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STUDYING AND ANALYSING FACTORS AFFECTING ON THE PERFORMANCE AND PRODUCTIVITY OF STEEL STRUCTURE ERECTION TEAMS

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ABSTRACT

Steel Structures playing a significant role in Construction industry and it's a widely used in malls, stories, parking, multi-storey building, warehouses, railways and bridges, etc. Due to this important of the steel structure and the multiple usages it's become needed to study steel structure erection methods and the productivity of implementation teams and the factors that effecting on the productivity. This research concerns a case study on one of a very widely used steel structure building rigid frames and investigate the productivity of steel structure implementation teams work (erection teams) through studying and analyzing the factors that effect on productivity. The ranking of factors will be useful in steel construction sector to save time and money and will help in the estimation of the durations of tasks, all the data used in this research from questionnaire, interviews, work study are collected from previous projects.

INTRODUCTION

Productivity is commonly defined as a ratio between the output volume and the volume of inputs. In other words, it measures how efficiently production inputs, such as labor and capital, are being used in an economy to produce a given level of output [1]. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker. Steel structures are widely used because of their benefits, including strength, durability, design flexibility, construction speed, and cost efficiency. Steel structures use various types of connections, and the quality of the connections plays a significant role in determining the performance of the structural system. However, traditional steel connection systems rely on on-site welding and bolting, a labor intensive and skilled-worker-required process. Reducing welding and bolting efforts in steel member connections presents an opportunity for improving construction productivity.Several studies about the labor productivity in construction manufacturing were done such as about measuring productivity, finding factors effecting on construction productivity and improving construction productivity, etc. All these studies agreed to there are no international standards factors effecting on the construction productivity. In construction industry the improving of the construction productivity is so significant to achieving the main goals of any project Quality, Time and Cost [2].

The main aim of this study was to evaluate the effective factors on the performance and productivity of steel structure erecting team. To accomplish this, the authors performed analyses of data collected from steel project under erection.

BACK GROUND AND LITERATURE REVIEW

Labor Productivity

Laborer construction productivity "LCP" generally defined as the average hours required from the labors to installing any material. In other words it's the relation between inputs and outputs these inputs and outputs differ from manufacturing to another and between the same manufacturing. Labors are the basic inputs in construction industry where in construction laborers expressed as "Manpower" (MP) cost to the quantity of output produced [2]. And every laborer at site can work hard and share in to increase construction productivity. In construction productivity there are two levels of productivity issues macro and micro level. Macro level deals with organization of laborer, contracting and work legislations, the micro level deals with site works. To improving anything one

must be able to measure it at first, so to improving the productivity must be able to measure it carefully and then the measured productivity will be compared with estimated value or production standard [3]. Understanding the factors affecting on laborer construction productivity "LCP" is so useful to measure and improve productivity very well [4]. As mentioned above to improve and study the productivity first of all must be able to measure it. In construction the most dependent method to measure the productivity is the number of produced units per hours consumed [3]. In view of this there are two methods to measure the construction productivity. These methods are Total Factor Productivity "TFP" and Partial Factor Productivity "PFP". In TFP all outputs and inputs taken in consideration as show in equations (1) and (2). Total Factor Productivity will be determined as:

$$TFP = \frac{Total\ Output}{\sum All\ Input\ Resources} \quad \ldots\ldots\ldots (1)$$

Or

$$TFP = \frac{Total\ Output}{\text{Labor} + \text{Materials} + \text{Equipment} + \text{Energy} + \text{Capital}} \quad \ldots\ldots\ldots (2)$$

The TFP measure is often impractical since it is difficult to accurately measure and determine all of the input resources utilized to achieve the output.

Partial factor productivity (PFP) establishes a relationship between outputs and a single or selected set of inputs. The definition is best exemplified by the term labor productivity, where only the input of labor is considered as displayed in (3). Other single or partial factor productivity measures may include capital, energy, and equipment productivity. While the PFP only a single input taken in consideration as:

$$PFP = \text{Labor productivity} = \frac{\text{Output quantity}}{Labor\ Hours} \quad \ldots\ldots (3)$$

By focusing on a selected factor, in this research, labor input, the measurement process becomes easier and more controllable. As a result, more reliable and accurate data can be obtained. The complex nature of the construction process and the interaction of its activities make the partial factor productivity measure the popular option because effective control systems monitor each input separately [5].

Steel structure

Steel is a common building material used throughout the construction industry. Its primary purpose is to form a skeleton for the building or structure – essentially the part of the structure that holds everything up and together. Steel has many advantages when compared to other structural building materials such as concrete, timber, plastics and the newer composite materials. Steel is one of the friendliest environmental building materials – steel is 100% recyclable and in fact, according to the American Iron and Steel Institute, steel is the most recycled material in the United States reducing the burden on today's landfills. Steel, unlike wood, does not warp or twist and does not substantially expand and contract with the weather. Unlike concrete, steel does not need time to cure and is immediately at full strength. These advantages make steel the building material of choice. Steel as a building material has been studied and tested for many years. It might be said that the behavior of steel is better understand than any other building material. Steel is a predictable material and during the 1990's the industry had implemented new procedures for designing steel structures [6]. Design is the starting point in any project, the integration between the design and construction phases will result in greater crew productivity as construction considerations are taken into account at the design stage. Designers of steel structures should be aware not only with design process requirements for the structures but also with fabrication and erection methods to ensure that a steel Structure design can be safely, economically and reliably executed (fabricated, assembled and erected), these may determine whether a design is practical and cost efficient (design for construction).There are two separate phases of design [7].

1. Structural Design: The structural steel design should be produced according to Construction Management of Steel Construction and code of steel structures, Guidelines for the erection of building steelwork, which detail how risks can be eliminated or reduced in the design stage and helping for improving the crew productivity and projects performance.
2. Design for Erection: The second phase, the design for erection, is for the handling, transportation and erection of the individual members and structure. It may be produced independently of the structural design

of the building. Ideally, planning for the safe erection of structural steel work should be considered at the design stage. Structural design engineers should consider the safe working conditions for those involved in the erection stage and eliminate as many of the hazards as possible at this stage and improving the crew productivity and projects performance.

3. Fabrication: Fabrication is the process used to manufacture steel structures components that will, when assembled and joined, form a complete frame. The frame generally uses readily available standard sections that are purchased from the steelmaker or steel stockholder, together with such items as protective coatings and bolts from other specialist suppliers. Fabrication involves handling of the stock members, cutting them to size, punching and drilling for connections and preparing the connections, as well as shop painting or finishes when required.

Literature Review

Many researches have been carried out to find and study the factors that affecting on the construction labor productivity. Despite of the all efforts to investigate of factors that the construction labor productivity influenced by researchers, they have not agreed on universal set of factors with significant effect on construction labor productivity. The first time of using productivity word in 1766 it was invented by Quesnay [8]. There are many factors that involved the construction labor productivity most of research works on identifies these factors under categories from the previous studies.

RESEARCH METHODOLOGIES

Questionnaire design

The research depending on the previous data and literature review to quantified the factors that used in the questionnaire. The main source of collected data is from the questionnaire. This way is very efficient to supply a large amount of data comparatively with its cost.

A set of 47 factors were selected from the previous data and literature review. These factors were arranged by category into five categories according to the kind and nature of the factors. These categories are:-

- (Human/worker) factors that related to labors.
- (Project) factors that related to project issues.
- (Tools /Equipment's & Materials) factors that related to the tools problems and materials.
- (Management) factors that related to management such as planning monitoring and scheduling...etc.
- (Safety and Environment) factors that related to Safety and Environment.

The questionnaire contain the factors that affecting on the productivity and performance of the steel structure erection teams that was gathering from previous study and data as listed in Table 1. The respondents were requested to rate the each factor taking in the consideration the cost, time and quality according to their experiences gained from construction sites. The main points that take in account in the questionnaire to be easy to read and understand and there is no room of interpretation. And the most important thing is the time required to filling the questionnaire is very important to be efficient and take seriously to obtain topmost number of responses. Likert scale was used in this research to estimate the individual opinion of the questions. The scale of rating the factors affecting on the productivity and performance of steel structure erection teams from 1 to 5 according to the degree of effect where:-

1. Very Little Effect (1)
2. Little Effect (2)
3. Average Effect (3)
4. High Effect (4)
5. Very High Effect (5)

Pilot questionnaire

The purpose of this process is to minimize errors and problems that arise from them, converting the questionnaire as much as possible into reality. This small study was conducted to ensure that the questionnaire was easy to read and accurate. This small questionnaire was used by four researchers who they have experience in this field. The feedbacks of those four respondents were containing recommendations on design, improved drafting and general content. These recommendations were taken into consideration and the necessary modifications were made to the questionnaire before the survey began.

Data analysis

Previously the researchers were using the standard deviation and mean to ranking the factors this method is not used at present, because some researchers have thoughts that the mean and standard deviation are not suitable measure to estimate the rank of factor. In this research the relative important index (RII) was relied [8] - [9]. The analysis of the data ensures that the weighted average is used to ranking each factor where the years of experiences of the respondents were took in the account [10].

Table 1, List of data used in the research

Code	Class	Factors
H1	Human/worker	Skills and Experience
H2		Worker Motivation
H3		Working Overtime
H4		Number of Brakes and Duration
H5		Worker´s integrity
H6		Incentive policies
H7		Training
H8		Workforce absenteeism
H9		Resistance to accept new technologies
H10		Health care ,Food and sanitary facilities
P1	Project	The methods of construction
P2		The Complexity of Design
P3		Project Size
P4		The Height of Construction
P5		The access to the project
P6		Late Payments
P7		Location and area Condition
P8		Dispute and litigation costs
P9		Type of Soil
P10		Quality control requirements
TM1	Tools/equipment's & Materials	lack or late supply of materials
TM2		Unsuitability of materials storage
TM3		lack of Tools or equipment
TM4		The type and quantities of equipment's available
TM5		The skills of Crane operator
TM6		Availability of Electrical Power for tools
TM7		Maintenance of equipment's and tools
M1	Management	Clear and daily task assignment
M2		Insufficient supervision
M3		Poor coordination
M4		delay in work monitoring
M5		moving of laborers
M6		poor communication
M7		Delays in payments to workers
M8		Delays in payments to suppliers
M9		poor planning
M10		Job site planning
M11		Managers efficiency
SE1	Safety and Environment	Security conditions
SE2		availability personal protection equipment's PPE
SE3		daily site safety instructions
SE4		Reward and punishment safety policy
SE5		Work at night

SE6		Working at height
SE7		Rains
SE8		High Wind
SE9		Humidity

To calculate the RII for each factor the equation 4 will be used:

$$RII_Y\,(\%) = \frac{5n1+4n2+3n3+2n2+1n1}{5(n5+n4+n3+n2+n1)} \quad \ldots\ldots (4)$$

RII_Y it's the RII % for each category of experiences years (Yn where n=1, 2, 3 and 4). And n1 the number of respondents selected 1, n2 the number of respondents selected 2, n3 the number of respondents selected 3, n4 the number of respondents selected n4 and n5 the number of respondents selected 5.after calculating the RII for each factor separately and for each category of experience years then calculating the overall RII using equation 5 depending on the weight of experiences years. (Y1) for number of experiences years 4 years or less than, (Y2) for experiences from 5-8 years, (Y3) for experiences from 9-12 years and (Y4) for experiences more than 12 years in construction (see Table 2).

$$Overall\ RII = \frac{\sum_{Y=1}^{Y=4} (Y*RIIy)}{\sum_{Y=1}^{Y=4} Y} \quad \ldots\ldots (5)$$

After finding the overall RII for each factor arrange the factors descending order. The ranks of factor according to the RII of the factor were factors with highest overall RII will be at the top of list that mean this factor has very significant effect on the productivity and performance of steel structure erection teams and the factor with the lowest overall RII will be at the bottom of the list that mean this factor has no effect on the productivity and performance.

Table 2: The experiences background of respondents

Y categories	No of experiences years	No of respondents	average experiencs years
1	4 years or less	7	3
2	from 5-8 years	14	6.42
3	from 9-12	9	9.77
4	more than 12 years	9	18.55

RESULTS AND DISCUSSION

In this research 45 questionnaire form distributed to the respondents that who have related to the research scope. All of them engineers with different education degree BSc, MSc and PHD with different years of experiences. And received feedback from 39 of the respondents, only 6 did not send back the form that means the percentage of responding 86.67%. The respondents were with average years of experiences is 9.384, minimum experiences years was 2 and maximum experiences 25 year.

To examine the gathered data from questionnaire Cronbach's alpha used, Cronbach's alpha is a measure of internal consistence. It is considered to be a measure of scale reliability it is not statistics test –it is a coefficient of reliability. The accepted value of alpha 0.7 or more than it is acceptable in most social silence research and that mean there is internal consistency [12]. For the data used in this research alpha value was determined by SPSS and it was 0.908 that mean there is very high internal consistency as show in Table 3.

Table 3, Reliability statistics

Cronbach's Alpha	N of Items*

.908	47

*N number of items is the number of questions where each factor in the questionnaire considered as question.

Human/worker related factors
The analysis of the data and ranking of the factors under human category are shown in the Table 4.

Table 4: Overall RII and ranking of the factors under the human category.

Rank	Code	Factor	Overall RII %
1	H1	Skills and Experience	73.02
2	H7	Training	71.08
3	H6	Incentive policies	63.49
4	H5	Worker´s integrity	51.75
5	H2	Worker Motivation	50.89
6	H4	Number of Brakes and Duration	47.84
7	H10	Health care ,Food and sanitary facilities	46.35
8	H8	Workforce absenteeism	43.81
9	H3	Working Overtime	40.51
10	H9	Resistance to accept new technologies	38.10

The results of the ranking show that H1 was ranked in the top of this category human factor with overall RII 73.02%. Factor H1 was in third relative for all 47 factors that mean the factor skill and experience of labor play a significant role in the performance and productivity of steel structure erection teams, while the lowest value of overall RII for the category of human factor was H9 resistance to accept new technologies and that refers to this factor H9 It does not have much effect.

This result supported by research in United Kingdom to ranking the factors that affecting on the labor productivity Were the skill and experience ranked at the most important factor with very high effect on the productivity and performance [13]. There is also other research that recognized that the experience and skills of workers have a very important role in the production process in construction as well as the quality of production [14]. In the table 5 it's obvious that factor H7 Training have approximately have the same importance of skill and experience were the overall RII was 71.08 and its ranked at the second position according to human category and at the five position relative to the all 47 factors.

Project Related Factors
Table 5 shows the analysis and ranking of the factors that relate to the project category.

Table 5, Overall RII and ranking of the factors under the project category.

Rank	Code	Factor	Overall RII %
1	P4	The Height of Construction	80.10
2	P2	The Height of Construction	56.25
3	P10	Quality control requirements	55.17
4	P1	The methods of construction	52.54
5	P3	Project Size	49.71
6	P6	Late Payments	47.94

7	P9	Type of Soil	46.22
8	P7	Location and area Condition	43.27
9	P8	Dispute and litigation costs	42.03
10	P5	The access to the project	32.06

The factor P4 the height of construction was ranked at the top of this list with the first position with overall RII 80.1% as well as it was ranked at the first position relative for all 47 factors. That means the height of the construction is the most important factor to the productivity of steel structure erection teams. On the other hand the factors P2, P10 and P1 have 56.25%, 55.17% and 52.54 overall RII respectively and ranked 2, 3 and 4 according to the category of project.it is clear that P5 is a the bottom of this list with overall RII 32.06% and ranked at the tenth position and ranked at the last position relative to the all 47 factors that mean this factor has not any effect on the performance and the productivity of steel structure erection teams. The results show that the factors P6 late payments and P9 type of soil ranked at the positions 6 and 7 respectively in the category of the project with overall RII 47.94% and 46.22% that indicate these two factors have the same effect on the productivity and performance in this category, and ranked at the positions 31 and 36 relative to the all factors.

Tools/equipment's & materials related factors

Table 6 indicate the overall RII and the ranking of the factors related to the category of tools and materials factors.

Table 6, Overall RII and ranking of the factors under the tools & materials category.

Rank	Code	Factor	Overall RII %
1	TM6	Availability of Electrical Power for tools	69.62
2	TM3	lack of Tools or equipment	68.06
3	TM1	lack or late supply of materials	68.00
4	TM5	The skills of Crane operator	64.89
5	TM4	The type and quantities of equipment's available	63.75
6	TM7	Maintenance of equipment's and tools	59.17
7	TM2	Unsuitability of materials storage	58.54

TM6 with overall RII 69.62% was ranked at the top of this list under the category of the tool and materials factors and its position related to the all factors was the seventh. This result show the importance of the electrical power source in the construction site of steel structure because most the used equipment's worked by electrical power and the absence of this power will lead to stop most of construction activities such as welding and fastening. Both TM3 and TM1 almost have the same overall RII 68.08% and 68% respectively that mean the same effect of those two factors the lack of tools or equipment's and the lack of materials. In the construction industry the equipment's and materials have a very significant effect on the construction labor productivity and this result substantiated by [15], [16] and [17]. The skills of crane operator classified at the fourth position in this list with overall RII 64.89%. Moreover, it was ranked Fourteen among the all forty seven factor this result indicate to the importance of this factor on the construction productivity. The others factors TM4, TM7 and TM2 were ranked 5, 6 and 7 respectively with overall RII 63.75% ,59.17% and 58.54% these factors have almost the same moderate effect on the performance and productivity of steel structure erection teams, furthermore these results approved by [18] and [19] that show the moderate effect of these factors on the construction productivity.

Management related factors

Under this category the factors that related to the management such as scheduling, planning supervision …etc. in the table 7 show the results of the gathered data analysis and classified the factors according to the importance of each factor with respect to the management category and the overall 47 factors.

The highest overall RII in this table 71.43% belong to M10 job site planning factor. M10 classified according to all factors ranked the fourth position that mean this factor have very effect role on the productivity and performance of steel structure erection team. M9 poor planning factor was ranked at the second factor with respect to this while M9 the fourth factor relative to all factors. Poor planning was ranked the second factor with overall RII 68.7% and the 8th relative to the 47 factor from this result it's obvious that the high impact of this factor on the productivity and performance of steel construction team. Manager's efficiency have an important role on productivity and performance and that is supported by the results were the overall RII of M11 was 66.76% with the third position in the category of management and was classified at the eleven position in the overall factor list. In general the delays of payments in each industry will effect on the performance and the productivity of this industry in the above table can see the M8 and M7 these two factors related to the delays in payments with to level the supplier's and the workers and the overall RII for both M8 and M7 was 65.71% and 61.9% respectively at the fourth and fifth position in the list of management. M5 represents the factor of moving laborers that mean the change of the tasks of labor many times during the working day that will lead to dispersion of the labor and that will be effect on the performance and productivity as we note the overall RII of this factor moving of laborers 50.6% at the 6th position. In the category of project factors the positions 7, 8 and 9 were ranked to M2, M1 and M4 respectively with RII 49.46&, 46.16% and 45.3%. M2 was ranked 29 at the list of all factors and the two others M1 clear and daily task assignment, M4 delay in work monitoring were listed at the positions 37 and 38 respectively relative to the list of all factors that bring to light M7 have moderate or average effect on the performance and productivity while the M1 and M4 have low impact on the performance and productivity of steel structure erection teams. In the end of this table can notice that M3 and M6 were ranked 10 and 11 with overall RII 43.87% and 40.32%, that point out the poor coordination and poor communication have very low effect on the performance and productivity.

Table 7, Overall RII and ranking of the factors under the management category.

Rank	Code	Factor	Overall RII%
1	M10	Job site planning	71.43
2	M9	poor planning	68.70
3	M11	Managers efficiency	66.76
4	M8	Delays in payments to suppliers	65.71
5	M7	Delays in payments to workers	61.90
6	M5	moving of laborers	50.60
7	M2	Insufficient supervision	49.46
8	M1	Clear and daily task assignment	46.16
9	M4	delay in work monitoring	45.30
10	M3	Poor coordination	43.87
11	M6	poor communication	40.32

Safety and environment related factors

In Table 8 it can notice the overall RII and ranking of the factors related to the category of safety and environment.

Table 8, Overall RII and ranking of the factors under safety and environment category

Rank	Code	Factor	Overall RII %
1	SE8	High Wind	76.86
2	SE7	Rains	70.48
3	SE6	Working at height	66.57
4	SE2	availability personal protection equipment's PPE	64.48
5	SE4	Reward and punishment safety policy	55.65

6	SE3	daily site safety instructions	48.35
7	SE1	Security conditions	47.59
8	SE5	Work at night	46.60
9	SE9	Humidity	42.98

SE8 with overall RII 76.86% was ranked at the first factor under the category of safety and environment and take the second rank among the all forty seven factors that show the very high effect of high wind on the performance and productivity of steel structure erection team and that is logically when take in the consideration the steel erection teams usually work at the height locations. The rains SE7 have RII 70.48% and this shows the high impact of this factor on the productivity and performance, were the rains was ranked second in this table and take the 6 position according to overall table. The third and fourth factors ranked in the category of safety and environment were SE6 and SE2 the working at height and availability of personal protection equipment's PPE with overall RII 66.57% and 64.48% respectively that indicate to these two factors have over moderate impact on the performance and productivity of the erection team, whereas in spite of the positive role of the PPE but sometimes its hinder the movements of labor especially for laborers those did not get used to wear the PPE. The daily site safety instruction have importance role to save the life of working teams and that is very important issue in every industry SE3 was ranked 6 with respect to the category of safety and environment with 48.35% RII. The RII 47.59%, 46.4% and 42.98% for the three factors SE1, SE5 and SE9 respectively were ranked at the end of this list with position 7, 8 and 9, while SE1, SE5 and SE9 were ranked 33, 34 and 42 relative to the all factors list that show the moderate or less than moderate effect of the security condition and work at night on the performance and productivity, and the low effect of the humidity on the productivity and performance as shown in Table 9.
Table 10 shows the average overall RII and the ranking of each category. The tools and materials category was ranked the first with average overall RII 64.58 and at the second rank was the safety and environment with 57.73%, while the management, human and project were ranked 3,4 and 5 respectively with average overall RII 55.47%,53.68% and 50.53.

CONCLUSIONS AND RECOMMENDATION

Productivity is the main yardstick for the construction industry and the steel structure is one type of construction industry. This research aimed to identify the factors that affecting on the performance and productivity of steel structure erection teams. And ranking these factors according to the degree of effecting and the level of impact of each factor, and which factor more affecting from the others

The results show the height of construction is very affecting factor with very high impact on the performance and productivity of the steel structure erection teams, Work in high-rise buildings is less productive for workers because of fear of falling, difficulty moving and handling tools furthermore the unstable nature of the steel structure during the erection process. To overcome the height problem and the difficulties of the work of steel structure, it is recommended to do training courses for erection work team and the

Table 9, The overall RII and ranking of all factors

Rank	Code	Factors	Overall RII%
1	P4	The Height of Construction	80.10
2	SE8	High Wind	76.86
3	H1	Skills and Experience	73.02
4	M10	Job site planning	71.43
5	H7	Training	71.08
6	SE7	Rains	70.48
7	TM6	Availability of Electrical Power for tools	69.62
8	M9	poor planning	68.70
9	TM3	lack of Tools or equipment	68.06
10	TM1	lack or late supply of materials	68.00
11	M11	Managers efficiency	66.76
12	SE6	Working at height	66.57

13	M8	Delays in payments to suppliers	65.71
14	TM5	The skills of Crane operator	64.89
15	SE2	availability personal protection equipment's PPE	64.48
16	TM4	The type and quantities of equipment's available	63.75
17	H6	Incentive policies	63.49
18	M7	Delays in payments to workers	61.90
19	TM7	Maintenance of equipment's and tools	59.17
20	TM2	Unsuitability of materials storage	58.54
21	P2	The Complexity of Design	56.25
22	SE4	Reward and punishment safety policy	55.65
23	P10	Quality control requirements	55.17
24	P1	The methods of construction	52.54
25	H5	Worker´s integrity	51.75
26	H2	Worker Motivation	50.89
27	M5	moving of laborers	50.60
28	P3	Project Size	49.71
29	M2	Insufficient supervision	49.46
30	SE3	daily site safety instructions	48.35
31	P6	Late Payments	47.94
32	H4	Number of Brakes and Duration	47.84
33	SE1	Security conditions	47.59
34	SE5	Work at night	46.60
35	H10	Health care ,Food and sanitary facilities	46.35
36	P9	Type of Soil	46.22
37	M1	Clear and daily task assignment	46.16
38	M4	delay in work monitoring	45.30
39	M3	Poor coordination	43.87
40	H8	Workforce absenteeism	43.81
41	P7	Location and area Condition	43.27
42	SE9	Humidity	42.98
43	P8	Dispute and litigation costs	42.03
44	H3	Working Overtime	40.51
45	M6	poor communication	40.32
46	H9	Resistance to accept new technologies	38.10
47	P5	The access to the project	32.06

Table 10, The average of overall RII and ranking of the all category

Rank	Code	Category	Average of overall RII%
1	TM	Tools/Equipment's and Materials	64.58
2	SE	Safety and Environment	57.73
3	M	Management	55.47
4	H	Human/Workers	52.68
5	P	Project	50.53

use of modern equipment and cranes, besides using workers team with special skill and special age to work at high level.

The second more affecting factor was the high wind speed and this factor classified under the category of safety and environment. So the speed of the wind should defined by the official to work in steel structures and increase the number of teams in this case, as well as recommend reduce working hours to reduce the risk in these cases.

Although in the other type of construction such as concrete buildings this factor will be less importance but because of the manner of the steel structure erection process required lifting the members and moving it with high rise the wind speed becomes too effecting factor. The third most important factor is team skills and experience as this factor is very influential on productivity and performance so you should pay attention to the selection of workers with experience and skill. Planning the work of the site ranked fourth, where systematic and correct planning makes work more productive and team performance is regular especially in these types of constructions there are high risks on the lives and materials therefore the good planning is the key of success of these projects.

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