

A Study on Labour Productivity Management

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ABSTRACT: Labour Productivity remains an intriguing subject and a dominant issue in the construction sector, promising cost savings and efficient usage of resources. Productivity is one of the most important issues in both developed and developing countries. The developed countries are aware of the importance of economic growth and social welfare. The developing countries which face unemployment problems, inflation and resource scarcity seek to utilize resources and in such a way as to achieve economic growth and improve citizens lives. The aim of this project work is to identify factors affecting labour productivity and also to study causes i.e. labour problems on site and its effects on the construction projects. Some of the important factors affecting labour productivity are; quality of site management, material shortage, timely payment of wages, labour experience, misunderstandings between labour and superintendent etc. Here problems faced by the labour on construction sites (in & around Chennai) are dealt in detail. Problems like non-availability of proper accommodation, basic amenities, low wages, safety related problems, security etc., exists in almost all Indian construction sites. This work concentrates on labour productivity ratios that are reducing day by day, which in turn harms organization's profitability. In this study an attempt has been made to relate the ill effects of falling labour productivity with the productivity of other resources such as material, equipment and capital. Analysis of the data was collected by using MS - Excel methods and SPSS Software.

I.INTRODUCTION

Construction has the largest potential for creating employment. Labour Productivity is one of the key components of every company's success and competitiveness in the market. Productivity translates directly into cost savings and profitability. Increase in labour productivity does not imply for any compromise in quality of construction. A construction contractor stands to gain or lose, depending on how well his company's productivity responds to competition. Construction companies may gain advantage over their competitors by improving upon productivity to build projects at lower costs. The concept of productivity is importantly linked to the quality of input, output, and process. Labour Productivity is also a key to long-term growth. Improvement in construction productivity is not possible without identifying factors that influence productivity. [1]

Labour Productivity is the one of the most important factor that affects overall performance of any small or medium or large construction industry. There are number of factors that directly affect the productivity of labour, thus it is important for any organization to study and identify those factors and take an appropriate action for improving the labour productivity.[2] At the micro level, if we improved productivity, ultimately it reduces or decreases the unit cost of project and gives overall best performance of project. There are number of activities involved in the construction industry. Thus the effective use and proper management regarding labour is very important in construction operations without which those activities may not be possible.[3]

Achieving better labour productivity requires detailed studies of the actual labour cost. Various labours have different variables affecting their productivity levels. For every project, productivity, cost, quality, and time have been the main concern. Better productivity can be achieved if project management includes the skills of education and training, the work method, personal health, motivational factors, the type of tools, machines, required equipment and materials, personal skills, the workload to be executed, expected work quality, work location, the type of work to be done, and supervisory personnel.

Objectives of the project:

- To identify major factors affecting labour productivity.
- To identify the productivity gaps and find out the reasons for low site productivity.
- To give suggestion on enhancing the labour productivity with suitable solutions.[4]

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

Productivity Measurement Methods

Common productivity measurement methods involve the work measurement of workers. For effective control of productivity at construction projects, it is important to measure work; no control and improvement may be achieved without measurement. Work measurement helps in the development of work standards that will permit management to produce and operate with more satisfactory results. Work measurement may be applied by management to determine how well its employees are performing, not only in production operations, but also in engineering, clerical, and administrative tasks (Otis, 1980).[5] While there is no single, industry-wide technique for work measurement in construction, there is various measurement applications available based on different definitions of productivity. Measurements range from industry-wide economic parameters to the measurement of crews and individuals, and are occasionally based on observations and instincts. Each of these measurements has its own unique purpose. The following common techniques for productivity measurement and obtaining information about the time spent on productive and non-productive activities by workers. [6] These techniques include work samplings, five minute ratings, craftsmen questionnaires, foreman delay surveys, time-lapse photography or video recordings, and group timing techniques.

General Factors that affect Labour Productivity

Lack of material, Delay in arrival of materials, Unclear instruction to labourer, Labour strikes, Financial difficulties of the owner, High absenteeism of labours, No supervision method, Supervisors absenteeism, Lack of equipment and design changes, There is no definite schedule, Poor management, Unproductive time (internal delay, extra break, waiting & relaxation), Lack of skill, Supervision delay, Lack of tools & equipment, Poor instructions, Poor quality of labour, Supervision factor, Material factor, Execution plan factor, Health & safety factors, Labour shortages, Working time factor, Accidents, Organization factors, Improper training, Bad weather, Use of alcohol & drug.[7][8].

Questionnaire

The questionnaire form is designed in Likert scales running from virtually no impact, little impact, average impact, high impact, very high impact. These five positions will be given weights of 1,2,3,4 and 5 for scoring purposes. It requires the respondents to indicate the degree of agreement with each of a series of statement related to the stimulus objects. This type of question is easy to construct and administer. Respondents readily understand how to use the scale.[9]

The questionnaire can be viewed to contain two distinct segments. The first segment covering questions 1 to 7 are aimed at understanding more about the organizational profile of the responding company, nature of business. Questions include such issues as duration of project, designation of respondent, experience of the respondent in the link of work, structure and site location.

The second segment covering questions 8 form the most essential part of the questionnaire, and are targeted at the respondent's views on construction labour productivity.[10] This is followed by the key question, which is directed at the respondents' views as to what aspects of their labourers' work would have a great impact on improving construction labour productivity. A total of 51 aspects were highlighted. A Likert scale of 1 to 5 (1 being "virtually no impact"; and 5 being "very high impact") is being used in this question, and respondents simply work down the list by ticking the appropriate number that reflects their views.[11] Explanations of each individual aspect were also provided on a separate sheet in the survey.

The final question covering questions explores the respondents' attitude towards improving construction labour productivity. Unlike question 8 on productivity improvements, which merely subjects the respondent to a hypothetical situation, this segment contains questions with a definitive end and directly asks the respondents if they would like to do a specific thing about improving construction labour productivity. As respondents are mainly asked to tick the appropriate boxes, the questionnaire was designed so that respondents would not spend more than 15 minutes to complete it. An opportunity for the respondent to make additional comments about the general topic of construction labour productivity was also given at the end. It is also worth to note that the questionnaire was piloted to various

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

academic members of staff and industrial partners to test the feasibility and understandability of the questionnaire.[12][13]

Data Collection

Data collection is the most critical part of the study since the accuracy of the data will determine the success or failure of the research. The data's are obtained through literature studies and questionnaire that are analyzed using appropriate analytical techniques in order to portray a clear perspective on the research.

Data Analysis

Responses from questionnaire are then compiled and analyzed. After collecting required number of samples, data analysis is done to arrive at different factors which lower the productivity. These factors are then analyzed to find its effect on different aspects of the project using different statistical method which is specified on later sections.

Method of Analysis

SPSS Statistics is a software package used for statistical analysis. It is now officially named "IBM SPSS Statistics". SPSS Statistics (originally, Statistical Package for the Social Sciences, later modified to read Statistical Product and Service Solutions) was released in its first version in 1968 after being developed by Norman H. [14-16]Nie, Dale H. Bent, and C. Hadlai Hull. SPSS is among the most widely used programs for statistical analysis in social science. It is used by market researchers, health researchers, survey companies, government, education researchers, marketing organizations and others. Statistics included in the base software

The graphical user interface has two views which can be toggled by clicking on one of the two tabs in the bottom left of the SPSS Statistics window. The 'Data View' shows a spreadsheet view of the cases (rows) and variables (columns). Unlike spreadsheets, the data cells can only contain numbers or text and formulas cannot be stored in these cells.[17]

The 'Variable View' displays the metadata dictionary where each row represents a variable and shows the variable name, variable label, value label, print width, measurement type and a variety of other characteristics. Cells in both views can be manually edited, defining the file structure and allowing data entry without using command syntax. This may be sufficient for small datasets. Larger datasets such as statistical surveys are more often created in data entry software, or entered during computer-assisted personal interviewing, by scanning and using optical character recognition and optical mark recognition software, or by direct capture from online questionnaires. These datasets are then read into SPSS.

II.ANALYSIS OF QUESTIONNAIRE

Field data were collected from construction sites with a view to understand the real time difficulties in achieving higher construction labor productivity. Random sampling was done in the construction sites. Medium firms are contacted for the survey. Sites within the city such as residential buildings are covered to avoid uniqueness of data. A total of 30 firms were approached. Around 5 firms denied responding due to reasons such as non availability of time, presence at the site etc. In the course of the research, it is felt that one more survey is required to know contractors view on different factors affecting labor productivity. Hence the survey is carried out to know contractors opinion to improve productivity. The objectives behind the Surveys were explained below.[18]

Main finding

Table 1 tabulates the perceptions of the respondents with regards the potential areas of labour productivity improvements. From the table, it can be seen that emerging top of the groups of variables are the work environment issues. [19]This is coherent to popular believe since work environment issues include factors that are conventionally known to be manageable such as site congestion, sequencing and interference, information flow and materials management. Therefore, these are the aspects of the work, which the respondents naturally feel they would have a greater control over and thus influence the outcome productivity. Work content issues ranked second out of the four and this relates to the technicalities of construction projects, e.g. use of technology, quality and specifications,

**International Journal of Innovative Research in Science,
Engineering and Technology**
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

standardization and prefabrication. Though not directly manageable by on-site managers, the choice of undertaking a particular project in a productive way may be governed by the procurement route, in particular the choice of whether to tender for a project. As the scope of change during the early stage of a project tends to be highly possible and most economical, proper planning during this stage is crucial in order to achieve optimum productivity.[20]

Ranked third are workforce issues. This is alarming, as one would have expected that workforce issues should be top of management's priority given the labour-intensiveness of the industry. Perhaps the rise of self-employment in the 1970s and the regular use of contract labour, together with the virtual non-existence of an appropriate training structure (and culture), could explain the respondents' lack of confidence in managing the workforce to achieve a higher rate of productivity. [21] This may also be the reason as to why much research in the field of productivity tended to focus on such issues as lean construction and robotics. The lack of confidence in the training structure within the construction industry is also mirrored by the scores of the sub-group skills training and qualifications. The individual scores of the various qualifications are also rated very poorly by the respondents.

Despite the somewhat bleak picture painted on the confidence of managing workforce issues, it is interesting to note that within this group contains three of the top ten ranking variables, namely Welfare amenities (rank 1), Communication within labors, Availability of components (rank 2). Ranked 4 is Construction Technology involved in labors respectively. Ranked 5 are Health and Safety, Site Administration Duties and Scheduling. Ranked 8 are Utilization and Health and Safety Management. Rank 10 is Experience of planner. Welfare amenities, Site Administration Duties within labors Issues further emphasizes the shortage and deficiency in the skills and training of the workforce; whilst communication with labors supports the fact that the industry is dependent on contract labour. Relating to skills and training, an overwhelming perceived a strong link between training and labour productivity level.[22]

Among the four factor groups affecting construction labor productivity, Regulation were found as the most important group mean index of 3.57 (high impact), as can be seen Table 2. Two factors are investigated in this group, and Health and safety 3.7 (high impact), Building Regulations 3.43 (low impact), are ranked by the participants as the two most effective factors in this group. These results columns indicated the most promising factors that can initially give opportunities with a particular care for improving labour productivity.

**International Journal of Innovative Research in Science,
Engineering and Technology**
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

Table 1: Potential areas of labour productivity improvements as perceived by respondents

S.NO	DESCRIPTION	MEAN	RANK IN TOTAL	GROUP RANK
A) Work content issues		3.37		3
1	Standardization	3.13	45	
2	Prefabrication	3.20	40	
3	Size of components	3.40	23	
4	Availability of components	3.77	2	
5	New products	3.47	20	
6	Uniqueness	3.07	49	
7	Simplicity	3.20	40	
8	Quality requirements	3.30	33	
9	Specification	3.30	33	
10	Construction technology involved	3.73	4	
11	Cost control	2.87	51	
12	Resource allocation	3.37	26	
13	Scheduling	3.70	5	
14	Experience of planner	3.63	10	
B) Work environment issues		3.32		4
15	Congestion	2.93	50	
16	Weather	3.33	29	
17	Sequencing and interference	3.10	47	
18	Faulty work	3.57	12	
19	Information flow	3.33	29	
20	Procurement	3.10	47	
21	Delivery	3.57	12	
22	Storage	3.33	29	
23	Packaging	3.37	26	
24	Availability	3.57	12	
25	Capacity	3.13	45	
26	Availability	3.37	26	
27	Simplicity	3.23	38	
28	Maintainability	3.27	35	
29	Utilization	3.67	8	
C) Workforce issues		3.47		2
30	Supervision	3.20	40	
31	Communication within labors	3.77	2	
32	Communication within company	3.57	12	2
33	Communication within subcontractors	3.40	23	
34	Communication with suppliers	3.53	17	
35	Health and safety management	3.67	8	
36	Bonus schemes	3.27	35	
37	Turn over	3.40	23	
38	Training investment	3.57	12	
39	Job prospects	3.20	40	
40	Welfare amenities	4.00	1	
41	Secondary school qualification	3.27	35	
42	Safety training	3.23	38	
43	Quality training	3.47	20	
44	Material handling training	3.60	11	
45	Level of site experience	3.33	29	
46	Working hours	3.20	40	
47	Shift work	3.53	17	
48	Travelling time to work	3.50	19	
49	Site administration duties	3.70	5	
D) Regulation		3.57		1
50	Building regulations	3.43	22	
51	Health and safety	3.70	5	

**International Journal of Innovative Research in Science,
Engineering and Technology**
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

Table 2. Mean of Regulations

Rank in group	Regulation	Mean	Rank in total
1	Health and safety	3.70	5
2	Building regulations	3.43	22



Figure 1. Statistical results of Regulations

The second most important group is work force issues 3.47 (high impact). The twenty factors were totally researched as shown in table 3 and Welfare amenities 4.0 (very high impact), Communication within Labors 3.77 (high impact) was ranked 1 & 2 by the sector professionals as the effective factor. However Supervision, Job Prospects, Working Hours was found out as the least important factor with the mean 3.20 (low impact). The other factors have high impact. Then the work content issues 3.37 (high impact) including fifteen elements are the considerable group, as shown in table 4.

**International Journal of Innovative Research in Science,
Engineering and Technology**
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

Table 3 Statistical result of Work force issues

Rank in group	Workforce issues	Mean	Rank in total
1	Welfare amenities	4.00	1
2	Communication within labors	3.77	2
3	Site administration duties	3.70	5
4	Health and safety management	3.67	8
5	Material handling training	3.60	11
6	Communication within company	3.57	12
7	Training investment	3.57	12
8	Communication with suppliers	3.53	17
9	Shift work	3.53	17
10	Travelling time to work	3.50	19
11	Quality training	3.47	20
12	Communication within subcontractors	3.40	23
13	Turn over	3.40	23
14	Level of site experience	3.33	29
15	Bonus schemes	3.27	35
16	Secondary school qualification	3.27	35
17	Safety training	3.23	38
18	Supervision	3.20	40
19	Job prospects	3.20	40
20	Working hours	3.20	40

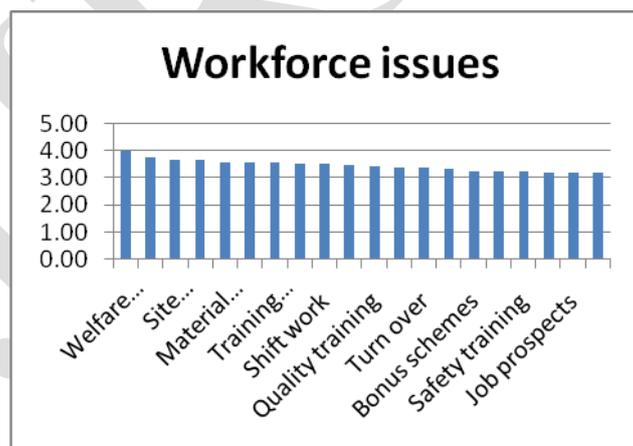


Figure 2. Mean of Work force issues

The third most important group is Work content issues 3.37 (Average impact). The factors are totally researched as shown in table 4, and Availability of components 3.77 (very high impact), Construction technology involved and Scheduling 3.73 (high impact) was ranked by the sector professionals as the effective factor. However Cost Control was found out as the least important factor with the mean 2.87 (Low impact). The other factors have high

**International Journal of Innovative Research in Science,
Engineering and Technology**
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

impact upon efficiency. Then the Work Environment issues 3.32 (Low impact) including twenty elements are the considerable group, as shown in table 4.

Table 4. Statistical results of work content issues

Rank in group	Work content issues	Mean	Rank in total
1	Availability of components	3.77	2
2	Construction technology involved	3.73	4
3	Scheduling	3.70	5
4	Experience of planner	3.63	10
5	New products	3.47	20
6	Size of components	3.40	23
7	Resource allocation	3.37	26
8	Quality requirements	3.30	33
9	Specification	3.30	33
10	Prefabrication	3.20	40
11	Simplicity	3.20	40
12	Standardization	3.13	45
13	Uniqueness	3.07	49
14	Cost control	2.87	51

Finally, the least important group Work Environment issues of which mean results were summarized in table 5 is determined as Utilization has of 3.67 (high impact). Congestion 2.93 (low impact).

Table 5. Statistical results of Work Environment issues

Rank in group	Work environment issues	Mean	Rank in total
1	Utilization	3.67	8
2	Faulty work	3.57	12
3	Delivery	3.57	12
4	Availability	3.57	12
5	Packaging	3.37	26
6	Availability	3.37	26
7	Weather	3.33	29
8	Information flow	3.33	29
9	Storage	3.33	29
10	Maintainability	3.27	35
11	Simplicity	3.23	38
12	Capacity	3.13	45
13	Sequencing and interference	3.10	47
14	Procurement	3.10	47
15	Congestion	2.93	50

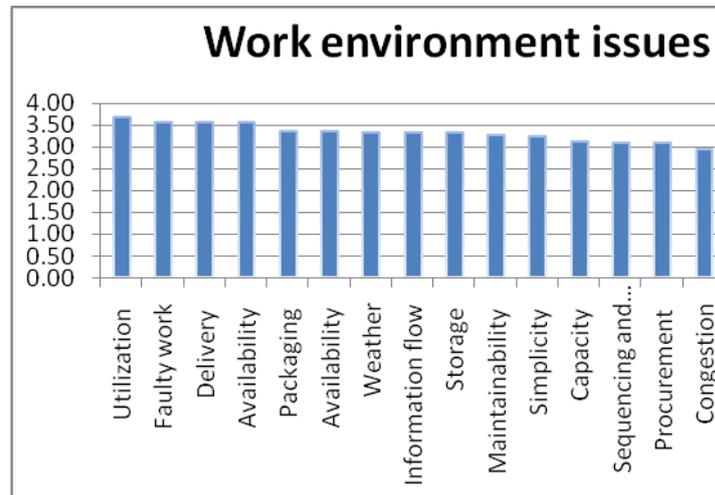


Figure 3 Mean of Work environment issues

The top ten factors are given as a whole table 6. The results of comparison between these factors are presented in the last column of it. The first three factors (1-3) are evaluated as very “important”, then the other seven factors “important”.

According to the results, one Regulations and two workforce issues factor were found out ‘very important’ while neither Regulation issues factors nor work force have been listed as very “important”.

Table 7. Summary of results

Top Ten Factors	Mean	Rank in Total
Welfare amenities	4.00	1
Communication within labors	3.77	2
Availability of components	3.77	2
Construction technology involved	3.73	4
Health and safety	3.70	5
Site administration duties	3.70	5
Scheduling	3.70	5
Utilization	3.67	8
Health and safety management	3.67	8
Experience of planner	3.63	10

The following 10 major factors which primarily impact construction labour productivity and therefore of which poor gratification on a construction site likely leads to great demotivation and continued low productivity, the factors are Welfare amenities, Communication within labors, Availability of Components, Construction Technology involved, Health and safety, Site Administration Duties, Scheduling, Utilization, Health and Safety Management and Experience of Planner. The above type of summarizing the sub factors in the four groups of factors affects the labor productivity can be convinced for small scale projects. For medium scale projects, the inferences can be made by group

**International Journal of Innovative Research in Science,
Engineering and Technology**
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

ranking the factors. By group ranking the factors, inferences are discussed in conclusion chapter, and summarizing the results by ranking sub factors and its discussion are described below.

III. ANALYSIS BY USING SPSS SOFTWARE

Table 7. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Standardization	30	1	5	3.13	1.008
Prefabrication	30	1	5	3.20	1.157
Size of Components	30	1	5	3.40	1.133
Availability of Components	30	1	5	3.77	1.040
New Products	30	1	5	3.47	1.332
Uniqueness	30	1	5	3.07	1.112
Simplicity	30	1	5	3.20	1.031
Quality Requirements	30	1	5	3.30	1.088
Specifications	30	1	5	3.30	1.236
Construction Technology	30	1	5	3.73	1.081
Cost Control	30	1	5	2.87	1.224
Resource Allocation	30	1	5	3.37	1.098
Scheduling	30	1	5	3.70	1.119
Experience of Planner	30	1	5	3.63	1.066
Congestion	30	1	5	2.93	1.143
Weather	30	1	5	3.33	1.155
Sequencing and	30	1	5	3.10	1.296
Faulty Work	30	1	5	3.57	1.194
Information Flow	30	1	5	3.33	1.124
Procurement	30	1	5	3.10	1.094
Delivery	30	1	5	3.57	1.135
Storage	30	1	5	3.33	1.269
Packaging	30	1	5	3.37	1.189
Availability	30	1	5	3.57	1.251
Capacity	30	1	5	3.13	1.196
Availability	30	1	5	3.37	1.098
Simplicity	30	1	5	3.23	1.040
Maintainability	30	1	5	3.27	1.285
Utilization	30	1	5	3.67	1.269
Supervision	30	1	5	3.20	1.064

**International Journal of Innovative Research in Science,
Engineering and Technology**
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

Communication within	30	1	5	3.77	.971
Communication within	30	1	5	3.57	1.305
Communication with	30	1	5	3.40	1.133
Communication with	30	1	5	3.53	1.106
Health and Safety	30	1	5	3.67	1.155
Bonus schemes	30	1	5	3.27	1.048
Turn over	30	1	5	3.40	1.070
Training Investment	30	1	5	3.57	1.223
Job prospects	30	1	5	3.20	1.031
Welfare amenities	30	1	5	4.00	1.145
Secondary School	30	1	5	3.27	1.048
Safety training	30	1	5	3.23	1.223
Quality training	30	1	5	3.47	1.106
Material handling training	30	1	5	3.60	1.404
Level of Site Experience	30	1	5	3.33	1.155
Working hours (include	30	1	5	3.20	1.064
Shift work	30	1	5	3.53	1.167
Travelling time to work	30	1	5	3.50	1.253
Site administration duties	30	1	5	3.70	1.119
Building Regulations	30	1	5	3.43	1.104
Health and Safety	30	1	5	3.70	1.119
Valid N (listwise)	30				

IV.DISCUSSION AND CONCLUSION

The basic idea of this project is to study various factors affecting labor productivity on construction. As discussed, Fifty one factors were considered for the study and categorized into four different groups, work content issues, work environment issues, work force issues, and regulations. Based on the analysis, the following inferences are arrived,

- On analyzing the four groups, **Regulation** ranked 1as an important factor. On that line Building regulation is major factor (**table 4.2**). Accidents on sites are common phenomenon in complex and congested site locations. Labour should be provided with full safety training and required PPEs to safeguard themselves from dangerous accidents. Apart from losing on man-hours, an accident on site can spoil all the reputation of the company in the mind of all the stakeholders including labour. Labour feel secured at safe sites and tend to produce more. Material should be stored at appropriate locations and it should be easily accessible and reduce site congestion.
- **Work force issues** ranked 2 among the other three groups. On that line, communication and site experience see (**table 4.4**). Good supervision is very much essential to get maximum output from the labour. Good supervision avoids mistakes and in turn rework. Supervisors should have good interpersonal skills to get work done through labour. Proper communication between labors and employees and good supervision to avoid many problems in work siteImproving productivity could be best carried out by means of development in

**International Journal of Innovative Research in Science,
Engineering and Technology**
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

management quality rank three (**table 4.4**). Should be avoid Managerial errors of site engineers and managers who lack proper experience, knowledge, and management skills can improve worker efficiency. Managers and project managers should recruit appropriate workmen for a particular task. Friendly relationships should be maintained with them and made aware of their importance to the project and thereby to the organization.

- **Work content issues** ranked three among the major groups. On that line, complex design is major factor (**table 4.3**). Building Components ranked as one of the major factor in this sub group. Building Components and incomplete drawings should be avoided and care should be taken to avoid confusion among the various construction agencies. Planning begins from the day a project is conceived. Managers should try to plan the project in such a way that there are no repetition of work, no emergency and less number of overtime in the project. Managers should develop an overall plan providing a general outline of work using bar or flow charts. They should also develop contingency plans if the original plan fails. He should prepare a detailed planning for work execution at the task level. Change orders and design error should be avoided as much as possible. These factors can be costly and time consuming. Work sequences can also be affected due to rework and thereby lose in productivity.
- **Work environment issues** ranked 4 as an important factor. On that line, information flow, material management, site congestion and faulty work those sub factors are major factors in work environment issues (**table 4.2**). Good information flow between labors and employees to avoid faulty works and problems faced by labour and to reduce the problems and to improve productivity. Labour should know what kind of work he is doing and what is the best method to do it. It improves labour productivity in a big way. It can be understand that labour are not permanent employees to any organization but then if training will be provided to them, they will be motivated to work for the same organization for longer duration.

REFERENCES

1. ArunMakulsawatudom, Margaret Emsley and Kuldej Sinthawanarong (2004) 'Critical Factors Influencing Construction Productivity in Thailand' The Journal of KMITNB, vol.14, No.3, pp 54-59.
2. Chau K.W. (2009) 'Explaining Total Factor Productivity Trend in Building Construction: Empirical Evidence from Hong Kong' the International Journal of Construction Management, pp 45-54.
3. Das J., Paul Das M., Velusamy P., "Sesbania grandiflora leaf extract mediated green synthesis of antibacterial silver nanoparticles against selected human pathogens", Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy, ISSN : 1386-1425, 104(), (2013) pp.265-270.
4. Derek Miles (2005) 'TOWARDS GUIDELINES FOR LABOUR-BASED CONTRACTING' A frame work document, The Mart initiative in association with ILO.
5. Harish B.N., Menezes G.A., "Antimicrobial resistance in typhoidal salmonellae", Indian Journal of Medical Microbiology, ISSN : 0255-0857, 29(3) (2011) pp. 223-229.
6. Hanna A.S., Donald G. Heale (1994) 'Factors affecting construction productivity: Newfoundland versus rest of Canada', Canadian Journal of Civil Engineering, vol. 21, No.4, pp 663-673.
7. Kandasamy A., Mohan R., Caroline M.L., Vasudevan S., "Nucleation kinetics, growth, solubility and dielectric studies of L-proline cadmium chloride monohydrate semi organic nonlinear optical single crystal", Crystal Research and Technology, ISSN : 1521-4079, 43(2) (2008) pp. 186-192.
8. Keith Godin, Milagros Palacios, Jason Clemens, & Niels Veldhuis (2007) 'Measuring Labour Markets in Canada and the United States' The Fraser Institute, Canada.
9. Khanaa, V., Mohanta, K., Saravanan, T., "Comparative study of uwb communications over fiber using direct and external modulations", Indian Journal of Science and Technology, ISSN : 0974-6846, 6(S6) (2013) pp.4845-4847.
10. Osama Moselhi, Charles Leonard and Paul Fazio (1991) 'Impact of change orders on construction productivity', Canadian Journal of Civil Engineering, vol. 18, No.3, pp 484-492.
11. Osama Moselhi F., Ihab Assem M. and Khaled El-Rayes M. (2005) 'Change Orders Impact on Labour Productivity', Journal of Construction Engineering and Management, vol. 131, No. 3, pp 354-359.
12. Kumar Giri, R., Saikia, M., "Multipath routing for admission control and load balancing in wireless mesh networks", International Review on Computers and Software, ISSN : 1828-6003, 8(3) (2013) pp. 779-785.
13. Panas, A. and Pantouvakis, J. P. (2010) 'Evaluating Research Methodology in Construction Productivity Studies', the Built & Human Environment Review, Vol. 3, No.1, pp 63-8.
14. Pomp J.M. (1998) 'Recent Trends in Dutch Labour Productivity: the Role of Changes in the Composition of Employment' working paper no. 98, CPB Netherlands Bureau for Economic Policy Analysis, Netherlands.
15. Randolph H. Thomas and Karl A. Raynar (1997) 'Scheduled Overtime and Labour Productivity: Quantitative Analysis', Journal of Construction Engineering and Management, Vol. 123, No. 2, pp 181-188.

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Engineering and Technology**
(An ISO 3297: 2007 Certified Organization)

Vol. 3, Issue 12, December 2014

16. Ronald Gulezian and Frederic Samelian (2003) 'Baseline Determination in Construction Labour Productivity-Loss Claims', Journal of Management n Engineering, Vol. 19, No. 4, pp 160-165.
17. Subramanian C.N. (2000) 'Labour Movement in India as Reflected in the Indian Labour Year Book 1997'
18. Sudhir Saxena (2009) 'Problems of Labours on Construction: A Qualitative Research', International Research Journal, Vol. 2, No. 7, pp 53-55.
19. Tolga Ozturk and Muhittin Inan (2010) 'Comparisons of environmental effects and productivity by road construction machines in forest areas in Turkey', African Journal of Biotechnology, Vol. 9, No.31, pp. 4918-4925.
20. William H. Lazonick (1981) 'Production Relations, Labour Productivity, and Choice of Technique: British and U.S. Cotton Spinning' Journal of Economic History, Vol. 41, No.3, pp 491-516.
21. William M. (2005) 'Impact of Change's Timing on Labour Productivity', Journal of Construction Engineering and Management, Vol. 131, No. 11, pp 1219-1223.
22. Yakubu A. Yakubu (2010) 'Factors Influencing Female Labour Force Participation in South Africa in `2008' The African Statistical Journal, Vol. 11, pp 85-104.
23. J. Pavithra, A Study on Distribution Channels in Cement Industry , International Journal of Innovative Research in Science, Engineering and Technology, ISSN: 2319-8753, pp 192-199, Vol. 1, Issue 2, December 2012.
24. J.Arul Hency Sheela, QUALITATIVE ANALYSIS OF SECONDARY METABOLITES OF THE PLANT CLEMATIS GOURIANA , International Journal of Innovative Research in Science, Engineering and Technology , ISSN: 2319-8753 , pp 2831-2834, Vol. 2, Issue 7, July 2013.
25. J. Pavithra, A Study on the Role of Foreign Direct Investment in Retail industry in India , International Journal of Innovative Research in Science, Engineering and Technology , ISSN: 2319-8753, pp 71-81, Vol. 1, Issue 1, Nov 2012.
26. J.Arul Hency Sheela, Qualitative Analysis of Primary Metabolites of the Plant Clematis Gouriana , International Journal of Innovative Research in Science, Engineering and Technology , ISSN: 2319-8753, pp 9011-9013 , Vol. 3, Issue 2, February 2014.
27. J. Pavithra, Advertising Ethics in India , International Journal of Innovative Research in Science, Engineering and Technology , ISSN: 2319-8753 , pp 225-229, Vol. 1, Issue 2, December 2012.
28. J.Arul Hency Sheela, Phytochemical Constituents of the Plant Clematis Gouriana , International Journal of Innovative Research in Science, Engineering and Technology , ISSN: 2319-8753 , pp 9965-9968 , Vol. 3, Issue 3, March 2014.