explained previously. Thus, poor business performances such as time delay and cost

overrun can be significantly reduced by: Providing adequate construction planning at the beginning of the project. Accurate estimation.

- Preventing changes in projects during construction.
- Improving contract management.

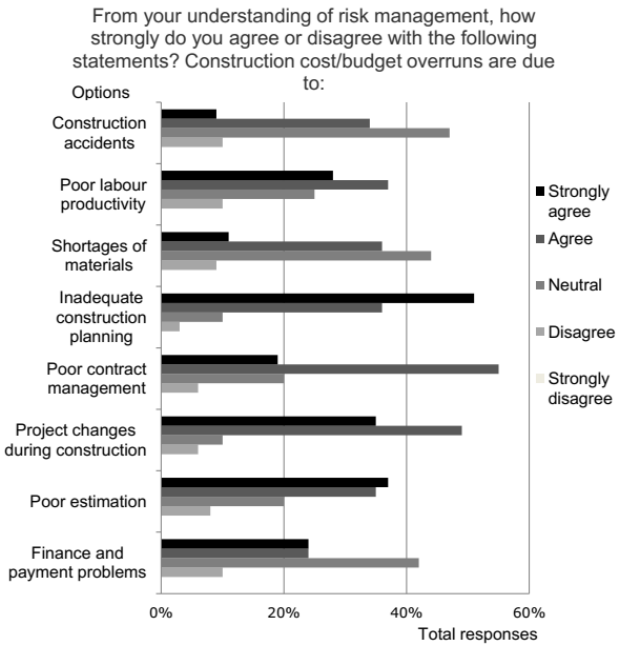

Fig. 5. Respondents' positions about construction cost overruns.

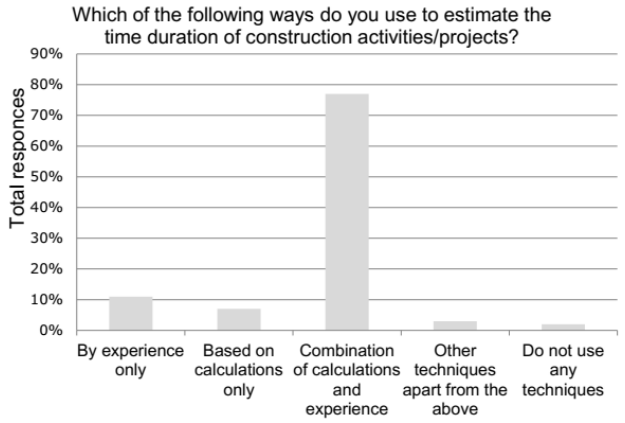

Fig. 6. How respondents estimate duration of construction activities/projects

3.3. Controlling Time and Cost in Constructing Projects

Fig. 6 illustrate the respondents answer regarding the following strategy in a project duration estimating method. The results illustrated that almost 77% of respondents control the duration of their project activities by coupling of both experience and calculation methods. whereas, just 11% and 7% of respondents determine the duration based on method of experience or calculations only (respectively).

Fig. 7 shows the result when the survey asked the respondents how they determine the costs of the projects that they have executed. The result demonstrates that 73% of the respondents depend both experience and calculation method in determining the cost of their projects. Just 17% of the respondents depend calculation method in determining the cost of their projects, and only 2% of respondents based on experience only.

The survey sought to discover the proportion of projects completed within the specified time according to the respondents, 44% of whom indicated that their projects were sometimes completed within the specified time, 30% often completed their projects within the specified time, and only 7% of respondents always completed their projects within specified time (Fig. 8).

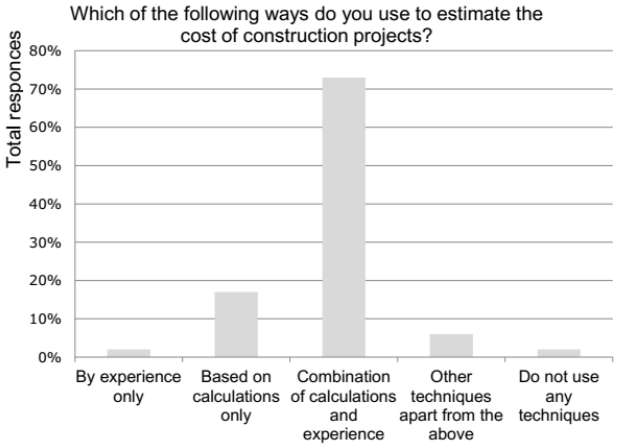

Fig. 7. How respondents estimate cost of construction projects.

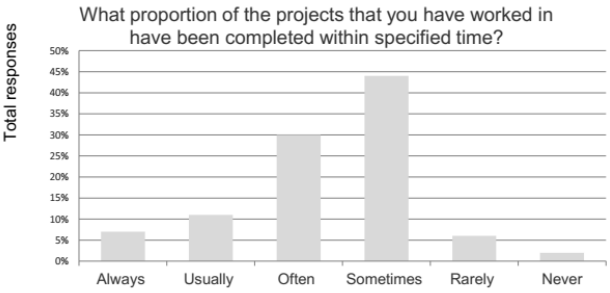

Fig. 8. Proportion of projects completed in specified time

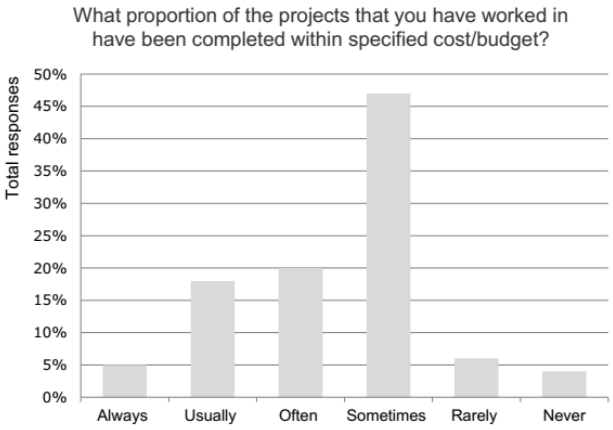

Fig. 9. Proportion of projects completed in specified budget.

The survey also sought to discover what proportion the projects have been completed within specified cost/budget by respondents. Nearly half of the respondents (47%) sometimes completed their projects within the specified cost, 20% often, and only 5% of respondents always completed their projects within the specified cost (Fig. 9).

According to the results from Figure 8 and Figure 9, construction time delays and cost overruns are common in construction projects and frequently occur. A realistic and accurate estimate could be helpful in developing an active strategy for controlling the overruns of both time and cost of the construction projects. Furthermore, the projected time and cost of construction should be based on coupling of both experience and calculation strategy. Many professionals estimate the construction cost and time based on calculation only or experience only, which may increase the business risk. In addition, some construction difficulties that produce risk to the time and cost of construction cannot be anticipated based on calculation only (without experience). that improving communication between client and designer is insignificant.

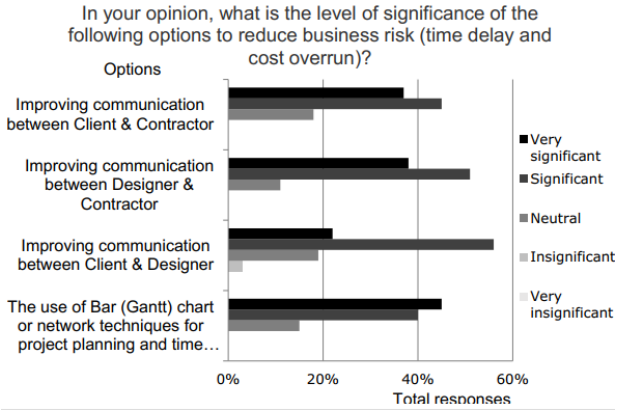

Fig. 10. Respondents' opinions about signifiant of options to reduce business risk.

It is clear from the results shown in Fig. 10 that better communication between construction parties on the same project is significant to govern both cost and time of construction projects. The sharing of information regarding risks on projects, as well as having a common priority of business can ensure that everything possible is done to minimize the chance of cost overruns and time delay in a construction projects. Moreover, the use of bar (Gannt) chart or network technique is significant to control time and cost of construction.

4. CONCLUSIONS

This research, is aimed to reduce business risk (time delay and cost overrun) in a construction projects, by an accurate identifying and evaluating the management of such risk. An online questionnaire was used to achieve the aim of this research. A various range of ideas was collected from construction professional who have a widespread range of experience and working in various construction sites to compare between these ideas. Reviewing the previous related studies have obtained a useful information was the first step, which provided the theoretical background about business risk management and were supportive in designing the questionnaire. The results confirmed that the poor business presentation, such as construction cost/budget overrun, and time delays were not uncommon in any construction projects. The research found the most important factors leading to time delay and cost overrun were inadequate construction planning, poor estimation, project changes during construction, poor contract management, and finance and payment problems. The research concluded that poor business performance could be significantly reduced by providing better construction planning at the beginning of the project, preventing changes in projects during construction, improving contract management and improving finance and payment problems. Moreover, improving communication between the construction parties on the same site is very significant for any construction cost and time controlling. The sharing of information regarding risks on projects, as well as having a common priority of business can ensure that everything possible is done to reduce the chance of time delay and cost overrun.

Based on this research, in general the most of construction projects were not finished within specified cost and time because, as stated by most questionnaire participants, they only 'sometimes' completed their construction projects within the specified time and cost. A realistic and accurate estimate could be helpful in developing an active strategy for controlling the overruns of both time and cost of the construction projects. Furthermore, the projected time and cost of construction should be based on coupling of both experience and calculation strategy. Many professionals estimate the construction cost and time based on calculation only or experience only, which may increase the business risk. In addition, some construction difficulties that produce risk to the time and cost of construction cannot be anticipated based on calculation only (without experience). Either of these methods alone might increase the business risk. Thus, further study on business risk and identify penalties for poor business performance is inevitable.

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