Study on Factors Affecting Labour Productivity In Construction Industry

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I. INTRODUCTION

Labour productivity is defined as the output generated per hour worked. It may be defined as ratio of output to input. In order to calculate productivity values for an industry, three pieces of information are required: the industry's output, the industry's employment data, and the average number of hours worked.

Productivity represents goods and services produced in relation to the recourses utilized in their production. Higher productivity means efficient use of inputs and vise versa. According to Peter Drucker, "Productivity represents the balance between all factors that will give the greatest output at smallest effort." The term productivity is used synonymously with the labour productivity. Firstly the labour force is the most important

1.1 INDUSTRY PERSPECTIVE & CHANGING TRENDS IN EMPLOYMENT SKILLS

Over the last few years, Mumbai has been witnessing tremendous growth in construction activities, both in housing and infrastructure construction segment. Bulk of the construction projects have been executed by established industry players. These players have been investing heavily into technology to derive better economies of scale, which has resulted into a huge demand for skilled technical professionals like: civil engineers, project managers, materials managers, quality assurance managers, safety engineers, work engineers, quantity surveyors, contract managers, project administrators, machine operators, project managers, computer operators, etc (3).

1.2 IMPORTANCE OF STUDY

The concept of 'developing' workers is not seen in the construction industry; here, the workers 'develop' themselves, learning from master craftsmen, under whom they work. The most skilled workers are the disciples of their Gurus, and have learnt the hard way. It is a "do it yourself" industry, but the question is- How long can the industry adopt this attitude? There is need to focus on the quality and quantity of its workers, their ways of learning. Skills are not only a requirement for quality and productivity of construction, but they give leverage to workers for improving their economic and social condition. Today, the workers jobs and incomes depend upon more their skill levels than ever before, and hence there is requirement of skill development

II. LITERATURE SURVEY

2.1 INTRODUCTION

Capital-labour MFP (Multifactor Productivity), based on value-added. This productivity measurement is useful for the analysis of micro-macro links, such as the industry contribution to economy-wide MFP growth and living standards, as well as, for analysis of structural change. Its main advantage as a productivity measure is the ease of aggregation across industries. The data for this measurement is also directly available from national accounts. The main drawback to the value-added based capital-labour MFP is that it is not a good measure of technology shifts at the industry or firm level. It also suffers the disadvantage of other value-added measures that have been double deflated with a fixed weight Laspeyres quantity index.

Following is the percentage distribution of workers by skills in Infrastructure construction sub sector in the year 1995-96 and 2004-05. The difference in the skill distribution between the years is seen due to the rapid technological progress made over the years. Skill distribution for infrastructure construction segment in India.

Table: 2.1 Distribution of skill workers in construction Industry

Skill Distribution in Construction Industry	1995-96 (per cent)	2004-05 (per cent)
Engineers	4.71	8.47
Other Technicians	2.46	4.43
Clerical	4.40	4.40
Skilled Workers	15.35	27.62
Unskilled Workers	73.08	55.08

2.2 HOUSING CONSTRUCTION SUB SECTOR

Housing construction sub sector is labour intensive and absorbs less skilled manpower compared to infrastructure construction sub sector. Table 2.1.1 gives the distribution of manpower requirement by trades in housing construction sub sector. Not much technological progress has taken place using housing sub sector as the construction activity takes place with the traditional and low cost technology. The unskilled component in the sub sector is to the tune of 54.43 per cent and it is controlled by mistris and jamadars who also act as the bridge between unskilled labour seeking work and contractors who offer work. It has been found that workers in the housing construction sub sector are often rural migrants who were mostly landless labour. In the skilled category, much of the employment is likely to be generated for masons, as they comprise of 30.42 per cent of the total labour. The next category that is in demand is carpenters, who comprise of almost eight per cent of the total employment.

Table: 2.2.1Composition of employees in housing segment

Categories of labours	1. Percentage
Unskilled	54.43
Mason	30.42
Carpenter	7.94
Plumber	0.32
Electrician	0.47
Others	6.42
Total	**100**

Table 2.1.2 shows the investments made in the industry over the past years. The civil engineering construction industry sets in motion the procedure of economical growth in the country; investment in this sector contributes 7.6% (2015-16) of Gross Domestic Product (GDP) growth. This means formal planning and above board financial planning will be the obvious destination of the construction sector in the country, with over 3.1 Crore persons employed in it (5).

2.3 CURRENT STATUS OF CONSTRUCTION INDUSTRY IN INDIA

"There is wide variation in labour productivity among different countries in the world owing to a host of factors, most of which are directly and positively related to the level of economic development of the countries concerned. It is important to underscore the fact that differences in labour productivity levels have essentially nothing to do with differences in how hard workers work – on the contrary they often indicate differences in working conditions. A poor worker in a developing economy can work long hours, strenuously, under bad physical conditions, but yet have low labour productivity and, therefore, receive a low income because he or she lacks access to technology, education, or the factors needed to raise productivity. Similarly a worker in a highly developed economy may have high labour productivity despite working relatively fewer hours." To know the current status of the construction industry in India, it is essential to know the employment of labours in the industry. In the country like India large volume of labours are available. The employment of the labours is continuously increasing due to the boom in the construction industry. The approximate numbers of labours working in the industry is shown below:

Fig 2.3.1(A) Employment of labours in construction industry in India

As India is also a developing country, the labour productivity is also increasing due to the availability of labours at low wages and ready to work in unhygienic conditions. The productivity of construction labour in India is as shown in Fig 2.3.1 (B)

Fig 2.3.1(B) Labour Productivity in India

III. DATA COLLECTION

3.1 FEATURES OF CONSTRUCTION INDUSTRY

Construction industry is unique in many ways:

1) In this Industry no basic educational qualification is essential for the builder or worker to start the work. This is mainly responsible for the reduction in the productivity.
2) After securing the work the contractor wish to get maximum profit by giving less facility to the labours for their living, wages & welfare.
3) Generally no Unions are present on the private contractors site results the domination of labours by the contractor as there are other peoples who are waiting for their jobs on low wages. Those labours are not stable at one place for more time.
4) The workers/labours do not get any training from the contractor results in low productivity and poor quality control in the construction.

3.3 CONSTRUCTION INDUSTRY IN INDIA

Construction Industry in India, is one of the key sectors for economic growth. It becomes all the more relevant considering its support to other core sector industries and providing sustenance to a large number of manufacturing units across the country. India is on the threshold of an economic revival as it presents great opportunity for investment in construction and infrastructure. Construction industry is defined as land, including the air above it and the ground below it, and any constructions or structures on it. It covers residential housing, commercial offices, and trading spaces such as theatres, hotels and restaurants, retail outlets, industrial constructions such as factory government constructions. Construction industry involves the purchase, sale, and development of land, residential and non-residential constructions.

The main players in the Construction industry are the landlords, developers, builders, real estate agents, tenants, buyers etc. Recently the Government of India carried out a nationwide survey under Census'2001, which in addition to the normal counting of population, male, female etc even carried out a census about the constructions in India, which brought about some interesting facts related to the prevailing condition of existing constructions in India

Construction Industry is a major employment driver, being the second largest employer next only to agriculture. This is because of the chain of backward and forward linkages that the sector has with the other sectors of the economy. About 250 ancillary industries such as cement, steel, brick, timber, construction materials etc. are dependent on the construction industry. It is difficult to estimate the exact contribution of the Construction Industry to gross domestic product (GDP) as it appears in a desegregated and dispersed form in the National Accounts Statistics, Govt. Of India (Shown in table 3.3.1).To get an idea of the contribution of the Construction Industry to GDP, an attempt is made to factor in the value added to ownership of dwellings, which constitute housing, real estate services and construction. During the period 2005-06 to 2009-2010 the Construction Industry grew by 7.3 per cent. Construction industry is a big employment generator. According to an estimate of the National Construction Organization, every one million rupees spent on construction generates 3000 man days of skilled and semi-skilled labour and 1300 man days of managerial and technical employment.

Table 3.3.1 Percentage share of GDP at Factor cost in Real Estate And Construction

S. No.	Year	Real Estate	Construction
1	2005-06	10.6	7.9
2	2006-07	9.5	8.0
3	2007-08	8.7	8.1
4	2008-09	10.4	8.0
5	2009-10	7.8	7.9
6	2010-11	6.9	7.9

The Construction sector in India is unproductive. The sector contributes only 1 per cent of GDP in India, as compared to 3 per cent in Russia and 6 per cent in Brazil. Labour productivity in the sector is less than one-fifth its potential. There are two key reasons for the poor productivity performance of the sector. The first is the artificial scarcity of land created by various distortions in the land market. The second is the lack of standards for construction materials and

the poor enforcement of the standards that exist. These factors create a situation where competition in Construction is not based on construction costs, but is instead based on securing access to land and managing material
costs. The distribution of the labours engaged in the construction industry in each state per 1000 male/female is given below;

Table 3.3.2 The number of workers engaged PER 1000 Numbers (male) in construction

Sr. No	Name of State	Agriculture & forestry etc	Mining & Quarrying	Manufacturing	Electricity	Construction	Wholesale & retail etc	transport & Storage	Financing Insurance	Community Services	Others	All
1	Andhara Pradesh	488	17	43	19	73	102	62	34	61	101	1000
2	Assam	421	14	54	7	62	108	61	38	107	128	1000
3	Bihar	380	23	65	14	73	87	32	26	97	203	1000
4	Chhatisgarh	599	31	47	15	29	80	22	9	106	62	1000
5	Delhi	14	0	163	21	74	281	243	99	100	5	1000
6	Goa	58	61	177	37	20	162	28	41	113	303	1000
7	Gujrat	377	8	119	8	78	111	44	19	99	137	1000
8	Haryana	356	13	75	32	87	123	70	52	99	93	1000
9	Himachal Pradesh	372	7	45	39	148	116	46	29	120	78	1000
10	Jammu & Kashmir	291	7	70	35	124	94	68	9	85	217	1000
11	Jharkhand	477	62	90	17	48	65	32	11	83	115	1000
12	Karnataka	460	17	94	13	97	114	45	33	52	75	1000
13	Kerla	333	7	70	44	127	127	92	39	58	103	1000
14	Madhya Pradesh	477	36	47	15	93	89	23	24	83	113	1000
15	Maharashtra	490	14	107	24	37	99	62	41	67	59	1000
16	Meghalaya	611	40	0	13	20	52	77	18	94	75	1000
17	Orissa	430	55	99	17	87	95	50	29	87	51	1000
18	Punjab	358	13	86	40	115	70	27	19	48	224	1000
19	Rajstan	398	75	70	13	106	90	35	26	83	104	1000
20	Sikkim	258	0	287	1	107	103	57	0	53	134	1000
21	Tamil Nadu	378	9	122	23	93	116	70	34	87	68	1000
22	Uttaranchal	306	18	79	13	125	100	43	22	155	139	1000
23	Uttar Pradesh	504	15	69	27	102	65	24	14	56	124	1000
24	West Bengal	365	5	187	18	71	118	66	36	79	55	1000
25	Chandigarh	60	0	171	19	31	189	147	48	212	123	1000
26	Dadra & Nagar Haveli *											
27	Daman & Diu	339	9	53	35	3	339	70	132	20	0	1000
28	Pondecherry	157	64	102	402	64	18	87	45	61	0	1000
	Overall	429	21	88	21	82	98	49	29	77	106	1000

* Reliable Estimates could not received due to very low coverage including non-coverage or urban sample

Table 3.3.3 The number of workers engaged PER 1000 Numbers (Female) in construction sector(15).

Sr. No	Name of State	Agriculture & forestry etc	Mining & Quarrying	Manufacturing	Electri-ty	Construction	Wholesale & retail etc	transport & Storage	Financing Insurance	Community Services	Others	All
1	Andhara Pradesh	619	25	105	7	46	62	7	10	34	85	1000
2	Assam	517	41	36	8	14	45	6	13	156	164	1000
3	Bihar	448	17	98	21	35	44	3	5	203	126	1000
4	Chhatisgarh	707	30	19	18	40	35	2	8	63	78	1000
5	Delhi	6	4	33	2	8	125	36	29	680	77	1000
6	Goa	114	0	104	0	40	38	16	28	281	379	1000
7	Gujrat	541	9	47	1	67	48	14	3	148	122	1000
8	Haryana	294	8	23	3	44	54	15	24	420	115	1000
9	Himachal Pradesh	667	3	0	6	67	16	7	3	188	43	1000
10	Jammu & Kashmir	128	27	297	4	56	15	3	1	286	183	1000
11	Jharkhand	510	47	53	12	32	34	5	16	153	138	1000
12	Karnataka	591	16	124	2	45	63	9	10	59	81	1000
13	Kerla	331	4	134	12	23	124	17	116	141	98	1000
14	Madhya Pradesh	618	17	48	14	73	15	4	7	92	112	1000
15	Maharashtra	726	10	43	10	16	41	13	23	85	33	1000
16	Meghalaya	730	0	0	0	22	87	1	0	139	21	1000
17	Orissa	521	45	26	12	111	40	21	6	103	115	1000
18	Punjab	90	10	34	25	34	13	4	60	150	580	1000
19	Rajstan	565	83	64	5	99	41	8	8	52	75	1000
20	Sikkim	310	0	282	0	53	189	47	0	6	113	1000
21	Tamil Nadu	481	6	185	7	55	44	7	20	117	78	1000
22	Uttaranchal	690	0	14	1	37	37	13	8	99	101	1000
23	Uttar Pradesh	461	11	75	20	71	64	27	13	117	141	1000
24	West Bengal	269	3	262	11	40	45	3	14	221	132	1000
25	Chandigarh	0	0	65	1	0	0	123	63	729	19	1000
26	Dadra & Nagar Haveli *											
27	Daman & Diu	606	0	0	61	0	161	19	150	3	0	1000
28	Pondicherry	227	197	183	8	49	162	67	24	83	0	1000
	Overall	554	19	92	9	48	48	10	16	108	96	1000

* Reliable Estimates could not revived due to very low coverage including non-coverage or urban sample

IV. HYPOTHESES STATISTICAL ANALYSIS & RECOMMENDATIONS

4.1 INTRODUCTION

Detailed survey of the construction site is carried out. This includes the interviews of the experts of the construction industry. This helps me to dive the same problem into number of sub factors. The questionnaire is prepared depending on the interviews conducted. The questionnaire is prepared by me. The questionnaire includes nine major factors which are further subdivided into 56 factors. The questionnaire is getting approved from the experts from the construction industry. The questionnaire includes the five point scale. This questionnaire is then filled from the experts. This data collected is termed as round no 1.

The data collected from round one is analyzed. The frequency of individual factor is calculated. The highest frequency is considered for the further study. The percentage of those factors are calculated. Higher the percentage, Lower the productivity.

After the analysis, those factors having highest percentages are separated out. Some recommendations are given to the construction industry experts. As those

recommendations will help those people to concentrate on the areas which are mainly responsible for the lower productivity.

After 45 days, the same questionnaire getting filled from the same experts for the same site. Depending on the data received, from the industry, analysis is done.

After this it is found that, due to the recommendations given to experts, the percentages get lowered. This means lower the percentage, higher the productivity.

The data collected is analyzed by using the Delphi method. The factors having high impact on the productivity are considered for further study.

4.2 THE DELPHI METHOD

The name "Delphi" derives from the Oracle of Delphi. The authors of the method were not happy with this name, because it implies "something oracular, something smacking a little of the occult". The Delphi method is based on the assumption that group judgments are more valid than individual judgments.

The Delphi method was developed at the beginning of the Cold War to forecast the impact of technology on warfare. In 1944, General Henry H. Arnold ordered the creation of the report for the U.S. Army Air Corps on the future technological capabilities that might be used by the military.(21)

Different approaches were tried, but the shortcomings of traditional forecasting methods, such as theoretical approach, quantitative models or trend extrapolation, in areas where precise scientific laws have not been established yet, quickly became apparent. To combat these shortcomings, the Delphi method was developed by Project RAND during the 1950-1960s by Olaf Helmer, Norman Dalkey, and Nicholas Rescher. It has been used ever since, together with various modifications and reformulations, such as the Imen-Delphi procedure.

Experts were asked to give their opinion on the probability, frequency, and intensity of possible enemy attacks. Other experts could anonymously give feedback. This process was repeated several times until a consensus emerged.(23)

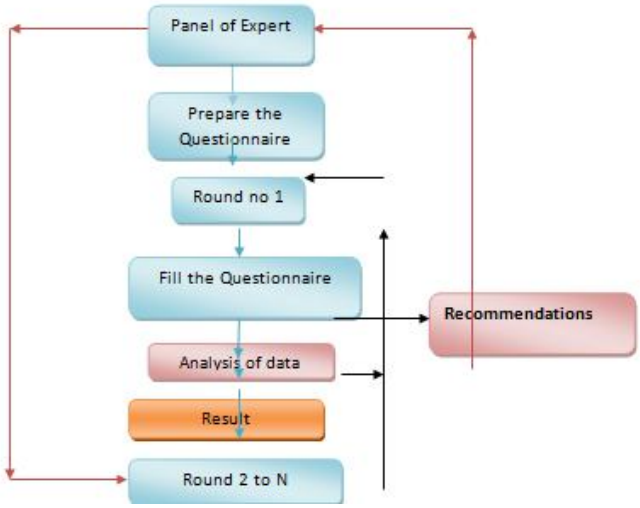

Fig 4.2.1 Working of Delphi Method. (19)

4.3 IMPLEMENTATION OF THE METHOD FOR THIS STUDY

The key issues considered in preparing Delphi Study were

1) The definition of Experts and their selection
2) The number of round
3) The questionnaire structure.

The Delphi method used in this research considered of two rounds. In the first round of the Delphi questionnaire the respondents were asked to rate the various factors affecting the labour productivity on five points scale. In round two of the Delphi survey they were asked to reconsidered their options and see whether they would adjust the original rating with their original ratings of round one. The factors considered having at least 50% of the Delphi Experts were taken for further analysis .(22)

4.4 RECOMMENDATION

1. Workforce skill (Training and certification of workforce)

1. The people at the top know what they want done but the message gets lost on its way down.
2. Provide project management training to field/plant personnel.
3. Ensure proper job training to construction worker to enhance experience.
4. Investment in apprentice training is required. Proper mentorship programs will maximize both work performance and training effectiveness.

2. Workplace relations

1. For the repetitive type of works a separate workforce shall be maintained which can develop easy way to perform any repetitive job easily.
2. Holidays shall be provided on the festivals.
3. The cultural activities like get together for families, gathering for kids etc. shall be arranged in regular intervals.
4. The working hours shall be finalized depending on the type of the work. e.g. the works requires more care and alertness, working hours shall be less as compared to the ordinary works.
5. Managers to spend a day walking in workers to experience firsthand what issues are around delays, equipment, shortages, tool shortages, etc.
6. Improve first line leadership (supervisor) which may include training / coaching / mentoring.
7. Ensure adequate field supervision and management of workforce.
8. Work with unions. This included ideas such as:
   - Work with unions collaboratively, or minimize their influence or even eliminate unions.
   - During slowdowns and economic downturns engage unions in discussions on how to reduce costs and potentially reduce benefits to members.
9. Drug test everyone regularly and randomly and implement zero tolerance on drug use.

3. Technology uptake and innovativeness

1. New technology shall be mobilized at the site which will help the labours to work faster.
2. A separate store shall be maintained which consist of all the spare parts of the working equipments at site required for the maintenance.
3. A skilled workforce of mechanic shall be available on the site round the clock to reduce the time of repair.
4. The equipments of new generation which include new technology shall be engaged on the work to reduce the time, effort and improve the productivity.
5. Continuous communication between the working labours/operators, supervisors shall be maintained.
6. Avoid overlapping of trades which can lead to delays.

4. Employee Motivation

1. Rewards shall be given to the labours after completion of any particular stage of work.
2. Daily communication on construction status and success.
3. Clear lines of communications.
4. Minimize levels of communication
5. Provide systems and procedures that are simple, effective and user friendly.
6. Clarity of roles and responsibilities and authority.
7. Give labour force clearer and more direct instructions.
8. Provide timely decisions.
9. If any particular job requires special type of training, the same shall be arranged before the start of work.
10. General instructions regarding the work safety, procedures shall be given to workers regularly.

5. Incentive programs

The following ideas and strategies were provided regarding incentive programs:

1. Include incentives for efficiency and for achieving milestones.
2. Consider bonus incentives at the trade, foreman and management levels.
3. Accountability of scope, time and cost. Maybe even a little bit of friendly competition.
4. Care for employees is an incentive. This means the flexibility to meet workers needs, consistent with project needs.
5. Monitor worker moral and watch for early warning for problems.
6. Full access to comprehensive employee and family assistance programs. Reduce distractions of many kinds.
7. Labour and all other associated workers should have bonus incentive clauses (today as in the past they try to make the project last as long as possible).
8. Engage foremen with management and support them.

6. Labour welfare

1. Work in the construction industry is arduous; it involves much manual or physical activity. It is also hazardous and dirty. Good welfare facilities not only improve workers' welfare but also enhance efficiency.
2. Welfare facilities improve morale and consequently improve efficiency.
3. A sufficient number of water flush-type lavatories for men/women when this is practicable, including sufficient urinal accommodation; chemical lavatories may be used.
4. Effective natural and/or artificial lighting and ventilation;

5. One wash-basin for every 15 workers with a sufficient supply of water and an adequate means of removing waste water.
6. Schools for the children shall be arranged. Child-care facilities pay for themselves by relieving working mothers on site of anxiety over the safety and welfare of their children.
7. Security persons shall be deputed round the clock at the labour camp.
8. The entertainment facility like television, newspaper shall be provided at the labour camp for the entertainment of the labours after the work. This gives the relaxation to the labours after the work.
9. Improve ground and air transportation. Fly-in, fly-out for craft labour.

7. Absenteeism

1. The wages shall be paid at regular interval and those shall be according the rules of the government of India.
2. No extra deductions shall be made in the wages paid to the labours.
3. Health camps shall be arrange regularly on the construction site which included free checkup and medicine for the working persons.
4. Training on the first aid shall be arranged on the related works on the site.
5. Special medical camps shall be arranged for the workers who are addicted of tobacco/cigarette/alcohol.
6. The work shall be arranged according to the environmental conditions.

8. Communication

1. Work processes need to recognize challenges of communication on mega project.
2. Daily communication on construction status and success.
3. Clarity of roles and responsibilities and authority.
4. Clear lines of communications.
5. Minimize levels of communication.
6. Provide systems and procedures that are simple, effective and user friendly.
7. Be honest with completion reporting. Too often construction states they are “ready”. Too often work is rushed and not completed properly to get the equipment to site. Too often equipments and (people sits for months), at site, because construction is not ready after all.
8. Good communication between owner and contractor.
9. Give labour force clearer and more direct instructions.
10. Provide timely decisions.
11. Clear and effective communication amongst parties (including impact of changes).
12. Sound, integrated and realistic schedule with fall backs to adjust if absolutely necessary.
13. Well coordinated project team dedicated to project consisting of client, EPC contractor and prime construction contractor.
14. Communications should include the big picture. Where is the whole project relative to budget and expectations? What are the challenges? What can be expected through the coming period?

9. Personal factors;-

1. In older persons, especially in skilled jobs, experience and efficiency compensate for lower work capacity
2. Establish project canteens to provide balanced meals. Arrange talks on nutrition.
3. Start work at first light and avoid working during the heat of the day.
4. Where ever possible, temporary shades shall be established under which the labours can work during the hot/rainy season.

10. Psychological factors;-

1. Healthy environment shall be provided to the workers, so that they can work more efficiently and can concentrate on their job.
2. Security shall be provided to the workers from the local politics.
3. The short tempered labours shall be kept away from the work to avoid collision between the labours.
4. The quantity of work shall be judged before allotment to the labours.

V. COMPARISON & DISCUSSION

5.1 INTRODUCTION

This chapter deals with the result of the data analyzed. For this purpose, data is collected from four different sites. Nine factors are considered for the study. Delphi method is used for the analysis. In this method, the data is collected in two rounds one and two. The result obtained in both rounds is compared in this chapter. The graph shows the increase/decrease in the percentages in both the rounds.

5.2 COMPARISON BETWEEN DIFFERENT FACTORS

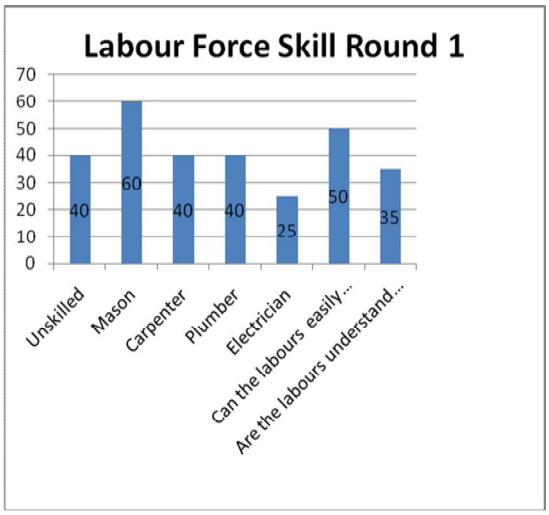

Fig 5.1.Percentage of factors of labour

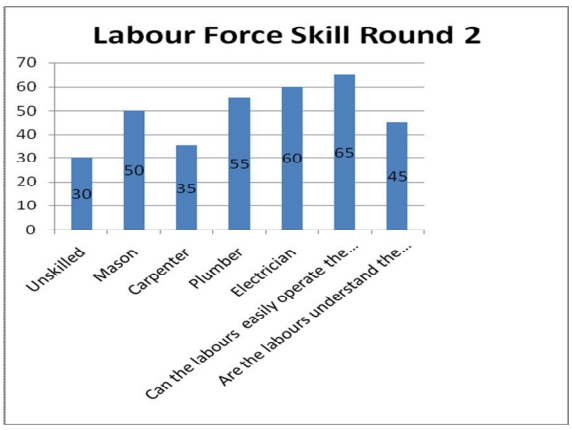

Fig 5.2.Percentage of factors of labour force skill force skill

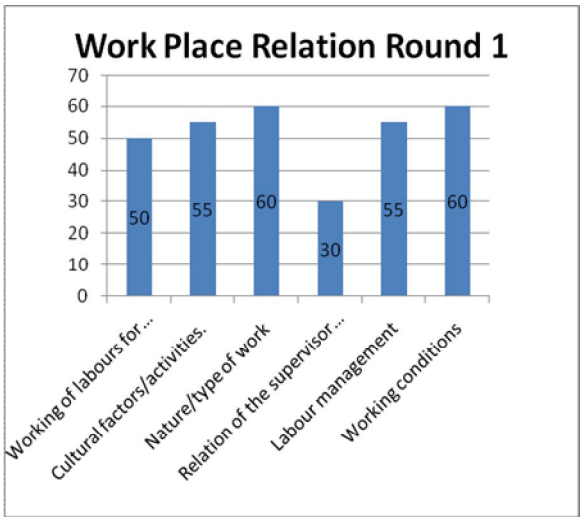

Fig 5.3.Percentage of factors of Work Relations

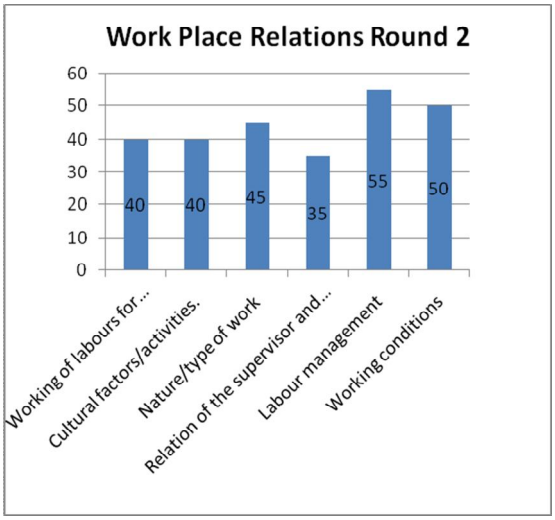

Fig 5.4.Percentage of factors of work Relations

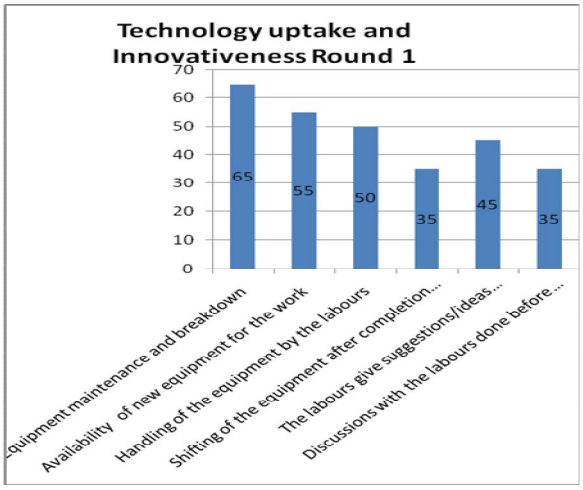

Fig 5.5.Percentage of factors of Technology Uptake & Innovations

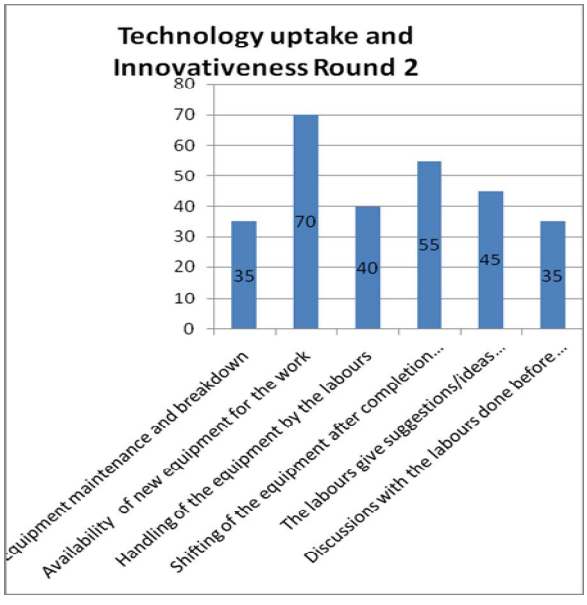

Fig 5.6.Percentage of factors of Technology Uptake & Innovation

Fig 5.7.Percentage of factors of Employee Motivation

Fig 5.8.Percentage of factors of Employee Motivation

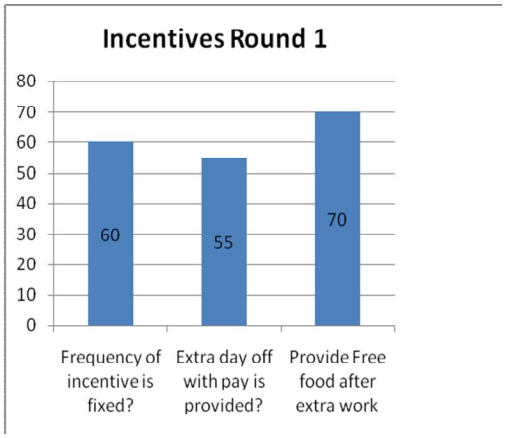

Fig 5.9.Percentage of factors of Incentives

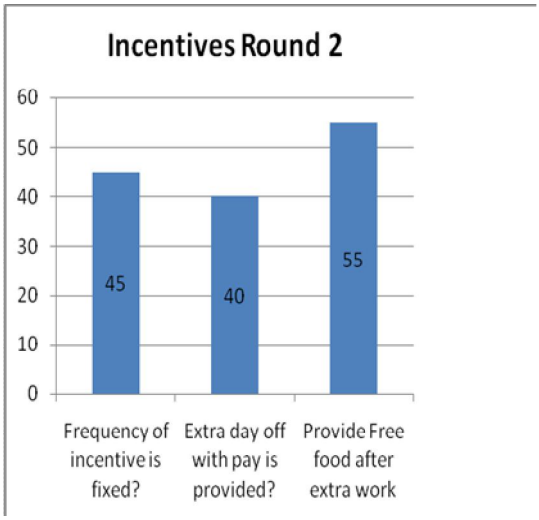

Fig 5.10.Percentage of factors of Incentives

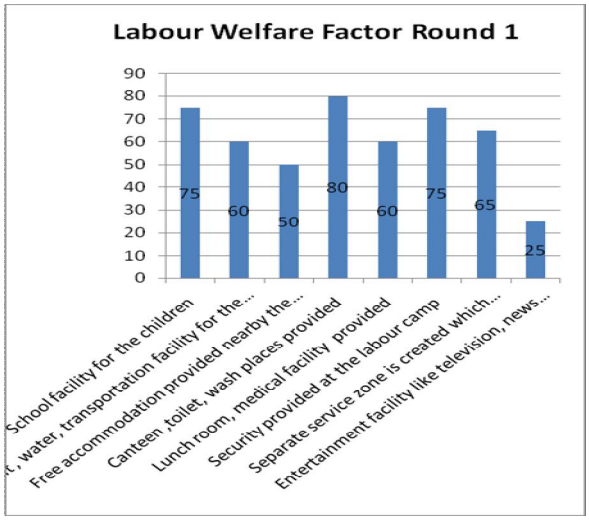

Fig 5.11.Percentage of factors of Labour Welfare

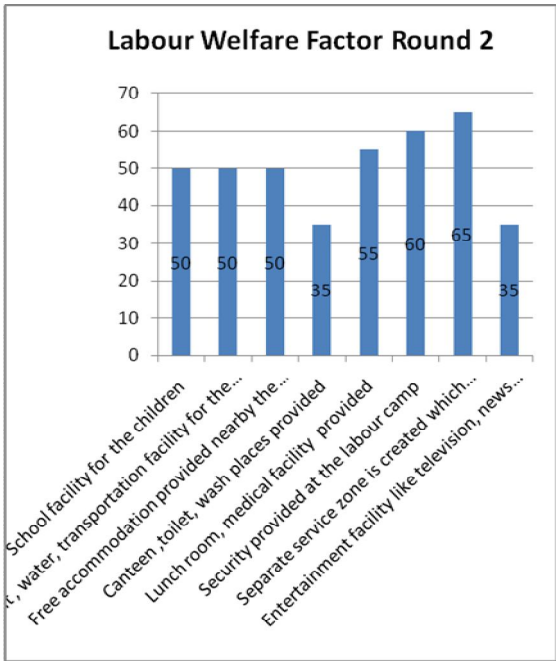

Fig 5.12.Percentage of factors of Labour Welfare

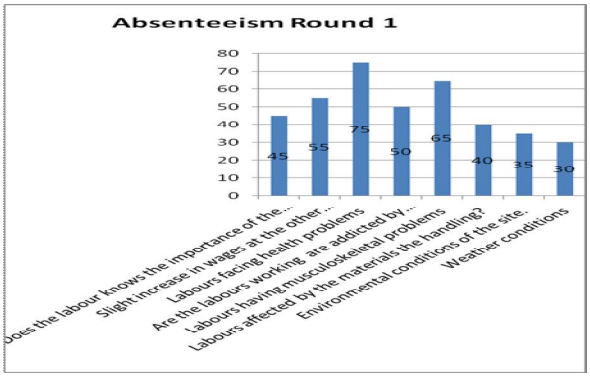

Fig 5.13. Percentage of factors of Absenteeism

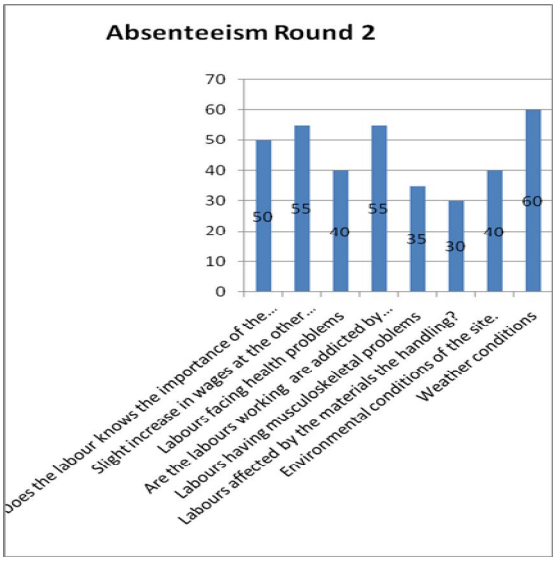

Fig 5.14.Percentage of factors of Absenteeism

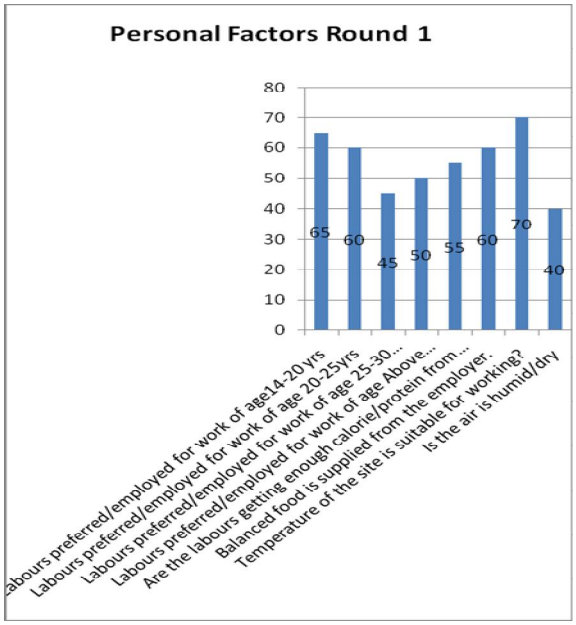

Fig 5.15. Percentage of factors of Personal Factor

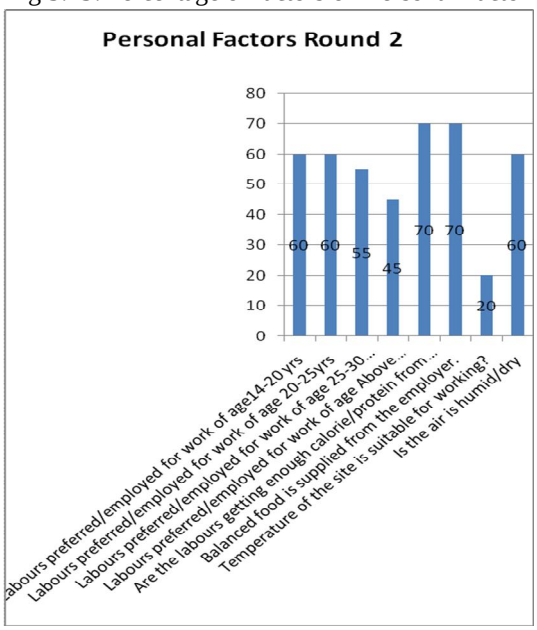

Fig 5.16.Percentage of factors of Personal Factor

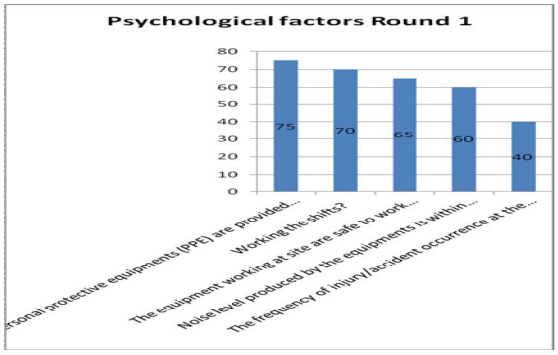

Fig 5.17.Percentage of factors of psychological factor

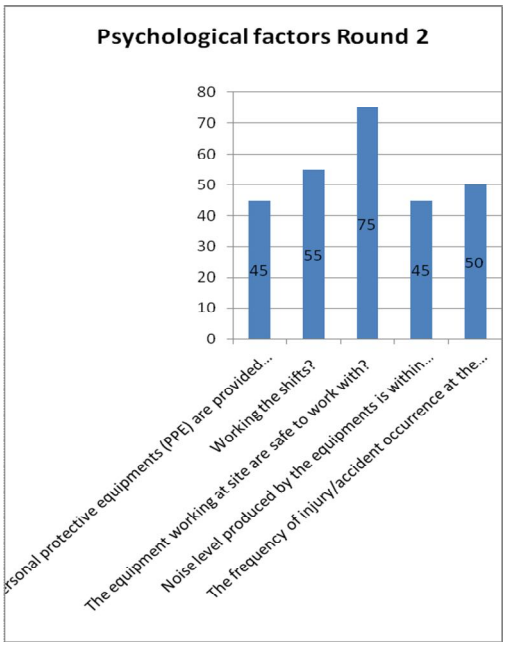

Fig 5.18.Percentage of factors of Psychological factors

Discussion

1. After training, (during round 2), somewhat improvement in the work of unskilled labour, mason and the carpenters was observed. Majorly the reduction in percentage of problems of plumber was observed as 15% below that of problems of unskilled labours and mason were reduced by 10%. But the problems regarding the plumbers and electrician get increased from 40% to 55% and 25% to 60% respectively (fig 5.1 &5.2).
2. From (fig. 5.3 & 5.4) it was observed as training had a very considerable impact on work place relations. Working of labours for repetitive work was recorded as 40%. So 10% of reduction was observed. Due to training the nature and the type of work was not seemed as boring to the labours. So in round no 2, it was recorded as only 45% from 60%. No improvement or reduction was seen in the labour management. The effect of working conditions on productivity was recorded as 50% in round no 02.
3. From (fig 5.5 & 5.6) shows The prevalence of training on technology uptake and innovations is shown in Due to training it was observed as the effect of equipment maintenance and breakdown on productivity was recorded as 35% prior to 65%. The labours could handle the equipment carefully. So in round no 02, handling of equipment by labours was reduced upto 40%. In that 10% of reduction was seen. There is considerable change in the discussion with the labours before the start of the work. The decrease of percentage is 35%.
4. From (fig (5.7 & 5.8) shows the effect of training on employee motivation. In round 02, 50% of supervisors recorded that there was no bad effect of arranging training program for workers on productivity with 5% reduction. And the bad effect of overtime wages provided to labours was recorded as 50% with 10% reduction. The percentage of continuous communication of managers to the workers also reduced from 65% to 55%.
5. In round no 02 many supervisors and engineers agreed due to incentives, the problems regarding the productivity were reduced. The effect of extra day off with payment on productivity was found to be reduced upto 40% prior to 55% f. Providing free food after extra work was recorded upto 70% to 50% reduction was seen in that. fig (5.9 & 5.10)
6. Like School facility for the children reduces the percentage of productivity from 75% to 50%. The percentage of canteen, toilet, wash places provided was found to be reduced up to 35% from 80%. So it was clear that, providing these facilities productivity can be improved. Due to security provided at labour camp, accidents, thefts can be avoided and the extra burden on productivity due to absenteeism was saved. So it was observed that, the percentage reduction in security provided at labour camp was 15%.(fig. 5.11 & 5.12)
7. The percentage recorded for labours facing health problems and labours having musculoskeletal problems were reduced upto 35% from 65%. Precautions were taken to overcome weather conditions reduced the effect of weather condition on productivity upto 30% from 60%. (fig 5.13 & 5.14)
8. The considerable changes was not seen on personal factors except the Temperature of the site is suitable for working, is reduced from 70% to 20%. As shown in (fig 5.15 & 5.16)
9. Due to training, the effect of psychological factors on productivity was get begin as shown in (fig 5.17 & 5.18) The effect of providing personal protective equipment to the workers on the productivity was found to be reduced upto 45% prior to 75%. The effect of working in shifts and the effect of noise level by equipment was found to be reduced by 15%.

VI. CONCLUSION

The study was conducted for construction sites. Twenty experts were selected on voluntary basis for experimental research. A questionnaire of 326 labours was carried out for collecting the information. For this purpose 11

project managers, 5 engineers & 4 Sr. supervisors were selected. Out of total 326 labours 194 were unskilled labours, 60 were mason, 47 carpenter, 14 plumber & electrician were 11 in number. The labour productivity was measured through questionnaire at the end of both rounds. The productivity affecting areas were determined by employing modified Delphi Method. (Ref. 19 to 23). The original method was modified to suit the requirement of the research.

The impact of labour force skill on productivity was 48.57% averagely. It shows that the labours must be skillful and for that they must be educated.

1. Workplace relations play very important role on modulating the productivity.
2. 60% supervisors reported that the equipment maintenance & breakdown affect the productivity. Hence it was concluded that, technology uptake and innovations is a key factor affecting the productivity.
3. Averagely 61.25% of supervisors recorded the acute effect of labour welfare on productivity in round no 01. But after training in round 02,it was averagely only 50%. Thus training helps to change the acute effect into begin.
4. Absenteeism plays a direct role in reducing productivity. Training helps to reduce the absenteeism by 49.38% to 45.63%. thus by reducing the health problems,, MSD Problems, environmental conditions and giving proper training to the workers it reduces the number of absent workers per day.
5. In personal factors, labours preferred for work of age 14 to 20 years was found as major problems affecting the productivity.
6. In round no 01, 74% of supervisors were recorded that providing personal protective equipment can affect the productivity. The importance of PPE was seen after training & only 41% supervisors recorded the same.
7. The significant correlation between availability of new equipment for workers and the labours having proper knowledge of ergonomics for handling new equipments.

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