

# **An Assessment of Soft Factors Leading to Rework and its Impact on Project Performance-The Experience of Pakistani Construction Industry**

Muhammad Umer

*(Assistant Professor, Department of Civil Engineering, NED University of Engineering & Technology, Karachi , Pakistan)*

[emumer@neduet.edu.pk](mailto:emumer@neduet.edu.pk)

Rizwan U. Farooqui

*(Professor, Department of Civil Engineering, NED University of Engineering & Technology, Karachi , Pakistan)*

[rizulhak@neduet.edu.pk](mailto:rizulhak@neduet.edu.pk)

Muhammad Saqib

*(Assistant Professor, Department of Civil Engineering, NED University of Engineering & Technology, Karachi , Pakistan)*

[msaqibm@neduet.edu.pk](mailto:msaqibm@neduet.edu.pk)

## **Abstract**

In a typical construction project, there is a lot of diversified activities, in a complex environment that involves multiple levels of trades, suppliers and installers, and where many activities take place simultaneously, the likelihood for errors, omissions and poor management practices can often lead to quality failures, which must then be reworked. Rework is a general problem in the construction business all over the world but the problem tends to be bigger in developing countries such as Pakistan. Thus, project management role can provide effective fulcrum for tracking of rework occurrences and thereby implementing suitable management measures for reducing the resultant impacts on productivity and project performance. This study has been carried out to assess the soft factors leading to concrete rework and its impact on project performance based on primary data obtained from various building construction projects in Karachi. The analysis of responses led to drafting of conclusions and recommendations. The major findings of the study are: As far as the broad umbrella soft factor "Human resource capability" is concerned the subset factor "goal divergence by any of the stake holder" has been determined to have the most severe effect on cost and time, whereas "lack in experience of consultant and contractor" has been deduced to have most severe effect on quality. Similarly, the broad umbrella soft factor, "Leadership & Communication" the most severe impact on cost is the subset factor "client desired for modification of architectural design after execution", the subset factor "late design change" has the most severe impact on time, and the subset factor "conflict in contract documents" has the most severe impact on quality.

## **Keywords**

Soft Factors, Rework, Leadership & Communication, Productivity and Project Performance

## **1. Introduction**

According to PMI, rework is an endemic problem in building construction projects and is an area of research that has received limited attention. Thus, project management role can provide effective fulcrum for tracking of rework occurrences and thereby implementing suitable management measures for reducing the resultant impacts on productivity and project performance. In poorly managed projects the gross impact of rework could be equal or even exceed the anticipated markup/profit margin level. Also in some cases, there will be some carry forward “ripple effects” on different aspects such as stress, motivation, relationship and reputation. Hence the identification and immediate attention of severe causes of concrete rework in building construction would lead to a reduction in the frequency of reworks.

## **2. Scope & Objectives**

The scope of this study is to: “To assess the soft factors leading to rework in concreting rework, on different on-going building construction projects in Karachi and qualitative assessment of the impacts of concrete rework on success parameters such as time, quality and cost”. The study has been undertaken to, “Investigate the soft factors of quality non-conformance at different building projects” and “To identify the impact of rework on the parameters that governs a project’s performance”.

## **3. Literature Review**

Construction industry is wide and complicated. There are a lot of activities involved in this industry. In a large complex environment that involves multiple levels of trades, suppliers and installers, and where many activities take place simultaneously, the likelihood for errors, omissions and poor management practices can often lead to quality failures, which must then be reworked. Rework is a general problem in the construction business all over the world but the problem tends to be bigger in developing countries such as Pakistan (Karachi).

An efficient construction sector is a pre-requisite to effective national development and employment; as civil and industrial engineering works are usually a major contribution to the country’s GDP. Definitions of rework found in existing literature are: Alwi et al., (2002), “Reworks and wastages are known as non-value adding symptoms that affect the productivity and performance in construction projects”. Love & Li (2000): “The unnecessary effort of re-doing a process or activity that was incorrectly implemented the first time”. Josephson, Larsson & Li (2002), “The unnecessary effort of correcting construction errors” [3]. Love et al. (1997) stated that “Invariably, these issues (rework and variations) contribute to project overruns in time, cost and naturally client dissatisfaction. Any efforts targeted towards eliminating rework, has a noteworthy impact on productivity as seen from earlier studies on similar topic.

Earlier studies have shown that “rework costs vary between 3 and 15 per cent of project’s contract value” (Burati, Farrington and Ledbetter, 1992; Abdul-Rahman, 1997; Josephson and Hammurlund, 1999). In addition, Rethinking construction, 1998 in Aminudin (2006) stated that: “up to 30% of construction is rework, labor is used at only 40-60% of potential efficiency and at least 10% of materials are wasted”.

These costs can have numerous origins are often referred to as failure costs. “In some countries, rework is a chronic problem and with these costs ranging between 12% and 15% of the total project cost” (Davis et al, 1989; Neese and Ledbetter, 1991). According to Taneja (1994), “In structural and interior works of projects, the costs of rework can be range from 4% to 12% - or average 8% of the total budget”. Another investigation associated of rework costs was conducted by Love et al. (1997) on two building projects. He found that the rework cost was between 2.4% and 3.3% of the total project cost. A study conducted on nine construction projects concluded that “Due to poor quality in construction, the costs of rework could be as high as 15% of the total budget” (Neese and Ledbetter, 1991).

Rework can lead to several overruns, and so these overruns indicate that somewhere in the construction process rework might have occurred. This characteristic can be used to locate possible rework in finished projects. To effectively reduce the cost of rework in construction, it is necessary to have an understanding of its causes, and the construction industry has to become adoptive and responsive to these forces of change (Love et al, 1997). Cited by Alvi et.al (2001), Serpell et al. (1995) argued that in most cases, construction managers do not know or recognize the factors that produce waste nor do they have measurements of their performance so as to reduce their negative effects.

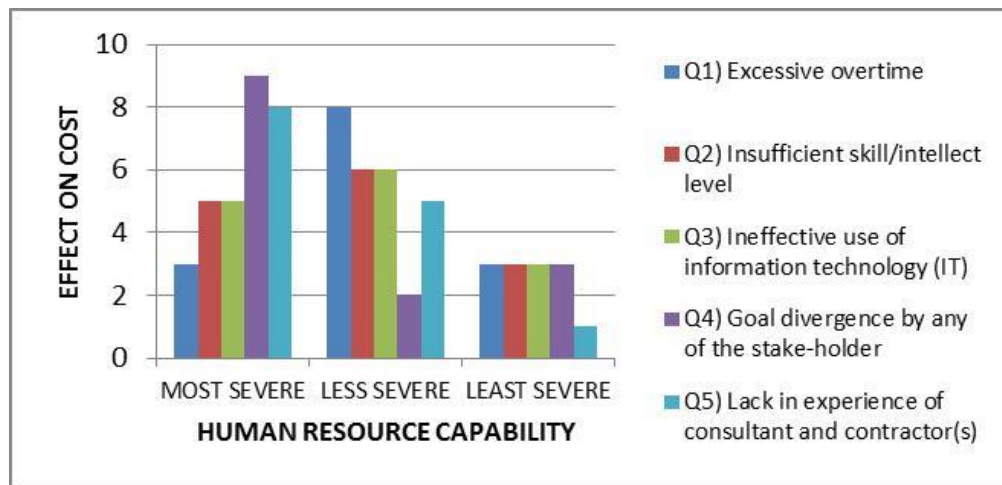
Since rework has been seen as an ill wind that may blow no good to the construction industry because of its contributions to cost over-runs and time-delays couple with the facts that it cannot be totally avoided. Therefore, the evaluation of rework and identification of significant factors (leading to the occurrence of rework) are essential. An improvement and control of the factors governing the concrete rework would help in enhancing project delivery processes in Construction industry. This research will focus on major cause of failure costs, namely rework and by gaining understanding of the mechanisms of causes and impact of rework, the advancement toward its reduction in construction can be made.

#### 4. Analysis

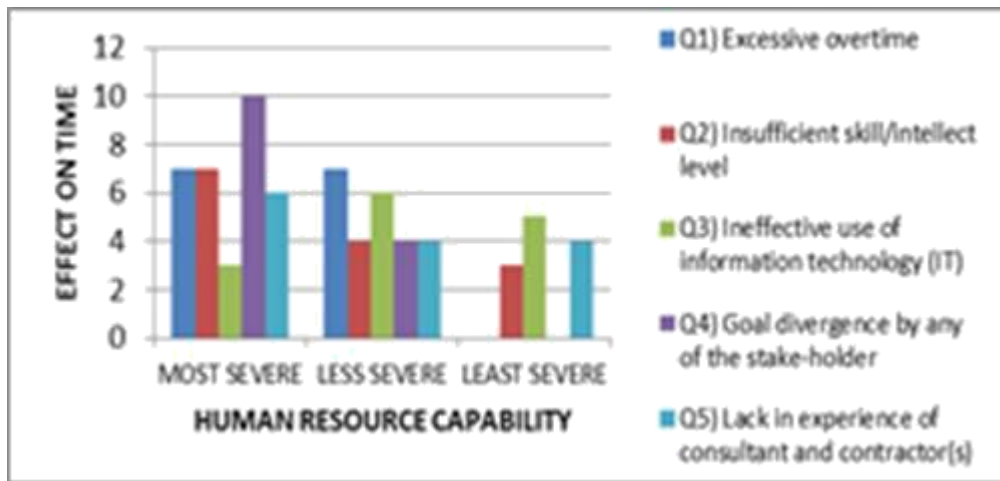
The preliminary data analysis is presented in succeeding sub-sections.

##### □ Human Resource Capability

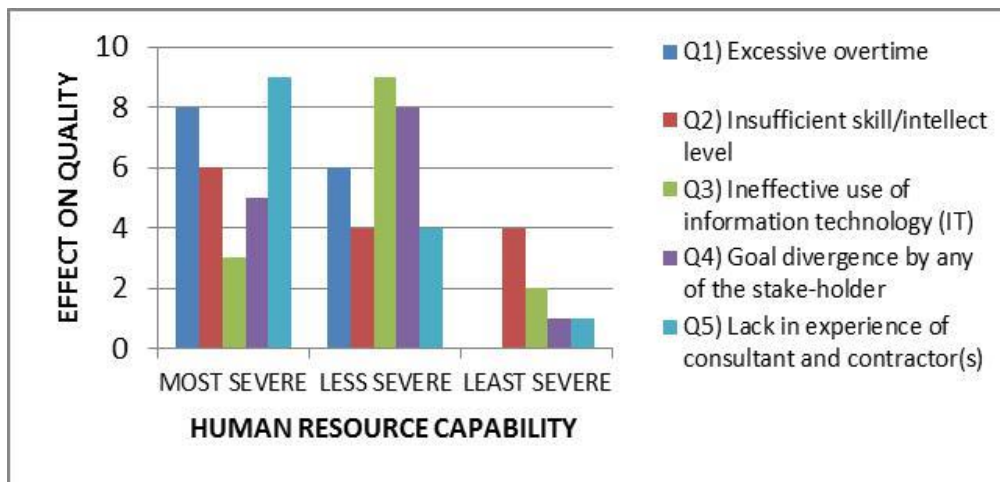
Human resource capability part consisted of the following five questions in the questionnaire. 1. Excessive overtime, 2. Insufficient skill/intellect level, 3. Ineffective use of information technology (IT), 4. Goal divergence by any of the stake-holder, 5 Lack in experience of consultant and contractor(s).



**Figure 01(a): Human Resource Capability Effect on Cost**



**Figure 01(b): Human Resource Capability Effect on Time**



**Figure 01(c): Human Resource Capability Effect on Quality**

Figure 1(a) shows that most severe effect on cost is goal divergence by any of the stake holder .Similarly, less severe impact on cost according to this bar chart is excessive overtime. And least severe impact on cost is excessive overtime, insufficient skill/intellect level, Ineffective use of information technology (IT), goal divergence by any of stake holder.

Figure 1(b) shows that most severe effect on time is goal divergence by any of the stake holder. Similarly, less severe impact on cost according to this bar chart is excessive overtime. And least severe impact on time is Ineffective use of information technology (IT).

Figure 1(c) shows that most severe effect on quality is lack in experience of consultant and contractor. Similarly, less severe impact on quality according to this bar chart is Ineffective use of information technology (IT). And least severe impact on time is insufficient skill/intellect level.

**Leadership and Communication**

Leadership and communication part consisted of the following seven questions. 1. Change of scope, 2. Unintentional Error and omissions in drawings, 3. Poor document control, 4. Late design changes, 5.

Awarding of contract to "lowest" bid contractor, 6. Conflict in contract documents, and 7. Client desired for modification of architectural design after execution.

Figure 2(a) shows that the most severe impact on cost is client desired for modification of architectural design after execution. And the less severe impact on cost is unintentional error and omissions in drawings. Similarly, the least severe impact on cost is conflict in contract documents.

Figure 2(b) shows that the most severe impact on time is late design change. And the less severe impact on time is unintentional error and omissions in drawings. Similarly, the least severe impact on time is client desired for modification of architectural design after execution.

Figure 2(c) shows that the most severe impact on quality is conflict in contract documents. And the less severe impact on quality is late design change. Similarly, the least severe impact on quality is Unintentional Error and omissions in drawings, Poor document control, Awarding of contract to "lowest" bid contractor.

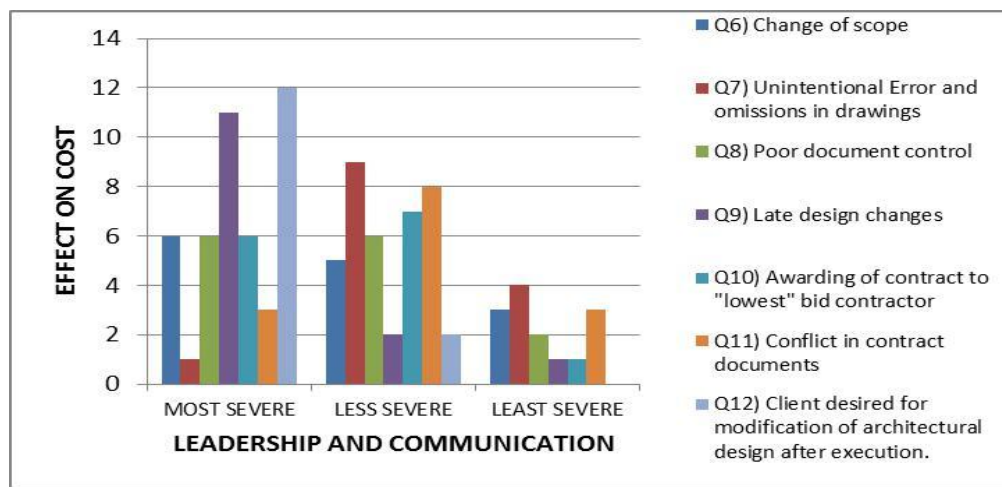


Figure 02(a): Leadership and Communication Effect on Cost

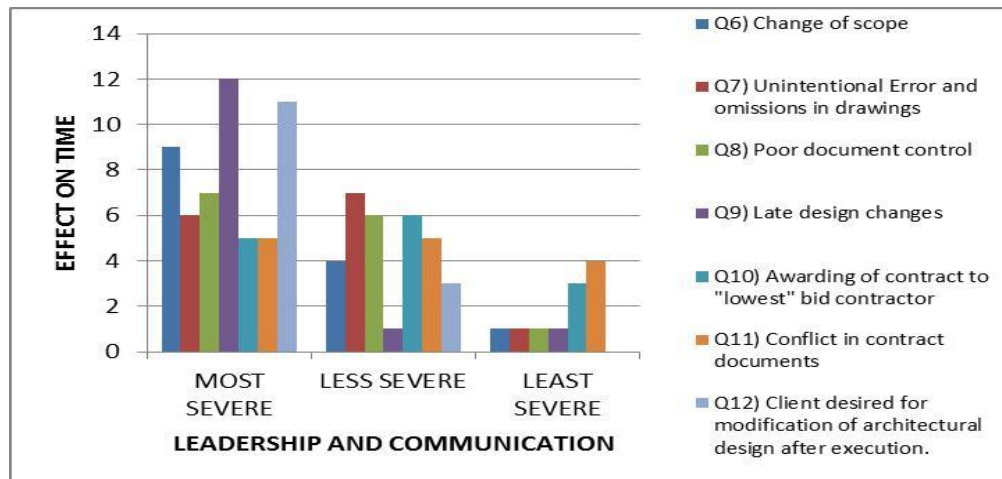


Figure 02(b): Leadership and Communication Effect on Time

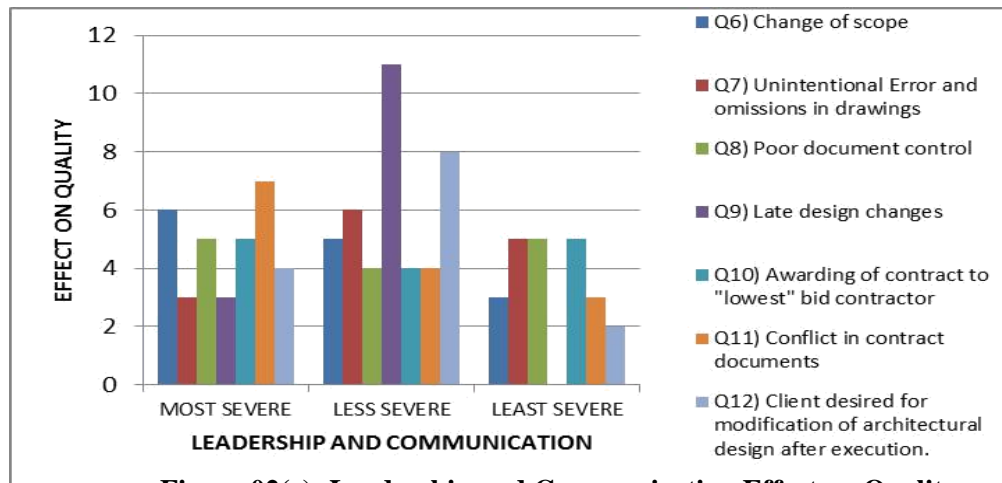


Figure 02(c): Leadership and Communication Effect on Quality

## 5. Conclusions and Recommendations

This study offers a macroscopic view of the soft factors leading to concrete rework. In addition, it provides a platform for further research, specifically, in the context of controlling the success parameters of construction projects since rework is one of the major determinants of construction productivity. This study aimed at investigating the reworks in constructing reinforced concrete structure by determining the wasting cost and time delay due to rework, identifying rework factors, and exploring the frequency and effect of rework items in project cost, time and quality. In the sampled building projects, that most severe effect on cost is, “goal divergence by any of the stake holder” and “client desired for modification of architectural design after execution”. Whereas, the most severe effect on time is, “goal divergence by any of the stake holder” and “late design changes”. Most severe effect on quality is of “lack in experience of consultant and contractor” and “conflict in contract documents”. Based on these conclusions, it is recommended that appropriate contractual arrangements be made to bind all the participating stakeholders to avoid such project pitfalls. In addition sound project management systems be instituted so that controlling of the identified factors may be facilitated.

## 6. References

- Alwi, Sugiharto and Hampson, Keith and Mohamed, Sherif (2002) Non Value- Adding Activities: A Comparative Study Of Indonesian And Australian Construction Projects . In Proceedings 10th of the International Group of Lean Construction Conference , pages pp. 627-638, Gramado, Brazil.
- Hwang, B. G., Thomas, S. R., Haas, C. T., & Caldas, C. H. (2009). Measuring the impact of rework on construction cost performance. *Journal of Construction Engineering and Management*, 135(3), 187-198.
- Love, P. E., Mandal, P., Smith, J., Irani, Z., Treloar, G., & Faniran, O. (2000). DECOREM: A Design and Construction Rework Minimisation Model. In ICSTM.
- Love, Peter E.D.; Mandel, Purnedu, and Li, Heng (1997a) A Systematic Approach to Modelling the Causes and Effects of Rework in Construction, pp347-355.
- Y.C. Mastenbroek (2010) Reducing rework costs in construction projects. (Bachelors Thesis), University of Twente
- Alwi, Sugiharto and Keith, Hampson and Sherif, Mohamed (2001) Effect Of Quality Supervision On Rework In The Indonesian Context. *Asia Pacific Building and Construction Management Journal* 6:pp. 2-6
- Alarcón, L. F., Grillo, A., Freire, J., & Diethelm, S. (2001, August). Learning from collaborative benchmarking in the construction industry. In Ninth Annual Conference of the International Group for Lean Construction (IGLC-9).
- Burati, J. L., Farrington, J. J., & Ledbetter, W. B. (1992). Causes of quality deviations in design and construction. *Journal of construction engineering and management* Vol. 118 No. 1 . (Burati)

- Amiruddin, B. A. (2006). Exploitation of contract documents for construction project planning and controlling. Unpublished Master of Science thesis, faculty of Civil Engineering, Universiti Teknologi, Malaysia.
- Alwi, S., Hampson, K. D., & Mohamed, S. A. (1999). Investigation into the relationship between rework and site supervision in high rise building construction in Indonesia.