

An analysis of Factors affecting Labour Productivity in Construction Projects in Housing Sector of Assam

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Abstract: Poor labour productivity remains a challenging issue in front of the housing construction sector in Assam for a long. Causing many awful outcomes to the clients and the public at a large, it stands as one of the vital impediments against the improvement of this important sector in the state. Being largely a labour-intensive entailing a high portion of labour cost in overall project cost, the overall performance of a construction project hinges much on labour productivity. However, behind the poor labour productivity in construction projects of housing sector of Assam, many and diverse factors are found to be influential. For deserving a good image among the public and ensuring reasonable business profit for the contractors/ builders, the improvement of the labour productivity in building construction project seems to be an urgent requirement. Against this backdrop, an attempt has been made to estimate the labour productivity and relative importance of the influential factors through analysing the factors affecting the labour productivity in building construction projects in Assam.

Key Words: Labour Productivity, Construction Projects, Housing Sector and Relative Importance.

1.Introduction:

Despite the trend of utilizing machines and capital equipments, the construction works of the housing sector in Assam remains largely to be labour-intensive. Labour productivity i.e. the qualitative aspect of labour is more crucial than its quantity for construction productivity. In a construction project in housing sector, labour cost entails a higher portion in overall project cost. This point is supportive to the findings of Guhathakurta and Yates, who opined that construction projects are largely labour-based where labour costs constitute from 30% to 50 % of overall projects costs (S Guhathakurta & J Yates, 1993,pp.15-25).In fact, the output and hence, the overall performance of a construction project in the housing sector hinges much on the skill and productivity of labour. In Assam, the labour market of the housing sector has been operating with abundant labour supply, largely in unskilled category. Parallel to it, this sector has confronted scarcity in supply of highly skilled, experienced and qualified workers that are conducive in augmenting labour productivity. Productivity improvement of labourers is of much importance in effective and efficient conversion of resources into marketable products, and in determining the business profitability of a builder/ promoter (S Wilcox et al, 2000). A reduction in productivity that adversely affects the plan and schedule of the work may cause delay in completing the project that ultimately results in heavy monetary loss (Thomas, 1991, pp.423-444).

In Assam, due to poor labour productivity, the clients of this sector -the contractor and the owners of establishments in many cases have been found to experience unpleasant output even at higher expenditure. This, however, unveils incompetency in building construction in housing sector to deserve a good image among the householders of the region as in Kerala (Vijayan, Raj, Varghese, & Paiker, 2019). This is a big challenge in front of the private sector of the state. This complies with the views of ILO, which opined that the image of the construction industry among its clients and the public at large is poor as most of them have had an awful experience, mainly at the hands of some inexperienced and unqualified builders and masons (ILO, 2001. pp.13-26). Since labour constitutes a large part of the cost of a building construction project, the quantity of labour hours in performing the construction task is more liable to influence the management (K shashank et al, 2014). For reducing labour cost, the labour productivity requires to be improved. Emphasizing on the role of project management, a researcher urged that the project management could improve the labour productivity, if the factors such as the skill and training, personal health, motivation, equipment and materials, the workload, work quality and supervision are properly managed (M Rowlinson & S Proctor, 1999, pp.369-396). As such, labour productivity is a measure of overall effectiveness of an operating system in utilizing labour, equipment and capital to convert efforts of labourers into useful output rather than a measure of capabilities of the labourers (K shashank et al, 2014). So, for estimating the performance in a building construction project, an organization needs to understand and be capable to foresee the factors affecting labour productivity. Against this background, an attempt has been made to estimate labour productivity, to identify and evaluate the factors affecting this qualitative aspect of labour in construction projects in housing sector of Assam.

2. Literature review:

Labour productivity in building construction work is a complex and multifaceted issue. Due to heterogeneity of construction outputs and their inputs, it is extremely difficult to measure. Some Researchers have defined productivity as the amount of goods and services produced by a unit of factor in a specific time. A researcher, Drewin has defined it as value of output produced by a worker per unit of time (Drewin, 1982). Some others define it as output-input ratio as to measure the production efficiency. The U.S. Department of Commerce has defined it as dollars of output per person-hour of labor input (Adrain, 1987). Another two researchers, D Ardit and K Mochtar have viewed it as the ratio between total output and total inputs, expressed in dollars (D Ardit & K Mochtar, 2000, pp.15-27). For reducing much of confusion and misunderstanding on labour productivity, a researcher, Stavros C. Nicolaou has given an acceptable definition of labour productivity in construction as the amount of work performed (output) by a labour (input) over a specific period of time with a given capital-labour ratio (Nicolaou, 1987, pp.5).

However, productivity of labourers or construction performance in a housing project depends on wide range of factors from quality and skill of the labourers to weather condition and government regulation. Many researchers in the different parts of the world have inquired into the factors affecting labour productivity in construction industry. The study of Polat and Ardit have identified a number of factors affecting labor productivity and grouped them according to their characteristics. These factors are- design, plan, material, equipment, labour, health and safety, supervision, working time, project factor, quality, leadership and coordination, organization, owner/consultant, and external factors (G Polat & P Ardit, 2005, pp.697-712). Another study by Adnan Enshassi et al have shortlisted the vital factors affecting labour productivity in a building project as material shortage, lack of labour experience, lack of labour surveillance, misunderstandings between labour and superintendent, and drawings and specification alteration during execution (Adnan Enshaassi et al, 2007, pp.245-254). Researchers, Lim and Alum have pointed out inadequate supervision, shortage of skilled labourers, high rate of labour turn over and labour absenteeism as significant factors influencing productivity of construction labourers in Singapore (J Alum & E C Lim, 1995, pp.295-303).

In a study in Iranain construction industry, Zakari et al have found material shortage, weather and site condition, equipment breakdown, drawing efficiency/change orders and shortage of proper tools and equipment to be the influential factors (M Zakari et al, 1996, pp.417-426). In another study in Thailand, it has been found that several critical factors such as, shortage of materials and equipments, default drawings, incompetent supervisions, absenteeism among the labourers and rework influence the productivity of labourers in construction venture (A Makulsawatudom & K Sinthawanarong, 2004, pp.1-6).

In Turkey, another group of researchers have identified several factors such as quality of site and material management, payment of labour, planning, supervision, work discipline, occupational education and labour training for construction industry as important and ranked them in accordance to their gravity (Aynur Kazaz et al, 2016). The researchers, Brent and Ellis have categorized the factors affecting construction productivity into four major groups- management, manpower, technological and external. In the management group, incompetent supervision influence most adversely. In the manpower group, the most significant factor is shortage of experienced and skilled workers. Rework is considered as the root factor in the technological group. Among the external factors, rain and high temperature are most influential (Brent G. Hickson & Leighton A. Ellis, 2014, pp.4-11). In Spain, the researchers, Robles et al have identified and grouped the responsible factors into five categories- project, human, management, material and tools, and environmental. In their calculation of RII, material and tools have been ranked at top, followed by management. Human is in 3rd position, project in 4th and environmental condition in 5th position (Rbels, 2014, pp.1021-1030). Conducting a survey in Tamil Nadu (India), Shree Raja Gopal and Murali have found 54 factors affecting construction productivity and categorized them into several groups- workforce, management, psychological, material/ equipment, safety and external (Shree Raja Gopal T G & Murali K, 2015, pp.45-50).

Thus, the earlier literature related to the factors affecting construction productivity differs from one another. However, such kind of study has not so far been done in Assam. So, it is important to identify and evaluate which are the crucial factors affecting construction productivity in the state for improvement of this growing sector having high employment absorptive capacity, especially for those with low education and skill abundant in the state.

3. Objectives:

- i. To estimate labour productivity in construction projects in housing house of Assam.
- ii. To identify, rank and analyze the factors affecting labour productivity in housing construction projects of Assam.

4. Research Methodology:

The methodology of the study contains mainly analytical techniques and data framework. In this study, labour productivity in building construction has been tried to compute with the following formulas-

$$\text{Labour Productivity} = \frac{\text{Added value (Net output)}}{\text{labour-hours invested}} \quad \text{(Equation – 6.1)}$$

$$\text{Net Output} = \text{Selling price of building (value of output)} - \text{Cost on external purchases}$$

$$\text{(Equation-6.2)}$$

$$\text{Total labour hour invested} = (\text{No. of workers}) * \text{Average working hours}$$

$$\text{(Equation-6.3)}$$

Again, no. of workers employed is calculated as-

$$\text{No. of labourers employed} = \frac{\text{Labour cost(Wage cost)}}{\text{Average wage rate}} \quad \text{(Equation-6.4)}$$

For assessing the effects of various factors on labour productivity, the technique of Relative Importance Index (RII) has been used. In this technique, the relative importance of each factor has been measured from the weights based on importance that the respondents (contractors/builders) have given to each factor. However, this technique is based on ordinal measurement scale, termed as Likert's scale¹. For obtaining the responses (weights) of the contractors toward various factors, 5 points on Likert's scale has been adopted. Here, a respondent has a choice to rate only one point on the ordinal scale for each factor.

Table-1: The Five Points Likert's scale for ordinal measurement of importance:

Degree of importance	No importance	Little importance	Indifferent	Moderate importance	Major importance
Points	1	2	3	4	5

The formula used for estimating RII is as follows, where the value of RII lies between 0 and 1(0 ≤ RII ≤ 1):

$$RII = \frac{\Sigma W}{A * N} \quad \text{(Equation-6.5)}$$

Here, A=the highest point/weight, N= total number of respondents and

ΣW= Total weight (total rating value) given by the respondents to a particular factor.

It is calculated through a formula given below-

$$\Sigma W = \Sigma (p * n) = 5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1 \quad \text{(Equation-6.6)}$$

Here, 1... 5 =the points in Likert's scale indicating different degree of importance (weight).

n₁= Number of respondents selecting "No importance" option.

n₂= Number of respondents selecting "Little importance".

n₃= Number of respondents for "Indifferent/ do not know".

n₄= Number of respondents for "Modest importance".

¹ Likert's scale is a technique of measuring ordinal data that uses integers in ascending or descending order to rank data on an ordinal scale.

n_5 = Number of respondents for "Major importance".

$$N = n_1 + n_2 + n_3 + n_4 + n_5$$

Data: Based on the factors identified in the earlier research works, a questionnaire has been designed for conducting personal interview with the sample contractors/builders(30nos) in class-I category covered in the study. The sample class-I contractors have been selected purposively from the register of contractors/builders in the office of public works buildings& NH department, Guwahati Assam. In Assam, the class-I contractors have the rights to operate their functioning over all areas in the state. So, the sample design for selecting the contractors from different categories of town seems to be futile and hence, it has not done. In addition to the contractors, several project engineers (5nos) and projects/site managers (5nos) having long experience (more than 10 years) on construction projects have been interviewed for this purpose.

5. Results and Discussion:

5.1: Estimation of labour Productivity in construction projects in urban housing sector of Assam:

Through personal interview with 30 sample contractors/ builders in the sample urban construction areas, the required information/ data for estimating productivity of construction labourers in the housing sector has been collected. Diverse responses of the contractors relating to selling price of a building, cost on materials, labour cost involved and average working hours have been found. Taking average of the responses/ results, the following information has been confirmed.

i. In the state, at current cost and price structure, for completing construction of a two thousand square feet RRC building with normal design requires a total cost of around Rs. 30 lakh on external purchase of raw materials, including the payment of labourers and other required services such as wear and tear of capital equipments and services of managerial staff.

ii. Out of Rs. 30lakh, for paying wages to the workers in various skills and trades, termed as labour cost or wage cost, approximately 10 lakh is required. For workers in different skill category and trades, Rs. 350/ may be taken as an average daily wage rate and 8 (eight) hours as average working hours.

iii. The average market price/ selling price of a two thousand square feet building in the state is around Rs. 40 lakh.

Based on these information, a proximate labour productivity in building construction in the urban housing sector has been tried to estimate as follows:

Putting the selling price of building and cost on external purchase in equation-6.2

$$\text{Net output} = \text{Rs.}40,00,000 - \text{Rs.}30,00,000 = \text{Rs.}10,00,000.$$

Again, substituting values of labour cost and average wage rate in equation-6.3

$$\text{No. of labourers employed} = \frac{\text{Rs.}10,00,000}{\text{Rs.}350} = 2858 \text{ nos (approximately)}$$

$$\begin{aligned} \text{Labour hours invested} &= (2858 \text{ nos}) * 8 \text{ hours, (from equation-6.2)} \\ &= 22864 \text{ hours.} \end{aligned}$$

$$\begin{aligned} \text{Now, Labour Productivity} &= \frac{\text{Rs.}10,00,000}{22864 \text{ hours}} \text{ (from equation-6.1)} \\ &= \text{Rs. } 43.74 / \text{per labour hour} \end{aligned}$$

This indicates that on average, a BCW produces an amount of output (i.e. perform work) worth of Rs.43.74/ only per hour, and it is almost equal to per hour average wage rate of Rs. 350/8= Rs.43.75/.This indicates that the marginal productivity of labour is at par with the wage rate. However, this is the case when the contractor is able to sell the building at Rs. 40, 00,000/ making a profit of Rs. 10, 00,000/. All these reveal that labour productivity in building construction sector of the state is at poor level. With higher productivity of labourers and lower wage rate, a builder may earn lump sum profit. In practice, a number of diverse factors such as poor management, use of poor technology, material/ equipments, lower safety, psychology and bad environment have been found influencing the labour productivity negatively in building construction in the housing sector in the construction sample sites.

5.2: Factors affecting labour productivity in building construction projects:

In the present study, various factors influencing labour productivity in building construction in the housing sector of the state has been searched and some similar factors have been merged together, and thereafter the identified factors have been categorized into seven different groups, viz:

i. workforce, ii. management, iii. technical, iv. safety, v. psychological, vi. material & equipment and vii. external

5.2.1: Workforce group:

In the workforce group, in total 7 factors that may affect labour productivity in building construction project have been taken into account. The inadequate skill & experience of the workers is ranked at 1st position both in the workforce group and in overall rating of the selective factors affecting labour productivity, with a RII value of 0.91 (tables-2&9). This complies with the finding of Paulson, who opined that the experience of craftsman highly affects the labour productivity (Paulson, 1975, pp.623-633). This finding is justified on the ground that skill and experience improve the intellectual and physical abilities of a worker, which enhances the labour productivity.

With RII of 0.83, the disloyalty and work cheating of the workers has been found to be in the 2nd rank (table-2) and 6th rank among 28 selective factors affecting labour productivity (table-9). Most of the contractors in the sample areas have reported that this is an awful feature largely among the local residential workers and this is significantly hurting the labour productivity in the building construction works.

Absenteeism among the workers has been found in 3rd rank in the workforce group, and in 8th in overall rating, with RII of 0.80 (tables-2&9). Absenteeism has been found to be acute among the commuters of local residential workers. Moreover, a high tendency to visit home has been observed among rural migrant workers residing in construction camps due to their chronic attraction towards the village life. Poor health condition of the workers ranks at 4th position in workforce group, and in 11th in the overall rating with the RII value of 0.77 (tables-1&). It is natural that the difficult, dangerous and dirty works in building construction require the fresh health of the workers, which can improve the labour productivity.

Overtime work finally causes fatigue and increases absenteeism that reduces the labour productivity (Hinze, 2010, pp.264). Overtime work with RII value 0.75 is in 5th rank in the workforce group, and in 13th rank among the selective factors (tables-2&9). A researcher finds that on an average, a construction labourer serves effectively for 3.5 hours in a 8 hours shift, and spends 20% of the allotted time on value-adding activities (H M alinaitwe et al, 2007, pp.169-176).

Misunderstanding among the crew is at 6th rank in the workforce group, and in 18th rank among all the factors, with RII of 0.70 (tables-2&). Building construction works are performed largely in combined effort of the workers, and the workers team require well understanding and cooperation among them. So, absence of such virtues among the crew has strong possibility to adversely affect the labour productivity. Use of intoxicant among the workers (RII=0.60) has ranked at 8th in the manpower group, and in 21th in overall rating (tables-2&9). In some cases, high use of intoxicants by the workers has developed some adverse circumstances at the worksites causing injuries, accidents, rework and/or misplacement. Any of such incidents ultimately slows the work progress.

Table-2: Ranks of the factors in the workforce group:

Factors	ΣW	N	A*N	RII	Rank
Inadequate Skill & Experience of the workers	137	30	150	0.91	1
Absenteeism among workers	120	30	150	0.8	3
Disloyalty & Work Cheating among the workers	125	30	150	0.83	2
Poor health conditions of the workers	115	30	150	0.77	4
Use of intoxicants among the workers	90	30	150	0.6	7
Misunderstanding & Non-cooperation among the crew members	105	30	150	0.7	6
overtime work	113	30	150	0.75	5

5.2.2: Managerial factors:

Building construction management plays equally an important role in upgrading the labour productivity, efficiently utilizing workforce, materials, equipments and technical resources. Despite use of modernized technology and trained labourer, efforts of improving labour productivity may not be fruitful in the absence of experienced and devoted management (Gundecha, 2013,pp.13).

In the managerial group, the system of work execution and mode of labour payment for executing construction work have ranked top with RII value of 0.88 and in 3rd in overall ranking (tables-3&9). Most of the respondents (i.e. contractors/ builders) in the sample areas stated that the unit rate system, i.e. piece rate system is effective in yielding higher output and productivity than the daily (time) rate system. Under unit rate system, a worker is more inclined to complete the task assigned soon with a view to earning higher income; while daily wage rated labourers look for completion of the stipulated 8 hours of time, instead of quantity of output produced.

A contractor of building construction often subcontracts the task to other parties. So, the quality of work and productivity of labourers in the project undertaken depend much on such outsourcing tasks to a significant extent. Under the managerial group, the rank of the magnitude of subcontracted work is estimated to be 2nd with RII value of 0.87 (table-3). This factor, among all the selective factors affecting labour productivity, ranks in 4th position (table-9). With a RII value of 0.79, improper planning & scheduling of project have come in the 3rd rank in the managerial group, and in 9th rank in the overall rating (tables-3&9). This is justified on the ground that if work schedule is prepared with default, then it may reduce labour productivity over time in the form of schedule compression, which may require extra labour or overtime work to finish the task. Similarly, improper project planning may lead to reformulation of overall time-frame and revision of project's budget.

Incompetent supervision of labourers with a RII value of 0.74 has been found in the 4th position in managerial group and in 14th position in overall grading (tables-3&9). It is usual that incompetent supervision leaves opportunity for work cheating in the cases of daily/ time rated workers. In some cases, the delay in site inspection has been found causing low productivity; and hence it is ranked in 5th position (RII=0.73) in the managerial group, and in 15th position in the overall grading (tables-3&9). High rate of labour turnover & frequent termination of workers bring in negative effect on labour productivity in construction works; and hence, these factors are ranked in 6th position (RII=0.72) in the managerial group, and in 16th position in the overall rating (tables-3&9). Strong financial condition of a contractor/ builder is crucial in smooth running of a construction project. This factor has been ranked at 7th position in the managerial group, and in 17th position in overall grading with a RII value of 0.71 (tables-3 &9).

Table-3: Ranks of the factors in the managerial group:

Factors	ΣW	N	A*N	RII	Rank
Incompetent supervision of the workers	111	30	150	0.74	4
System of Work Execution/ mode of employment of workers	132	30	150	0.88	1
Improper planning & Scheduling of project	118	30	150	0.79	3
Labour turnover & Termination	108	30	150	0.72	6
Financial condition of the Contractors	106	30	150	0.71	7
Inspection delay	110	30	150	0.73	5
Magnitude of subcontracted works	130	30	150	0.87	2

5.2.3: Technical factors:

Among the technical factors, the sample respondents have put much importance on clarity of the drawing and specification prior to the execution of the project. Most of them have reported that many times they have experienced alternation of design and specification of the project during execution, due to the claims raised by the owners. This causes a loss, such as extra time for adjustment of resources and workers, reworks, work stoppage (partly or completely) and hurt on labour morale, and labour productivity in building construction. Findings of Thomas et al support this fact, who revealed that there is a 30% loss of efficiency when work changes are to be performed. On the above justification, the respondents have placed this factor on the top rank (RII=0.85) in the technical group, and in 5th in overall rating (tables-4 &9).

The respondents have opined that the more complex the level of design is in a project, the more likelihood in reduction of labour productivity in that project. This view may be justified on the ground that a project having higher complex design consumes more labour time and effort, and it needs experienced and trained masons. The rank of this factor is found to be 2nd with RII value 0.78 in the technical group and in 10th position in overall grading (tables-4&9).

Another synchronized factor that affects labour productivity is changing orders by the client (contractors or consultant) on the required materials for the project. It has been observed that sometimes the contractor has to replace the materials, as these are not found of specified quality and price for which they placed order; and hence, they claim for change, which may consume sufficient time for resettlement. This factor has been ranked in 3rd position (RII=0.76) in the technical group, and in 12th in overall rating (tables-4&9).

Table-4: Ranks of factors in the technical group:

Factors	ΣW	N	A*N	RII	Rank
Unclear Drawings & Specifications	127	30	150	0.85	1
Design Complexity level	117	30	150	0.78	2
Changing orders by contractors during execution	114	30	150	0.76	3

5.2.4: Material & Equipment Group:

Emphasizing the quality of materials and equipments, the respondents in sample areas have given higher points of weight on the quality factor and ranked at the top (RII=0.89) among the factors in the material and equipment group; and in 2nd position in the overall ranking (tables-5&9). This can be justified on the ground that quality materials and equipments not only give quality output, it also saves the labour time and confers a sense of pleasure among the labourers. Handling of quality equipments become comfortable and labourers could complete a task within short span. Contrary to it, with poor quality materials even if skilful labourers find difficult to yield a satisfactory output, and there occurs waste of materials. Poor and old equipments may entail numerous breakdowns; consume more labour hours and delays completion of a project.

The respondents have ranked the shortage of materials & equipments in 2nd position (RII=0.8) under the material and equipment group, and in 8th in overall ranking (tables-5&9). This finding is justified on the ground that in the absence of required amount of materials and equipments in the work site, labourers have to remain idle till their supply. Such circumstances lead to under utilization of labourers and low productivity.

Again, if the material storage and equipments are located at a distant place from the work site, an extra time is required to fetch the same to the work site that results in masonry productivity loss (H R Thomas & A S Sakarcin, 1994, pp.228-239). Improper arrangement of materials and tools may also cause wastage of working hours of other labourers. So, it is reasonable to rank the unsuitable storage location & arrangement of material-equipments in 3rd position with a RII value of 0.66 in the group, and in position in 20st in overall rating (tables-5 &9).

Table-5: Ranks of the factors in materials& equipment group:

Factors	ΣW	N	A*N	RII	Rank
Poor quality of raw materials& equipments	134	30	150	0.89	1
Shortage of materials& Equipments	120	30	150	0.8	2
Storage location& material arrangement	99	30	150	0.66	3

5.2.5: Safety factors:

Job of building construction is hazardous in nature, where safety of life is at high risk. Violation of safety rules may reduce labour productivity in various ways entailing accident, causing death, disability or injury. Globally, the quantum of fatal accidents causing either disability or death to labourers is much higher in building construction sector than in any other sectors of an economy. In Spain, the rate of accident in construction sector has been increasing steadily from 97 in 1992 to 142 nos per thousand workers in 1999 (ILO, 2001. pp.13-26).

The respondents in the sample areas have viewed the worksite accidents as an important factor affecting labour productivity in the safety group. It is estimated at the top rank (RII=0.81) and 7th in overall grading (tables-6&9). Recognizing the significant impact of accidents on labour productivity, two researchers, Thomas and Sarkarcan have pointed out three types of accidents in terms of their severity on productivity. First, an accident causing death to an injured worker may lead to total stoppage of work for a number of days. Secondly, accidents leading an injured worker to be hospitalised for at least 24 hours cause a decline in the productivity of the crew in which the injured worker was serving. Thirdly, small accidents, such as injuries caused by nails and steel ropes can stop work in a few cases (H R Thomas & A S Sakarcan, 1994, pp.228-239).

During field survey, it has been found that most of the fatal accidents causing either death or permanent disability of a worker are associated with the works performed in height and within confined space. However, it is an unavoidable evil for a worker, either due to little scope for arranging safety measures or avoidance of the same. Hence, this factor has a significant impact on labour productivity; and with a RII value of 0.68, it is placed in the 2nd rank within the safety group, and in 19th position in overall rating(tables-6&9).

In the most of the construction sites surveyed, the workers are observed to violate the safety measures, which may lead to accidents of different types among them. In a few construction sites, the workers have used safety equipments while working. However, most of the workers are not aware of the safety precautions, mainly due to the non-recruitment of worksite safety officers by the contractors in the state. From the response of the respondents, this factor is ranked at 2nd position in the safety group and in 19th position in overall ranking (RII=0.68) (tables-6&9).

Table-6: Ranks of factors in safety group:

Factors	ΣW	N	A*N	RII	Rank
Worksite Accidents	122	30	150	0.81	1
Avoidance of safety precautions	102	30	150	0.68	2
Working at height & within confined space	102	30	150	0.68	2

5.2.6: Psychological Factors:

Delay or irregularity in payment has a negative impact on labour productivity; and hence, with a RII value of 0.85, it has been ranked at 1st position in the psychological group; and in 5th position in overall grading (tables-7&9). The logic behind it is that irregular payment hurts this poor section of people worsening their economic condition, and imposes a negative psychological effect generating discontent or worksite unrest. These may reduce labour productivity in construction activity.

Not receiving of welfare benefits by the workers in the private building construction sector has not been found significantly affecting the labour productivity. With a much small RII value (0.32), it has been ranked at the 2nd position in the psychological group, and in a much lower position (22th) in the overall ranking (tables-7&9). Similarly, pay amount is not an influential factor. During field survey, the actual wage rate received by most of the labourers was found to be higher than the state fixed wage rate. So, it has scored a small value of RII (0.32); and hence, it is ranked in the 3rd position in the psychological group; and a much lower rank of 23th in overall ranking (tables-7 &9).

Table-7: Ranks of the factors in the psychological group:

Factors	ΣW	N	A*N	RII	Rank
Irregular / Late payments	128	30	150	0.85	1
Low amount of Payments	48	30	150	0.32	3
Little Welfare benefits	52	30	150	0.35	2

5.2.7: External factors:

Major portion of building construction works is the outdoor work under open sky. As such, labour productivity in such work depends much on climatic condition such as rain, temperature and humidity. The building construction works slack during summer season due to frequent and/or heavy rainfall, high temperature, hence these are run normally during winter season. The climatic condition of the state is not favourable for promoting the labour productivity in building construction, mainly in the rainy season. Its average impact on labour productivity in building construction with an

estimated RII value of 0.83 has been ranked in 1st position in the external group; and in 6th position in overall rating (tables-8& 9).

The government regulations for building construction projects in the country (India) and for that matter in Assam are subject to a small change in the form of implementation of Building and Other Construction Workers' Cess/ Welfare Act, 1996. Provision of various welfare assistances to construction workers and the Cess collected from the contractors/owners of establishment under this Act would be highly effective in improving labour productivity in construction, if this Act is properly implemented. Till the last date of field visit (15th May, 2018), the implementation of this Act in the state (Assam) has been found to be much poor. Hence, it cannot be considered as an influential factor affecting labour productivity in construction works. So, with a small RII value (0.31), this external factor has been ranked in 2nd position in the group, and in lowest position (24th) in overall rating (tables-8 & 9).

Table-8: Ranks of factors in external group:

Factors	ΣW	N	A*N	RII	Rank
Adverse Climatic Conditions	124	30	150	0.83	1
Government Regulation	46	30	150	0.31	2

The overall ranking of factors affecting labour productivity in building construction projects in the state (Assam) demonstrate the relative importance/weight of each factor with RII value (table-9). Among all the selective factors, the top 10 factors are identified for policy recommendation. These are -

- i. Inadequate skill and experience of the workers,
- ii. Poor quality of raw materials and equipments,
- iii. System of work execution,
- iv. Magnitude of subcontracted works,
- v. Late payment,
- vi. Unclear drawings & specifications,
- vii. Disloyalty & Work-cheating among workers,
- viii. Adverse climatic conditions,
- ix. Worksite accidents,
- x. Shortage of materials & Equipments.

Table-9: Overall ranking of factors affecting labour productivity in Building Construction project:

Factors	RII	Rank
Inadequate Skill & Experience of the workers	0.91	1
Poor quality of raw materials& equipments	0.89	2
System of Work Execution/ mode of employment of workers	0.88	3
Magnitude of subcontracted works	0.87	4
Irregular / Late payments	0.85	5
Unclear Drawings & Specifications	0.85	5
Disloyalty & Work Cheating among the workers	0.83	6
Adverse Climatic Conditions	0.83	6
Worksite Accidents	0.81	7
Shortage of materials& Equipments	0.80	8
Absenteeism among workers	0.80	8
Improper planning & Scheduling of	0.79	9
Design Complexity level	0.78	10
Poor health conditions of the workers	0.77	11
Changing orders by contractors during execution	0.76	12
Overtime work	0.75	13
Incompetent supervision of the workers	0.74	14
Inspection delay	0.73	15
Labour turnover& Termination	0.72	16
Financial condition of the Contractors	0.71	17
Misunderstanding & Non-cooperation among the crew members	0.70	18
Working at height & within confined space	0.68	19
Avoidance of safety precautions	0.68	19
Storage location& material arrangement	0.66	20
Use of intoxicants among the workers	0.6	21
Little Welfare benefits	0.35	22

Low amount of Payments	0.32	23
Government Regulation	0.31	24

5.3: Conclusion and Policy Prescription:

The contractors/ builders running building construction projects in Assam are bound to increase profit margin for covering higher labour cost due to the low labour productivity. Behind the poor labour productivity in building construction projects in Assam, a number of varied factors are found to be in operation. The major factors negatively affecting construction productivity in Assam relate to skill of the workers, quality of materials and equipments, system of work execution, subcontracted works, late payments, work cheating behaviour of the workers, climatic conditions, accidents and shortage of materials & equipments. For deserving a good image towards the construction projects among the public and making it a profitable investment venture for the contractors/builders, the improvement of construction productivity and hence, labour productivity is an urgent requirement.

For improving labour productivity in building construction projects in Assam, the following has been suggested for policy prescription-

- i. For improving skill and quality of the building construction labourers of the state, either the labour and employment department of the state or the state construction workers' welfare board need to organize at least two/three day skill and training course half yearly and may issue certificate of skill and quality to the workers after successful completion of the course. Again, for ensuring proper skill and quality of the workers employed, the concerned project managers may undertake onsite training programme for the newcomers before allotting tasks to them.
- ii. The contractors should supply quality materials and equipments in the sites. For ensuring it, these should be purchased from well recognized companies. Again, the equipments should be maintained with regular service.
- iii. The concerned management personnel should supervise properly the subcontracted works, in addition to the works managed at their own.
- iv. The workers should be paid in time and motivated for encouraging them to work in devotion.
- v. For ensuring safety against probable accidents and injury, the state needs to enact laws with compulsory provision for use of safety equipments and safety measures among the workers. Again, the 'State construction workers' welfare board' may organize at least two day safety course every year for issuing green safety cards (GSC) to BCWs. Simultaneously, the state may enact laws to prohibit the entry of a labour into construction work who do not have such green safety card (GSC).

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