

## Change Management and Change Process Model for the Iranian Construction Industry

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Received 9 January 2012, Accepted 28 March 2012

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**ABSTRACT:** Changes are inevitable in construction projects. They could lead to disruptive impacts on the quality, schedule and budget of projects. Identifying changes and anticipating their consequences can help project teams mitigate these negative impacts. As a result, a change process model has been defined to improve this procedure. At first the present paper defines some of the key terms in this process and aims at depicting a clear image of these definitions as they are fundamental and can lead to vague assumptions. The causes and effects of change have been described in a precise and brief manner. Both qualitative and quantitative methodologies were utilized in this research, which includes 8 open-ended and 16 close-ended questions. The results clearly showed that there is not a change management procedure available in the Iranian construction industry; therefore, the existence of such procedure is vital in order to achieve the contractual obligations of time, cost and quality. Finally, a change process model tailored to the requirements of Iranian construction industry has been defined in some details. Several aspects of proposed change management process for developing a proactive and improving procedure have also been presented in the final section. This paper aims at providing a platform for employing change management practices in large organizations in Iran with a concise review of the available studies carried out in the past few years.

**Keywords:** *Change, Change order, Change notice, Start up, Change management, Process model*

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### INTRODUCTION

During the development phases of every construction project, many decisions have to be made based on the assumptions, incomplete information and personal experiences (Hao et al., 2008); or generally uncertain conditions; which can lead to adjustment at a later stage of the project. Incomplete information on the project variables at the early stages of projects leads to inadequate knowledge of future conditions (Ibbs et al., 2007). Consequently, it may result in imprecise estimates arising from ambiguity in project parameters (Motawa, 2005). Therefore, changes are inevitable and if they are not managed properly, delay and cost overruns

would occur; the key point is trying to avoid them or at least reduce their negative impact (EPSRC, 2004).

Based on a research carried out by Engineering and Physical Sciences Research Council in UK, "there are no widely accepted standard and comprehensive change management methods" currently being employed (EPSRC, 2004). "Method" in this case is referring to a toolkit with certain functions and procedures which can be used in order to manage the changes properly and to minimize their impact on time and cost.

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### Literature Review

A review of academic literature was carried out on the main rationale of implementing Change Management system. The main body of research relates to the impacts of Changes and a growing literature on the Modeling of Change processes and also Change Management System.

The majority of researches that have been carried out in this field address the impacts of change on various aspects of project delivery. Among these, the effect of change on cost of the project is the dominant subject whilst time, quality, labor productivity and value of projects overall life cycle are other focused subjects.

It can be concluded that change management is an integral part of project management; hence the requirement of a change process model to improve the delivery method of projects is of paramount importance. It was back to 1994 when Construction Industry Institute (CII) commenced researching in this field trying to apply the concept of best practices in this field to manage changes more properly. It was in 1999 that two new concepts emerged in this field, a standard procedure for change orders was introduced by Cox et. al (1999) while CIRIA created a toolkit for change management according to best practices. It was in 2001 that Ibbs introduced a change management system. This system was based on five principles which were working closely together. Ibbs also did a great study in 1997 that quantified the impacts of change that would happen during the execution of a project.

It can be concluded that most of the researches have had a focus on recognizing a change process which is basically founded on best practices from what have already been mentioned. The critical success factors of these change processes are another subject that has been focused on. Considering the abundant number of causes of change and their consequences, it can be concluded that these researches are valuable and helpful, but are not satisfactory in all respects. Hence, there is a growing need for modeling cause and effect relations in change management system.

### Definition of Change

“In construction projects, a change refers to an alteration or a modification to pre-existing conditions, assumptions and basic information,

or requirements (project or client)” (EPSCR, 2004). It includes work, time, cost and method of performance.

The following definitions help the management team to handle changes more effectively:

#### Change notice

A document issued by the client (or by contractor to subcontractors) notifying them of the possible and potential changes that may be encountered. The purpose of change notice is:

- ✓ Provide the revised or new data, drawings or any other document that may be necessary;
- ✓ Asking the involved parties for the new schedule and the effects on the contract price;
- ✓ The effects that these changes, including deletions, additions and revisions may have on other activities (successor or predecessors).

Hypothesis 1: There is a significant positive relationship between IC and ratios of market to-book value.

#### Change Notice Request

A document issued by contractor for initiating request for change notice due to some unforeseen factors such as differing site conditions, constructive events and changes.

#### Change Order

A document represents the commercial and technical resolution of a contract change (CURT, 2004). A change order describes the scope, price, schedule and method of payment for a change. It may be agreed to and signed by both parties; or, if authorized by the terms of the contract, issued unilaterally representing your determination of an equitable adjustment.

A change order (or amendment package) would usually consist of the following information:

- ✓ Change order
- ✓ Commitment authorization
- ✓ Change summary; a narrative description why the change was made
- ✓ Technical documents; like Drawings, Calculation sheets, sketches
- ✓ Change notice

- ✓ Contractor proposal
- ✓ Cost analysis
- ✓ Schedule analysis
- ✓ Correspondence and any record of negotiation
- ✓ Any supporting documents.

#### **Change Proposal**

A proposed adjustment to contract price or/and time of performance in response to a change notice or any other circumstance in which the contractor believes an adjustment to the price or performance is due. Proposal should conform to the contract requirements for pricing of adjustments.

#### **Extra Work**

Extra work is the work which is outside of the general scope of the contract. The agreement with the contractor for the extra work is formalized in an amendment, which defines scope, payment terms and schedule. We should always remember that not all the additional work is extra work (Park, 2002). The addition of extra work should be treated as sole source procurement requiring appropriate approvals.

All approved contract changes must be communicated and confirmed in writing by a change notice and then incorporated into the contract by use of a change order. As a minimum, the following items shall be included in the change order:

- ✓ Descriptive scope of the change;
- ✓ Method of payment;
- ✓ Time and schedule adjustment;
- ✓ Direction to proceed or to wait for notice;
- ✓ Acknowledgement.

#### **Types of Change**

Changes can be labeled in various ways, where Motawa et al. (2007) categorized them in the best possible way. Firstly he divided changes in to three main groups: changes based on time, need and impact. Changes based on time can be described as: anticipated or emergent, proactive or active, gradual or radical, pre-fixity or post-fixity.

Based on need, change could be elective or required, discretionary or non-discretionary, preferential or regulatory. Finally change can be

beneficial, neutral or disruptive. As it may be interpreted from their titles, "gradual change" happens slowly over a prolonged period with low intensity. On the contrary radical change is sudden with a marked impact.

As another example, anticipated changes are planned or thought of in advance and occur as the project management team anticipated them in the planning stage. On the other hand, emergent changes happen spontaneously and are not originally intended. In the same way, in an elective change the project management team can decide whether to implement the change or not, while in the required change they haven't got any other option (EPSCR, 2004).

#### **Causes of Change**

Changes in construction industry can be caused by various sources at different stages of the work. The cause of change may originate from external or internal issues that may occur during the development phases of project (from basic design to construction). External causes may be triggered because of:

- ✓ Changes in the client's need, policies or taste
- ✓ Changes in government decision's and policies
- ✓ Changes in the economical environment of the country or economical condition of all the stakeholders
- ✓ Changes in the competing market, e.g. Activities of our competitors may force us to alter our approach and perspective to various projects
- ✓ Changes because of the political situations of the country, e.g. sanctions imposed to Iran

Internal changes may occur as a result of changes in the company's management policies or changes in its organization objectives and perspectives. To go in to much more details, changes usually originated from either design or construction activities. Changes based on design may include design change, design errors, omissions, information and operation improvements. Lu and Issa (2005) believe that most frequent and most costly changes are often related to design, such as design changes and design errors. Other researchers back this idea

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up by stating that the primary cause of change orders are owner initiated changes and designer's errors and omissions (Senaratne and Sexton, 2011).

Construction changes may occur as a result of weather conditions, inappropriate site conditions, unsatisfactory ground conditions and material handling and delivery. Figure 1 illustrates the causes of change in a more appropriate and concise way.

#### Effects of Change

As stated before, project change can result in delays and cost overruns if the project management team doesn't implement a proper change management system. At the planning stage, changes can lead to revisions or rework

while in construction phase changes can have more drastic impacts like demolishing the part which has already been constructed and rebuilding it (Love et al., 2000).

A research by the University of Salford indicated that the cost of rework in construction project can be as high as 10 to 15% of the original contract value. Manavazhi and Xunzhi (2001) figured out that approximately, 30 percent of the overall planned time of designers was consumed by design variations which were mostly the result of client initiated changes. Simultaneously, project changes can have some indirect effects which eventually result in severe impacts on project budget or schedule. Figure 2 would depict effects of project change in a better way.

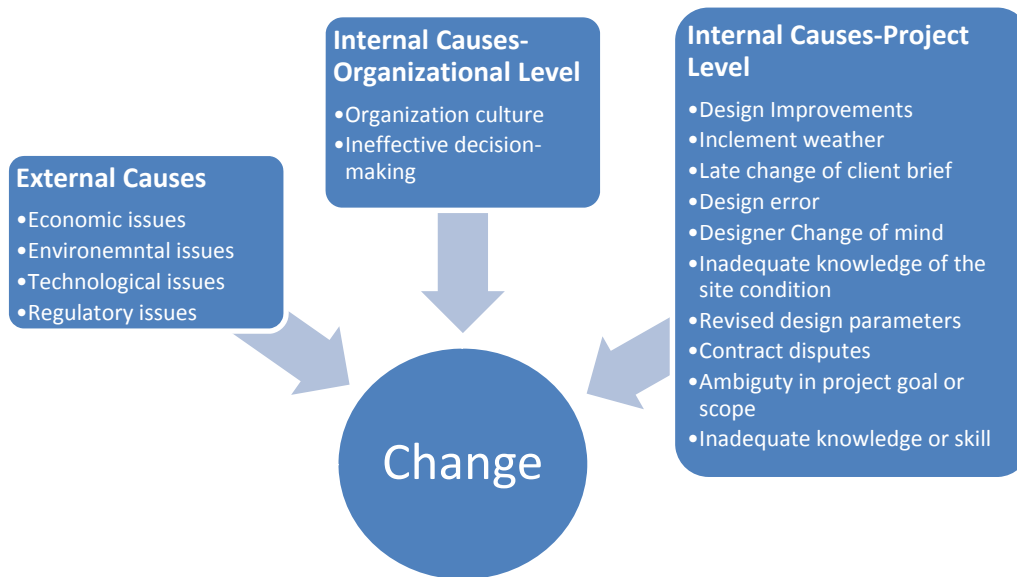


Figure 1: Causes of change

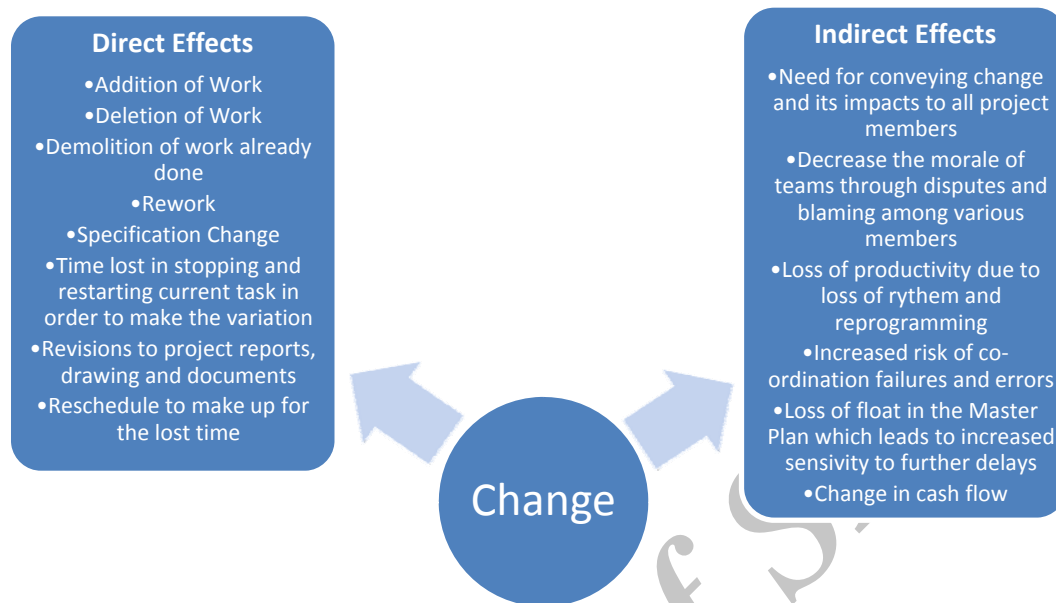


Figure 2: Effects of change

### Change Management

Change management is a combination of procedures, job descriptions and toolkits with the aim of:

- ✓ Anticipating possible changes in the basic engineering and detailed engineering stages
- ✓ Recognizing changes, in design or construction, which have already occurred
- ✓ Providing preventive actions and (in case of not being avoidable) mitigation plans
- ✓ Coordinating both changes and subsequent compensation actions across the entire project team

In other words, it is an application-oriented procedure which requires innovation in both engineering and project management. In general, there are two approaches toward change management:

**I. Reactive:** which improves efficiency in handling the change after its occurrence.

**II. Proactive:** Identify and forecast potential changes and develop solutions *before* the change occurs (Cox et al., 2006).

In a similar way, Ibbs et al. (2001) defined a change management system which was founded on five principles: 1) promote a balanced change culture; 2) recognize change; 3) evaluate change; 4) implement change; and 5) continuously improve from lessons learned.

### Research Objectives

The objectives of this research are as follow:

- To investigate the existence of a practical change management procedure along with the required expertise and knowledge regarding to it.
- To analyze the available change management procedures and tailor it the Iranian construction industry.
- To research and point out issues, critical success factors and requirements concerning the implementation of this change management procedure.

### RESEARCH METHOD

Research strategy can be defined as the way in which the research objectives can be questioned (Naoum, 2007). Both qualitative and

quantitative research methodologies were utilized in this research. Qualitative method was used as the nature of the research was optimizing process and developing techniques to remove existing flaws. In addition, nature, type and availability of data relating to the purpose of the study was another reason. After developing theories using qualitative method, quantitative method was used to measure tangible features of the concepts, find facts about them and collect these factual evidences.

Consequently, twenty four questions were extracted from an in-depth literature review and one case study. Firstly, a list of all correspondents based on their expertise was created. It must be mentioned that all the correspondents were working in a mega Iranian consultancy firm. Afterwards, a covering letter was emailed to them asking if they are willing to be interviewed by the author. Thirty six people including four project directors, nine project managers and twenty three project engineers were selected. Qualitative research data included eight open-ended questions while the quantitative data was gathered by the aid of sixteen close-ended questions asking for the correspondent's opinion on the change management procedure. The open-ended questions gave the interviewee's the freedom to express their views. Therefore some of the assumptions and consequently close-ended questions were modified after carrying out the interviews. People chosen to be interviewed were homogenous, sharing same characteristics, with almost similar experiences and were involved in same projects.

The main reasons for choosing the personal interview technique were:

1. Familiarity with a number of interviewees
2. Obtaining accurate and trustworthy results out of questions through the interpersonal contact
3. Explaining some answers to achieve the objectives of the project
4. Lack of familiarity with the concept of Change Management rendered the use of a questionnaire not a reliable data collection tool
5. Emergence of new facts and problems during the personal interviews

## RESULTS AND CONCLUSION

### Data Analysis

Considering the nature of the research and also the type of data which was going to be analyzed, the descriptive method was used in order to discuss the results of open-ended and close-ended questions. It was assumed that the level of importance for the answers is equal. Therefore the results have been analyzed homogeneously and not been categorized for project engineers, managers and directors.

### Results

Eighty-nine percent of interviewees (32 out of 36) believed that there is no system available for applying change management procedures in mega construction companies in Iran. Thirty-four interviewees (94%) thought that there must be a section dealing with change management procedure in construction companies. They also believed that the existence of the change management procedure is regardless of the size of the company. Fifteen interviewees (42%) thought that in the management level of the construction industry in Iran, there is not enough educational background to deal with change, claim and risk management.

Twenty-nine interviewees (81%) believed that not employing any change management procedure in Iranian construction Industry led to considerable cost overruns and severe delays (more than 5%). Seven other remaining interviewees believed that it would result to moderate impacts (less than 5%) on cost and schedule. Surprisingly, none of the interviewees thought that it doesn't have any effect on budget and schedule.

Fourteen interviewees (39%) believed that clients in construction industry should declare the change management as a mandatory procedure in contracts. The results of open-ended questions in this section made it crystal clear that most of the interviewees believed that the management level of construction companies in Iran shall accept the change management procedure as a beneficiary tool which can help their organizations dramatically in order to achieve the cost, schedule and quality required by contract and would avoid further claims and disagreements.

Thirty-one interviewees (86%) believed that the proposed change management procedure can be easily employed in construction companies in Iran with a help of a primarily introduction.

### **Change Management Process Model**

Using a practical model for change management can help the project team dramatically in order to identify changes and evaluate their impacts as early and accurately as possible. After digging in several case studies and researches which have been carried out across the globe, the author found a unified Process model for change management (EPSRC, 2004). This model consists of four stages which are defined more thoroughly in the following paragraphs. It shall be noted that these steps have been evolved continuously throughout the research and especially after carrying out the interviews and analyzing their result.

#### **1. Start Up**

This step provides the necessary requirements for managing changes happening in various development phases. It provides the project management team with the appropriate tools and facilities to respond to occurring changes readily. It also enables the team to manage changes in the best possible way and provide a contingency plan for the anticipated changes provisioned in the planning stage. During this stage the project management team should: 1) Allocate resources for various change management processes, 2) Initiate and choose change management processes, 3) Define selective approaches toward change management, 4) Align project elements to change management process.

#### **2. Identify and Evaluate**

The main objective of this step is to enable the project management team to identify actively the possible changes that might occur in the future activities of the project. Timing is of great importance here, in other words the earlier a change is identified the lower the impacts will be. Once a potential change is identified, the project team will estimate the possible impacts especially on project's budget and schedule.

Accordingly the project management team will provide mitigation plan for reducing the impacts of this possible change. The team may

employ various assessment methods and provide the project manager with different options. The routine procedure may result in a table which depicts the chances for the change to happen, their symptoms, impacts on other activities of the project, various mitigation methods, the extent of their effectiveness, and the related cost and time impacts.

This step can lead to creating a Proposal Change Order (PCO) which is a brief description of the change, its impacts and the anticipated action plans with regard to cost and time factors. The project management team may also provide an analysis of the change impacts on quality and safety.

#### **3. Approval**

Once the PCO is prepared, it shall be approved by appropriate members of the team. It can be anticipated in the initiating or planning stage, that a change review board with defined allocated roles will be responsible for this task. After approval by the change review committee, the proposal shall be approved by the client to be finalized. This is a pivotal moment for the project as the approval of the proposed change order will result in modification of the contract and the rejection of it may lead to further claims which will be discussed in a separate report "Claim Management". The author will try to provide this report aiming to illustrate the close relationship between Change, Claim and Risk Management. This topic is not discussed in any research and the author believes is of great importance for the well implementation of the construction projects.

#### **4. Implement and Review**

As soon as the change is approved, it should be communicated to all the teams and various disciplines whose work is going to be affected by the approved change. In order to keep a record of who has been informed, the project team shall prepare a list of all the people who are going to be contacted. It is a very crucial task, as any ignorant in this stage may lead to irreversible damages.

Subsequently, the contacted people are responsible for updating their schedule and amending their work. They should prepare an updated schedule with a provisional time table showing the proposed duration for completing

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the new tasks. They should also provide the project management team with a list indicating all the activities which are going to be affected as a result of these changes. The coordination here is of great importance, as any change in any discipline's activity may lead to severe changes to another. Therefore the project management team should communicate and coordinate every single detail with the respective teams,

disciplines and parties in the best possible way and keep a record of all the communications. After receiving the proposed time tables, tasks and plans, the project management team should review and comment on them. Preparing a lessons-learned log at this stage can help implementing the future projects in a better way and will create a priceless piece of knowledge.

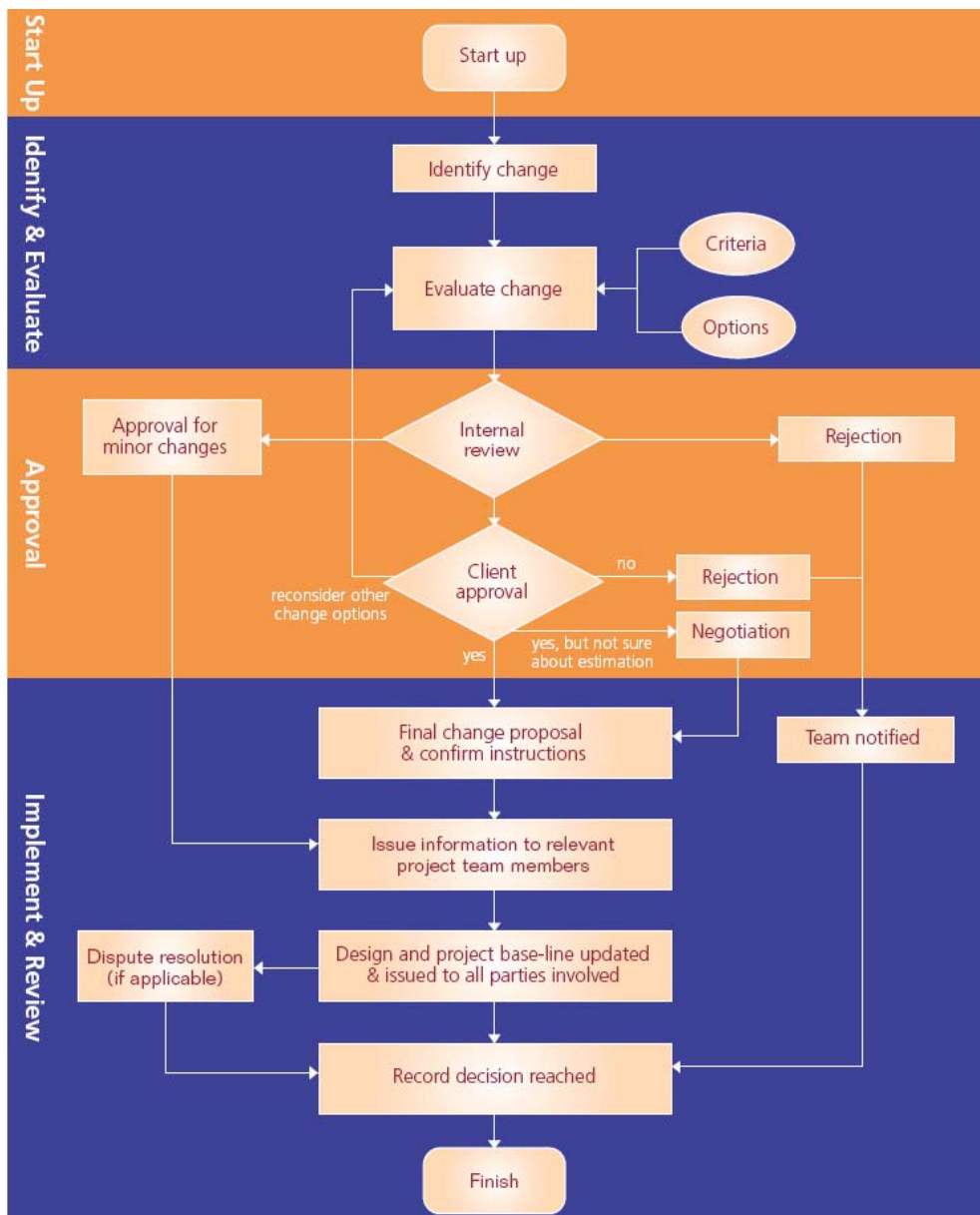


Figure 3: Generic project management process (CIRIA, 2001)



## CONCLUSION

The results of the interviews clearly depicted that implementing a practical and standard change management procedure for the construction industry of Iran is essential. It was also identified that although the leaders in managing construction projects in Iran believe that not implementing a proactive change management system led to severe cost and time overruns but there is not a system available for applying a change management procedure.

### Proactive and Improving Change Control System

Analyzing the results of interviews on one hand and the data acquired by doing an in-depth research on a case study on the other, helped the author to tailor the change management procedure to meet the Iranian construction industry requirements.

Meanwhile, this research also identified that in order to have a proactive change management system the following points would help the Project management team dramatically:

- ✓ Thorough and in-depth analysis of the project characteristics which can lead to change and the interrelationship between the change causes and effects.
- ✓ Improving change identification, assessment and prediction methods throughout the life cycle of projects.
- ✓ Modeling multi causes of change in order to evaluate the change effect more accurately.
- ✓ Modeling the change cause and effect in order to improve approach strategies.
- ✓ Implementing an effective change control system in an orderly fashion way.
- ✓ Assessing the likelihood of the project change occurrence during the initiating process and defining a control mechanism over the project segments that have high influence on the project.
- ✓ Implementing FACD (Functional Analysis Concept Design) commencing in the initiating stage and continuing in the design phase which enables partnering of client and designer to reach a comprehensive and functional design. By implementing this method, the chances of design change will reduce abundantly.

- ✓ As a conclusion, the project management team should: 1) identify the change process, 2) identify the factors affecting the change process and finally 3) employ the best practice recommendations for managing change during the project life cycle.

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