

Identification of Factors Affecting Construction Productivity in Pakistan Industry

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Abstract — Construction productivity is significant requirement which is point of focus for every construction manager. The main purpose of this study is to understand and highlight the factors which affect the labor productivity in Pakistan focusing Karachi which is the financial hub of the country. Karachi generates a big chunk of revenue and contributes to gross domestic product (GDP) of Pakistan. The main objective of this study is to identify the main factors affecting labor productivity of contractor, consultant and perspective of client. The data collection was carried out by one hundred sixty (160) questionnaire surveys. The results showed that feeble management and worst site conditions are solely responsible for degradation in both efficiency and output of the project.

Index Terms –Labor productivity, Productivity in Pakistan, Design Factors, Environment Factors, Relative Important Index

I. INTRODUCTION

The success of any construction project is governed by its productivity in all phases of project life cycle including time, cost and quality. Prompt productivity is the recipe of the successful project and it is achieved by maintaining the progressive and pleasant environment. The construction industry has a rough environment and unskilled labor, which gives tough time to managers to execute the projects smoothly with reduced cost and better quality. Whereas, depending upon different site working temperatures, evaluated the impacts of high temperature outdoor working environments on construction labor productivity by focusing two building projects in China [1]. Labor productivity was measured using the production rate of workers and was categorized in direct work, indirect work and idle time by taking direct observations in the field. He observed that early morning (07:00 to 09:00) showed increased productivity and time from 14:00 to 15:00 was termed as the most difficult time for the workers. Looking into the literature, plenty of research papers are available on labor productivity highlighting the importance of efficiency of members in the market. In this paper contractors, clients and consultants are targeted for the outcome of the results.

However, it was evaluated that field workers can detect more accurate factor affecting productivity as they are one who are physically indulged on site [4]. In previous study the labor productivity compared by preparing a questionnaire to understand the construction manager and labor workers prospective [5]. The same technique was used in various countries for contractors, which are listed in Table I.

II. METHODOLOGY

A. Method of Analysis:

The method of analysis consists of questionnaire survey which was used to gather the information from client, consultant and contractor. One hundred and Sixty (160) questionnaires were distributed to people from client, consultant and contractor employees. Questionnaires were distributed by email and physically to respondents. The survey was distributed into five factors which have direct impact on the project, whereas to create focal points, many other sub-factors were included which are enlisted below:

- a) *Design factors*
 - i) Build ability (design of a building facilitates with ease of construction)
 - ii) Type of contract (e.g. unit rate, lump sum)
- b) *Environment factors*
 - i) Thermal environment.
 - ii) Inclement weather.
 - iii) Health.
- c) *Manpower factors*
 - i) Difficulty in recruitment of supervisors.
 - ii) Difficulty in recruitment of workers.
 - iii) Changing supervisors.
 - iv) Changing workers.
 - v) High rate of labor turnover.
 - vi) Absenteeism at work site.
 - vii) Communication problem with foreign workers.

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- viii) Alcoholism similar problems with workforce.
- ix) Labor disruption (e.g. manpower shortages, strikes).
- x) Lack of skill.
- xi) Discipline.
- xii) Fatigue.

d) *Site factors*

- i) Material shortages.
- ii) Delays in materials deliveries to site.
- iii) Rework.
- iv) Delays due to crew interference.
- v) Congested work area.
- vi) Site access.
- vii) Incidents (e.g. equipment breakdown, planning errors)

e) *Management Factor*

- i) Motivation.
- ii) Financial incentives.
- iii) Overtime.
- iv) Crew size.
- v) Inspection delays
- vi) Lack of equipment.
- vii) Disruption of water supplies.
- viii) Stop work orders due to site accidents.
- ix) Stoppages of work by consultants.
- x) Stop work orders because of infringements of government regulations.
- xi) Stoppages because of disputes with owner / consultants.
- xii) Stoppages because of insolvency of subcontractors / suppliers

B. Method of Analysis and Results:

To analyze the data and create a conclusion, Relative important index (RII) technique was used to create a benchmark for all factors. The survey was conducted with total 134 respondents from a variety of people including consultants, clients and contractors. RII technique was used because it is very much suitable for this study. RII is the best technique to identify significant factors and helps to highlight the factors which are critical and have importance. RII is being calculated by equation given below:

$$RII = \sum \left[\frac{W}{A} * N \right] \quad (0 \leq RII \leq 1) \tag{I}$$

Where:

W is the weight of each factor given by the respondent and it ranges from 1 to 5 (1- strongly disagree, 5- strongly agree).

A is the highest factor.

N is the total number of respondents.

Table I
Important Factors Affecting Labor Productivity, According To Different Countries.

Country	Researcher	Year	Number of factors investigated	Most important factors affecting labor productivity.
Egypt	El-Gohary et. al [2]	2014	30	<ul style="list-style-type: none"> • Labor experience and skills. • Incentive programs. • Availability of the material and ease of handling. • Leadership and competency of construction management.
India	Thomas and Sudha Kumar [3]	2013	44	<ul style="list-style-type: none"> • Material unavailability.
Turkey	Kazaz et. al [4]	2008	37	<ul style="list-style-type: none"> • Quality of site management. • Material management. • On-time payment.

Whereas from the workers' point of view following important factors affect productivity.

USA	Dai et.al [5]	2007	83	<ul style="list-style-type: none"> • Construction equipment
Chile	Rivas et. al [6]	2011	38	<ul style="list-style-type: none"> • Lack of equipment, materials, tools

III. RESULTS AND DISCUSSION

The overall questionnaire consists of 41.2% of the replies from the Contractor side 38.2% of the replies are from consultant and 20.6% are from Client side which are graphically represented in Fig. 1.

After collecting surveys, relative importance index analysis was calculated by using prescribed formula. Results were compiled in one graph shown in Fig.2 to understand the important factors.

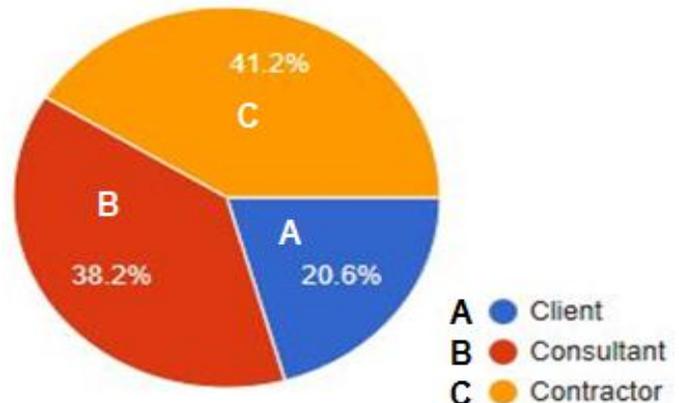


Fig. 1. Percentage of Respondents

RII of Factors Affecting Labor Productivity



Fig. 2. RII values of factors affecting labor productivity.

The objective of this report is to find out the main aspects which contribute to affecting the productivity. Results are listed as per ranking of the factors in Fig. 2.

A) Design Factors:

Design factor consists of two sub factors include build ability and type of contract. The value of RII for build ability is 0.71 and for type of contract is 0.62 as shown in Fig. 3.

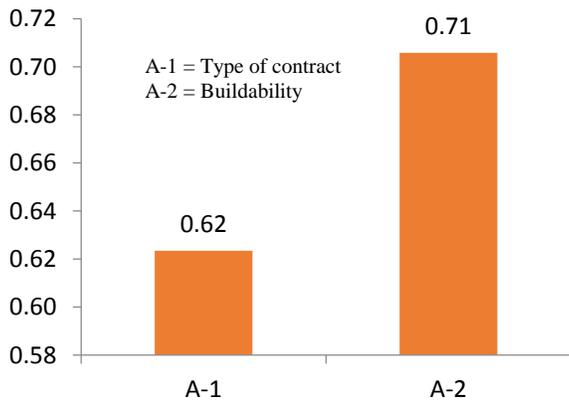


Fig. 3. RII values of Design factors.

B) Environment Factors:

Results show that environmental factors may not affect the labor productivity as compare to other factors and the results were RII = 0.72 for health and RII = 0.66 for weather conditions.

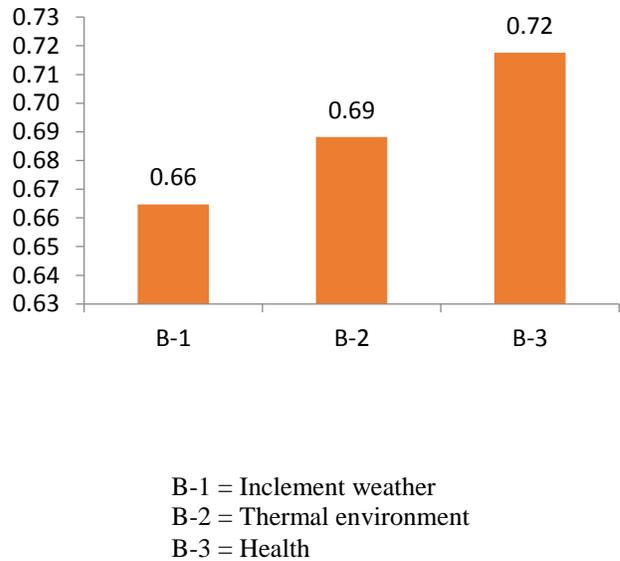


Fig. 4. RII values of Environment factors.

C) Manpower Factors:

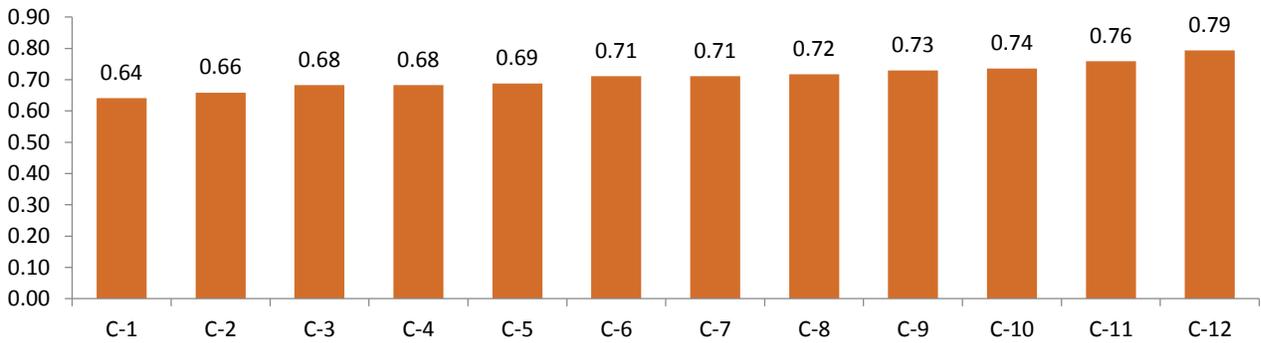
Respondents ranked manpower factors as a third factor influencing the productivity. Characteristic like lack of skills, communication problem between workers from different background and frequent change of supervisors may lead to affect the productivity as shown in Fig 5.

D) Site Factors:

Site factors are ranked second RII=0.73 with influencing aspects such as delay in the delivery of material at site RII= 0.80, shortage of material RII= 0.78 and incidents like (equipment breakdown, process break down) RII= 0.75 affect the productivity as per the standards as shown in Fig 6.

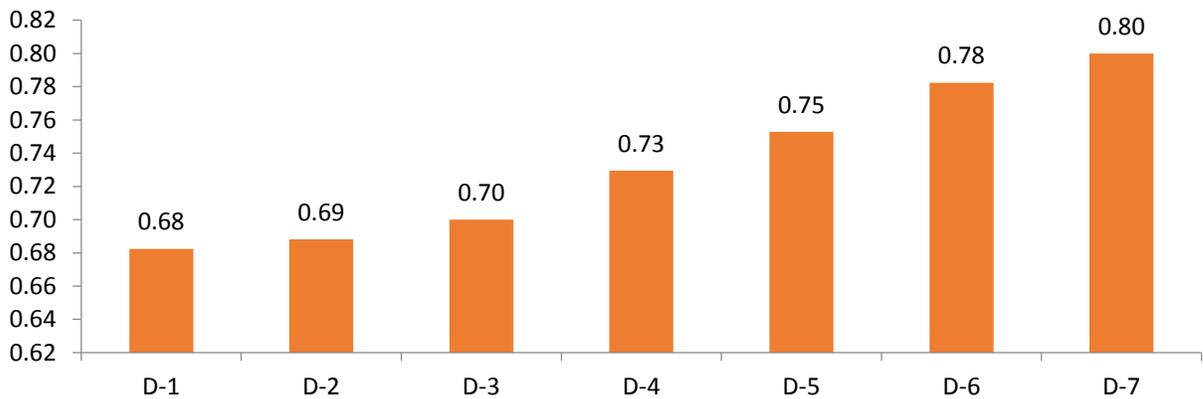
E) Management Factors:

The results show that management factors had a very high impact on construction productivity with relative importance index value 0.74 and ranked first among the five factors affecting productivity. Summary of results showed in Fig 7 defines that management factors like financial incentives RII=0.85, scheduling and coordination RII=0.82, motivation RII=0.78 have a major impact on productivity.



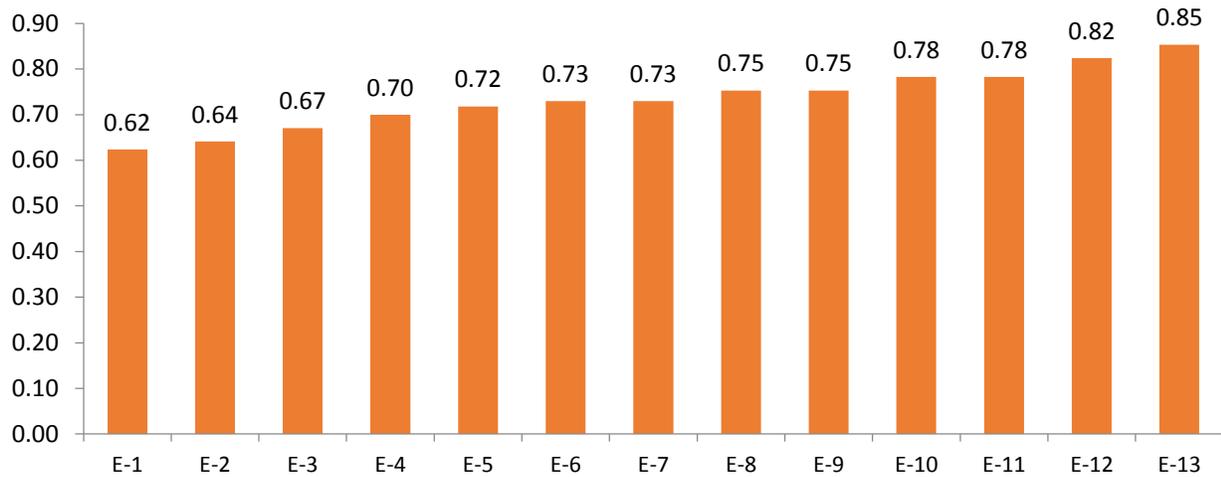
- C-1 = Difficulty in recruitment of supervisors
- C-2 = Difficulty in recruitment of workers
- C-3 = Changing workers
- C-4 = High rate of labour turnover
- C-5 = Alcoholism & similar problems with workforce
- C-6 = Absenteeism at work site
- C-7 = Fatigue
- C-8 = Changing supervisors
- C-9 = Discipline
- C-10 = Labor disruption.
- C-11 = Communication problem with foreign workers
- C-12 = Lack of skill

Fig. 5. RII values of Manpower factors.



- D-1 = Congested work area
- D-2 = Site access
- D-3 = Delays due to interference with other crews
- D-4 = Rework
- D-5 = Incidents
- D-6 = Material shortages
- D-7 = Delays in materials deliveries to site

Fig. 6. RII values of Site factors.



E-1 = Stop work orders because of site Accidents

E-2 = Stoppages because of insolvency of subcontractors / suppliers

E-3 = Stoppages because of work being rejected by Consultants

E-4 = Crew size

E-5 = Disruption of water supplies

E-6 = Inspection delays

E-7 = Stoppages because of disputes with owner / consultants

E-8 = Overtime

E-9 = Stop work orders because of infringements of govt. regulations

E-10 = Motivation

E-11 = Lack of equipment

E-12 = Poor scheduling & coordination

E-13 = Financial incentives

Fig. 7. RII values of Management factors.

IV. CONCLUSION

The analysis presented in report concluded that management factor is the most influential factor, whereas site factors are second most dominant factor which decrease the labor productivity. The labor working in unpleasant working conditions to earn their living is admissible for financial incentive to boost their morale and to motivate them to work harder. The second sub important factor which disturbs the productivity was found to be shortage or unavailability of materials on construction sites. In Pakistan, the labor is usually hired on daily wages, but absence of materials on site force them to sit idle, which ultimately makes them dull in the later performance. The report is based on general factors affecting construction productivity in Pakistan. Many previous authors have identified various factors affecting labor productivity of their respective native countries however, the report presented statistics of labor industry of Pakistan.

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