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Factors Affecting Material Management in Construction Industry of Khyber Pakhtunkhwa Pakistan

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ABSTRACT: Material management is in the leading concerns facing professionals in construction industry globally. The industry has a prominent part in economic growth for countries all universally. This study highlights the factors affecting material management which lead to cost overrun in the construction industry of Peshawar (Khyber-Pakhtunkhwa) Pakistan. Improvement in material management and proactive approach in planning & management results in saving of cost and time. This study emphasized on various factors for improving material management practices and cost controlling in construction industry of Kpk, Pakistan. Questionnaire survey and practical material management approach assessment was adopted to assess the effect of each factor. The relative importance index (RII) of all the twenty (20) factors, affecting material management and cost was calculated. This study was also compared with the factors and procedures, affected material management and cost with projects studied as case studies in the target area, which can be utilized by the project managers to consider certain features related to material management and cost in diverse areas. The foremost factors which are sorted out and conclusions of this study will help project managers to anticipate weak areas of material management and cost impacts in their projects to offer precise approaches for project success.

KEYWORDS: materials, construction industry, importance index, factors

I. INTRODUCTION

Most of the construction projects are either cost overrun or time overrun. Construction projects are often complex in nature in context of the materials, specifications and scope, planning and management practices. Conferring to Webster's dictionary materials is "the elements, constituents, or substances of which something is composed or can be made." Material constitutes substantial portion of the total project cost. The success of a project is dependent on efficient material management. Therefore materials management is most critical part of a project and needs serious attention.

Materials for building projects accounts for a high percentage of total cost of the project, thus is an important and attractive resource to be controlled [Navon, 2009]. Materials are the physical materials that are procured and used to yield the final product and do not suggest that materials are the final product. The cost of construction materials, especially steel and cement, fluctuate randomly in Pakistan which leads to increase in overall cost of the project. It has been reported in the statistic bulletin of Pakistan that the rates of steel have been increased in average of 9.78% in 2017 with base rate in 2006-2007 and 6.1% increase is recorded from Nov 2015 to Dec 2016. Similarly the production

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capacity of cement in the country is also improved from 20.83 million ton to 46.94 million while the rates have been increased in the market by 54.46% percent since Jan 2005.

After the earthquake of 2005 in the country, the building codes and specifications were revised and improved to resist the drastic damage of the structures. FATA belt of the country is badly affected in the war against militancy which has affected the adjacent region of the province. People have migrated from the areas affected in militancy to the settled areas. This has made the requirement of infrastructure development in the province to accommodate the internally displaced people. Further, donor funded agencies are also operating in the province to develop and improve the existing infrastructure. This has made increase in the demand of the construction material. According to the trading economics report, GDP (Gross domestic product) from construction industry in Pakistan is improved from 254.251 billion PKR to 287.569 billion PKR in 2016. GDP from the construction in Pakistan reached the highest value of 287.569 billion PKR in 2016 and a record low value in 2006 of 186.380 billion PKR. The construction industry of Pakistan contributes 2.45 percent to the total Growth Domestic Product (GDP). It offers a widespread source of employment for the population of the country. It is facing continuous competition, cost escalation, lacking behind from schedule and decrease in profit margins.

The objective of the research study was to identify factors affecting material management mainly for material management with a view to minimize cost overrun in the project(s).Ranking and evaluation of factors affecting materials management based on the descriptive analysis and assessment of impact of these factors on project success and profit margin. The study will support the project team to control the limited resources at their disposal to material management on site and revise the policies, in order to ensure project completion within budget and increase profit margin. A thorough review of the literature revealed a number of factors associated with material management in Pakistan and all over the world. Thus the aim was raised to identify the most prominent features through questionnaire study influencing material management in building projects of KPK (Khyber Pakhtunkhwa), Pakistan. The identified factors were studied in projects selected for case studies.

II. LITERATURE REVIEW

Many project owners do not understand the importance of resource management, which begins with the conceptual and planning phases of a construction project [Merlin D. Kirschenman 1987]. Major problems which construction projects face are usually due to inadequate procurement system, lack of resources, discrepancies between design and construction, lack of project management practices, variation orders, communication lapses, cultural issues, and different interests of the participants. Some others also identify poor labor productivity and lack of professional contractors as major problems [Syed & Ali, 2017]

Many studies found that the pattern of problems causing construction delays seems to be somewhat identical across various developing countries [Toor & Ogunlana, 2008]. Construction projects experience much uncertainty because of shortages of material and labor unfavourable weather conditions, unstable political environments, inadequate cash reserves, possible inflationary effects on project costs, and the short-term nature of most construction projects, which makes it more challenging to sustain a stable project organization [Edward J. Jaselskis, 1991]. Effective construction planning requires complete understanding of each particular activity. Only then can detailed methods and resource requirements (plant, labor, materials) be established, enabling the works to be carried out safely, economically and to the quality required to meet client requirements. Hence, prior and adequate arrangement for provision of resource involved in construction such as type and quantity of material, manpower, machines and finance are required at each stage of construction. There are various factors that cause failing resources management [Rahman, Memon, & Karim, 2013]. For managing a productive and cost efficient site, efficient material management approach is vital. The material management system in any project ensures that the right quality and quantity of material is selected, effectively purchased, properly delivered and safely handled on site in a timely manner and at a proper reasonable cost [Gulghane & Khandve, 2015]. Materials should be obtained at a reasonable cost, and be available for use when needed. The cost of materials represents a large proportion of the cost. Analysis of project cost for civil engineering projects showed the materials and plant component can be up to 70% of the project cost dependent upon the type of project and the extent of mechanization and plant used, whilst on commercial building and housing projects the proportion is around 45%-50% [Donyavi & Flanagan, 2009].

In developing countries, practice of manual materials management and control procedures are unsatisfactory as they are labor intensive, inaccurate and error prone. All these reasons leads to waste and surplus of construction materials, delays in projects, decrease in labor productivity and lack of up-to-date and real-time information of the project

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[Gulghane & Khandve, 2015]. Factors contributing to this complexity include a variety of existing human and material resources. Diversity of tasks that each working unit is able to execute, the performance of each working unit, the involved costs, and the distribution of all resources over different places are the contributing factors. All these factors indicate a high number of variables, resulting in a somewhat difficult optimization process. The basic objective of resource management is to supply and support the project so that established time objectives can be meet and cost can be kept within the project budget [Rahman et al., 2013].

III. RESEARCH METHODOLOGY

In applied social research interviews and questionnaire survey is the mostly used technique of data collection [Syed & Ali, 2017]. In primary study, literature was collected and various factors affecting material management were identified, formed a pilot questionnaire and discussed with total twenty five professionals of construction industry but received the response from only twenty field experts and after slight modifications a concluding questionnaire was designed. The final questionnaire was distributed among the professional engineers from contractors, consultants, clients of the building projects in the target area. The responded questionnaires had been recollected for analysis of the data. After getting the filled questionnaires, acquired data were put in excel sheet and applied Statistical Package for Social Sciences (SPSS) for further analysis. Reliability test was conducted to check the data's uniformity. The Cronbach α coefficient was calculated to check the data's consistency which was found 0.765 using SPSS. Analysis of the data indicated that significance value of each factor was less than 0.5 which showed that the data was not normal, which means non parametric test, Kruskal wallis test was needed to further analyze. Relative importance index or percentage score method was primarily used to sort out the factors affecting material management.

A. Sample Population

For reliable data analysis accurate calculation of sample size is very significant. Keeping in mind the statistical significance of data analysis it certifies that the data for the research study is the true representation of our target population. Professional Engineers working with contractors, consultants and clients were the target population for this study. In this research the sample size is calculated by Dilman's (2000) empirical formula:

$$Ns = \frac{Np \text{ x } P \text{ x } (1-P)}{(Np-1)\left(\frac{B}{C}\right)^2 + P \text{ x } (1-P)}$$

Where
Ns = Sample size
Np = Population size
P = Proportion of the population that is expected to choose one of the response categories; P =0.7
B = acceptable sampling error; (±10% or ±0.10)
C = Z statistic associated with the confidence level (2.33 corresponds to 98% confidence level)
Out of 145 respondents, 110 filled the questionnaire which was well thought out for the analysis. Thus the response rate was 75.86%.

B. Data Analysis

The responded questionnaires were collected for data analysis. The questionnaire was given to 145 professionals in the target area, working in different capacities in the construction. Out of 145 professionals, 110 filled the questionnaire and responded back. Hence 110 numbers of responses were considered for final data analysis. Five point Likert scale was adopted for scaling the responses, having 1 signified strongly disagree and 5 indicated strongly agree. Having compiled the data, significance of the subject twenty factors affecting material management was calculated by following percentage score

$$RII = \frac{\Sigma(Pi * Ui)}{N * n}$$ (Gündüz, Nielsen, & Özdemir, 2012)

Where,
Pi = Respondent's rating Ui = Number of respondents placing identical rating
N = Sample size n = Highest value on Likert scale
Ranking of Factors Affecting Material Management Based On Percentage Score Method as per table 1.

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Table 1: Ranking of Factors Affecting Materials Managemnt (Percentage Score Method)

Factors Affecting Material Management	RII	RANK
Poor financial status of a company has impact on procurement procedures and loss.	0.89	1
How would you rank the effect of "Right construction methods & proper handling" on project cost?	0.86	2
Changes in Material Specifications During Construction results project cost overrun.	0.86	2
Projects are cost overrun due to improper planning of activities.	0.84	3
Poorly defined responsibilities and coordination of the team results in expensive procurement.	0.83	4
Materials planning and procurement process is critical in context of project cost.	0.82	5
How critically you see the company's procurement policies impact the project cost?	0.82	5
The prices of cement and steel increase with increase in fuel prices in the market.	0.81	6
Late delivery of materials affects the project budget.	0.81	6
To what level you agree that the profit is lost if the market is not surveyed properly?	0.80	7
Poor design/revision of design has impact on material management.	0.79	8
Poor estimation of materials is the main reason for the cost overrun of the projects.	0.78	9
Poor price check is a factor in increase of the cost of steel and cement.	0.74	10
Inefficient warehouse management is a factor contributing to cost increase.	0.74	10
Supply monopoly in the market leads to increase in cost of cement and steel.	0.74	10
The project's profit can be increased if the steel and cement is procured directly from the company.	0.71	11
Raise in the cost of electricity has impact on cost of cement and steel increase.	0.70	12
Fluctuation in the cost of cement and steel has impact on project time line.	0.66	13
How severely have you faced the shortage or increased cost of cement and steel due to supply and demand problem?	0.65	14
Increase in the cost of cement and steel is the main reason for the cost overrun of the projects.	0.65	14

Complete ranking of all the twenty factors were such as poor financial status of a company ranked first with RII of 0.89, right construction methods and proper handling of material at second rank with RII 0.86, Changes in material specifications during construction results cost overrun is also been marked at second position with RII 0.86, Improper planning of activities is at third rank with RII 0.84, Poor defined responsibilities and coordination of the team resulting expensive procurement at fourth rank with RII 0.83, material planning, procurement process and procurement policies at fifth rank with RII 0.82, rise of cement & steel with increase in fuel prices and late delivery of materials affecting project cost are ranked at sixth with RII 0.81,Improper survey of market having impact on profit is ranked at seventh having RII 0.80, Poor design/revision of design has impact on material management is at eight position with RII 0.79, poor estimation of material is the main reason cost overrun at ninth rank having RII 0.78, poor check of prices by government, inefficient warehouse management and supply monopoly in the market remained at the same level having position at tenth with RII 0.74, Profit can be increased if steel and cement is procured directly from the company at eleventh having RII 0.71, rise in the electricity prices has impact on cost of materials like steel and cement is having RII 0.70 and remain at twelfth position, Fluctuation in cost of cement and steel has impact on time line at thirteenth position with RII 0.66 while shortage of material due to supply and demand problem and increase in cost of cement and steel is the main reason of cost overrun are at fourteenth rank with RII 0.65 as shown in table 1.

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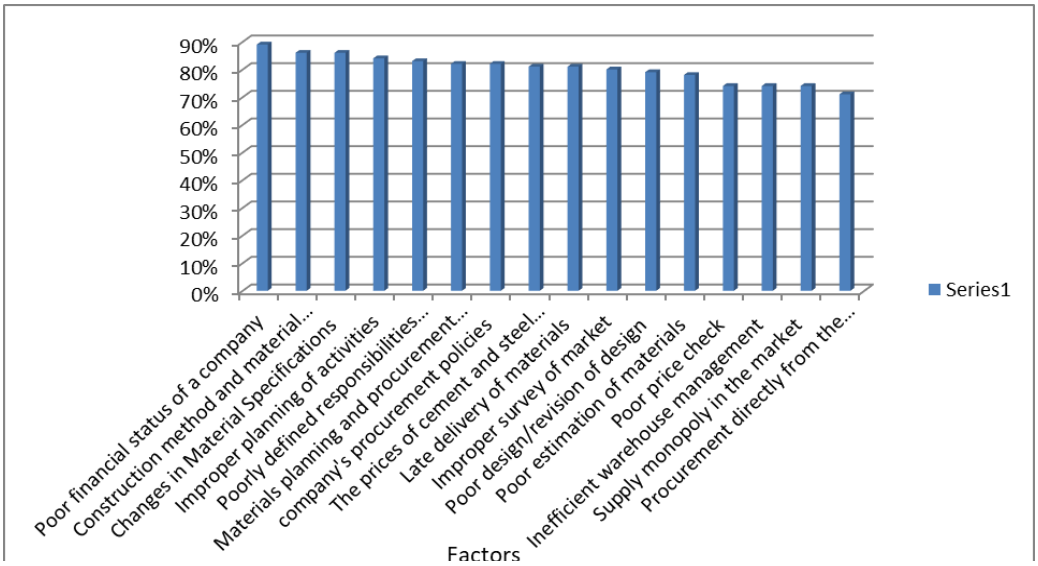

Figure 1. Mean weight of top material management factors

C. Descriptive statistics

The factors affecting construction labor productivity and their impact data as shown in the table 02 using Statistical Package for Social Sciences (SPSS). It includes the number of respondents, maximum and minimum range of the Likert scale, Mean and Standard deviation [Kasim, 2008]. The correlation has been developed between the different productivity factors and showing the ranking as high, low and average impact.

IV. RESULTS AND DISCUSSIONS

A. Correlation of top five influencing factors on the basis of RII

The factors studied for the current research were further correlated, the foremost and least influencing factors identified by using RII, were correlated.

Table 2: Factors, Statistical data, RII and RII.

S.No	Factors	Statistical Data					Range	Remarks	RII	RII Ranking
		Max	Min	Mean	Std.Dev	N				
1	Changes in Material Specifications During Construction results project cost overrun	1	5	4.31	0.955	110	4-5	Highest Impact	0.86	2
2	Poorly defined responsibilities and coordination of the team results in	1	5	4.14	1.062	110	4-5	Highest Impact	0.83	4
3	Projects are cost overrun due to improper planning	1	5	4.21	0.92	110	4-5	Highest Impact	0.84	3
4	Poor estimation of materials is the main reason for cost overrun of projects.	1	5	3.92	0.89	110	4	High Impact	0.78	9
5	Increase in the cost of cement and steel is the main reason for cost overrun of	1	5	3.25	0.93	110	3	Average Impact	0.65	14
6	Profit is lost if the market is not surveyed properly.	1	5	4.02	0.835	110	4	High Impact	0.80	7
7	Supply monopoly in the market leads to increase in cost of cement and steel.	1	5	3.68	0.856	110	3-4	High Impact	0.74	10

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8	Poor price check is a factor in increase of the cost of steel and cement.	1	5	3.69	0.965	110	3-4	High Impact	0.74	10
9	Fluctuation in the cost of cement and steel has impact on project time line.	1	5	3.31	1.056	110	3	Average Impact	0.66	13
10	The project's profit can be increased if the steel and cement is procured directly from	1	5	3.55	0.944	110	3-4	High Impact	0.71	11
11	Materials planning and procurement process is critical in context of project cost	2	5	4.11	0.682	110	4	High Impact	0.82	5
12	Late delivery of materials affects the project budget.	1	5	4.05	0.871	110	4	High Impact	0.81	6
13	The Company's procurement policies impact the project cost.	2	5	4.08	0.731	11	4	High Impact	0.82	5
14	shortage or increased cost of cement and steel due to supply and demand problem	1	5	3.26	0.983	110	3	Average Impact	0.65	14
15	Rank the effect of "Right construction methods & proper handling" on project	1	5	4.28	0.803	110	4-5	Highest Impact	0.86	2
16	Poor financial status of a company has impact on procurement procedures and	2	5	4.46	0.738	110	4-5	Highest Impact	0.89	1
17	Raise in the cost of electricity has impact on cost of cement and steel increase	1	5	3.5	0.965	110	3-4	High Impact	0.70	12
18	Prices of cement and steel increase with increase in fuel prices in the market	2	5	4.07	0.906	110	4-5	Highest Impact	0.81	6
19	Inefficient warehouse management is a factor contributing to cost increase	1	5	3.69	0.821	110	3-4	High Impact	0.74	10
20	Poor design/revision of design has impact on material management.	1	5	3.95	0.999	110	4-5	Highest Impact	0.79	8

B. Most Influencing factors

Correlation of the five most influencing factors (Identified based on RII) were found using spearman's coefficient as the data is non-parametric found by normality test as recommended by Walliman. Table 3 shows correlation of influencing factors

Table 3: Five most influencing factors (Identified based on RII) using spearman's coefficient

MT No	Correlation/Coefficient/Sig (2 – tailed)	MT16	MT1	MT15	MT3	MT2	MT11	MT13
MT16	Correlation Coefficient	1.000	-.047	.237*	.094	.066	.271**	.103
	Sig. (2-tailed)	.	.624	.013	.331	.496	.004	.286
	N	110	110	110	110	110	110	110
MT1	Correlation Coefficient	-.047	1.000	-.060	-.067	-.086	.153	-.105
	Sig. (2-tailed)	.624	.	.535	.484	.372	.111	.273
	N	110	110	110	110	110	110	110
MT15	Correlation Coefficient	.237*	-.060	1.000	.079	.058	.260**	.350**
	Sig. (2-tailed)	.013	.535	.	.415	.550	.006	.000
	N	110	110	110	110	110	110	110
MT3	Correlation Coefficient	.094	-.067	.079	1.000	.115	.162	.100
	Sig. (2-tailed)	.331	.484	.415	.	.232	.091	.297
	N	110	110	110	110	110	110	110
MT2	Correlation Coefficient	.066	-.086	.058	.115	1.000	.063	.012
	Sig. (2-tailed)	.496	.372	.550	.232	.	.515	.901
	N	110	110	110	110	110	110	110

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MT11	Correlation Coefficient	.271**	.153	.260**	.162	.063	1.000	.261**
	Sig. (2-tailed)	.004	.111	.006	.091	.515	.	.006
	N	110	110	110	110	110	110	110
MT13	Correlation Coefficient	.103	-.105	.350**	.100	.012	.261**	1.000
	Sig. (2-tailed)	.286	.273	.000	.297	.901	.006	.
	N	110	110	110	110	110	110	110

*Correlation is significant at the 0.05 level (2-tailed).
**Correlation is significant at the 0.01 level (2-tailed)

As per the given table 3, MT16 (financial status of the company) is having positive and significant relationship with MT15 (right construction methods and proper handling) (alpha=.237), MT11 (Materials planning & procurement) (alpha=.271) whereas relationship with all other items are insignificant.
The second row shows that MT1(Changes in materials specification resulting cost overrun) is having insignificant relationships with all available items.
In third row, MT15 (right construction methods and proper handling) has significant and positive relationship with MT16 (financial status of the company) (alpha=.237), MT11 (materials planning and procurement) (alpha=.260) and MT13 (company procurement policies)(alpha=.350). Rest of the relationships is insignificant.
In fourth row, MT3 (projects are cost overrun due to improper planning) has insignificant relationship with all the items.
In fifth row, MT2(poorly defined responsibilities and coordination of the team) carries insignificant relationships with all the items.
In sixth row, MT11(materials planning and procurement process) has positive and significant association with MT16(poor financial status of a company)(alpha=.271), MT15(right construction methods and proper planning) (alpha=.260) and MT13 (procurement policies of a company)(alpha=.261). Rest of the relationships is insignificant.
In seventh row, MT13 (Procurement policies of a company) has positive and significant association with MT 15 (Right construction methods and proper handling) (alpha=.350) and MT11 (materials planning and procurement process) (alpha=.261). Rest of the relationships is insignificant.

C. Correlation of the five least influencing factors (Identified based on RII) were found using spearman's coefficient as the data is non-parametric found by normality test [Walliman, 2011].

Table 4: Five least influencing factors (Identified based on RII) using spearman's coefficient

MT No	**Correlation/Coefficient/ Sig (2 –tailed)**	MT4	MT7	MT8	MT19	MT10	MT17	MT9	MT5	MT14
MT4	Correlation Coefficient	1.000	.163	.161	.042	.360**	.059	.216*	.265**	.156
	Sig. (2-tailed)	.	.090	.094	.664	.000	.540	.024	.005	.103
	N	110	110	110	110	110	110	110	110	110
MT7	Correlation Coefficient	.163	1.000	.349**	.184	.188*	.150	.310**	.210*	.263**
	Sig. (2-tailed)	.090	.	.000	.054	.049	.119	.001	.028	.006
	N	110	110	110	110	110	110	110	110	110
MT8	Correlation Coefficient	.161	.349**	1.000	.173	.292**	.169	.418**	.106	.240*
	Sig. (2-tailed)	.094	.000	.	.070	.002	.078	.000	.268	.011
	N	110	110	110	110	110	110	110	110	110
MT19	Correlation Coefficient	.042	.184	.173	1.000	.152	-.166	.189*	.187	.106
	Sig. (2-tailed)	.664	.054	.070	.	.113	.082	.048	.050	.272
	N	110	110	110	110	110	110	110	110	110
MT10	Correlation Coefficient	.360**	.188*	.292**	.152	1.000	.079	.497**	.120	.173
	Sig. (2-tailed)	.000	.049	.002	.113	.	.414	.000	.211	.070

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	N	110	110	110	110	110	110	110	110	110
MT17	Correlation Coefficient	.059	.150	.169	-.166	.079	1.000	.234*	-.214*	.016
	Sig. (2-tailed)	.540	.119	.078	.082	.414	.	.014	.025	.871
	N	110	110	110	110	110	110	110	110	110
MT9	Correlation Coefficient	.216*	.310**	.418**	.189*	.497**	.234*	1.000	.190*	.337**
	Sig. (2-tailed)	.024	.001	.000	.048	.000	.014	.	.046	.000
	N	110	110	110	110	110	110	110	110	110
MT5	Correlation Coefficient	.265**	.210*	.106	.187	.120	-.214*	.190*	1.000	.222*
	Sig. (2-tailed)	.005	.028	.268	.050	.211	.025	.046	.	.020
	N	110	110	110	110	110	110	110	110	110
MT14	Correlation Coefficient	.156	.263**	.240*	.106	.173	.016	.337**	.222*	1.000
	Sig. (2-tailed)	.103	.006	.011	.272	.070	.871	.000	.020	.
	N	110	110	110	110	110	110	110	110	110

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

As per the given table 4, MT4 (Poor estimation of materials) is having positive and significant relationship with MT 10 (profit if key items of building projects like steel and cement are procured directly from supplier) (alpha=.360), MT9 (fluctuation in cost of materials) (alpha=.216) and MT5 (Increase in cost of cement and steel is the main reason of cost overrun) (alpha= .265), whereas relationship with all other items are insignificant.

The second row shows that MT7 (Supply monopoly in market leads to increase of the cost of steel and cement) has significant and positive relationship with MT8 (Poor price check is a factor in increase of cost of steel and cement) (alpha=.349), MT10 (profit if key items of building projects like steel and cement are procured directly from supplier) (alpha=.188), MT9 (fluctuation in cost of materials) (alpha=310), MT14(shortage or increased cost of cement and steel is due to supply and demand issue) (alpha= .263).

The third row shows that MT8(Poor price check is a factor in increase of cost of steel and cement) is significant with MT7 (Supply monopoly in market leads to increase of the cost of steel and cement) (alpha=0.349), MT10 (profit if key items of building projects like steel and cement are procured directly from supplier) (alpha=0.292), MT9 (fluctuation in cost of materials) (alpha=0.418) & MT14 (shortage or increased cost of cement and steel is due to supply and demand issue) (alpha=0.240).

Forth row reflects that MT19 (Inefficient warehouse management) has a positive relation with MT9 (fluctuation in cost of materials) (alpha=0.189) only.

Fifth row shows that MT10(profit if key items of building projects like steel and cement are procured directly from supplier) has significant relation with MT4(Poor estimation of materials) (alpha=0.360), MT7(Supply monopoly in market leads to increase of the cost of steel and cement) (alpha=0.188), MT8(Poor price check is a factor in increase of cost of steel and cement) (alpha=0.292), MT9(fluctuation in cost of materials) (alpha=0.497).

Sixth row indicates that MT17(raise in cost of electricity has impact on cost of the materials) is significant with MT9 (fluctuation in cost of materials) (alpha=0.234) & MT5(Increase in cost of cement & steel is the main reason for cost overrun) (alpha=-0.214).

Seventh row shows that MT9 (fluctuation in cost of materials) has significant relation with all the factors MT4(Poor estimation of materials) (alpha=0.216), MT7(Supply monopoly in market leads to increase of the cost of steel and cement) (alpha=0.310), MT8(Poor price check is a factor in increase of cost of steel and cement)(alpha=0.418), MT19(fluctuation in cost of materials) (alpha=0.189), MT10 (profit if key items of building projects like steel and cement are procured directly from supplier) (alpha=0.497), MT17(raise in cost of electricity has impact on cost of the materials) (alpha=0.234), MT5 (Increase in cost of cement and steel is the main reason of cost overrun) (alpha=0.190) and MT14(shortage or increased cost of cement and steel is due to supply and demand issue) (alpha=0.337).

Eight row points out that MT5 (Increase in cost of cement and steel is the main reason of cost overrun) has positive relation with MT4 (Poor estimation of materials) (alpha=0.265), MT7 (Supply monopoly in market leads to increase of the cost of steel and cement) (alpha=0.210), negative correlation with MT17(raise in cost of electricity has impact on cost of the materials) (alpha=-0.214) and positive significance with MT9 (fluctuation in cost of materials) (alpha=0.190) and MT14 (shortage or increased cost of cement and steel is due to supply and demand issue) (alpha=0.222).

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Ninth row shows that MT14 (shortage or increased cost of cement and steel is due to supply and demand issue) has positive relation with MT7 (Supply monopoly in market leads to increase of the cost of steel and cement) (alpha=0.263), MT8 (Poor price check is a factor in increase of cost of steel and cement) (alpha=0.240), MT9 (fluctuation in cost of materials) (alpha=0.337) and MT5 (Increase in cost of cement and steel is the main reason of cost overrun) (alpha=0.222).

D. Rule for identification of significant and insignificant relationship:

And so on. The rule is simple, wherever there is found * (single sign) or ** (double sign) on the numeric value, it will mean significant relationships while all other relationships will be insignificant. Moreover, second identification for significant relationship is that the sig. value must be below .05 for significant relationship which also means that all relationships that has higher sig value than .05 are insignificant.

V. CONCLUSION

A check list has been designed which will benefit the project managers to predict and give due diligence to the factors which have impact on cost variation. This will contribute to overcome and control those factors at the initial stage of the project. To endorse the outcomes of analysis, case studies of five different projects were taken and it was observed that most of the factors which resulted in delay and cost overrun of the projects were within top ten factors identified through the questionnaire based survey.
The outcomes achieved by data analysis and current study the ranking of the factors along with its weightage were ranked as follows;

S.No	Factors	Ranking %
1	Financial status of a company	89%
2	Right construction methods & proper handling	86%
3	Changes in Material Specifications During Construction	86%
4	Improper planning.	84%
5	Poorly defined responsibilities and coordination	83%
6	Materials planning and procurement process	82%
7	Company's procurement policies	82%
8	Prices of cement and steel	81%
9	Late delivery of materials	81%
10	Improper market survey	80%
11	Poor design/revision of design	79%
12	Poor estimation of materials	78%
13	Poor price check from authorities	74%
14	Inefficient warehouse management	74%
15	Supply monopoly in the market	74%
16	Procurement directly from the company.	71%
17	Raise in the cost of electricity has impact on cost of cement and steel increase.	70%
18	Cost overrun due to delay in time	66%
19	Shortage of materials due to supply and demand phenomenon.	65%
20	Increase in the cost of cement and steel in market	65%

VI. RECOMMENDATIONS

The prime contribution of this study is to emphasis on development of cost management and materials management system in the small construction companies in Pakistan. During the growth of the study it has been experienced that the

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study could have been more improved if this could be conducted for each factor and for projects of different nature. Hence it is recommended that study for each factor may be carried out for further data collection and guidance.

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