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RESEARCH PAPER

Effect of Changes in Planning on Project Objectives in Construction Industry of Pakistan

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ABSTRACT

Changes are very common and likely to occur at any stage of the project. The research is done to know the effect of changes in planning on scope, time and cost. Actual filed data from the construction industry of Pakistan was collected to know the real time effect. Project trade-off is one of the most important parts for all important projects. According to field data collected it found that mostly changes does not cause reduction in project scope and project cost, but they can reduce the project time. As the project objectives are closely linked to each other's, a study can be conducted to know the effect of one project objective over the other one. The Results of this research are very use full to create a relation between project changes in planning and their effect on project objectives; scope, cost and time.

Introduction

Construction is a key sector for the economy of any country and it has multiple back and forth linkages with other sectors. It contributes considerably to economic development of a country and its employment. Infra structural always needs lot of attention and supervision from different departments for proper execution(Ministry-of-Finance, 2016).

Pakistan is also among the developing country that is having strong expansion in construction works. Today, construction is among the major sector in Pakistan's economy "Construction is considered as one of the potential components of industrial sector and it has recorded a substantial growth as of last year's" (Ministry-of-Finance, 2016). Similarly, infrastructure development budget at provincial level is increasing. Part of infrastructure in ADP of Punjab 2014-2015 was 137,532M (PnD, 2014). While the same for ADP 2015-2016 was 144,576M (PnD, 2015). With the current rapid economic expansion of the country, Pakistan now offers a rising market for the construction. Even with this opportunity for expansion the challenges will be wide" (Farooqui & Ahmed, 2008).

In developing countries infrastructural development are on the way, But it is quite unfortunate that many of the construction projects fail to meet the scope, cost and schedule targets(Farooqui & Ahmed, 2008).Pakistan is also a country where scope change, cost overrun and delay in the projects can also be seen nearly in all projects. Various studies

have been conducted throughout the world about the causes of these variations in the construction project throughout the world.

Over spending, schedule overrun and scope &quality problems are common problems in the construction industry. These problems are majorly not the liability of a project team all the times but in most of the time, are caused by the changed requirement of client, technological constraints, site issues, financial problems, local regulations and many more.

Construction project decisions are frequently made based on insufficient knowledge, primarily through assumptions and the professionals' personal experiences, which may result in a situation requiring revision and/or redo. Both the modification and the revision are carried out using addition, subtraction, or replacement.(Anees, Mohamed, & Razek, 2013). Due to these decisions changes become essential for construction projects. The changes in the project and/or some adjustments are unavoidable as they are a realities at all stages of the project design and its construction(Senaratne & Sexton, 2008).

Literature Review

According to Nicholas and Steyn (2008)Project management is a combination of planning a project, making a schedule for project and then having a control over its activities so that project can meet its required objectives.

Project can be defined as it is a short term endeavor that is undertaken for the creation of a unique product, unique result or a unique services(PMI, 2013).

A project usually have a single and a definable purpose or end items , some result or a deliverables, usually that is specified in terms of project cost, performance requirements and project schedule(Nicholas & Steyn, 2008).

In the construction projects, the project changes are very widespread and these can occur at any of the project stages(Anees et al., 2013)

PMI (2013) Consider change as a process and use word "Change request "for project changes. The change request is usually defined as it is an official proposal to alter any deliverable, any document or any baseline(PMI, 2013). It also defines a complete process to manage the project change requests. The process is named as "Perform Integrated Change control"(PMI, 2013). The purpose to use this process is to control the generated change requests and only approve that change request which is expected to have positive effect on project objectives.

The project objectives includes "Scope, cost, time and Quality" (PMI, 2013). The completion of a project within the parameters of project scope, time, quality, cost, resources, and project risks should be taken into consideration when determining the project's success, as agreed upon by the project manager and senior management(PMI, 2013).

An important point is that project success can be considered against the project objectives however in management project success is usually calculated against the measures of the project cost, project time and project scope. The project success is normally evaluated, that the project has been delivered within the required time, budget and its specifications meets the clients expectations(Gherbal, 2015).

The project objectives scope, time & cost are planned and approved at start of project. After the approval of these objectives any change can only be made through proper channel.

The planning stage provides the framework over which most of the project decisions are made. Despite its importance, a lot of construction firms go through planning stage in an random style(Syal et al., 1992). This problem is mostly critical for small and medium size construction projects and the firms constructing these types of project projects in a design build environment(Syal et al., 1992).

One of the major aspects that make certain the successful accomplishment of a construction project is comprehensive project planning and control(Fajardo, Velázquez, & Grifé, 2006). Lack of planning makes it less likely to achieve complete project control, and to take timely decisions to keep projects on track. Lack of planning and control leads to project overruns in both project time and project cost. "This goal could be achieved following also an integrated approach for the planning and control phases of the project" (Fajardo et al., 2006).

"Twenty two percent of the companies do not perform planning at all" (Fajardo et al., 2006). While the remaining eighty-six percent companies do planning using Gantt charts and considers it as their only planning tool. Once a companies get construction contract, only 26% of them assess their plans prior to the start of the construction execution phase (Fajardo et al., 2006).

Researchers have divided the construction project in phases. PMI (2007) Propose that a construction project should be phased as follows.

- Feasibility Study
- Baseline Configurations
- Readiness to initial startup
- Contractual Completion

Generally, there are three major stakeholders in a construction project Client, Contractor and Consultant. Each of them perform planning of project related to their own part of work in the project however client has to look after the overall planning as well as client will directly affect with success or failure of the project.

PMI (2013) Define project scope as it is the summation of services, results, and products that are to be required from a project.

The construction industry occupies vital importance in most economies. But construction projects are always assumed to have delay and cost overruns. Lot of research has been done to know the cause of these delays in completion. The deviations of projects from their baselines are the biggest danger to construction sector. Literature has shown that majority of construction projects are delayed and this delay usually results in completion of projects beyond proposed time and estimated project cost(Mansoor 2016). The projects completed after their planned timelines had to face criticism. While the timely completion of construction projects is the judged as the efficiency and effectiveness(Mansoor 2016).

In construction, Change management requires an integrated solution. An effective construction change management procedure is required for the construction projects. (Hao et al., 2008). Managing change requires innovations from engineering to resolve the

problem. It is very common to have changes in construction projects and these can take place from different springs, due to different causes, Changes is a severe risk contributor to project(Hao et al., 2008).

Changes always result in rework to project, that increases the cost of project" (Sun et al., 2006). The total cost of rework in project of construction industry can be 10–15% of the total contract value(Sun et al., 2006). Other than rework, there are other direct effects of project change, that include the addition of project work; time loss; the revisions to project documents and reports; reschedule and work methods revision(Sun et al., 2006).

Material and Methods

As the named describes this chapter dealt with data analysis, Results and discussion on the results of the study. These will be done in the steps as described in the previous chapter.

Data entry from Google survey forms

Data collected through Google forms was downloaded and it was entered in excel sheet as per the required format of SPSS. (Numbers). Total 125 samples were collected using the Google forms.

Data entry from hard cop survey forms

Similar to Google forms data was entered in excel sheet from the hard copies as per the required format of SPSS. (Numbers). Total 62 samples were collected using the hard copies of survey forms.So in this way total = 187 Responses were collected for this research that is quit greater that the sample size estimated in the previous chapter.

The first step in the analysis was to check the data for any missing value, although in Google Forms it was ensured that any respondent should not submit the response with any missing information, however the data collected through hard copy of questionnaire was suspected to have any missing information. In the introductory statement it was requested to respondent to fill the complete forms. During analysis it was found that out of 187 respondents all of them have responded completely. The results for analysis can be seen in below table-01.

Table 1
Missing Values Check

Missing Values								
Element	CH1	CH2	CH3	CH4	CH5	CH6	S1	S2	S3
Valid	187	187	187	187	187	187	187	187	187
Missing	0	0	0	0	0	0	0	0	0
Element	T1	T2	T3	C1	C2	C3	E1	E2	E3
Valid	187	187	187	187	187	187	187	187	187
Missing	0	0	0	0	0	0	0	0	0
Element	IS	IT	IC	DS	DT	DC	Gender	Age	Sector
Valid	187	187	187	187	187	187	187	187	187
Missing	0	0	0	0	0	0	0	0	0
Element	Organization	Level of Job	Experience	PT1	PT2	PT3	PT4	PT5	Training
Valid	187	187	187	187	187	187	187	187	187
Missing	0	0	0	0	0	0	0	0	0

The data reliability test is very important for the generalization of results that have been drawn on the basis of sampled population. A full scale reliability test was performed on the collected data. The analysis results can be seen in below table. The reliability coefficient "Cronbach's Alpha value" is 0.819. This value is higher than threshold which is

usually 0.60. It is concluded from this analysis that the collected data is reliable enough that its results can be generalized on the target population.

Table 2
Reliability Analysis

Element	Number of items	Cronbach's Alpha
Scope	3	0.711
Time	3	0.820
Cost	3	0.782
Changes	6	0.731
Overall Element of Research	**15**	**0.819**

In this research Changes (in planning) were the independent variable and project objectives were the dependent variable. As the project objectives has further sub set scope, time and cost therefore there become three dependent variable of this research? The Liner regression was performed over the three models presented previously. The results of analysis are as below.

Change as Independent Variable & Scope as Dependent Variable

At 1st liner regression was performed taking change as independent variable and project scope as dependent variable. Analysis results obtained can be seen in table 4.6 (a - c)

Table 3
Liner Regression for Changes & Scope

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.423a	0.179	0.174	0.4534

a. Predictors: (Constant), CH_Avg

Table 4
ANOVAa

	Model	Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.551	1	7.551	36.734	.000b
	Residual	34.741	169	0.206		
	Total	42.292	170			

a. Dependent Variable: S_Avg
b. Predictors: (Constant), CH_Avg

Table 5
coefficients

	Model	Un standardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.68	0.267		10.029	0
	CH_Avg	0.432	0.071	0.423	6.061	0

a. Dependent Variable: S_Avg

The adjusted R square values from Table 3 it is found that the 17.4% variability of project scope (dependent variable) is accounted by the project changes (in planning) which is independent variable in this case.

From the table 4, F test that the model is significant and model is a good fit as the p- value is 0.000 that is less than the threshold value 0.05. so from Table 5 we have beta coefficients that are used to transform the regression equation 1.

$$\text{Project scope} = 2.68 + 0.432 \,(\text{Changes}) \quad \text{.........} \quad \text{Eq. 1}$$

The above equations tells that dues to one unit increment in "change in planning" there will be (2.62 + 0.432 x 1.0) = 3.112 unit increment in "Project scope". This means that if we change 1.0 unit of project planning the project scope will vary 3.112 units.

Out of 171 respondents 63% respondents were agree with the statement that project changes always increase the project scope and according to majority (50% of respondents) this increase can go be up to 5 - 10% of original scope. And incase changes cause decrease in scope according to majority (41% of respondents) it can decreases to less than 5 % of original scope. This scope change can be in the form of rework, revised or additional work of project.

Change as Independent Variable & Time as Dependent Variable

After scope the liner regression was performed taking change as independent variable and project time as dependent variable. Analysis results obtained can be seen in table 3,4,5

Table 6
Liner Regression for Changes &Time

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.362ᵃ	0.131	0.126	0.48052

a. Predictors: (Constant), CH_Avg

Table 7
ANOVAᵃ

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.867	1	5.867	25.411	.000ᵇ
	Residual	39.023	169	0.231		
	Total	44.89	170			

a. Dependent Variable: T_Avg

b. Predictors: (Constant), CH_Avg

Table 8
coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	**Std. Error**	**Beta**		
1	(Constant)	2.943	0.283		10.389	0
	CH_Avg	0.38	0.075	0.362	5.041	0

a. Dependent Variable: T_Avg

The adjusted R square values from Table 6 part - a it is found that the 12.6% variability of project time (dependent variable) is accounted by the project changes (in planning) which is independent variable in this case.

From the table 7 part - b, F test that the model is significant and model is a good fit as the p- value is 0.000 that is less than the threshold value 0.05. So from Table 8 part-c we have beta coefficients that are used to transform the regression equation 2.

$$\text{Project Time} = 2.943 + 0.38 \text{ (Changes)} \quad .... \quad \text{Eq. 2}$$

The above equations tells that dues to one unit increment in "change in planning" there will be (2.943 + 0.38 x 1.0) = 3.323unit increment in "Project time". This means that if we change 1.0 unit of project planning the project time will vary 3.323 units from the original one.

Out of 171 respondents 73% respondents were agree with the statement that the project changes always increase the project time and according to majority (38% of respondents) this increase can be up to 5 - 10% of original time.

Change as Independent Variable & Cost as Dependent Variable

After time the liner regression was performed taking change as independent variable and project cost as dependent variable. Analysis results obtained can be seen in tables below

Table 9
Liner Regression for Changes & cost

Model Summary				
Model	**R**	**R Square**	**Adjusted R Square**	**Std. Error of the Estimate**
1	.429a	0.184	0.179	0.47013

a. Predictors: (Constant), CH_Avg

Table 10
ANOVAa

	Model	**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	8.422	1	8.422	38.105	.000b
	Residual	37.353	169	0.221		
	Total	45.775	170			

a. Dependent Variable: C_Avg
b. Predictors: (Constant), CH_Avg

Table 11
Coefficients

	Model	**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
		B	**Std. Error**	**Beta**		
1	(Constant)	2.633	0.277		9.502	0
	CH_Avg	0.456	0.074	0.429	6.173	0

a. Dependent Variable: C_Avg

The adjusted R square values from above Table 9 it is found that the 17.9% variability of project cost (dependent variable) is accounted by the project changes (in planning) which is independent variable in this case.

From the table 10, F test that the model is significant and model is a good fit as the p- value is 0.000 that is less than the threshold value 0.05. So from Table 11 we have beta coefficients that are used to transform the regression equation 3.

$$\text{Project cost} = 2.633 + 0.456 \,(\text{Changes}) \qquad \ldots\ldots\ldots \quad \text{Eq. 3}$$

The above equations tells that dues to one unit increment in "change in planning" there will be (2.633 + 0.456 x 1.0) = 3.089 unit increment in "Project cost". This means that if we change 1.0 unit of project planning the project cost will vary 3.089 units from the original one.

Out of 171 respondents 69% respondents were agree with the statement that the project changes always increase the project cost and according to according to majority (39% of respondents) this increase can go up to 5 - 10% of original cost and incase changes cause decrease in time, according to majority (38% of respondents) it can decrease less than 5% of original cost.

Conclusion

In this research data of 171 respondents was used for statistical analysis at SPSS. Different analysis was done for screening the data, checking its reliability, knowing the characteristics f respondents, spread of data and the study of research model about its significance and the relation of variables. At the end field information regarding the research variables was also discussed. From this research following conclusions are drawn

a. Changes in planning have a significant relation with project objectives. Which mean if there is any change in planning any of the project objectives can get a hit. It can be toward +ve side or -ve side.
b. In overall perspective changes has effect on all three project objectives scope, time and cost but the from eq. 4.1 - 4.3 it is clear that initially changes has more effect on project time but later on the effect on project cost is much higher than that of scope and time. The one practical reason is also that with increase time project cost also increase.
c. According to field data collected it found that mostly changes does not cause reduction in project scope and project cost, but they can reduce the project time. This thing can also be observed in field project. In most of the filed project approvals takes long time therefore project team is asked to complete the project as per already agreed timeline without changing the scope and budget targets.
d. From frequency analysis it is also found that most of the respondents are agree that only approval of two authorities is enough for change order process and if we go more than 3 the effectiveness of change order may be compromised.
e. It is also found that the most of the respondents are agree that there should be a clause in contract permitting change order but at the same time there should be a complete process to handle these changes.
f. Respondents also agree that project objectives should be approved, controlled and monitored for their achievement.
g. A necessary change at a required time can be helpful in achieving the project management objectives as well as strategic project objectives.

h. The above mentioned conclusions and research work can help the project team to do trade of analysis of project objectives. From this study they can have a idea that when they are going to make some big change how much it can affect the scope, time and cost. So depending upon the requirements decision about approval or rejection of change order can be made.

Recommendations

Based on this research work following recommendation can be useful for future researchers

- A research can also be proceeded to know the other factors affecting the project objectives.
- As the project objectives are closely linked to each others, a study can be conducted to know the effect of one project objective over the other one.
- Research on causes of changes already has been done, further study can be done to link these cause of changes to project objective that may elaborate that any specific cause of change will hit any specific objective.

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