

**A**  
**DESSERTATION REPORT**  
**ON**

**“IMPACT OF EXTERNAL AND HUMAN FACTORS ON LABOR  
PRODUCTIVITY OF CONSTRUCTION PROJECTS IN IRAQ”**

**SUBMITTED BY**

**RYAD TUMA HAZEM**

**UNDER GUIDANCE OF**

**Prof. MRS. P.R.ADAVI**

In Partial of Fulfilment of

M.E CIVIL (CONSTRUCTION AND MANAGEMENT)

**DEGREE AWARDED BY UNIVERSITY OF PUNE**

**2014-2015**



*DEPARTMENT OF CIVIL ENGINEERING*

*M.A.E.E.R's*

*MAHARASHTRA INSTITUTE OF TECHNOLOGY*

PUNE-41038



M.A.E.E.R's

MAHARASHTRA INSTITUTE OF TECHNOLOGY, PUNE-41038

**CERTIFICATE**

**This is to certify that**

**RYAD TUMA HAZEM AL-KINANI**

*Has successfully completed a dissertation entitled*

**“IMPACT OF EXTERNAL AND HUMAN FACTORS ON LABOR PRODUCTIVITY  
OF CONSTRUCTION PROJECTS IN IRAQ”**

*This dissertation report is in partial fulfillment of the requirement of the post graduate degree of M.E CIVIL ENGINEERING (Construction & Management) of the University of Pune for the academic year 2014-2015.*

**Prof. MRS. P.R.ADAVI**

**Guide**

**Civil Engineering Department**

**MIT, PUNE**

**Prof. Dr. S.S.Pimplikar**

**Head of Department**

**Civil Engineering Department**

**MIT, PUNE**

**Prof.Dr.L.K.Kshirsagar**

**(Principal)**

**MIT, PUNE**



M.A.E.E.R's

MAHARASHTRA INSTITUTE OF TECHNOLOGY, PUNE-41038

**CERTIFICATE**

This is to certify that

**RYAD TUMA HAZEM AL-KINANI**

*Has successfully completed a dissertation entitled*

**“IMPACT OF EXTERNAL AND HUMAN FACTORS ON LABOR  
PRODUCTIVITY OF CONSTRUCTION PROJECTS IN IRAQ”**

*This dissertation report is in partial fulfillment of the requirement of the  
post graduate degree of M.E CIVIL ENGINEERING (Construction &  
Management) of the University of Pune for the academic year 2014-2015.*

Prof. MRS. P.R.ADAVI

Guide

Civil Engineering Department

MIT, PUNE

Prof. Dr. S.S.Pimplikar

Head of Department

Civil Engineering Department

MIT, PUNE

Prof. Dr. L.K.Kshirsagar

(Principal)

MIT, PUNE

(Pimplikar S. S.)  
Professor and Head  
Civil Engineering Deptt.  
M.I.T., Kothrud, Pune-38.



## **SYNOPSIS**

The labor productivity is one of the important issues to the contractors and subcontractors because it affects the profits of their construction projects not only in Iraq but it affects all other countries. Construction sectors in both level industry/ projects cite a many problems and suffer from a complex of various conventional factors, such as quality, duration, cost and safety. Construction sector is one of the diverse areas as it contains construction contractors, subcontractors, experienced engineers, different level of Consulting by consultants, designers/architects, clients, various types of suppliers, vendors and others.

The study deals with the issues related to external and human factors in construction projects. The study involves, identifying, analysis, discussion, and recommendation regarding impact of "*external and human*" factors on labor productivity in construction projects in Iraq context generally and specially in Mayan province.

Many studies in the last decades mentioned that for every construction project or general civil projects, productivity, cost, quality, and time represent the main concerns and anxieties for all parties, contractors, owners and engineers. To achieve the better labor productivity in any construction project, activities and tasks; it is required to deal with impact of various factors to minimize their negative impact on the construction projects and level of profits of construction contractors and subcontractors.

Recommended factors by level of experts and professional engineers were considered to compile the factors. 21 factors, categorized into 2 groups, were analyzed and ranked considering Relative Importance Index. The questionnaires were allotted to construction contractors, subcontractors, site engineers, managers in construction projects, consultants, and others.

Finally the study highlights the factors in both groups "external and human", how these factors make a negative impacts on labor productivity in the construction projects based on the point of view, opinions and responses of targeted groups in survey and discusses the final results and recommendation to enhance and develop the knowledge of human resources through best and continued training/workshops program, and to frame a strong assignment, vision, and a planned aspect to overcome all types of disturbances on the performance of construction projects. The discussions on impact of external and human factors are expected to make construction project meet profits and completion successfully.

<b>CONTENTS:</b>	<b>PAGES</b>
<b>CHAPTER. I: Introduction -----</b>	<b>01</b>
1. Introduction-----	02
1.1 Introduction to Study-----	02
1.2 Problem Statement -----	03
1.3 Objective of Study -----	04
1.4 Limitation of the Study-----	05
1.5 Structure of the Dissertation-----	06
1.6 Flowchart of the Dissertation-----	07
<b>CHAPTER.II: Literature Review-----</b>	<b>08</b>
2. Literature Review-----	09
2.1 Reviewed Labor Productivity from Different and Previous Studies-----	09
2.2 Impact of the different factors from previous studies on labor productivity-----	10
2.3 Arrangement and identification various factors affecting labor productivity in construction project-----	16
2.4 Critical Factors Affecting Labor Productivity in Construction Projects---	19
2.5 Outline from Previous Studies and literature Surveys-----	21
2.6 Background about labor productivity-----	22
2.6.1 Definition Aspects of Labor Productivity-----	23
2.6.2 Productivity Calculation Aspects-----	25
2.6.3 Tools and Methods to Identifications construction Labor Productivity----	26
2.7 Importance of labor productivity-----	26
2.7.1 General Importance of Labor productivity-----	26
2.7.2 Importance of Labor Productivity to Construction Projects in Iraq-----	28
2.8 Arrangement of “Human and External” Factors-----	29
2.8.1 Human Factors-----	29
2.8.2 External Factors -----	31
<b>CHAPTER.III RESEARCH METHODOLOGY-----</b>	<b>32</b>

3.	Research Methodology-----	33
3.1	Stage of Collection Data-----	33
3.2	Case Study-----	34
3.3	A Details of Case Study about Construction Labor Productivity-----	35
3.4	Documented of the Case Studies-----	36
3.4.1	Background of the project-----	36
3.4.2	Drawings and Technical Details-----	37
3.4.3	Situation around Construction Labor Productivity in the Case Study-----	39
3.4.4	Max and Min Rates of Wages for Construction Workers-----	46
3.4.5	Conditions of Works in Site of Construction Activities-----	47
3.4.6	Team of concreting activity in Details-----	50
3.5	Outcomes about construction labor productivity from the Case Study-----	51
3.6	Summary of the Case Study-----	59
3.7	Survey and Questionnaires Processes-----	61
3.8	Arrangement of the Questionnaire-----	61
3.9	Details of Questionnaire-----	61
3.10	Questionnaire Distribution Process-----	63
3.11	Population and Sample size-----	63
<b>CHAPTER.IV</b>	<b>ANALYSIS OF RESULTS -----</b>	<b>64</b>
4.	Analysis of Results-----	65
4.1	Collection Data from Survey-----	65
4.2	Measurement of Data Collection-----	68
4.3	Data Analysis Approach-----	69
4.4	Size of Construction Firms-----	69
4.5	Number of Projects per Year-----	69
4.6	Type of Construction Projects-----	70
4.7	Titles of the respondents' job -----	70
4.8	Phase of Results-----	70
4.8.1	Statistics of Collected Data-----	78
4.9	Analysis Data by using RII Techniques-----	73

<b>4.10</b>	Arrangement of the Results-----	75
<b>4.11</b>	Using Graphical to display the Results-----	77
<b>4.12</b>	Comparison between highest and lowest ranking factors-----	81
<b>4.13</b>	Maximum and Minimum for two Groups -----	83
<b>4.14</b>	Overall Ranking for Two Groups-----	84
<b>CHAPTER.V</b>	<b>DISCUSSION AND COMPARISON-----</b>	<b>85</b>
<b>5.</b>	Discussion -----	86
<b>5.1</b>	First Group: Human Factors-----	87
<b>5.2</b>	Second Group: External Factors-----	95
<b>5.3</b>	Presentation of Factors on Ishikawa Diagram-----	100
<b>5.4</b>	Comparison with Previous Studies-----	102
<b>5.4.1</b>	Presentation of the comparison-----	103
<b>CHAPTER.VI</b>	<b>STATISTICAL TESTS-----</b>	<b>104</b>
<b>6.</b>	Scope of Statistical Test-----	105
<b>6.1</b>	Test the level of significant and non-significant of the factors-----	106
<b>CHAPTER.VII</b>	<b>CONCLUSION-----</b>	<b>111</b>
<b>7.</b>	<b>Conclusion-----</b>	<b>112</b>
<b>7.1</b>	Actions on Human Factors-----	112
<b>7.1.1</b>	Actions on Human Factors-----	112
<b>7.1.2</b>	Actions on External Factors-----	114
<b>7.2</b>	Conclusion-----	116
<b>7.3</b>	Contributions of the present study-----	118
<b>CHAPTER.VIII</b>	<b>FUTURE SCOPE-----</b>	<b>119</b>
<b>8.</b>	Future Scope and Recommendation Points-----	120
<b>8.1</b>	Future Scope-----	120
<b>8.2</b>	Recommendation -----	122
	<b>REFERENCES-----</b>	<b>124</b>
	Books & Journals-----	124
	Web Sites-----	127
	<b>APPENDIX-----</b>	<b>128</b>

Appendix (A) QUESTIONNAIRE DETIALS -----  
 Appendix (B) PAPERS PUBLISHED-----

**LIST OF TABLES**

<b><u>Sr. No.</u></b>	<b><u>Name of Table</u></b>	<b><u>Page No.</u></b>
<b>Table 2.1</b>	Arrangement and identification the various factors from ( <i>previous studies</i> )	16
<b>Table 2.2</b>	Impact of critical factors on labor productivity	20
<b>Table 2.3</b>	Explanations and identifications about list of human factors.	30
<b>Table 2.4</b>	Explanations and identifications about list of external factors.	31
<b>Table 3.1</b>	Details of the Construction project	39
<b>Table 3.2</b>	Max and Min Rates of Wages for Construction Workers	46
<b>Table 3.3</b>	Working Overtime for skilled and unskilled workers.	48
<b>Table 3.4</b>	Time sheet for employees	49
<b>Table 3.5</b>	Overtime and Vacations	50
<b>Table 3.6</b>	Numbers of construction workers in each team	52
<b>Table 3.7</b>	Summary of production during two days in concreting activity	56
<b>Table 3.8</b>	Data collection by using Foreman delay Survey Method	56
<b>Table 3.9</b>	Calculation and percentages for each one Problem Causing Delay.	57
<b>Table 3.10</b>	Final Identify Human factor Based the Case Study	60
<b>Table 3.11</b>	Final identify external factor Based the Case Study	60
<b>Table 3.12</b>	Gathering of 21 external and human factors) affecting labor productivity of construction project in Maysan, Iraq used in questionnaire process	62
<b>Table 4.1</b>	Number of the participating companies in the survey	65
<b>Table 4.2</b>	Number of distributed Questionnaires of participated companies in the survey	65
<b>Table 4.3</b>	Details of Kinds of Participants from each Firm:-	66
<b>Table 4.4</b>	The numbers of targeted groups and their job titles	66
<b>Table 4.5</b>	Ordinal Scale Used for Data Measurement	68
<b>Table 4.6</b>	Type of Construction Projects	70
<b>Table 4.7</b>	Job Title of the Respondents	70



<b>Table 4.8</b>	Responses associated with human factors	71
<b>Table 4.9</b>	Responses associated with external factors	72
<b>Table 4.10</b>	Percentages of RII for Human factors	73
<b>Table 4.11</b>	Percentages of RII for External factors	74
<b>Table4.12</b>	Arrangement of first group based rankings	75
<b>Table4.13</b>	Arrangement of second group based rankings	76
<b>Table4.14</b>	The references letters of each human factors	77
<b>Table4.15</b>	The references numbers of each human factor	78
<b>Table4.16</b>	The references letters of each external factors	79
<b>Table4.17</b>	The references numbers of each external factor	80
<b>Table5.1</b>	RANK: LACK OF EXPERIENCE	87
<b>Table5.2</b>	RANK: WORK OVERTIME	89
<b>Table 5.3</b>	RANK: ABSENTEEISM	91
<b>Table 5.4</b>	Rank of PERSONAL PROBLEMS	91
<b>Table 5.5</b>	Rank of MISUNDERSTANDING AMONG LABORERS	92
<b>Table 5.6</b>	Rank Age	92
<b>Table5.7</b>	Rank of alcoholism	93
<b>Table5.8</b>	Rank of work accidents	93
<b>Table 5.9</b>	Rank of competition between laborers	94
<b>Table 5.10</b>	Rank of Disloyalty	94
<b>Table5.11</b>	Rank of Payments Delay	95
<b>Table5.12</b>	Rank of lack in training sessions	96
<b>Table 5.13</b>	Rank of Weather conditions	96
<b>Table 5.14</b>	Rank of Design Changes	97
<b>Table 5.15</b>	Rank of incomplete drawing	97
<b>Table5.16</b>	Rank of complex design in the provided drawing	98
<b>Table5.17</b>	Rank of variation in the drawing.	98
<b>Table5.19</b>	Rank of Rework	98
<b>Table5.20</b>	Rank of inspection delay from the authorities	99
<b>Table 5.21</b>	Rank of implementation of government law	100
<b>Table5.22</b>	Comparison with previous studies based rankings.	102
<b>Table6.1</b>	Indicates to all factors under test of severity indicators:	108
<b>Tables7.1</b>	Actions required on human factor to improve labor productivity	112
<b>Tables7.2</b>	display actions required on human factor to improve labor productivity	114

**LIST OF FIGURES**

<b><u>Sr. No</u></b>	<b><u>Name of Figures</u></b>	<b><u>Page No.</u></b>
<b>Figure 1.1</b>	Flowchart of the dissertation	7
<b>Figure 2.1</b>	illustration and Presentation of Various Factors impact on Labor Productivity	21
<b>Figure 2.2</b>	Summary from previous studies	22
<b>Figure2.3</b>	Productivity calculation aspects	25
<b>Figure 2.4</b>	Four main methods to identify Labor Productivity	26
<b>Figure3.1</b>	Diagram of three main steps of Research Methodology	33
<b>Figure3.2</b>	Layout plan of the project	35
<b>Figure3.3</b>	Sections in building	36
<b>Figure3.4</b>	Drawing (A) of the project	37
<b>Figure3.5</b>	Drawings (B) of the projects	37
<b>Figure3.6</b>	Drawings (C) of the projects	37
<b>Figure 3.7</b>	Drawings (D) of the projects	38
<b>Figure3.8</b>	local materials used in the project (Sand and Gravel)	40
<b>Figure3.9</b>	Cement used in the project	41
<b>Figure3.10</b>	Details of steels and framework in the site of project	41
<b>Figure 3.11</b>	Construction workers during regular and normal working hours	47
<b>Figure 3.12</b>	Required skilled workers per day	48
<b>Fig 3.13</b>	Required unskilled workers per day	49
<b>Figure3.14</b>	Details of concreting team	54

<b>Figure3.15</b>	Construction workers during bricklaying Activity	
<b>Figure3.16</b>	Many “males” construction workers in Iraq	59
<b>Figure3.17</b>	Many “females” construction workers in India	59
<b>Figure4.1</b>	Percentages (%) of Received Questionnaires from the total "83 questionnaires"	67
<b>Figure4.2</b>	distribution of the ranking values for human factor	77
<b>Figure4.3</b>	Ranking values for human factor	78
<b>Figure4.4</b>	Distribution of the ranking values for external factor	79
<b>Figure4.5</b>	Ranking of external factor	80
<b>Figure4.6</b>	Indicates to Percentages of Variation of Human Factor Group	81
<b>Figure4.7</b>	The gap between highest and lowest ranking in human factors	82
<b>Figure4.8</b>	Indicates to Percentage of Variation of External Factor Group	82
<b>Figure4.9</b>	The gap between highest and lowest ranking in external factors	83
<b>Figure4.10</b>	Rang of (MAX) & (MIN) for group of human factors and group of external factors	83
<b>Figure4.11</b>	Overall ranking between two groups	84
<b>Figure5.1</b>	Structure of discussion	86
<b>Figure5.2</b>	Important affects of this factor	88
<b>Figure5.3</b>	Regular work time	90
<b>Figure5.4</b>	Overworking time	90
<b>Figure5.5</b>	Presentation of Human and External Factors on Ishikawa Diagram	101
<b>Figure5.6</b>	Presentation of the comparisons with previous four studies	103
<b>Figure 6.1</b>	Percentages from high significant to non significant gradually	107
<b>Figure 6.2</b>	Comparative between three percentages of indexes “Human factor”	110
<b>Figure 6.3</b>	Comparative between three percentages of indexes “External factor”	110

**LIST OF ABBREVIATIONS**

#	<u>ABBREVIATIONS</u>	<u>DESCRIPTION</u>
1	%	Percentage
2	RII	Relative Importance Index
3	FI	Frequency Index
4	SF	Severity Factor
5	No	Numbers
6	Sr.	Series
7	M <sup>2</sup>	Meter Square
8	Fig	Figure
9	Max	Maximum
10	Min	Minimum
11	QTY	Quantity
12	US\$	United States' Currency (Dollar)
13	IQD	Iraqi Dinars
14	Rs	Indian Rupees
15	Hr	Hour
16	Hrs	Hours

**CHAPTER.**

**ONE**

**“INTRODUCTION”**

## **1. INTRODUCTION**

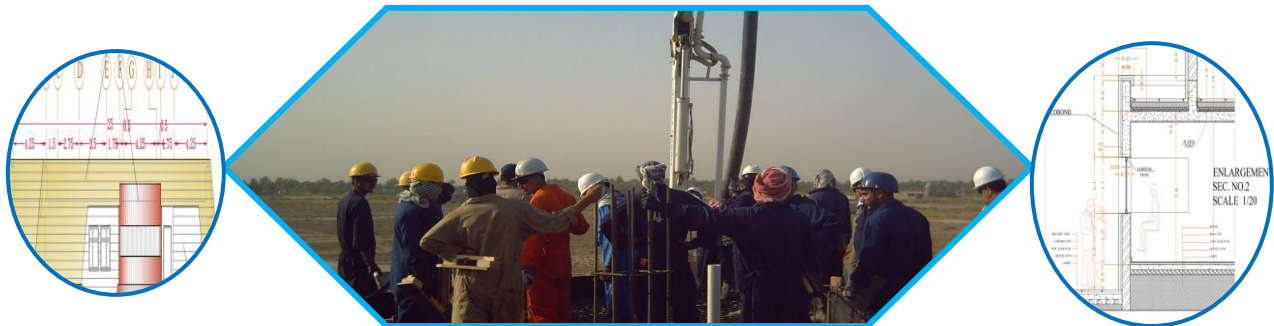
Construction industries still represent one of the important sectors in each country because it supports directly marketing fields, economics aspects, and general operations activities. A number of workers are direct beneficiaries of construction projects/sectors. The contractors, subcontractors and all construction partners supposed to interest more about this vital of the construction resources in the areas of their responsibilities to ensure the increasing their opportunities in reaching to required level of construction productivity.

### **1.1-Introduction to Study:**

For every construction project, productivity, cost, quality and time represent the main components for all parties, contractors, subcontractors, client, and engineers. Better planning and managing each construction project will make all the above parties reach their planned objectives and obtain better outcomes from any construction project.

There are a number of studies that have shown various factors of labor productivity and the extent of the impact of these factors on labor productivity in construction projects.

Over 2003, Iraqi governments invested huge amounts in the construction sector in all Iraqi cities and one of the significant issues troubling it local contractors and subcontractors was labor productivity. Construction labor productivity has become a big problem in the construction industry in most countries especially in Iraq. This study discover levels of impact of “external and human” factors on labor productivity in construction projects in Iraq. This study identifies two main groups and categorizes the main groups into twenty one sub cafeterias (21 factors). To display and detail the impacts ranges of “external and human” factors on labor productivity in construction projects in Iraq through this dissertation.



## 1.2- Problem Statement:

The construction sector is one of the biggest areas that are suffering from loss in labor productivity. Construction labor productivity represents one of the greatest issues and generates many problems and put all construction players in sequence of troubles. Each party in construction projects uses better planning and management to overcome on loss of productivity to make sure their projects meet with better profitability level.

In Construction sectors labor is more changeable and unpredictable than other project cost elements, it is urgent to recognize the impacts of various factors on construction labor productivity in any construction project. Many previous studies focus on that productivity loss outcome from various factors, which include: different variations aspects in detailed drawings, overtime need for achieving extra



works, bad management levels, and changes in climatic conditions such as gaps in temperatures during daily activities, human factor effects and others.

In fact, the papers of study focus on "External and Human" factors typically produce extra disturbances that affect labor productivity in any construction projects. Contractors or subcontractors are directly control on some of these factors and others are out of contractors' control in the sites of any construction projects in Iraq or any other. The study the impacts of "External and Human" factors on labor productivity will give us the initial ideas about the effect of these factors on labor productivity and then how to maximize labor productivity and minimize the losses or extra work hours necessary to complete the targeted task, event, and activity especially under construction stage at any project life cycle. The positive impact of labor productivity will enhance the level of profit and make any construction project meet with deadline as required and main objectives of any construction firm.

### **1.3- Objectives of the Study:**

The substantial objectives of this study are to identify the level of impacts of “External and Human” factors on labor productivity of construction project in Maysan, Iraq based on the views of consultants, contractors, project managers, and experienced engineers through data collection on the basis of questionnaire survey (Questionnaire attached).

The purpose is supported by the objective stated below:

- i. To highlight and arrange “external and human” factors which impact in construction projects on labor productivity through previous studies and literature surveys.
- ii. To analysis and calculate the Relative Important Index (RII) and give the ranking for various “External and Human” factors.
- iii. To discuss the opinions of some experienced engineers, local contractor and subcontractor which obtaining them through site visit of the case study.
- iv. To present human and external factors associated with labor productivity in construction projects in Maysan city in Iraq by using Fishbone (Ishikawa Diagram).
- v. To compare with previous selected studies according to the ranking.
- vi. To display an important required actions to improve labor productivity in construction projects in Iraq.
- vii. To make a conclusion about highest factors and their impacts on construction labor productivity.



#### **1.4-Limitations of the Study:**

There are some limitations of studying of labor productivity because it is one of the difficult fields to observe and check it in each site of the projects. One of significant issues about construction labor productivity is not same in each country, but it is different from areas to others.

The limitations of the Study were as in following list below:

- i. Weakness of some professional local construction companies in understanding all the factors affecting labor productivity in construction projects.
- ii. Limitation in collection of some data about each factor separately.
- iii. Difficult to measure and monitor all the factors affecting labor productivity in the site of each project periodically.
- iv. Limited time to do so many site visits to obtain perfect site view on all the construction sequences and procedures which will affect labor productivity directly.
- v. The lack of a database on workers' salaries and working conditions of a professional manner with local companies.

## **1.5- Structure of the Dissertation**

This study consists of the main chapters as followings:

**1. Chapter one:**

Introduction, Introduction to Study, Problem Statement, Objectives of the Study, Limitations of the Study.

**2. Chapter two:**

Literature review, Impact of the different factors from previous studies on labor productivity, Arrangement and identification various factors affecting labor productivity in construction projects, critical factors and Summary from Previous Studies and labor productivity aspects and its importance.

**3. Chapter Three:**

Research methodology, collection data, case study in details, indentify human and external factors, questionnaires details,.

**4. Chapter Four:**

Analysis of results by using tables and graphical.

**5. Chapter Five:**

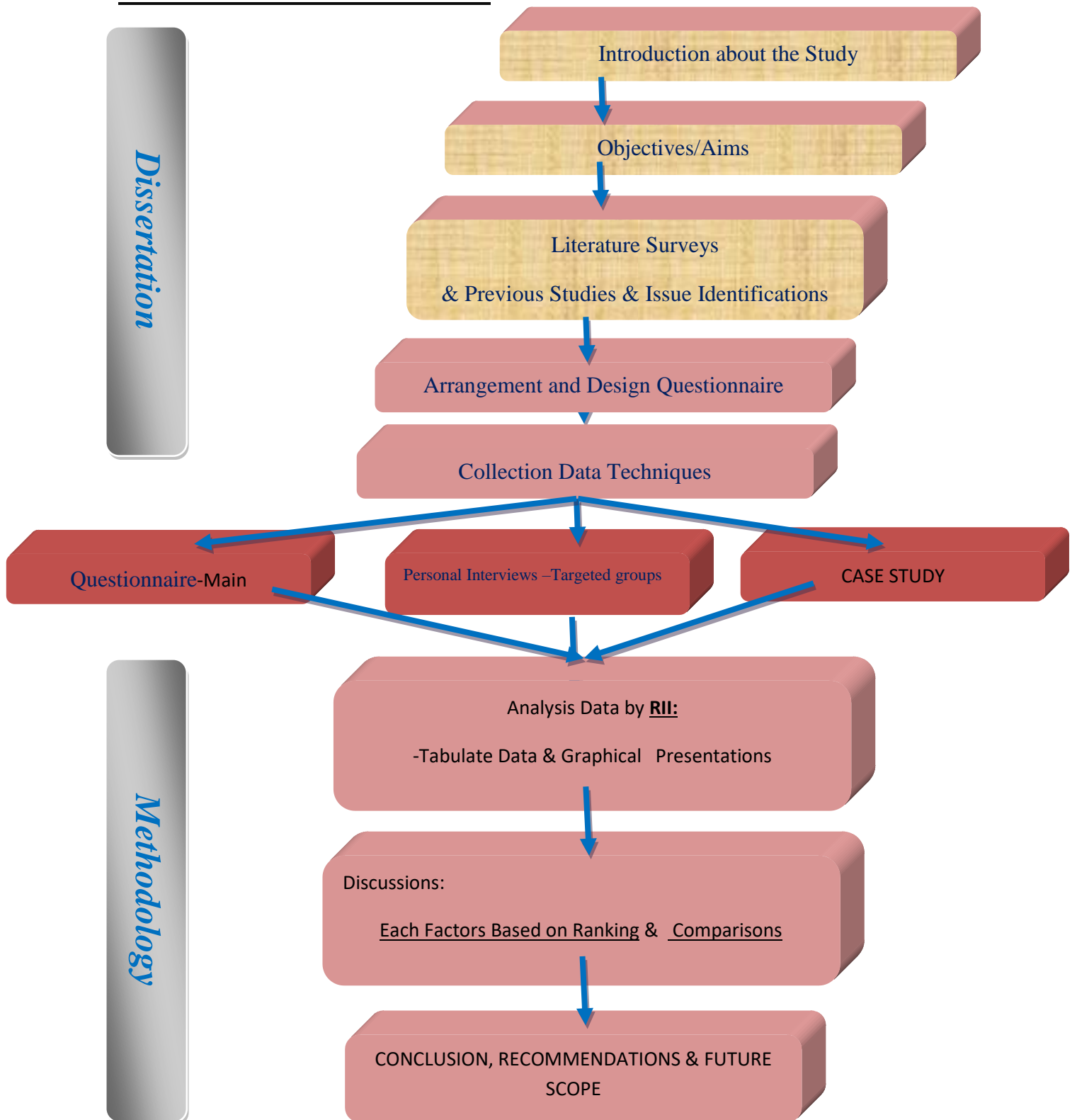
Discussions the results based on rankings of each factors, draw Ishikawa diagram, Comparison with Previous Studies

**6. Chapter Six:** Scope of Statistical test,

**7. Chapter Seven:** Conclusions and, required action s to improve labor productivity.

**8. Chapter Eight:** Future Scope within Recommendations.

## 1.6-Flowchart of the Dissertation



**Figure 1.1: - Flowchart of the Dissertation**

**CHAPTER.**

**TWO**

**“LITERATURE REVIEW”**

## **2. LITERATURE REVIEW**

This chapter of the study is included the survey process about the various aspects through the literature review and previous studies to reach to different opinions and ideas from other researchers and authors about the effects/impacts on labor productivity.

### **2.1- Reviewed Labor Productivity from Different and Previous Studies**

There are numerous studies have covered labor productivity during past years that reflect the highest importance and impact of labor productivity in the construction fields.

The following previous studies dealt with labor productivity in different levels:

#### **1<sup>th</sup>) Makulsawatudom and Emsley (2002):**

Past studies and research show the number of factors making an impacts on productivity, there are still unknown factors required to be further studied even in developed countries.

#### **2<sup>th</sup>) Polat and Arditi (2005):**

Their study stated that policies to raise productivity are not always same in each country. Their study arranged variuos factors affecting labor productivity and listed out these factors based on to their characteristics likes, design, execution plan, material, equipment, labor, health and safety, supervision, working time, project factor, quality, leadership and coordination, organization, owner/consultant, and external factors.

#### **3<sup>th</sup>) Thomas and Sakarcan, (1994):**

Built an ideal to describe the factors affecting labor productivity. In the model, two groups of factors determine the productivity, performance, work environment, and task to perform.

Work-environment factors refer to how well a job is organized and accomplished. Work to be done, or work content, relates to work required to perform and includes physical components of work, specification requirements, and design details.

Past study stated that tasks finished could make impacts on the labor construction resources by percentages: 15%, as works environment can make impacts on labor requirements by an extra

additional 25%. According to this indicator, there are more specific issues had been done through some researchers.

4<sup>th</sup>) Survey techniques and interviews state the standard methods/techniques that have been used in many and various studies about construction labor productivity. As in the following past studies:

- **(Lim and Alum 1995)** Conducted a survey of top construction contractors to identify the factors affecting productivity in Singapore.
- **(Portas and AbouRizk 1997)** achieved a questionnaire of superintendents and project managers to find out all possible factors associated with productivity. An interview conducted with contractors stated that weather and material delivery were the main adverse factors for site productivity **(Hassanein and Melin, 1997)**.
- A questionnaire identified: rework, material problems, tools, heavy-equipment availability, crew interference, overcrowded work areas, instruction, quality-control inspection, and management interventions as the main factors affecting craftsman productivity and motivation **(Chang and Borcharding, 1985)**.
- There is another survey with construction personnel **(Hanna and Heale, 1994)**: it was involved to gauge their opinion about the field of construction, specifically their knowledge about the factors that most impact on construction productivity. Based on a result, a set of comprehensive factors was recognized and grouped six: contract environment, planning, site management, working conditions, working hours, and motivation.

## **2.2- Impact of the different factors from previous studies on labor productivity:**

Logically and in general visions from any technical researches shows that productivity is the result/outcome of several associated factors and in the same time those factors are associated with different levels of production and they are impacted on the productivity levels as in construction sectors.

The various factors affecting labor productivity and reviews from past studies. As those previous studies has been discussed them as in the following:

- i) **Time Aspects:** During sequences of activities in construction projects, there are many duties and events which cause a loss of productivity such as work overtime. The most frequently shown reasons are fatigues and its impact on health of construction workers and increased absenteeism; decreased morale; reduced supervision effectiveness; poor workmanship, resulting in higher rework; increased accidents (Horner and Talhouni, 1995). Also time aspects are included overtime and its impact on construction labor productivity.
  
- ii) **Levels of Schedule Compression:** When there are any early delays in a construction project, compression of period/time frame for a later activity is often the tool to recover interruptions and to finish the specific task on schedule. Based on professional point of view, schedule compression may be possible without accelerating individual work activities by utilizing float in the project's overall schedule. Schedule compression, when linked with overtime, often results in major productivity losses due to shortages of material tools or equipment to support the extra labor's, resulting in difficult for planning and coordinating the task, and unavailability of experienced labors (National Electrical Contractors Association, 1983).
  
- iii) **Category of the project and its type:** To achieve essential productivity, every construction workers of a crew requires enough space to carry out task without being affected with the other crew staff. When more labors are pertained to do specific task/duties, in a fixed amount of space, it is probable that intervention may happen, this lessening in construction productivity. Additionally, when there are multiple projects and tardes are assigned to work in the same area, the probability of interference increment and construction productivity may be minimized. Interference among the different crews and construction workers is due to mismanagement on sites of any construction projects.
  
- iv) **Safety Procedures and Plans:** Accidents have high impacts on construction labor productivity. Various accident types happen at the construction site, such as an

accident causing death and resulting in a total work stopping for a number of days. Small accidents resulting from nails and steel wires can stop work and, thus, decrease productivity (Sanders and Thomas, 1991). Even insufficient by using plan of lighting shows decreased construction productivity because enough lighting is wanted to task efficiently and because insufficient lighting aspects has negative impacts. Employing a safety focal point or advisor assist workers to observe the required safety plans/regulations/instructions and to follow them, which can minimize the number of accidents, then to increase construction productivity.

- v) **Quality Aspects:** Inefficiency of construction equipments and poor quality of the raw materials are factors which cause low construction productivity. The construction productivity rate of ineffective equipment is low. Old construction equipment is subject to a large number of breakdowns, and it takes a long period for the laborers to finish the required tasks and work, thus reducing in construction productivity. Bad and poor quality material used for any construction activities and work is the other factor because poor constructions materials mainly lead to wrong work and can be unacceptable by client's supervisors, thus reducing the productivity aspects.
- vi) **Managerial Criteria/sub criteria:** Construction managers' experiences, skills and attitudes have a importance bearing on construction productivity. In many construction firms, productivity is not meet with required level and it become low even though the modern technology and trained workers are made available in those firms. Low productivity is because of inactive and incurious management aspects. Experienced, Committed and wide knowledgeable manager in construction field can obtain amazing outcomes from average people. Management level is the motivation to create both ability and willingness to do the works. Advanced technology demands best experience and knowledge from any operators who, in turn, work productively under professionally qualified direct managers. It is only through management aspects that optimum utilization of technical and human resources can be guaranteed.



- vii) **Manpower/ human Factor:** Previous studies and literature show that a lack of labor experience is the factor which makes negative impact on labor productivity and guide that, to reach good construction productivity aspects, labor can reflect an important role. Contractors and sub contractors at any site of project should have completely enough skilled laborers employed to be productive. If skilled labor is unavailable in that particular areas of work and a contractor is required to finish specific task or events with lower in skilled and experienced labor, it is likely that construction productivity will be affected. The privation of any crew member may influence the crew's production level because construction workers will be unable to match with the same production levels with fewer resources and with different crew members. Other human sub criteria likes misunderstanding among laborers produces disagreements and disputes about responsibilities and creates confusion among laborers, which direct to non-accomplishment the required work decreases labor productivity levels. Weak in levels of compensations and increments of laborer age negatively impact on labor productivity because labor speed, agility, and strength decline over time and reduce productivity (Heizer and Render, 1990).
  
- viii) **Motivation Factor:** Each contractor should have a plan about how to motivate their construction workers. Motivation is one of the significant techniques and factors affecting construction labor productivity. Motivation can best techniques which can be used in better way when labors personal aspirations are same to those of the construction firm. Factors likes a lack of financial motivation procedure and payment delays, non-provision of proper transportation, and a lack of training sessions are grouped in this topic (DeCenzo and Holoviak, 1990).
  
- ix) **Construction Supervision Methodology:** Mainly, any construction projects consist of design stages, drawings and technical specification and it may change during construction/executing stages. When detailed drawings or technical

specifications are with some wrongs and unclear construction productivity is anticipated to reduction since laborers in the sites are fuzzy about what needs to be finished and achieved... Those will leads to make delays in that specific task, or have to be fully stopped and defer it until obtaining clear orders and instructions. There is a 30% loss of productivity when work changes are being performed (Thomas et al., 1999). The inspection process for construction work by the direct supervisor is a major issue to proceed. For example, the contractor or subcontractors cannot pour concrete before an inspection of the all associated items with concreting activity such as checking formwork and verify steel work, thus impacting on labor productivity. (Zakeri et al., 1996). With non-achieving of the required work according to plans, technical specifications, detailed layouts and drawings, supervisors may submit a request for the rework of a specific activity. Technical supervisors' absenteeism prevents the work completely for activities that require their attendance and notices in the field, such as pouring of concrete and backfilling activity, moreover delaying inspection process of the finished and achieved work which, makes delays in starting new construction activity.

- x) **Material management/Tools:** Material management aspects is one of the most serious factor in construction sector so many construction players put this factor in their top priorities to avoid its negative impact on construction labor productivity. In the construction projects, each task in construction process can be affected if the required resources such as construction equipment, tools, and materials are not available in required time and in specific site. Thus construction productivity can be affected too much in non-availability of required resources in the required time and location. The contractors or subcontractors should have proper plans and clear procedures about selection suitable construction equipment and tools to minimize their impacts on labor productivity. Construction managers have to have good knowledge and well-experienced about sizes and amounts of required equipment to ensure increasing the levels of production of site-jobs. Selection appropriate construction equipment to do better site-job according to the particular conditions

in the site of project. Selection criteria should subject to many checks and inspections from project managers and direct supervisors at least twice per week.

- xi) **Project Management Factor:** Correct scheduling of work should be done via project manager. Improper scheduling of construction work, unready and lack of required construction equipment or labor may lead to the losses of productivity in stages of executing. Incorrect planning aspects of project initially generally may result lost labor productivity and create many problems for all construction partners. Prepare perfect site layout can help in increasing labor productivity. Non-available correct site layout can create some problems in site of the project and reflect negative impact on labor productivity because of poor sequences of equipments, construction workers, paths of materials. Poor site layout refers to incorrect in locations of workers' rooms,exits to site and entrances, restaurant and rest rooms..etc.
- xii) **Natural Factors:** Natural factors create many problems in so many construction projects and it is impact on labor productivity according to collection data from previous studies.  
The factors such as: minerals, water and fuel can affect construction productivity to assure extent.
- xiii) **External Factors:** External factors likes government laws, weather changes, payment delay, uncompleted drawing and variation in detailed drawing are significant factors to consider for finishing of any construction project at the required time and match completely with objectives of client. For examples, variation in temperatures, rains and wind speeds can affect labor productivity. The external factors may lead to stop the works in the site of construction totally or postpone some critical activities. In this case these factors can put the construction firms in trouble because time is pass and non progress in the site.

### **2.3- Arrangement and identification various factors affecting labor productivity in construction projects.**

According to the literature reviews, and past study surveys in section of the research can arrange the various factors affecting on labor productivity from previous studies. Some of the studies focused and measured by comparable factors and other confirmed some different factors. The factors arranged based on general criteria and no valuable consideration for this arrangement factor.

As in the table 2.1. Which Shows, the arrangement and identification the various factors from (*previous studies*):

**Table 2.1: arrangement and identification the various factors from (*previous studies*):**

<b>Serial No.</b>	<b>Impacts of general factors on labor productivity in construction projects from previous studies.</b>
1	Absenteeism from work
2	Governmental regulation, instructions and laws
3	Specification, Technical details and Drawing during implementation stage
4	Increasing numbers of construction workers
5	Variation in technical drawing
6	Quality Required in the construction works
7	Accidents in construction works
8	Impact of Equipments and construction tools (inefficiency)

9	Delay in Inspection process
10	Weak in transportation means
11	Construction methods
12	Types of structure of construction firm
13	Negative Impact of Financial motivation System
14	Lack of labor experience
15	Disloyalty
16	Complex in construction Drawing
17	Lack of availability of periodic meeting with construction workers
18	Lack of competition among laborers
19	Labor personal problems
20	Lack of Training Sessions
21	Misunderstanding between construction workers and supervisors
22	Misunderstanding among laborers
23	Low quality raw materials

24	Payment Delays
25	Supervision absenteeism
26	Rework
27	Misapply in time schedule
28	Shortage in availability of tools and equipments
29	Lack of Safety precaution in site of project
30	Unsuitability of materials storage location
31	Shortage in numbers of workers
32	Type of activities, events in the project
33	Working overtime
34	Impact of hourly wages
35	Practicing of the construction works at high places
36	Contractual methods
37	Changing of weather conditions
38	Miscommunication between workers and direct technical supervisors

## **2.4- Critical Factors Affecting Labor Productivity in Construction Projects**

- According to the study which achieved by (*Mistry Soham, Bhatt Rajiv, 2013*):

They confirmed about their outcomes and conclusion through the case study in South Gujarat Region of India that some critical factors (Total 51 feedbacks). They analyzed those feedbacks by using two tools: the Analytic hierarchy process(AHP) and Relative Importance Index(RII) techniques. From their study, total 27 factors were identified which affects labor productivity in construction projects in India. 51 feedbacks from various civil contractors were collected to identify critical factors by two techniques: AHP & RII. RII Technique gives first 5 crucial factors as: (1) Payment Delay, (2) Skill Of Labour, (3) Clarity Of Technical Specification, (4) Shortage Of Materials, (5) Motivation Of Labour.

AHP Technique gives first 5 critical factors as: (1) High/Low Temperature, (2) Rain, (3) High Wind, (4) Motivation of Labour, (5) Physical fatigue. The main outcomes from this study denote that there is a discrepancy in critical factors ranking by two methods. RII technique has confirmed to first rank to delays in payments while AHP technique shown first rank to high/low temperature. Contractors must be take high actions on these factors to enhance and improve in construction labor productivity which ultimately can help to get higher benefits from their contributions in the construction projects.

- **The study (Sherif M. Hafez, Remon F. Aziz,.. et al, (2014):**

They focused through their contribution in their research on some: Critical factors affecting construction labor productivity in Egypt, The understanding effect of each of the 27 factors reconnoiters on construction labor productivity in Egypt is specified. The overall factors are categorized under four main criteria/categories as follows: eight, under the “Technological category”; four, under the “Human category”; eleven, under the “Management category”; and four, under the “External category”. The table below shows the different critical factors which impact on construction labor productivity from past studies.

**Table 2.2: Impacts of Critical Factors on Construction Labor Productivity.**

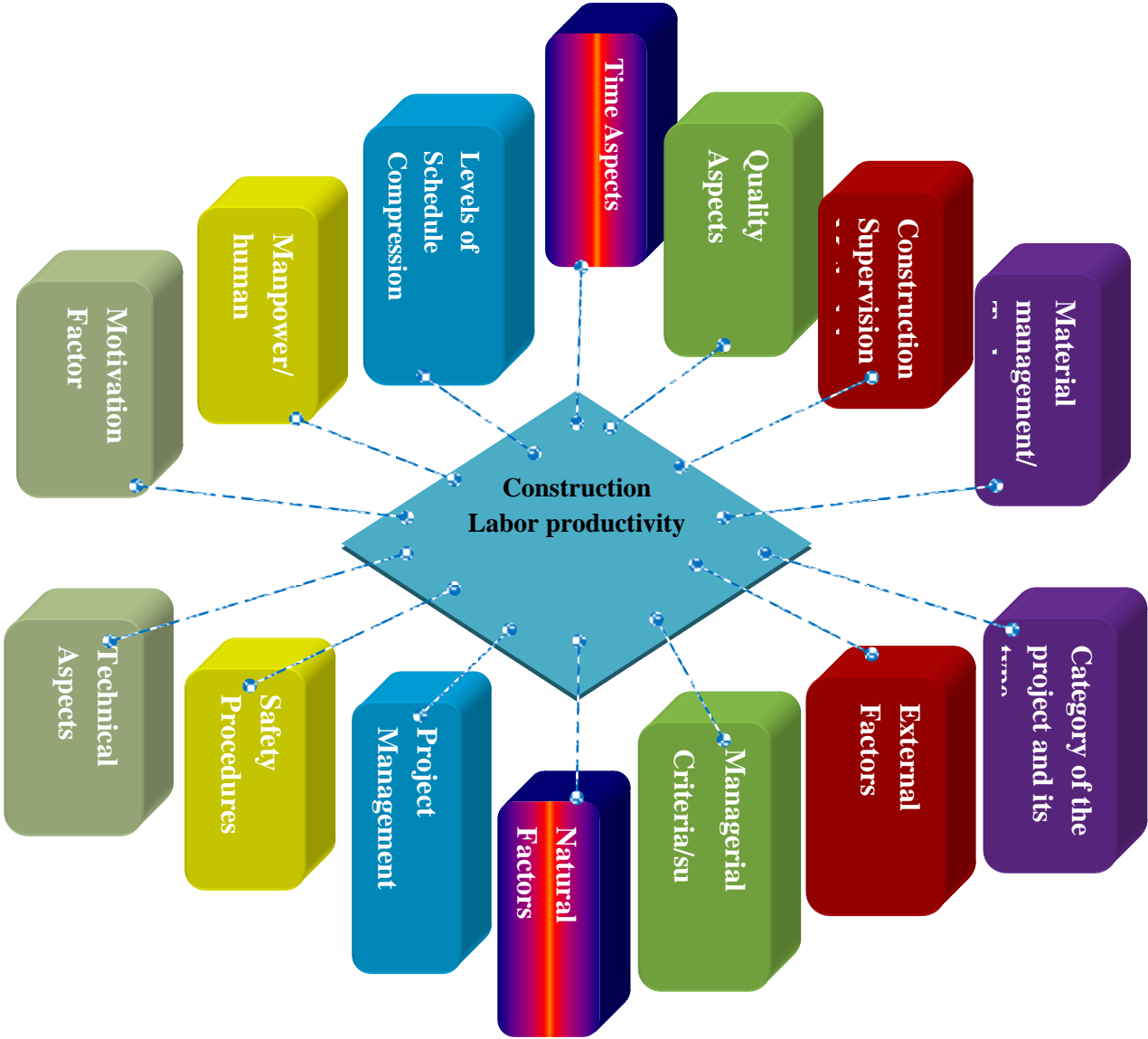
<b>Serial No.</b>	<b>Impact of critical factors on labor productivity from past studies</b>
1	Payment Delay
2	Skill Of Labor
3	Clarity Of Technical Specification
4	Shortage or un-available of Materials in the site of construction projects
5	Motivation of Labour
6	Variation in temperature
7	Rain impact factor
8	High Wind Speed
9	Site Management method
10	Physical fatigue
11	Technological category factors
12	Human/ workforces factors
13	Management factors
14	External factors

The range of impact above critical factors are various from country to others and from area to others.



**2.5- Outline from Previous Studies and literature Surveys:**

During the surveys on various articles and the previous studies about different cases of labor productivity in some countries and various construction locations. It can show that there are many factors impacted on labor productivity. The next figures illustrates those factors are associated with construction labor productivity and it gives us a precious idea about those factors.

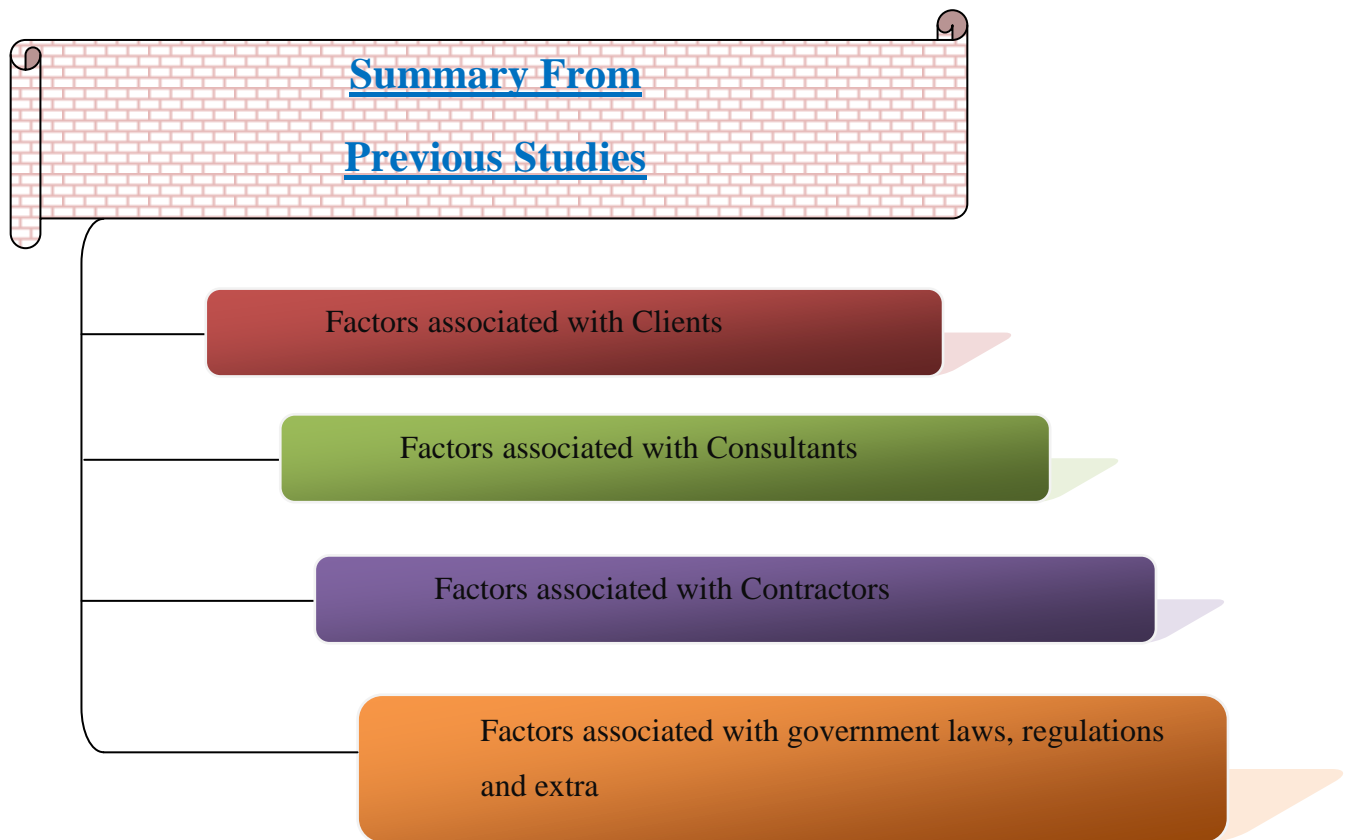


**Figure 2.1: illustration and Presentation of Various Factors impact on Labor Productivity**

Some of those factors are associated with three main contracting parties (3 Cs) they are:

1. Client
2. Consultant
3. Contractor

And other factors are associated with government laws, regulations and extra. The next figure displays the above summary:



**Figure 2.2: Summary from previous studies**

### **2.6- Background about Construction Labor Productivity:**

In this section of the literature reviewed, this study focuses on the different definitions of labor productivity, labor productivity formulas and its calculation aspects which usually used by

contractors, subcontractors on the project sites. Also, this section confirms and reflects the importance of labor productivity in general construction industries and its importance in Iraq.

### **2.6.1- Definition Aspects of Labor Productivity:**

Labor productivity has been defined in the literatures reviewed as:

*“The ratio of the output quantities to the input work hours”*

Or

As *“ratio of the work hours to the quantities (also called the unit rate)”*

The definition of its prior is shown and briefed as follows:

The formulizations of construction labor productivity can display in many routes and ways. As in construction events, productivity is usually matched with the meaning of labor productivity that shows:

$$\text{Labour Productivity} = \frac{\text{Output Quantity (M}^2\text{)}}{\text{Work hours (whr)}}$$

*Units of work placed or produced / manhour.*

The second formula is an inverse of the previous one “man hour per unit rate” is also commonly used. However, productivity is the ratio of output to all or some of the resources utilized to generate that output. Production is related with consumed resources directly to in any route and discipline of production levels. Resources used comprise: capital of work, labor, any types of energy, used raw materials in any production aspects and process, equipments utilized etc.

**Formulization of Productivity typically as in the following:**


$$\text{Output} / \text{Labor cost}$$


At any site of the project, the contractors and subcontractors are used in their calculation aspects the following labor productivity forms as in the below figure:

$$\text{Labor Productivity} = \text{Output} / \text{labor cost}$$

Or

$$\text{Labor Productivity} = \text{Output} / \text{work hour}$$

The previous literature reviewed showed no standard definitions about labor productivity in construction projects. The construction contractors and subcontractors are interested almost to use both previous formulas in their works.

Then, the inverted forms of labor productivity can be shown:

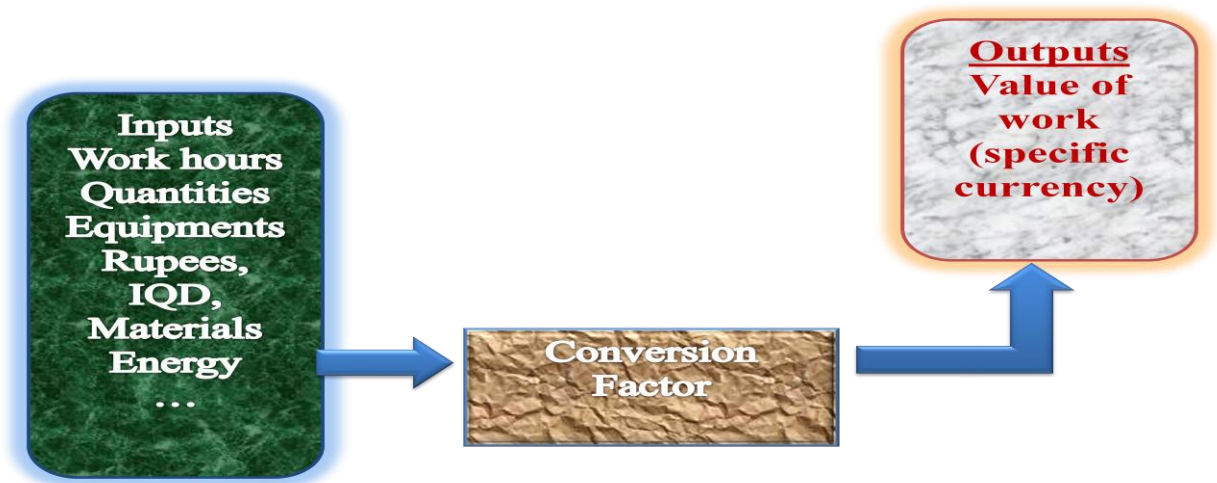
$$\text{Inverse formula of labor productivity} = \text{Labor cost}$$

Or

$$\text{Work hour} / \text{output}$$

### 2.6.2 Productivity Calculation Aspects:

The current part of the study shows the various aspects of calculation productivity as in the following description of the portrayal below:



**Figure2.3: Productivity calculation aspects**

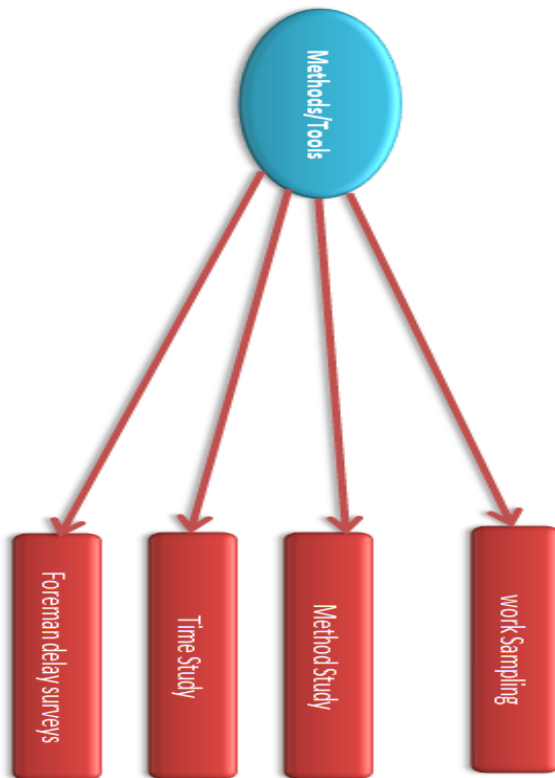
*Note: Specific currency such as Rupees, US\$, Iraqi Dinar.*

### 2.6.3-Tools and Methods to Identifications construction Labor Productivity:

While there are some tools used for identification and matching labor productivity. These methods can support the ways for improving labor productivity in any construction and civil works. And these tools/methods can help the contractors to understanding the production sequences in their projects, then to put valuable plant for enhancing levels of construction productivity. As in the following sketch which shows these main methods/tools:

1. Work Sampling
2. Method Study
3. Time Study
4. Foreman Delay Surveys

Note: the sequences of each above methods are various among them.



**Figure 2.4: four main methods to match Labor Productivity.**

### **2.7- Importance of labor productivity:**

Labor productivity is one significant parameter which makes contractors and subcontractors more worries about productions of their workers. The contractor give high priority to labor productivity, this reflect how its importance to them and their profits. The following explanation shows a part of the importance of labor productivity in this section of the study.

#### **2.7.1- General Importance of Labor productivity based literatures reviewed:**

Many past studies mentioned different level of importance of labor productivity. In construction sector, labor productivity has a large impact on contracting parties' importance and it reflects a major importance for contractors, subcontractors, owners and engineers in any construction project.

It is necessary to make sure that a reduction in productivity does not affect the plan and schedule of the work and does not make delays. The outcomes of these delays could result in serious money losses. Further, considerable cost can be saved if productivity is improved because the same work can be done with less manpower, thus reducing overall labor cost (*Thomas, 1991*).

One of the significant issues reflects the importance labor productivity in construction projects that is quality. Contractors, site engineers at any construction project give the highest and top priority to labor productivity to make sure that they will reach to required quality for each item according to technical specifications and drawing and others related with quality aspects in construction projects.

Contractors, subcontractors deal with labor productivity in high level of importance to make sure their projects under control as they planned for that in the first stage of construction site works.

The points below reflect a general importance of labor productivity:

- i) Main tool and vital method for any construction firms for measuring performance and put suitable plan for improving it in the construction industry.
- ii) Due to the importance and huge size of construction industry productivity trends carry huge consequences for the economy as all.
- iii) Productivity growth is necessary for both firms an individual and an industry or an economic sector.
- iv) In fact, there are many challenges in the construction works. One of the valuable and worth facts is that how to create and rise the levels of production and increasing of opportunities for productivity improvement aspects in any construction location in the world.

### **2.7.2- Importance of Labor Productivity to Construction Projects in Iraq:**

In Iraq, construction labor productivity is highly important matters in construction projects. The local contractors and subcontractors are suffering from instability in the production of the construction workers because many reasons are affected on their level of production. Those factors may cause losses in productivity and make a hug impact on the profits level of construction firms inside Iraq.

The points below refer to the outline of the importance labor productivity in Iraq as these point detail in the following:

- Important tool and method which help construction firms in Iraq for measuring of workers' production in construction sites.
- Give a real idea about the level of production to all contracting parties in any construction project.
- Reflecting of the size of profits for individual companies and industrial companies in construction sectors.
- Supporting the local contractors and subcontractors for measuring and evaluating performance of productivity for workers and put useful plan for improving construction productivity.
- Labor productivity is one of the necessary and scientific apparatus for creating valuable mirror about the base sequences of construction workers to avoid overlaps in the works for contractors in the construction sector.
- Contribute in keeping the production in continuous improvement level and help the local contractors to review the production level periodically that can assist the construction firms to understanding all aspects related with labor productivity.
- Labor productivity is making a great impact on the level of the construction industry and economy sectors.
- Through using developed technology and that will make perfection of labor productivity in the construction industry.
- Integrated tool for motivation workers to achieve their site-job in a perfect way.



- It is necessary for establishing wages and salaries data base about construction workers based on the types and natural of their tasks which they do it in the field of construction projects in Iraq.
- It is one of the many factors that help the contractors to select which project is to be suitable with their capacity.

## **2.8-Highlighting and Arrangement of “Human and External” Factors Base Literature Surveys:**

One of the objectives of this study is to identify and arrange “Human” and “External” factors. In order to match with this aim in this section of the research, we highlight and prepare these factors as in the next two tables orderly according to literature surveys on the previous studies and point of views of experienced engineers in the construction site of projects, local contractors/subcontractor and project managers..ect in Maysan city.

### **2.8.1 Human Factors**

Any construction company or organization considers their employees worthy assets and they try to make the best effort to keep their employees work in required production.

The productivity of any employee (workforce) is affected in some factors. These factors, as below are arranged to give a first impression with an explanation and clarification about each one.

**Table 2.3:-Explanations and identifications about list of human factors.**

Sr.	Human Factors	Explanation & Clarification of each Factors
1	Lack of experience	It refers to lack in level of knowledgement about the vocational and site required job , level of understanding such as technical works and others, and not enough skills lead to perform any job the project site unsuccessfully.
2	Misunderstanding among laborers	Creating a gap between the construction workers in the site of construction projects.
3	Disloyalty	This factor refers to the workers whom work in any construction organization should be in a high level of loyalty in the jobs.
4	Age	Ages of construction workers are always the normal range of the construction workers are from (18 years to 50 years) specially in hard work or tasks in construction projects.
5	Personal Problems	When minimize this factor, then achieving better work
6	Lack of competition between workers (laborers)	If there is more competition among laborers that will lead to obtain the required level of productivity and increasing it from time to time while the completion is available for long periods between workers.
7	Alcoholism	This factor is prohibited based on Human Resource manual and instruction of all construction companies, but some workers use alcoholism during the night that may affect on their production at the next day.
8	Absenteeism	If any worker reaches absently to the site of work, then this negative point about him.
9	Work overtime	Any workers are working extra hours or increasing the numbers of regular hours during working shifts, then that will overtime, which is exceeded on normal working hours per day.
10	Work accidents	It is refers to all accidents which may happen to any workers in the site of construction projects.

### 2.8.2 External Factors:

Productivity factors are classified into two categories (Olomolaiye et al. 199): external factors, the ones outside the control of the organization management and internal factors related to the productivity factors originating within the organization. The study dealt in (Questionnaire attached) the following external factors as these factors were outside of the control of any construction company. **Table 2.4:- Explanations and identifications about list of External factors.**

Sr.	External Factors	Explanation & Clarification of each Factors
1	Reworks	Making of proper step for correction of any construction failure, defects, non-conforming, and follow up all drawing, technical specification to meet with required quality.
2	Implementation of government laws	Follow up all the required instructions and regulations which come from local governments or central government.
3	Supervision delay	It refers to any order circles from direct supervisors or from top managements supervisors and it includes client's supervision in some site of construction projects.
4	Inspection Delay from authorities	When authorities inspect any construction works not in the required time and in scheduled periods.
5	Variation in the drawings	If there are any variations in drawing or differentials which happened almost between contracted drawing and the drawing provide to builders during phase of executing via clients' engineers or consultants or both of them.
6	Complex decision in provided drawing	It refers to how the decision is important in any construction activities and tools such as in labor productivity.
7	Incomplete drawing	Not finishing the required drawing in the time, then that will lead to impact on labor productivity.
8	Payment delays	Not paid the wages, salaries, bonus for workers via local contractors or subcontractors.
9	Design changes	No changes in design, then no waiting for executing construction items.
10	Training sessions	It supposes to do the planned training sessions in each quarter for targeted workers to minimize the lack of training sessions.
11	Weather conditions	It is one of the most out of control factors which includes variation in temperature, rain levels.

**CHAPTER.**

**THREE**

**“RESEARCH METHDODOLOGY”**

### **3. RESEARCH METHDOLOGY**

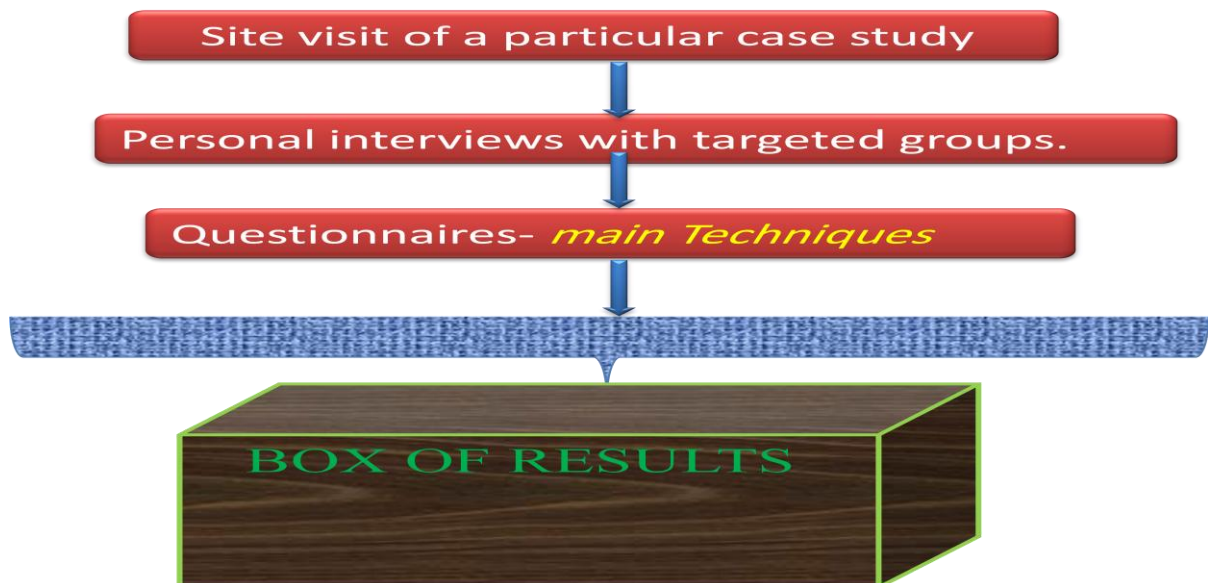
So many researchers are used in their research methodology aspects in the previous studies on survey questionnaires, direct interviews, studies one or more case studies from specific region. They are interested more about the collection of data stage to ensure that they can reach to their objectives in excellent ways. This chapter gives full idea about all required steps during research methodology to ensure meeting with all objectives of the study.

#### **3.1- Stage of Collection Data:**

The following methods are the main tools using in collection data stage or step as in the below:

- A) Site visit of a particular case study to obtain feedbacks and opinions from experienced engineers, contractors, and subcontractors. The case study and impression of the mentioned group is supported this research to identify and list out “human and external factors and understand the main conditions around construction workers to involve in the research.
- B) Questionnaires.
- C) Personal interviews with targeted groups.

The following diagram shows the above three steps during research methodology:



**Figure3.1: Diagram of three main Steps of Collection Data:**

Mainly the questionnaire method was used. It one of the appropriate and effective techniques for data collection from specific areas of the study and identify the rank of each factor. The questionnaire method is prime and first step is to display the negative impacts of the mentioned factors in this research. The study started on collection the most importance/significant factors to show their impact on labor productivity and highlight and arrange them under the groups of (Human and External) factors. A questionnaire had been prepared to deal with the issues associated with labor productivities and the point of views of (consultant, experienced engineers, contractors, subcontractors, and project managers) to meet with conditions of construction works in specific region “Maysan” town in Iraq.

### **3.2-CASE STUDIES:**

To achieve and match with main objectives of the study , the site visits to case study was done to observe some the conditions of workers and make interviews with targeted groups as part of survey process. One of the important thing is to support the study via obtaining of impressions and opinions of experienced engineers and contractors which through the current case study. All of these issues will assist to establish valuable actions required to improve construction labor productivity and presenting a clear and easy understanding conclusions. To reflect high contributions through the study to construction firms and their technical staffs in sites of construction projects.

The case study refelects as in the following the main and general information that is reltaed with site of the project and information as part of the study.

To identify and study the impacts of “human and external factors” on construction labor productivity, so this study is included the case study to give clear, reasonable an ideas and point of views about these factors and its impact on labor productivity through studying of production size of construction workers in concreting activity and brcklayering in the site of the following case study.

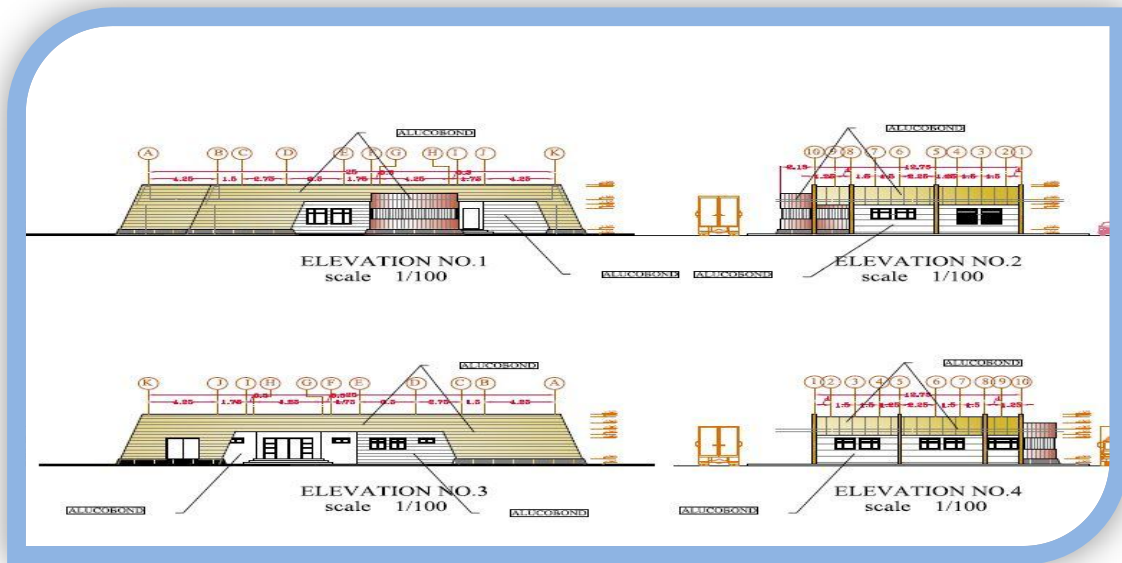


Figure3.4 :Drawing (A) of the project

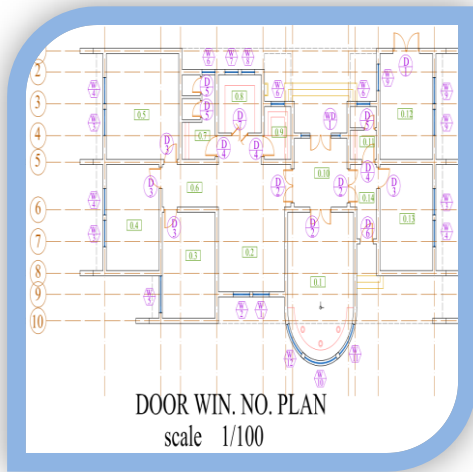


Figure3.5 : Drawings (B) of the projects

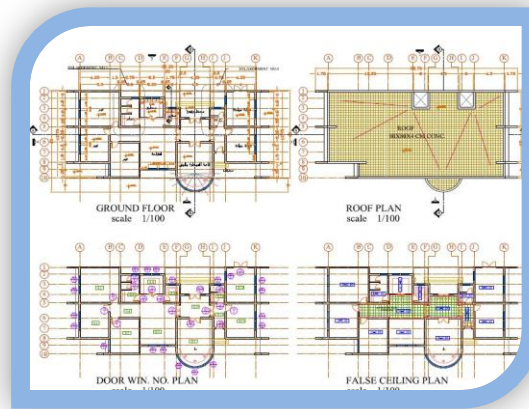
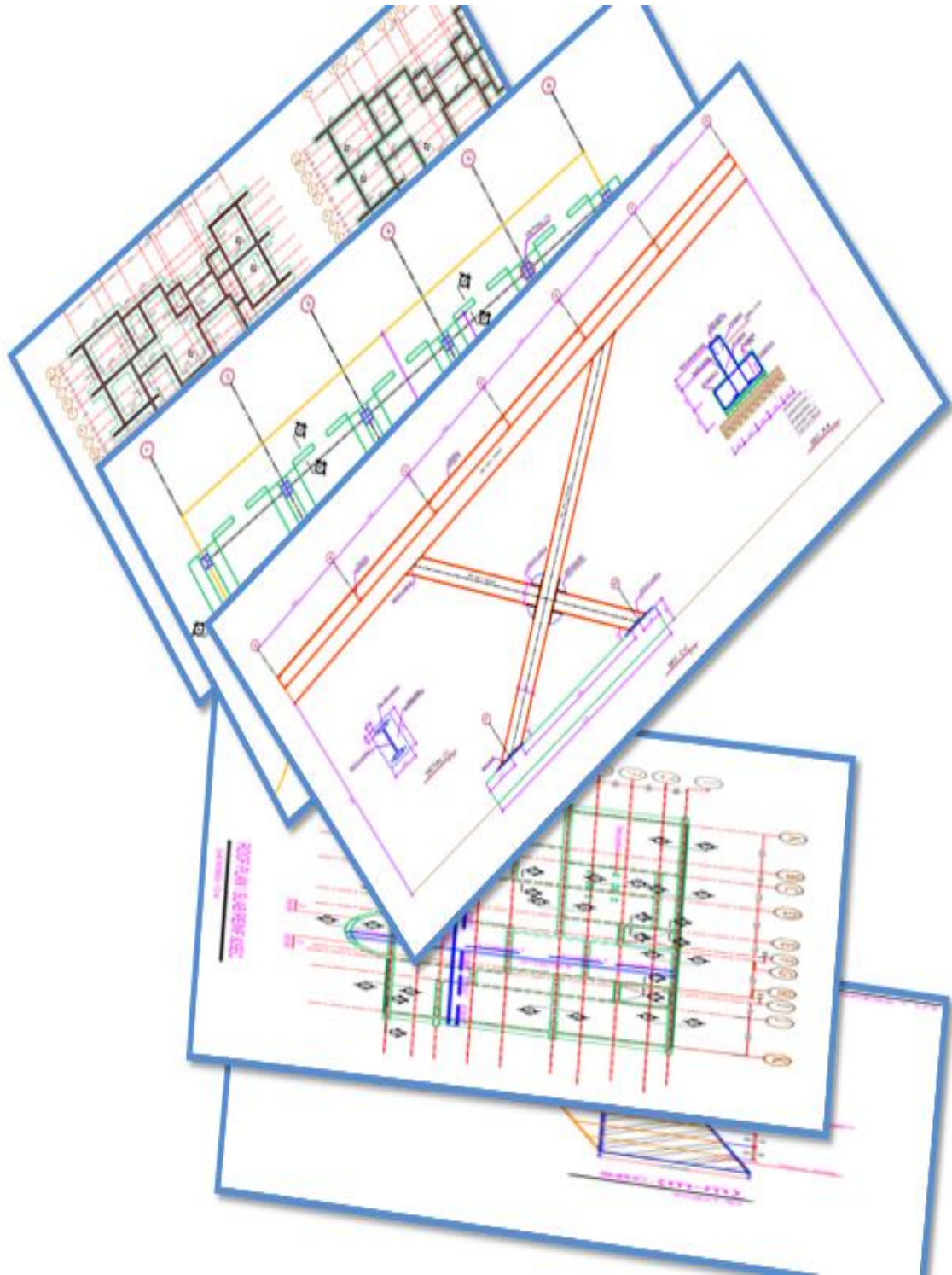


Figure3.6: Drawings (c) of the projects



**Figure 3.7:Drawings (D) of the projects**



### **3.4.3- Situation around Construction Labor Productivity :**

#### **1. Construction Conditions and Site's Details of the project:**

As shown in the table below :

**Table 3.1: Construction Conditions and Site's Details of the project**

<b>Technical and Non-Technical Information about the site of the projects</b>
Summarizing about the job description under observations: It is one of the high important activities which it need checking to meet with quality required to avoid negative impact of human factors and external factors. Also these activities depend on both skilled and unskilled workers and it need no. of workers in the site to make sure do it in the time.  } <b>Concreting activity for the 1<sup>st</sup> floor.</b>
Total Staff in the site during the site visit : <b>28 (skilled and Unskilled )</b>
Number of Skilled workers : <b>9 workers</b>
Un-skilled workers: <b>19 workers</b>
Experienced Engineers: <b>5 (male engineers)</b>
Subcontractors & suppliers: Five
Details of subcontractors and suppliers: <b>2(Cement Supplier), 1(Sand and Gravel (supplier) ), 1(steel bars supplier), 1 Water supplier</b>
<b><u>Weather condition in The Site of the project:</u></b> Site condition: is normal and average during the Summer Season Temperature: average in the site of project during June & July (30° to 47° ) Rain: No rain available during summer season

**Safety :** *Safety partially apply*

**Main equipment used:**

Shovel

Backhoe

Excavators

Compactor

Concrete pump

Patching Plant &

Concrete Mixture Machine

Track-Type Tractor Dumper Truck

Generator

Lifter

Small construction equipment (hand trucks, Drivers, drill, cutters, Grinders, vibrators, water pumps ...etc)

*Bearing capacity of soil*

*Natural ground Level for :*

*Yard & Roads assume as (0.00).*

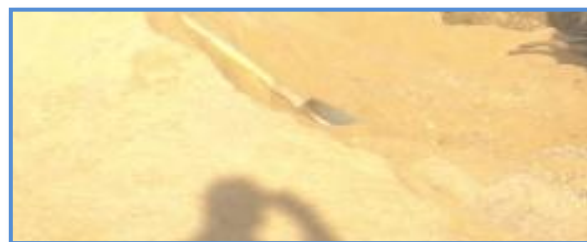
B.C=5 Tons

**Materials Used :**

For Casting Concrete “The reinforced concrete mix proportion (1:1.5:3).

Natural Sand. Photo show sand in the site:

- **Natural Angular Gravel and Sand**



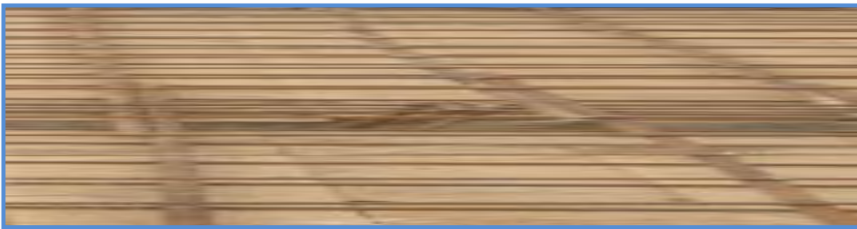
**Figure3.8 : local materials used in the project (Sand and Gravel)**

- Cement bags



**Figure3.9 : Cement used in the project**

- Steel bars in different sizes and dimensions:



**Figure3.10 : Details of steels and framework in the site of project**

- Pure water
- Wooden

**Some details about Subcontracting:**

a. The Contractor shall sub-contract the works to a third party only with a prior written approval of the Client , unless plans for sub-contracting a part of the works have been disclosed in the Contractor’s accepted bid. The sub-contracting of the works or a part of the works to a third party shall not affect the contractual relationship and mutual obligations between the Contractor and the Client , nor shall it release the Contractor from any liability under the Contract.

b. The Contractor shall ensure that all terms and conditions of this Contract are transferred to contracts with sub-contractors and shall be responsible for any default or neglect on the part of sub-contractors. The Client shall have no contractual relationship with the sub-contractor and any official correspondence and/or binding instructions will be between the Organization and the Contractor only.

Concreting Activity Verifications and Inspections:	Details of the Point which need for verifications them by using ( CONCRETE INSPECTION RECORD) as in the following details:
	1. Verify grounding/earthling
	2. Verify embedment’s in place i.e. pipes, conduits
	3. Verify anchor bolts fixed, measured and greased - taped off Material certificates checked, if applicable
	4. Verify template (vessels, columns)
	5. Verify weather protection
	6. Verify curing duration and finish
	7. Verify design mix
	8. Verify test cube taken.
	9. Patching/Pointing
	10. Saw cut joints, Install joint sealant
	11. Application if hardeners or dust proofing
	12. Pour date & Formwork remove date, & Pour accepted

**Forms required during concreting activity:** The forms were used for concreting activities as in the following points:

- ❖ PRE-CONCRETE CHECKLIST FORM: as in the below

PRE-CONCRETE INSPECTION CHECKLIST			N71001
Tag Description:		Tag No.:	
Subcontract No.:	Inspection Classification		Turnover System:
Contractor:	Contractor	<input checked="" type="checkbox"/> Client	Sub – System:
	Company	<input checked="" type="checkbox"/> Other	Location:
Concrete Structure/Location: <u>Stairs No.1 part (1)</u>		Equipment/Structural Steel Drawing No. _____	
Referenced Drawings: <u>s-1146 sh. 2</u>		U/G Electrical Drawing No. <u>N/A</u>	
Concrete Rebar & Embed. Drawings No. <u>s-0021 sh. 6</u>		U/G Mechanical Drawing No. <u>N/A</u>	
<b>1. Forms</b>		<b>3. Sub-Foundation</b>	
<u>Yes</u> Survey Checked	<u>N/A</u> Piles	<b>5. Misc.</b>	
<u>Yes</u> Orientation	<u>N/A</u> Compaction	<u>N/A</u> Keyways	
<u>Yes</u> Location (Coord)	<u>N/A</u> Cleanliness	<u>N/A</u> Blockouts	
<u>Plywood</u> Size	<u>N/A</u> Moisture	<u>N/A</u> Surface Roughened	
<u>4.05</u> Elevation	<u>N/A</u> Blinding Layer	<u>N/A</u> Bonding Agent	
<u>Yes</u> Clean And Oiled	<u>2.1</u> Elevation	<u>N/A</u> Type Of Finish	
<u>N/A</u> Chamfer	<u>N/A</u> U/G Mech. & Elect	<u>N/A</u> Sets/Test Specimen	
<u>Yes</u> Straight, Level, Plumb	<b>4. Embedment</b>		<u>N/A</u> Hot/Cold Weather Protection
<u>Yes</u> Adequate Bracing	<u>N/A</u> Anchor Bolts (Diameter, Length, Type)	<u>N/A</u> Joints	
<b>2. Re-Bar</b>		<u>N/A</u> Special Placing Equip. Required (Tremies, Pumps, Form Vibrators Screens)	
<u>02</u> Grade	<u>N/A</u> Anchor Bolts (Location, Projection) Per Survey Book	<u>N/A</u>	
<u>ø 10</u> Size	<u>N/A</u> Anchor Bolt Sleeves	<u>N/A</u> Finished Slope	
<u>Overlap</u> Splices	<u>N/A</u> Anchor Bolt Grounding		
<u>10 @ 20</u> Spacing	<u>N/A</u> Thread Projection		
<u>N/A</u> Clearance	<u>Yes</u> Weld Pads		
<u>N/A</u> Cleanliness	<u>N/A</u> Angle Iron		
<u>N/A</u> Adequate Support	<u>N/A</u> Inserts		
	<u>N/A</u> Pipes		
	<u>N/A</u> Conduits		
	<u>N/A</u> Ground Wire Earthing		
	<u>N/A</u> Water Stop		
<b>6. Order Concrete To The Following Specifications:</b>			
Mix Design _____	Patch Plant _____	Quantity <u>3 m³</u>	Delivery Per Hour _____
Max. Aggregate Size _____	No. Of Test Cylinders/Set _____		
Slump _____	No. Sets Required _____		
Admixtures _____			
Remarks _____			
<b>Contractor</b>		<b>Company</b>	<b>Client</b>
Name: _____	Name: _____	Name: _____	
Signature: _____	Signature: _____	Signature: _____	
Date: _____	Date: _____	Date: _____	

❖ CONCRETE POUR CARD: as in the following

CONCRETE POUR CARD		N71003A
Structure Description:		Structure No.:
Subcontract No.:	Inspection Classification	Pour No.:
Contractor: <i>Al. Safeer Co.</i>	Contractor <input checked="" type="checkbox"/> Client <input type="checkbox"/>	Dwg No.:
	Company <input checked="" type="checkbox"/> Other <input type="checkbox"/>	Location: <i>B.P.S 1</i>
Planning Information		
Originator <i>patch plant</i>	Date	
Pour Number	Quantity <i>3 m<sup>3</sup></i>	Cu. Yds.
Location <i>Stairs No.1 part (1)</i>	Elevation	
Design Mix <i>patch plant standard</i>	Placing Temperature <i>34 C°</i>	
Required Finish/Curing	Air Content	
Special Instructions <i>N.A</i>	Slump	
Pre Pour Release		
Civil	Date	
Mechanical	Date	
Electrical	Date	
Survey	Date	
Quality Control	Date	
Pour		
Weather <i>Normal</i>		
Placement Started	Date	Time pm
Placement Completed	Date	Time Pm
Cu. Yards Placed		
Remarks _____ _____		
Contractor                      Company                      Client		
Name:	Name:	Name:
Signature:	Signature:	Signature:
Date:	Date:	Date:

❖ CONCRETE INSPECTION RECORD: as in the following details

CONCRETE INSPECTION RECORD				N71002
Item Description:			Tag No.:	
Subcontract No.:		Inspection Classification		Turnover System:
Subcontractor:		Contractor <input checked="" type="checkbox"/>	Client <input type="checkbox"/>	Dwg.:
		Company <input checked="" type="checkbox"/>	Other <input type="checkbox"/>	Location:
Orientation: <u>Ok</u> Location (coordinates): <u>Stairs No.1 part (1)</u> Elevation: <u>From 2.1 to 4.05</u> *NOTE: Verify Delivery Ticket before unloading and attach to this form				
Description			Contractor	Company
1. Verify form work, Construction and Control Joints			Ok	
2. Verify rebar and covering, consolidation			Ok	
3. Verify <u>grounding/earthing</u>			N.A	
4. Verify <u>embedments</u> in place i.e. pipes, conduits			Ok	
5. Verify anchor bolts fixed, measured and greased - taped off Material certificates checked, if applicable			N.A	
6. Verify template (vessels, columns)			N.A	
7. Verify weather protection			N.A	
8. Verify curing duration and finish			Ok	
9. Verify design mix			Ok	
10. Verify test cube taken. Amount: <u>cm</u>			Ok	
11. Patching/Pointing				
12. Saw cut joints, Install joint sealant			N.A	
13. Application if hardeners or dust proofing			N.A	
14. Pour date				
15. Formwork remove date:				
16. Pour accepted			Yes	
Subcontractor		Company		Client
Name		Name		Name
Signature		Signature		Signature
				Date

### 3.4.4- Stated Max and Min Rates of Wages for Construction Workers:

The next table states approximately (min and max) wages rate for both category (skilled and unskilled) workers and others required construction workers in the field:

**Table 3.2: Max and Min Local Rates of Wages for Construction Workers during period of construction of the project**

Category/Type	Daily rate - Min (US\$)	Daily rate - Max (US\$)	Hourly rate – Min	Hourly rate - Max	No. of hr. in each day
Casual workers	20	40	3	10	8
Brick layer	24	40	3	10	8
Painters	20	40	3	10	8
Carpenters	25	40	3	10	8
cement masons	22	40	3	10	8
concrete finisher	20	40	3	10	8
ceiling installer	25	40	3	10	8
Electrician	25	40	3	10	8
plumbers & pipefitter	25	36	3	8	8
Field Monitor	24	40	3	5	8
Field Supervisor	24	36	4	6	6
Civil site Engineer	35	56	5	8	6
Electrical Engineer	35	56	5	8	6
Driver	24	32	3	4	8
Welder	24	42	4	7	6
steel workers	24	42	4	8	8
Tiles and Ceramic workers	25	40	5	8	8
operators	30	45	5	8	8



### **3.4.5-Conditions of the Construction Activities in the Site of project:**

In this section the study focus on the most important conditions around the construction workers in the site of construction projects through the site visits.

- a) Regular times for working as in the following points:
- Number of working hours is (8 hours per day).
  - Number of normal working days per week is 6 days.
  - There were not (days off) for the activities on critical path.
  - Regular day off for normal tasks is Friday.

Each working day start from 7:00 AM and end at 3:00 PM. For some construction activities such as concreting this is required to start earlier the work start from 5: 00 AM.



**Figure 3.11: construction workers during regular and normal working hours.**

- b) Working overtime:

Data collected from the site of project is done to check impact of overtime on labor productivity. As in The *table* and graphical show the numbers of skilled workers and numbers of unskilled workers in concreting activity process per week.

**Table 3.3: Working Overtime for skilled and unskilled workers.**

Date	Skilled workers	Unskilled workers
12/7/2014	8	24
13/7/2014	7	18
14/7/2014	7	20
15/7/2014	8	16
16/7/2014	7	20
17/7/2014	7	15
18/7/2014	8	16
19/7/2014	7	18

Total numbers of workers required in concrete activity according to contractor's plans are:

Every day of activity required 8 skilled workers & 24 unskilled workers.

Normal worked hours per day (8 Hours).

**Graphical by using:**

- i- As in the figures on the exploded pie to display the distribution of each values (skilled workers & Date):



**Fig 3.12. Required skilled workers per day**

- ii- As in the figures on exploded pie to display the distribution of each values (Unskilled workers & Date).

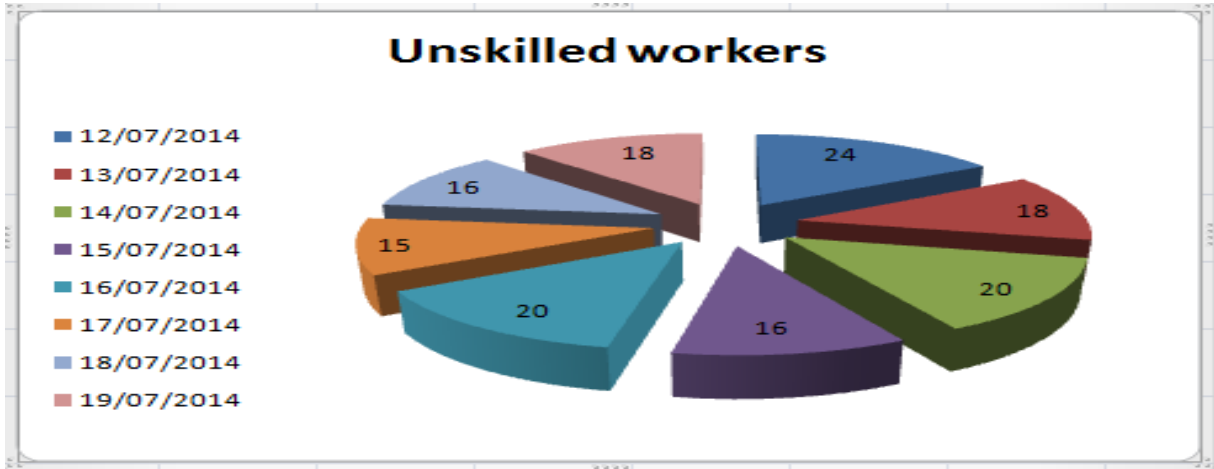


Fig 3.13. Required unskilled workers per day

C) Sample of required Timesheet: as in the following details Table 3.4: Time sheet for employees

Employee Name:		MONTHLY TIME SHEET - construction company-Iraq																												T O T A L		
Office:		Month / Year: July-2014																														
Position:		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28		29	30
		TH	FR	SA	SU	MO	TU	WE	TH	FR	SA	SU	MO	TU	WE	TH	FR	SA	SU	MO	TU	WE	TH	FR	SA	SU	MO	TU	WE	TH	FR	xx
Cost Centers Worked on During Month:																														0		
TIME OFF:																																
Holiday																														0		
Vacation																														0		
Home Leave																														0		
Sick																														0		
Bereavement																																
Unpaid Leaves																														0		
Other (R + R)																														0		
Total Time Off																														0		
Employee Signature: _____		Date: _____							Supervisor Signature: _____							Date: _____																

Timesheet is included overtime and vacations as in the following form as part of regular time sheet: **Table 3.5: Overtime and Vacations**

Overtime Time	Vacation Time
0	0
0	0

### **3.4.6-Team of concreting activity**

Those teams as in the s following details: The following five teams refer to construction workers who participate in concreting activity during its period.

**A:** Team of transportation Sand

**B:** Team of transportation Gravel

**C:** Team of Cement

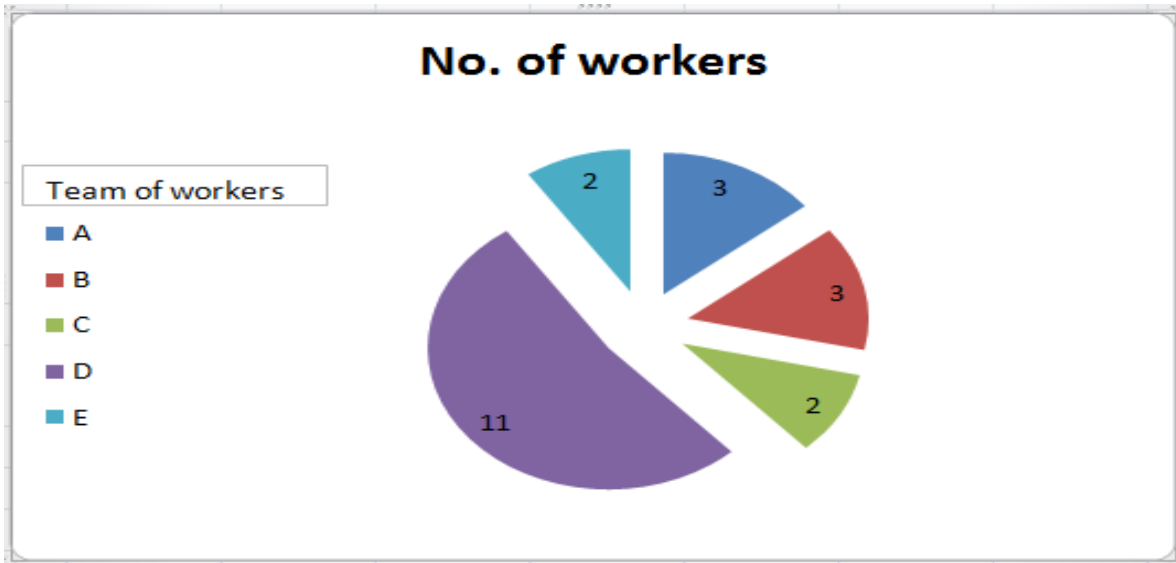
**D:** Team of casting concrete on floor within vibrator operator anf concreting pump.

**E:** Team of leveling & align concrete on floor.

**Number of workers of each team as in the following table.**

**Table3.6: Numbers of construction workers in each team**

Team	No. of workers
<b>A</b>	<b>3</b>
<b>B</b>	<b>3</b>
<b>C</b>	<b>2</b>
<b>D</b>	<b>11</b>
<b>E</b>	<b>2</b>



**Figure3.14 : Details of concreting team**

### **3.5-Outcomes about construction labor productivity Site Visits and Case Study:**

To brief the situation during the process of concreting activity in this case study about labor productivity and construction workers daily activities. This section of the case study focus on briefing of the production of casting concrete by the team for only the two critical days as these two selected days were not meet with required quantities during the periods of concreting process.

By depend on one of valuable method that was "Foreman Delay Survey ". Foreman Delay Survey tool earmark and give an imagine about the challenges issues during the observation of the sequences on the selected activities for the study. It was carried on bricklayers operating activities as mentioned in second points of these concluded outcomes. By depending on this useful tool that was foreman delay survey for finding out the labor productivity problems in the site of this project to support the research by understanding overall conditions as possible in construction process.

The mentioned points in next pages reflect the main outcomes from current case study about the scenarios around construction labor productivity in the site of project.

✚ 1<sup>st</sup> Point about the achieving quantities per hour via concreting activity teams.

A next two tables below show the summary of production during the two days by the teams of concreting activity:

**Table 3.7:- Summary of production during two days in concreting activity.**

Teams	Day	Time	Achieved Quantity Per Hour By the team M3	Remarks	
Production of Team : (A&B&C&D&E)	First Day	6:00 AM - 7 : 00 AM	15	Match with Required QTY per Hr	
		7:00 AM - 8 : 00 AM	15	Match with Required QTY per Hr	
		8:00 AM - 9 : 00 AM	10	Match with Required QTY per Hr	
		9:00 AM - 10 : 00 AM	10	Not Match with Required QTY per Hr	
		10:00 AM - 11 : 00 AM	10	Not Match with Required QTY per Hr	
		LUNCH TIME (11:00 AM TO 12:00 AM)			
		12:00 AM - 01 : 00 PM	15	Not Match with Required QTY per Hr	
		01:00 PM - 02 : 00 PM	15	Not Match with Required QTY per Hr	
		02:00 PM - 03 : 00 PM	10	Not Match with Required QTY per Hr	

Teams	Day	Time	Achieved Quantity Per Hour By the team M3	Remarks	
Production of Team : (A&B&C&D&E)	Second Day	6:00 AM - 7 : 00 AM	15	Match with Required QTY per Hr	
		7:00 AM - 8 : 00 AM	10	Match with Required QTY per Hr	
		8:00 AM - 9 : 00 AM	10	Match with Required QTY per Hr	
		9:00 AM - 10 : 00 AM	10	Match with Required QTY per Hr	
		10:00 AM - 11 : 00 AM	10	Not Match with Required QTY per Hr	
		LUNCH TIME (11:00 AM TO 12:00 AM)			
		12:00 AM - 01 : 00 PM	15	Match with Required QTY per Hr	
		01:00 PM - 02 : 00 PM	10	Not Match with Required QTY per Hr	
		02:00 PM - 03 : 00 PM	10	Not Match with Required QTY per Hr	

## 2<sup>nd</sup> point about Foreman Delay Survey:

This section of the case study, we focused on the survey process during the site visit of the case study to collect data from field about the other activity that was *bricklaying operation* in the current case study.

The details of the bricklaying operation activity as in the following points:

- Team is included :

**A:** bricklayer

**B:** bricklayer

**C:** bricklayer

**D:** bricklayer

**E:** bricklayer

**F:** construction workers (loading and achieving of bricks)

**G:** construction workers (loading and achieving of mortar).

By using foreman delay survey method to check and find out the problems are associated with labor productivity such as the causes the delays and losses in production level via construction workers.

To study consequential 2 days about bricklayer activity by counting the delay more than 10 minutes during the sequences.



The table below shows the collection data through survey:

**Table 3.8:- Data collection by using Foreman delay Survey Method**

<b>Foreman:</b>	<b>Ali. Q</b>		
<b>working Place:</b>	<b>Ground Floor</b>		
<b>Number in team</b>	<b>7</b>		
<b>Type of Activity</b>	<b>Bricklaying</b>		
	<b>No. of Hr lost</b>	<b>No. of Men</b>	<b>Total man.hour lost</b>
<b>Problems Causing Delay</b>			
waiting for tools	0.2	3	0.6
waiting for measurement	0.15	2	0.3
waiting for bricks	0.4	4	1.6
waiting for mortar			0
redo work such as (alignment, measurement)	0.25	3	0.75
Redo work such as (bricklaying)	0.2	3	0.6
late starts early quits	0.15	2	0.3
waiting for other materials	0.1	3	0.3
move to other place of work			0
waiting for information			0

<b>waiting team members</b>	0.1	3	0.3
-----------------------------	-----	---	-----

Each construction workers worked 8 hours per day.

The total manhours for 5 bricklayers during 2 days are in the following simple calculations:

$$5 * 1 \text{ days} * 8 \text{ hours} = 40$$

Total man.hours for 2 workers are:

$$2 * 1 \text{ days} * 8 \text{ hours} = 16$$

⇒ Total of the above = 56

**Table 3.9:- Calculation and percentages for each one Problem Causing Delay.**

<b>Problems Causing Delay</b>	<b>Bricklaying</b>	<b>Transporting process</b>	<b>Total (56)</b>	<b>% percentages</b>
<b>waiting for tools</b>	0.6	0.5	1.1	2.0%
<b>waiting for measurement</b>	0.3		0.3	0.5%
<b>waiting for bricks</b>	1.6		1.6	2.9%
<b>waiting for mortar</b>	0		0	0.0%
<b>redo work such as (alignment, measurement)</b>	0.75		0.75	1.3%
<b>Redo work such as (bricklaying)</b>	0.6		0.6	1.1%
<b>late starts early quits</b>	0.3		0.3	0.5%
<b>waiting for other materials</b>	0.3	0.6	0.9	1.6%
<b>move to other place of work</b>	0	1	1	1.8%
<b>waiting for information</b>	0	1	1	1.8%
<b>waiting team members</b>	0.3	0.5	0.8	1.4%

Based on the above data in the table we find out the highest percentage 2.9 % “waiting for bricks” as this associated with construction workers behavior. Then it is made negative impact on construction labor productivity in this case study.

**✚ 3<sup>rd</sup> point Feedback from local contractors, subcontractors and site experienced engineers about construction labor productivity:**

The site experienced engineers and local contractors are focused on some important points during their observations not only from one project but from several types of construction projects. Their observations were related with construction labor productivity.

As in Their opinions and feedback below:

- 1- Lack of experiences is represented one of the significant issues in construction projects and this issue need more interested by training the workers via construction companies to increasing the knowledge and level of understanding.
- 2- Many of construction workers have shortages in experiences. This reason is reflected "why?" the local construction companies are more depending on qualified workers, thus this matter lead to raise the level of their wages of experienced and qualified workers and create gap in wages between experienced construction workers and non-experienced workers. Also, non-available or shortage in numbers of required the experienced workers in the required time during construction works. As in Iraq, there are more investments in construction sector and non-availability of experienced workers may create many problems to local contractors.
- 3- The local contractors and experienced engineers explained that each construction companies are needed to give high priorities for overtime and absenteeism to minimize their negative impact on labor productivity.
- 4- Based on opinions of experienced engineers and Local construction contractors as they focused payment delay as they see the clients are almost made a delay in Payments under different, reasons. The issue of delay in payment Lead to high negative impact on construction labor Productivity and then many losses in final Profits and delay in completed Project in the required date or dates.

- 5- Also, they are focused on some extra factors. Those factors are associated with labor productivity and those factors are classified under main criteria “human and external” which are made a noticed high impact on construction labor productivity.
- 6- All construction projects are depended on male construction workers to do all site jobs. In some construction projects there are females engineers are to achieve some site jobs such as supervisions, Quality Control, preparing bill of quantities/measurements, and follow up monitoring and inspection tasks. Plus their working in administration sections in construction companies. This situation refers to 99% availability of construction workers is different completely in construction cases in other countries such as construction projects in India.



**Figure3.16: Many “males” construction workers in Iraq**



**Figure3.17: Many “females” construction workers in India.**

### **3.6-Summary from the Case Study:**

After we go up the case study as it is introduced the collected data associated with labor productivity and important feedbacks of experienced engineers and local contractors. Also, it briefs information from two main construction activities

concreting and bricklaying then we can reach to identify and listed out all the factors “Human and external” are associated with labor productivity to meet with one of the objective of this study by identifying these factors as in the tables below:

**Table 3.10:-Final Identify Human factor Based the Case Study**

<b>Sr.</b>	<b>Human Factors</b>
1	Lack of experience
2	Misunderstanding among laborers
3	Disloyalty
4	Age
5	Personal Problems
6	Lack of competition between workers (laborers)
7	Alcoholism
8	Absenteeism
9	Work overtime
10	Work accidents

**Table3.11:- Final Identify External factor Based the Case Study.**

<b>Sr.</b>	<b>External Factors</b>
1	Reworks
2	Implementation of government laws
3	Supervision delay
4	Inspection Delay from authorities
5	Variation in the drawings
6	Complex decision in provided drawing
7	Incomplete drawing
8	Payment delays
9	Design changes
10	Training sessions
11	Weather conditions

As in the next section of the study we can see the impact ranks of these above factors via analysis survey as main part of this research.

### **3.7- Survey and Questionnaires Processes:**

The process of survey has been done on previous studies and literature review. The data collection from case study to combine them together to identify and list out “Human and external” factors and divided these factors to sub criteria. During the stage of research and collection data email techniques was used to send the survey questionnaires and direct interview through site visit some construction projects. The collection of the answers from target group was done by direct interviews. The Collection process of general information about various “Human and External” factors affecting labor productivity in construction projects in the Maysan city in Iraq were the basic aim of the survey. The purpose and approach used in this survey was completely explained to respondents. Confidentiality in the process of data collection was ensured. In Additional obtaining the opinions of experienced engineers, contractors, subcontractors about those “Human and External” factor and their impacts on construction labor productivity to add their opinions in the discussion chapter as part of this research.

### **3.8- Arrangement of the Questionnaire:**

One of the important things of research study was about the number of respondents with complete information. Due to the high significance level for respondents in this research, the questionnaire was arranged in a simple format and pages for easy understanding of different levels of the target groups. The researcher explained all the parts of the questionnaires to respondents to answer their questionnaire full understanding without confusion about any section of the questionnaire.

### **3.9- Details of Questionnaire:**

The first step was to design and prepare the questionnaire based on communication and discussion. The questionnaire papers were categorized into two groups “external” and “human” factors. These two groups consisted of 21 factors for both external and human factors as in the attached “appendix”. The responses were to be based on the experiences, good communication, understanding English language and technical terms, knowledge of the

respondents and not related to any specific project. The method of questionnaire was simple and direct and this method was selected to establish a means of developing a list of factors impacting on labor productivity in construction projects.

**Table 3.12:-Gathering of (21 external and human factors) affecting labor productivity of construction project in Maysan, Iraq used in questionnaire process:**

Sr.	Criteria	Sub Criteria	NO. of Factors in its group
1.	Human Factors	Lack of experience	1
		Disloyalty	2
		Misunderstanding among laborers.	3
		Lack of competition between the Laborers	4
		Age	5
		Personal problems	6
		Alcoholism	7
		Absenteeism	8
		Work overtime	9
		Work Accidents	10
2.	External Factors	Implementation of government laws	1
		Rework	2
		Supervision delays	3
		Inspection delays from The authorities.	4
		Variations in the drawings.	5
		Complex designs in the provided drawings	6
		Incomplete drawings	7
		Payment delays	8
		(Lack of )Training sessions	9
		Design Changes	10

### **3.10. Questionnaire Distribution Process**

The target groups of this study were from the construction sectors such as local companies and technical department as in the following list:-

- 1-Contractors
- 2-Subcontractors
- 3-Consultant
- 4- Project managers
- 5- Experienced engineers

All above groups are associated with target construction organizations.

After approving the questionnaire via my supervisor on this research (Prof. MRS. P.R.ADAVI) then distribution of questionnaire was started directly to target groups as they mentioned above.

### **3.11- Population and Sample size:**

To find the sample size can be used the following formula for 94% confidence level by using “Kish Equation” ( Al-Shahri Mohammed, Assaf . S, A., Atiyah S., and AbdulAziz...e al (2001).

$$n = n' / [1 + (n'/N)]$$

Where: -

n =total number of population , N=Sample from a finite population

n'. = Sample size from an infinite population,  $n' = S^2/v^2$

$S^2$  = the variance of the population elements. V= a standard error from the sampling population. (Commonly used, S = 0.5, Also, V= 0.06). For N= 110, n = 83

Based on the above formula, the questionnaires have to distribute to targeted groups under for this study were questionnaire to 83 participants / staff from local construction companies.



These construction companies consist of from different level of staff (Technical staff and non-technical staff). The technical staff serve the study, they are:

= (Site experienced engineers, project site manager, consultants) + (Contractor, subcontractor).

**CHAPTER.**

**FOUR**

**“ANALYSIS OF RESULTS”**

## **4. ANALYSIS OF RESULTS**

Analysis of data and obtain the final results is one of the main approach in this study. To match completely with specific objectives which are mentioned in first chapter in this research so the next sections in this chapter refers to all results and levels of rankings of each factors.

### **4.1. Collection Data from Survey**

To accomplish and reach to targeted and the main objectives of the study in best way and successfully. One of the important stages in this study is collecting data from the target group.

To show all detail about data collection for the survey by using the tabulation of those data in this part of the study. Tables show gathering of statistical data:

◆ **Table 4.1: Number of the participating companies in the survey.**

<b>Details of Companies/Technical departments</b>	<b>Number of the participating companies in the survey</b>
<b>Governmental Technical Department</b>	<b>1</b>
<b>Local Companies (contractors + sub contractors)</b>	<b>9</b>
<b>Total</b>	<b>10</b>

◆ **Table 4.2: Number of distributed Questionnaires of participated companies in the survey:**

<b>Details of Companies/technical departments</b>	<b>Number of distributed Questionnaires of participated companies in the survey</b>
<b>Governmental Technical Department</b>	<b>22</b>
<b>Local Companies (contractors + sub contractors)</b>	<b>61</b>

<b>Total of Questionnaires</b>	<b>83</b>
--------------------------------	-----------

◆ **Table 4.3:Details of Kinds of Participants from each Firm:-**

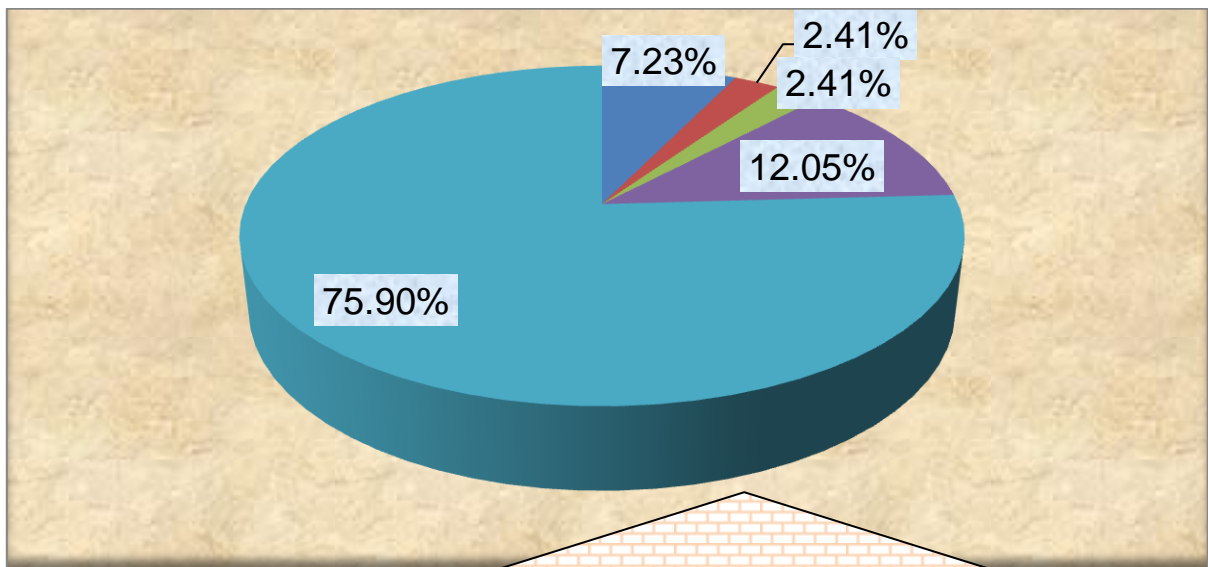
<b>Details of Companies/technical departments</b>	<b>No. of contractors</b>	<b>No. of Subcontractors</b>	<b>No. of Consultants</b>	<b>No. of Project managers</b>	<b>No. of Experienced engineers</b>
<b>Governmental Technical Department</b>	0	0	2	0	20
<b>Local Companies (contractors + sub contractors)</b>	6	2	0	10	43
<b>Sub of total of Questionnaires</b>	6	2	2	10	63
<b>Total of Questionnaires</b>	83				

◆ **Table 4.4shows the numbers of targeted groups and their job titles**

<b>Questionnaires Details</b>	<b>Number of distributed Questionnaires to staff of each company and technical departments</b>
<b>Contractor</b>	6
<b>Subcontractors</b>	2
<b>Consultants</b>	2
<b>Project managers in local companies</b>	10
<b>Experienced engineers in the local companies</b>	63

<b>Total of Questionnaires</b>	<b>83</b>
--------------------------------	-----------

⇒ A total of 83 questionnaires were achieved in above mechanism and process. Those groups of respondents are contractor, subcontractors, consultant, project managers and experienced engineers as they have the best knowledge and experiences in construction industry sectors. Their practical and sufficient technical understanding and experiences are an adequate indication to find out the perceptiveness of the importance of factors in both groups "Human and External" and their impacts on labor productivity in construction project.



Based on their experiences in many construction projects types such as:  
 New construction buildings,  
 Rehabilitation aspects,  
 Transportation projects,  
 Roads/transportation networks,  
 Water and sewage projects.

- ⇒ **Contractor (7.23%)**
- ⇒ **Sub contractors (2.41%)**
- ⇒ **Consultants (2.41%)**
- ⇒ **Project managers in local companies (12.05%)**
- ⇒ **Experienced engineers in the local companies (75.90%)**



**Fig 4.1: Percentages (%) of Received Questionnaires from the total "83 questionnaires"**

**4.2. Measurement of Data Collection:**

While there is a degree of danger are associated with different tasks/events in the sites of any construction projects then troubles can show it. According to availability of those different degrees of troubles, then the perfect plans is to minimize and overcome totally on those variations in degrees by using four expressions about the event and tasks levels as in the following:

- 1- Not Applicable
- 2- Does Not affect it
- 3- Somewhat affects it
- 4- Directly affect it

An apparent detailing of the standard event level was important to make target groups in the survey very well understanding the degree of each opposite event level. Also, supporting the survey by an oral and a draft explanation of Arabic language is to be the questionnaire is clear to participants. The particular questionnaire was organized to account the factors (human and external) impacting on labor productivity in the construction sector in mason city, Iraq.

The selection method is to use the appropriate technique for analyzing the level of measurement. In this study is used ordinal scales by assigning (1, 2, 3, 4) numbers. According to Likert scale.

**Table4.5. Ordinal Scale Used for Data Measurement:**

Item	Not applicable	Does not affect it	Somewhat affects it	Directly affects it
Scale	1	2	3	4

### **4.3 Data Analysis Approach:**

To implement the section of the analysis, a plan was used for data collection from the field and making the valuable evaluation and numerical values.

The results were analyzed in the study by using two various ways as in the following:

- i. Ranking of the different “Human and External” factors according to their significance, and using the calculating of their Relative Importance Index (RII).
- ii. Method of Relative Importance Index (RII) :  
Analyze the “Human and External” factors in the questionnaire are significant or non-significant.

The Relative Importance Index (RII) was utilized to make the different decision about the professionals’ point of views of the RII in construction sectors.

RII is used in the calculation process as declared below (Ugwu and Haupt, 2007, Iyer and Jha, 2005, Cheunge Et al., 2004 ).

$$\text{Relative Importance Index(RII) /Difficulty index} = \frac{\sum w}{AN}$$

#### **Where,**

**W:** is referred to the weighting presented to each factor by the respondents, ranging from (1 to 4).

**A:** is the highest weight = 4

**N:** is the total number of samples.

### **4.4 -Size of Construction Company:**

The average number of staffs in a construction company / organization was 17. It reflects the average number of staff (employees) which includes full time and part time working.

### **4.5. Numbers of implemented and under implementation Projects per Year:**

Construction projects per year as it was between the numbers of (2 to 4).

#### **4.6. Details and Types of Construction Projects:**

The type of construction project which employs targeted based on responses is stated in Table

**Table 4.6: Type of Construction Projects**

<b>Type of project</b>	<b>Respondents</b>
Residential	<b>5</b>
Commercial	<b>1</b>
Industrial	<b>1</b>
Government	<b>1</b>
Engineering,	<b>1</b>
Architecture	<b>1</b>
Others	<b>0</b>

#### **4.7 Titles of the respondents' job;**

**Table 4.7:- Job Title of the Respondents**

<b>Titles</b>	<b>Number of Respondents</b>
Contractor	<b>6</b>
Subcontractors	<b>2</b>
Consultants	<b>2</b>
Project managers in local companies	<b>10</b>
Experienced engineers in the local companies	<b>63</b>

#### **4.8. Phase of Results:**

After completion of the collection data from the survey then, in this section of the study applies RELATIVE IMPORTNACE INDEX (RII) on collecting data to obtain the results to see the size of the impacts of “ Human and External “ factors on labor productivity in



construction projects in Maysan city, Iraq according to responses from target groups in the survey.

#### **4.8.1 Statistics Aspects of Collected Data:**

By using the tabular techniques to classify all the responses from the participants as shown their details of the responses in the tables below:

**1<sup>st</sup> Group: HUMAN FACTORS:** Details of data collection about Human Factor as in the table:

**Table 4.8: Responses associated with human factors**

No. of Factor	Human Factors	<i>Response based Measurement Data from Questionnaires</i>				Total
		1 – Not applicable	2 – Does not affect it	3 – Somewhat affects it	4 – Directly affects it	
1	Lack of experience	1	2	9	71	83
2	Disloyalty	11	27	38	7	83
3	Misunderstanding among laborers.	4	24	28	27	83
4	Lack of competition between the Laborers	6	24	49	4	83
5	Age	6	27	26	24	83
6	Personal problems	4	23	30	26	83
7	Alcoholism	2	28	41	12	83
8	Absenteeism	1	19	22	41	83
9	work overtime	1	5	29	48	83
10	work Accidents	6	28	31	18	83
						830

**2<sup>nd</sup> Group: EXYERNAL FACTORS:** Details of collection data about External Factor as in the table:

**Table 4.9: Responses associated with external factors**

No. of Factor	External Factors	Response based Measurement Data from Questionnaires				Total
		1 – Not applicable	2 – Does not affect it;	3 – Somewhat affects it	4 – Directly affects it	
1	Implementation of government laws	7	30	26	20	83
2	Rework	4	29	34	16	83
3	Supervision delays	4	33	20	26	83
4	Inspection delays from The authorities.	5	34	23	21	83
5	Variations in the drawings.	2	28	34	19	83
6	Complex designs in the provided drawings.	5	24	33	21	83
7	Incomplete drawings	11	16	28	28	83
8	Payment delays	3	11	28	41	83
9	Training sessions	3	7	38	35	83
10	Design Changes	2	24	28	29	83
11	Weather Conditions	3	5	43	32	83
						913

#### **4.9 Analysis Data by using RII Techniques:**

The analysis procedures had been done by using analyzes by RII techniques for both groups (Human and External) on data collection from survey:

#### **1<sup>st</sup> Group: HUMAN FACTORS:**

**Table 4.10: -Percentages of RII for Human factors**

% Relative Important Index (%RII )				
% RII (A= 4 Highest , N= 83 (83*4=332)				
$\Sigma W$	AN	RII	%RII	RANK
316	332	0.9518	<b>95.18%</b>	1
207	332	0.6235	<b>62.35%</b>	10
244	332	0.7349	<b>73.49%</b>	5
217	332	0.6536	<b>65.36%</b>	9
234	332	0.7048	<b>70.48%</b>	6
244	332	0.7349	<b>73.49%</b>	4
229	332	0.6898	<b>68.98%</b>	7
269	332	0.8102	<b>81.02%</b>	3
290	332	0.8735	<b>87.35%</b>	2
227	332	0.6837	<b>68.37%</b>	8

**2<sup>nd</sup> Group: EXTERNAL FACTORS:**

**Table 4.11: Percentages of RII for External factors**

% Relative Important Index (%RII )				
% RII (A= 4 Highest , N= 83 (83*4=332))				
$\Sigma W$	AN	RII	%RII	RANK
225	332	0.678	<b>67.77%</b>	11
228	332	0.687	<b>68.67%</b>	9
234	332	0.705	<b>70.48%</b>	8
226	332	0.681	<b>68.07%</b>	10
236	332	0.711	<b>71.08%</b>	7
236	332	0.711	<b>71.08%</b>	6
239	332	0.720	<b>71.99%</b>	5
273	332	0.822	<b>82.23%</b>	1
271	332	0.816	<b>81.63%</b>	2
250	332	0.753	<b>75.30%</b>	4
270	332	0.813	<b>81.33%</b>	3

#### **4.10 Arrangement of the Results:**

In this part of the study, we try to state the factors and arrange them based on the ranks which obtain after calculation each one separately.

##### **A) ARRANGEMENT FOR FIRST GROUP: HUMAN FACTORS**

The arrangement has been carried out based on the values of % RII and rank as show that in the next table:

**Table4.12:- Arrangement of first group based rankings**

<b>Sr. of factor in questionnaire</b>	<b>Groups one " Human Factors"</b>	<b>RII (%)</b>	<b>RANK</b>
<b>1</b>	<b>Lack of experience</b>	<b>95.18%</b>	<b>1</b>
<b>9</b>	<b>Work overtime</b>	<b>87.35%</b>	<b>2</b>
<b>8</b>	<b>Absenteeism</b>	<b>81.02%</b>	<b>3</b>
<b>6</b>	<b>Personal problems</b>	<b>73.49%</b>	<b>4</b>
<b>3</b>	<b>Misunderstanding among laborers.</b>	<b>73.49%</b>	<b>5</b>
<b>5</b>	<b>Age</b>	<b>70.48%</b>	<b>6</b>
<b>7</b>	<b>Alcoholism</b>	<b>68.98%</b>	<b>7</b>
<b>10</b>	<b>Work Accidents</b>	<b>68.17%</b>	<b>8</b>
<b>4</b>	<b>Lack of competition between the Laborers</b>	<b>65.36%</b>	<b>9</b>
<b>2</b>	<b>Disloyalty</b>	<b>62.35%</b>	<b>10</b>

**B) ARRANGEMENT FOR SECOND GROUP: EXTERNAL FCATORS:**

The arrangement has been carried out based on the values of % RII and rank as show that in the next table:

**Table4.13:-Arrangement of second group based rankings**

<b>Sr. of factor in questionnaire</b>	<b>Groups Two " External Factors"</b>	<b>RII (%)</b>	<b>RANK</b>
<b>8</b>	<b>Payment delays</b>	<b>82.23%</b>	<b>1</b>
<b>9</b>	<b>(Lack of ) Training sessions</b>	<b>81.63%</b>	<b>2</b>
<b>11</b>	<b>weather Conditions</b>	<b>81.33%</b>	<b>3</b>
<b>10</b>	<b>Design Changes</b>	<b>75.30%</b>	<b>4</b>
<b>7</b>	<b>Incomplete drawings</b>	<b>71.99%</b>	<b>5</b>
<b>6</b>	<b>Complex designs in the provided drawings</b>	<b>71.08%</b>	<b>6</b>
<b>5</b>	<b>Variations in the drawings</b>	<b>71.08%</b>	<b>7</b>
<b>3</b>	<b>Supervision delays</b>	<b>70.48%</b>	<b>8</b>
<b>2</b>	<b>Rework</b>	<b>68.67%</b>	<b>9</b>
<b>4</b>	<b>Inspection delays from The authorities</b>	<b>68.07%</b>	<b>10</b>
<b>1</b>	<b>Implementation of government laws.</b>	<b>67.77%</b>	<b>11</b>

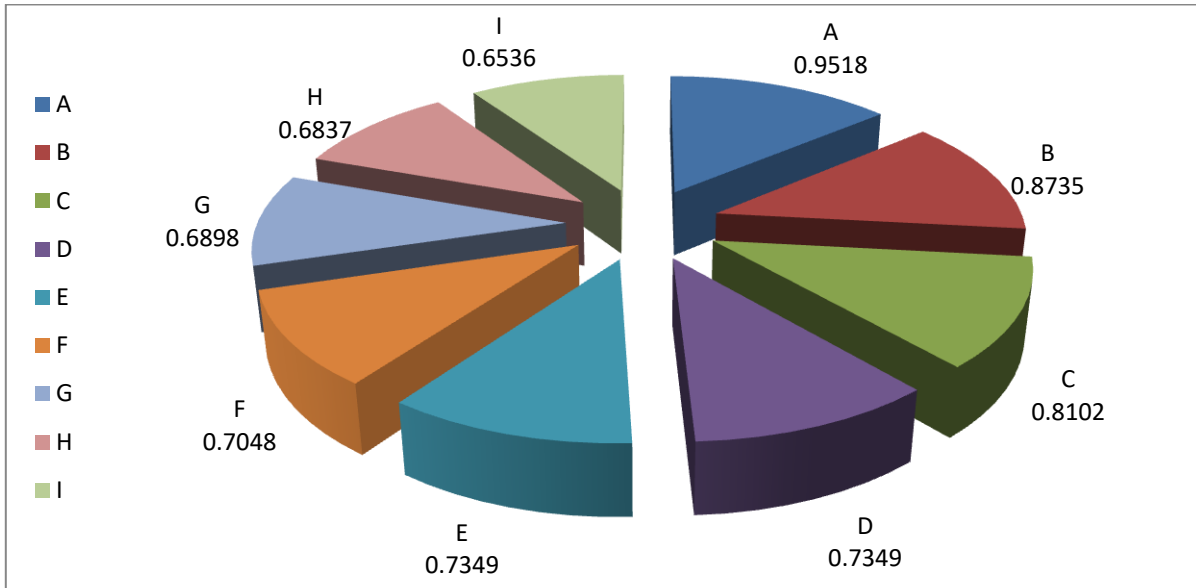
#### **4.11-Using Graphical to display the Results:**

In section of the study, we state the results of human and external factors based on their ranks.

##### **A) Human Factor Group:**

By depending on two graphical methods for representing results as in the following:

- i) Exploded pie to display the distribution of the values as in Fig4.2



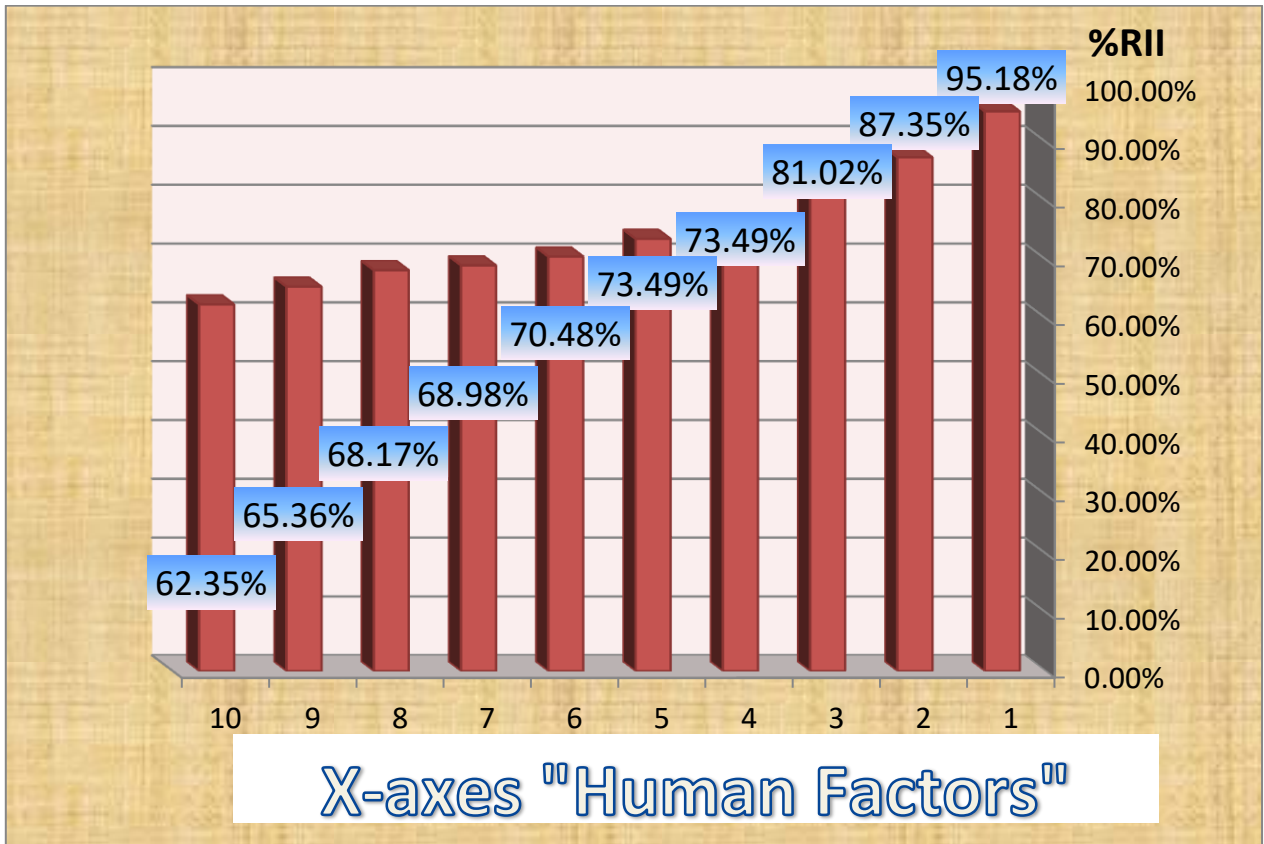
**Figure4.2: distribution of the ranking values for human factor**

Where, the letters from A to I in Graphical refers to Human Factors.

**Table4.14 the references letters of each human factor**

<b>Group of " Human Factors"</b>	<b>Letters References</b>
Lack of experience	A
work overtime	B
Absenteeism	C
Personal problems	D
Misunderstanding among laborers.	E
Age	F
Alcoholism	G
work Accidents	H
Lack of competition between the Laborers	I
Disloyalty	J

ii) Columns chart to display the distribution of the values: As in Fig4.3



**Figure4.3: ranking values for human factor**

Where, the numbers from (1 to 10) on columns in above figure refer to human factors as in below: **Table4.15- It shows the references numbers of each human factor**

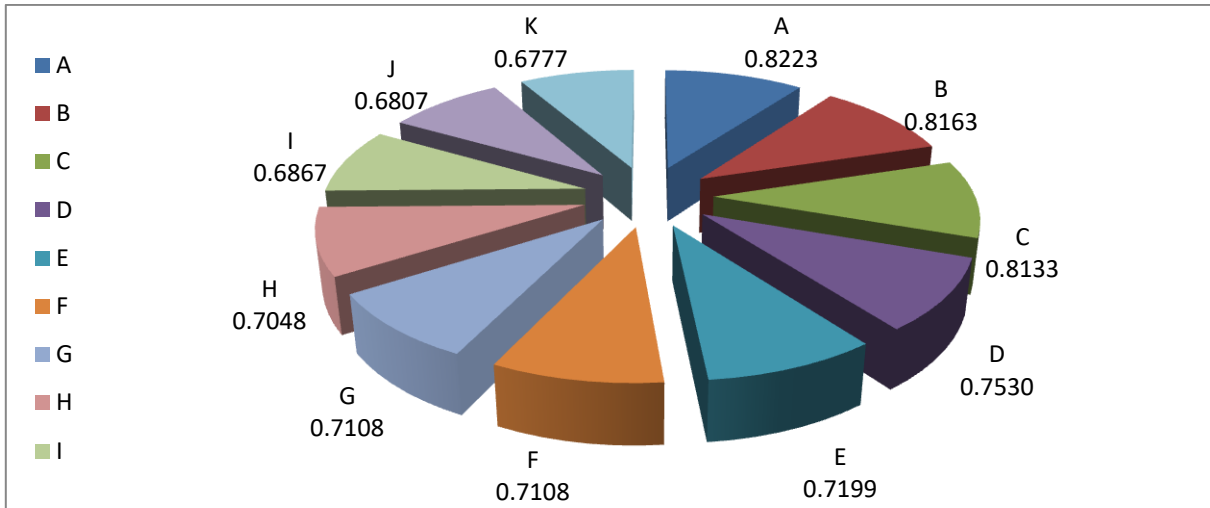
Group of " Human Factors"	Numbers
<i>Lack of experience</i>	<i>1</i>
<i>work overtime</i>	<i>2</i>
<i>Absenteeism</i>	<i>3</i>
<i>Personal problems</i>	<i>4</i>
<i>Misunderstanding among laborers.</i>	<i>5</i>
<i>Age</i>	<i>6</i>
<i>Alcoholism</i>	<i>7</i>
<i>work Accidents</i>	<i>8</i>
<i>Lack of competition between the Laborers</i>	<i>9</i>
<i>Disloyalty</i>	<i>10</i>



**B) External Factor Group:**

By depending two graphical methods for representing results as in the following:

I) Exploded pie to display the distribution of the values. **Fig4.4**



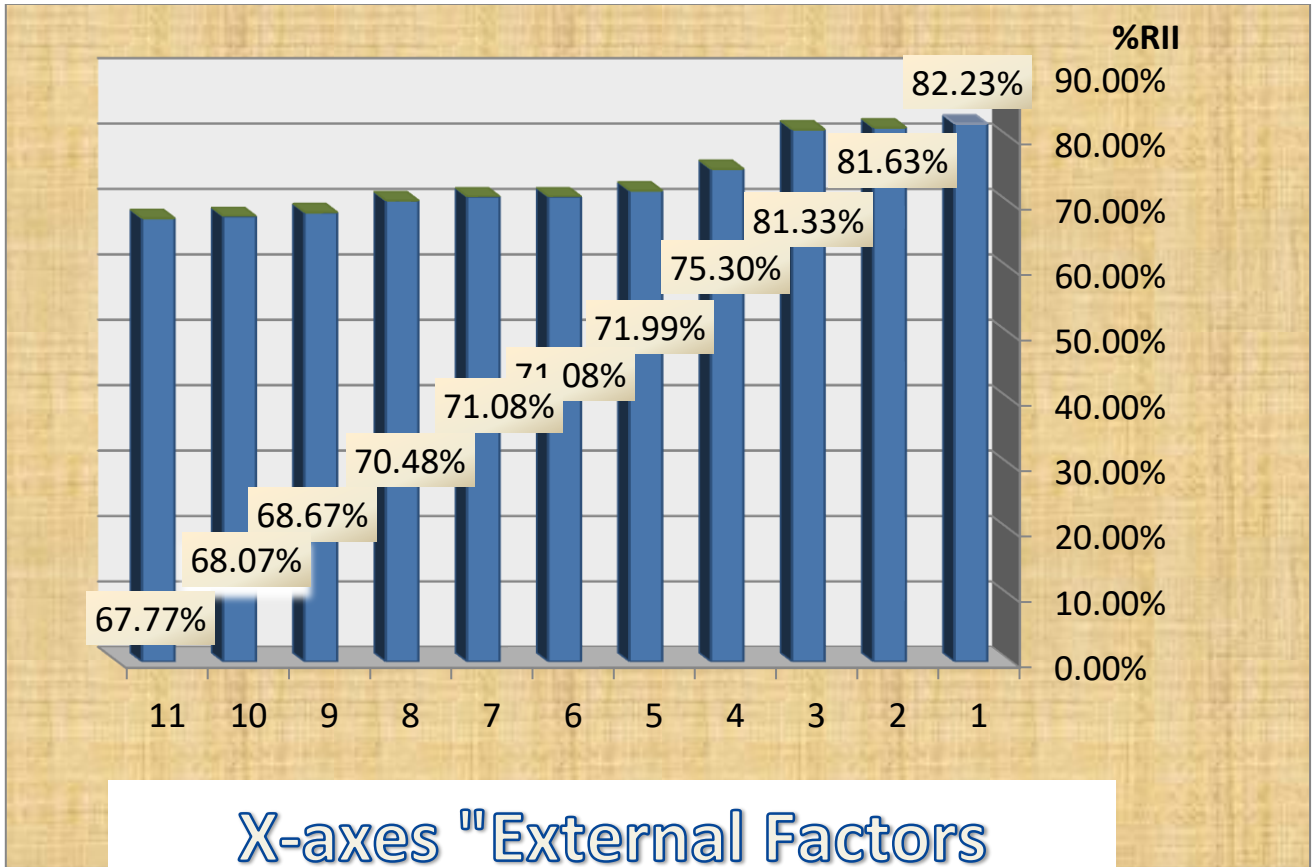
**Figure4.4: distribution of the ranking values for external factor**

Where, the letters from A to K in Graphical refers to External Factors as in the

**Table4.16: -The reference letters of each external factor**

Groups Two " External Factors"	Letters References
Payment delays	A
Training sessions	B
weather Conditions	C
Design Changes	D
Incomplete drawings	E
Complex designs in the provided drawings	F
Variations in the drawings	G
Supervision delays	H
Rework	I
Inspection delays from The authorities	J
Implementation of government laws.	K

II) Columns chart to display the distribution of the values as in **Fig4. 5:-**



**Figure4.5: Ranking of external factor**

Where, the numbers from (1 to 11) on columns in above figure refer to external factors as in below:

**Table4.17:- The reference numbers of each external factor**

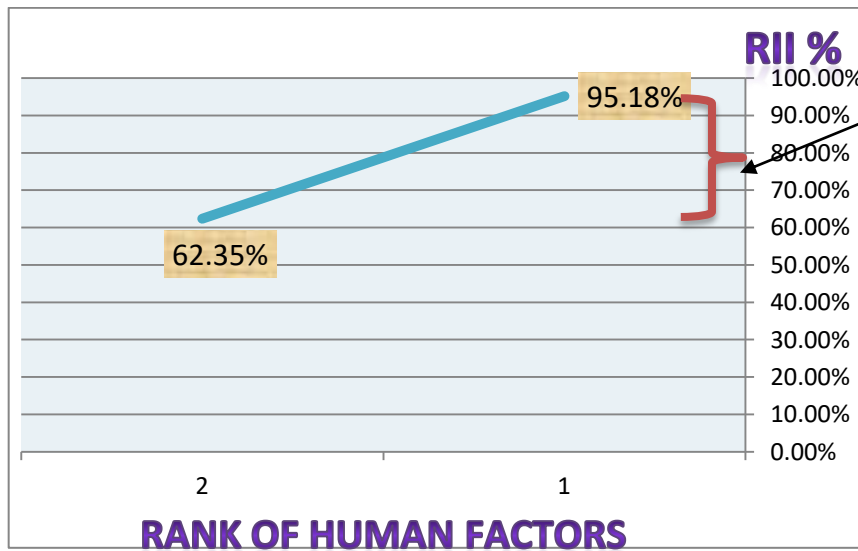
Groups Two " External Factors"	Number
Payment delays	1
Training sessions	2
weather Conditions	3
Design Changes	4
Incomplete drawings	5
Complex designs in the provided drawings	6
Variations in the drawings	7

Supervision delays	8
Rework	9
Inspection delays from The authorities	10
Implementation of government laws.	11

**4.12-Comparison between highest and lowest ranking factors:**

In this section, we show the comparisons between highest rank and lowest rank for human factor as group one and external factors. In this part of the study by representing them by line to be more clear and understanding the figures on the line presentation and to find out through the figures below as figures ascending by depending on RII percentages for each factors. The next two figures show the variations between highest rank and lowest rank for each group as in the following Figures.

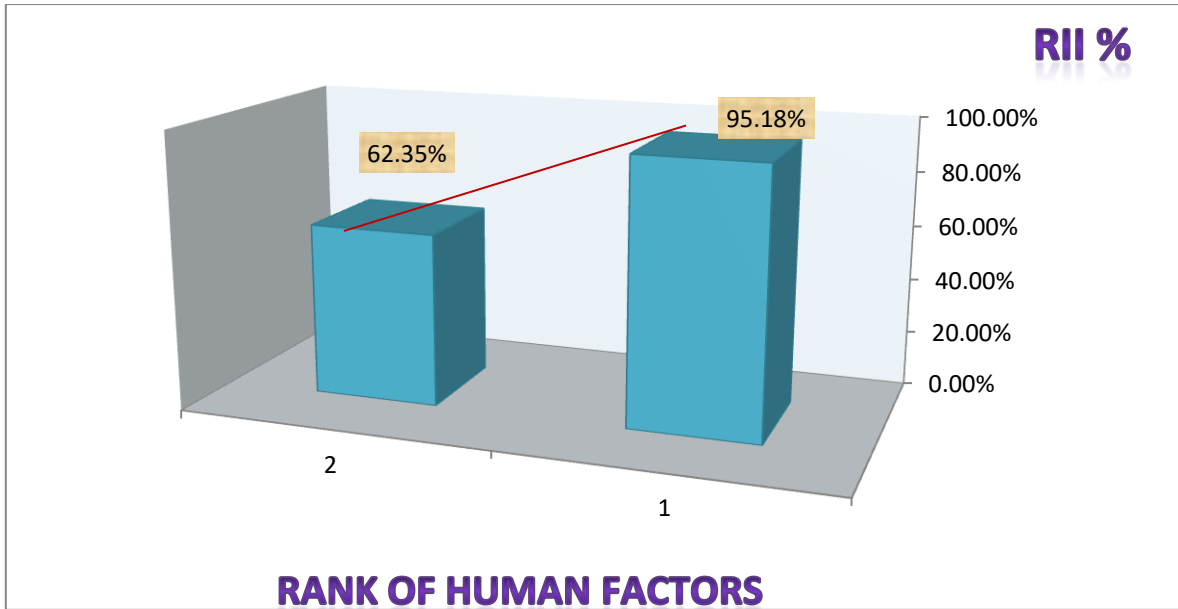
**Group One “Human Factor”:**



The variation between highest rank “lack of experiences” and lowest rank “disloyalty” is (32.75%).

The figure indicates to gap between the above factors and it reflects their negative impact associated with labor productivity.

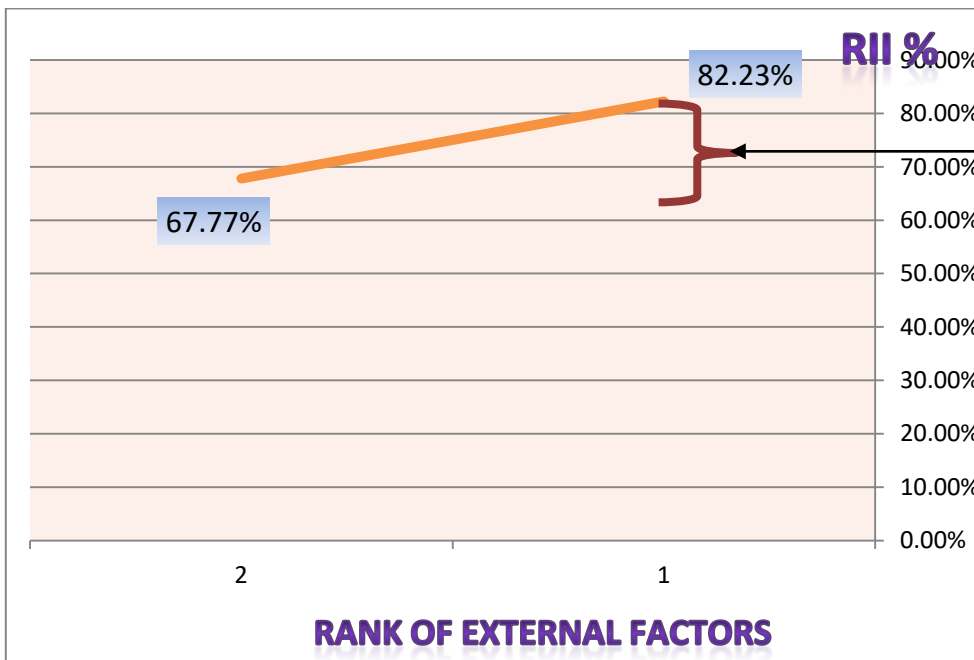
⇒ Fig4.6 indicates to Percentages of Variation of Human Factor Group.



**Fig 4.7:-** shows the gap between highest and lowest ranking in human factors.

- **Highest Rank:** under human group is *lack of experiences*.
- **Lowest Rank:** under human group is *disloyalty*.

**Group Two "External Factor":**

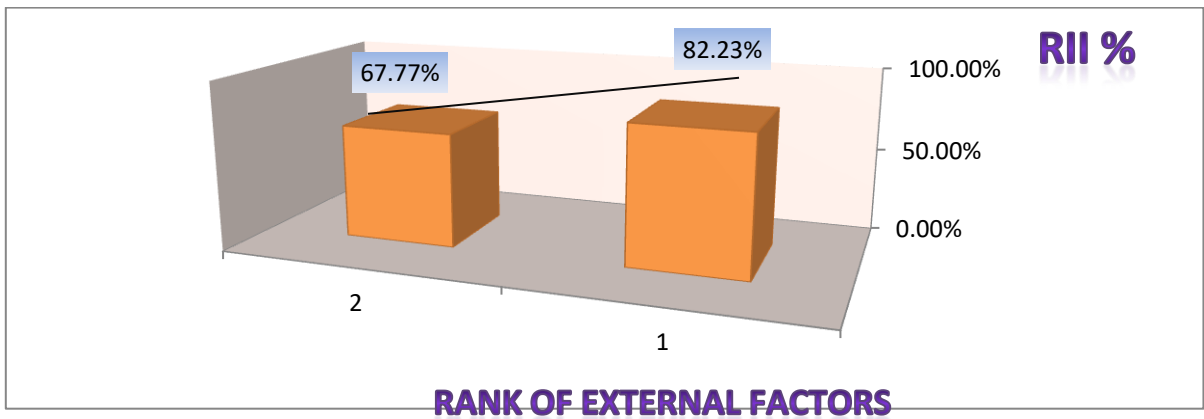


The variation between highest rank "Payment delays" and lowest rank "Implementation of government laws" is (14.46%).

The figure indicates to gap between the above factors and it reflects their negative impact associated with labor productivity.

⇒ Fig4.8 indicates to Percentage of Variation of External Factor Group

⇒ the gap between highest and lowest ranking in external factors:

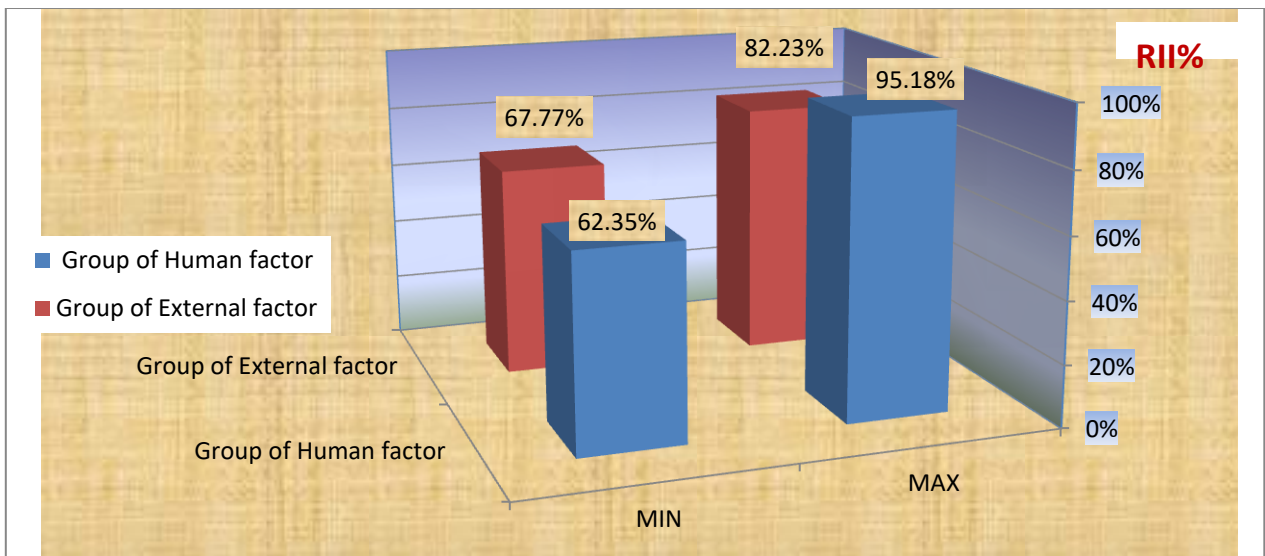


**Fig4.9:-** shows the gap between highest and lowest ranking in external factors.

- **Highest Rank:** under human group is *Payment delays*.
- **Lowest Rank:** under human group is *Implementation of government laws*.

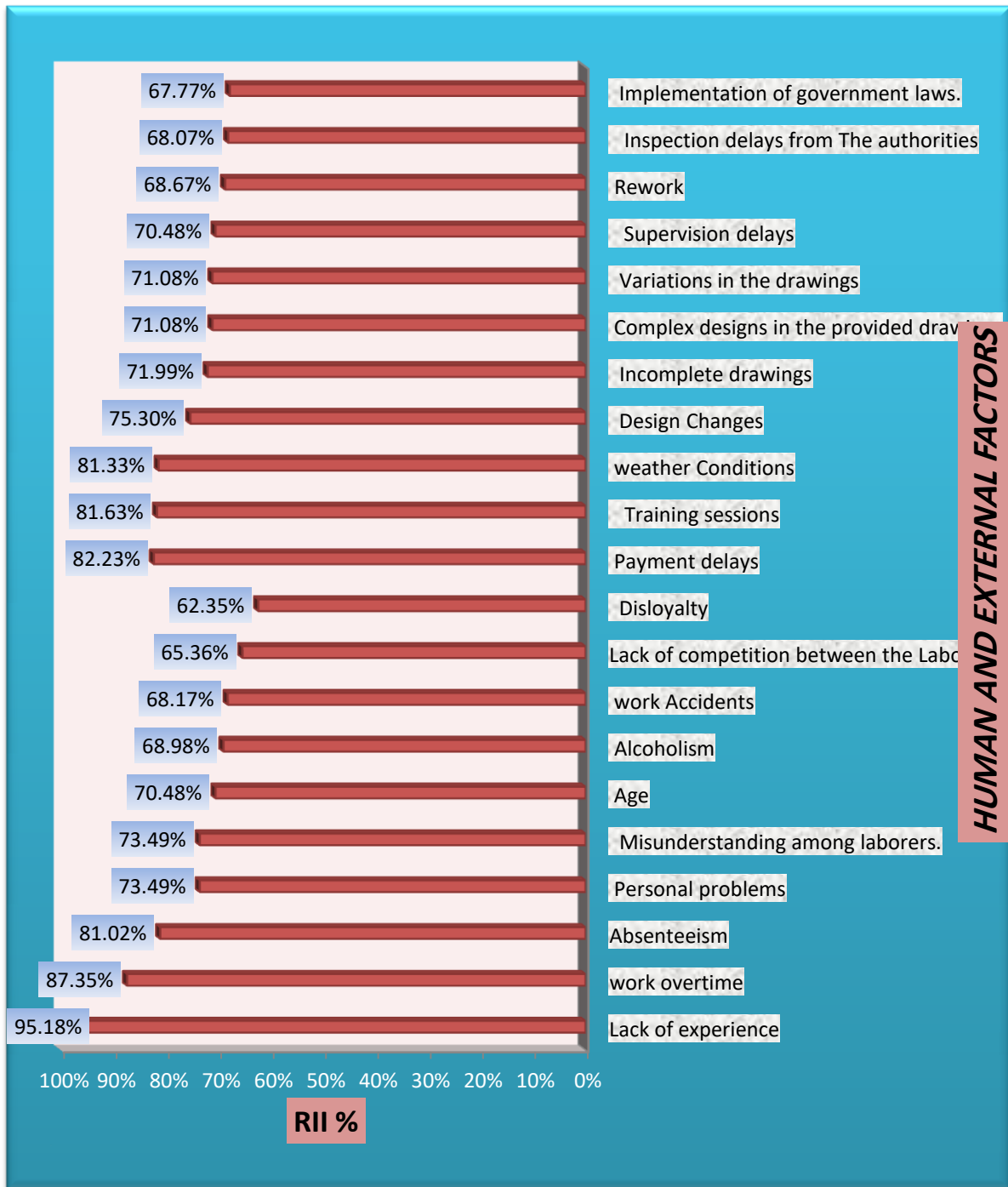
**4.13-Maximum and Minimum for two Groups :**

This three dimentional columns indicates the value of *MAX & MIN to human and external factors*



**Fig 4.10 :**shows Rang of (MAX) & (MIN) for group of human factors and group of external factors. The fig shows the variation between both factors “ human and external” based on using the min and max rang of ranks between them.

**4.14-Overall Ranking for Two Groups:**

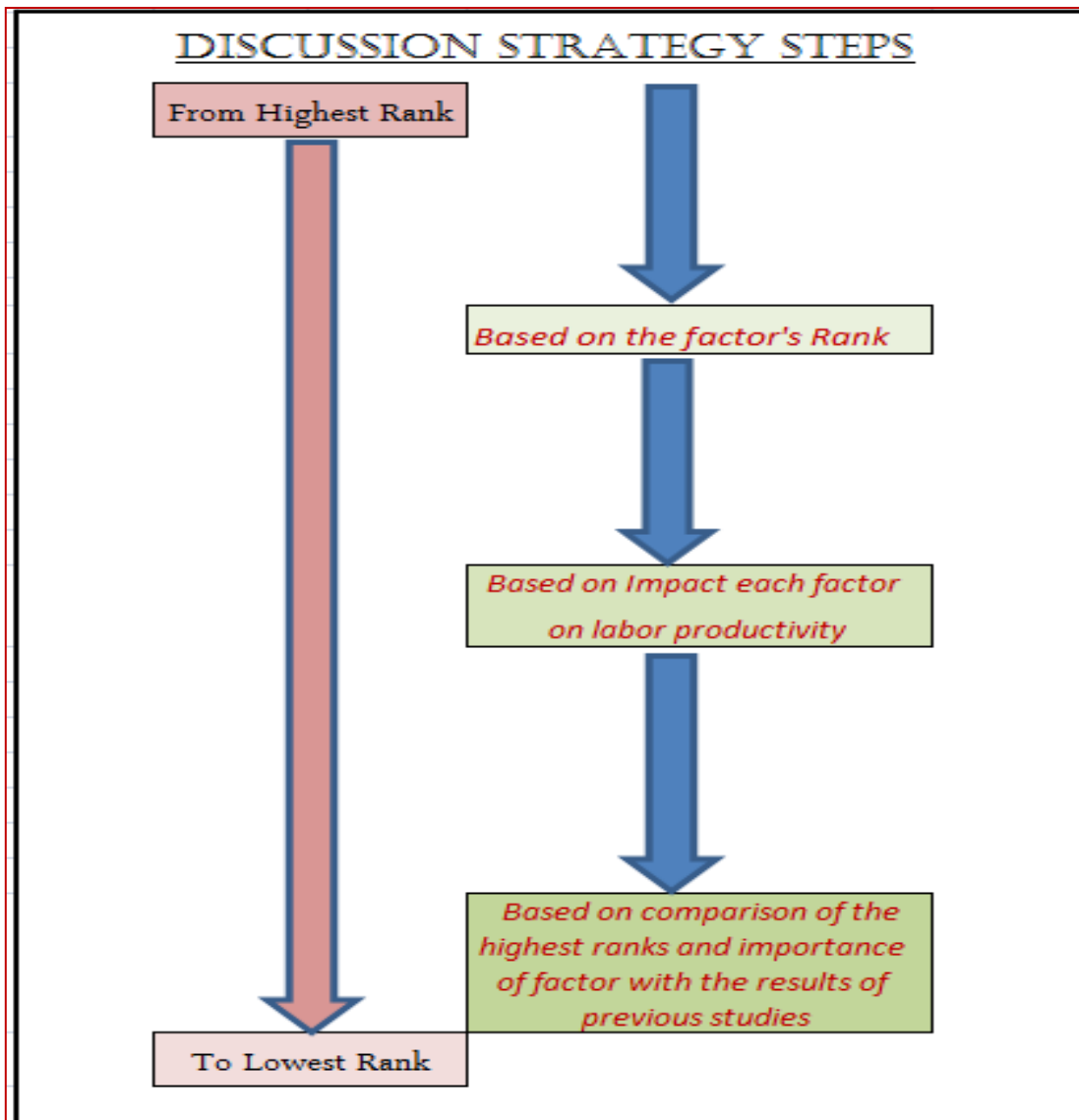


**Figure4.11: shows overall ranking between two groups.**

**CHAPTER.  
FIVE  
“DISCUSSION  
AND  
COMPARISON”**

## 5. DISCUSSION

The structure of this chapter focuses on discussion of those factors and their impact range on labor productivity based on the previous results in chapter four. We try to discuss each factor separately by depending on the level of RII and the ranks of each factor which obtain from previous results in past chapter. The discussion strategy starts from the highest rank of each factor then go ahead with others descending steps. **Below figure5.1:-** Shown the structure of discussion in the.



**Figure5.1:-** The structure of discussion.



### **5.1-First GROUP: HUMAN FACTORS**

In this study the human factors consist of 10 factors. In order to show their impact on labor productivity in Maysan city based on their rank level in the results of the questionnaire we begin in this discussion as following:

#### **1<sup>st</sup> RANK: LACK OF EXPERIENCE**

This factor had grants the highest rank level after making analysis of questionnaire as shown in the following table:

**Table5.1: RANK: LACK OF EXPERIENCE**

Factor	RII (%)	RANK
Lack of Experience	95.18%	1

According to contractors, subcontractors, project managers, consultants and experienced engineers this factor was obtained 95.18% under RII to be in the first level of the impact on construction labor productivity.

Lack of experience is one of the important factors which make a high impacts on labor productivity does not in Maysan city only, but in so many areas in the world so the different parties who are interested about the construction sectors they give the highest priorities to this factor. To enhance labor productivity that needs more interests about the developmental level of experiences of each worker and for both skilled workers and unskilled workers in any construction projects. To improve experiences in two levels these are in the intellectual and physical capacities of construction workers then to improve levels of their construction productivity. The availability of workers is not big issue for construction firm in Iraq, but the retaining of the experienced workers is one of the biggest issues that make many construction firm depend on the construction workers have low experience and that will make highest impact on the quality level of production and its required volume to achieve it in the time.

The photo below shows some errors which happened due to the lack of experiences. The lacks of experiences lead to inaccuracy in implementation construction items and that reflect negative impact on construction labor productivity and more costs on construction process.



**Figure5.2: photos refers to this important affects of this factor.**

## 2<sup>nd</sup> RANK: WORK OVERTIME

This factor obtained the second rank according to the results of a survey.

**Table5.2: RANK: WORK OVERTIME**

FACTOR	RII (%)	RANK
WORK OVERTIME	87.35%	2

This rank (87.35%) is refers to the issue related with regular time of construction workers and overtime in construction sectors. In Iraq the regular time of business work is start from 8:00 AM to 3:00 PM without lunch period. This regular time is to include almost all office works. In site of construction project the regular time start in many construction activities and tasks from 7:00 AM to 3:00 PM including one hour for launch period as done almost in site of construction projects. Any time will increase more than eight working hours then they will be under overtime issue. Based on this result in this research which gives us the overtimes are associated with labor productivity and how it refers as negative factor and lead to more loss in construction labor productivity.

There are many types of projects such as transportation, road work, pipelines works did not include particular and clear data base about regular work time and overtime. Unavailability of data is one of the challenges understanding all information related with overtime hours. The contractors and subcontractors almost record actual quantities and working hours then they can not calculate actually losses in construction labor productivity.

During the observations in construction projects, excessive overtime ultimately results in lower productivity, more fatigue and increasing in medical costs.

As in the photo below shows the regular work time in concreting activity.



**Figure5.3: Regular work time**

Next Photos shows overtime during the concreting activity at the evening time



**Figure5.4: overworking time**

### 3<sup>rd</sup> RANK: ABSENTEEISM

The absenteeism is one the important factor is associated with construction labor productivity as this study showed that in below table:

**Table 5.3: RANK: ABSENTEEISM**

FACTOR	RII (%)	RANK
ABSENTEEISM	81.02%	3

The above result refers to contracting parties and experienced engineers are suffering from the reduction in work volume as they looking forward to obtain it during the business day. One of the issues behind the absenteeism of construction workers the poor conditions and unavailability health policies may lead to increasing the absenteeism and then impact directly on construction labor productivity and not match with required labor productivity if the construction workers not appears in the site of construction works.

The absenteeism is one of the commonly issue is reduced construction labor productivity and the local contractors are suffering from this issue as the results of questionnaire reported that absenteeism created already the fears to both local contractors and subcontractors and its high impact on labor productivity.

4<sup>th</sup> RANK: PERSONAL PROBLEMS

The rank of this factor is (73.49%) as shown in the table below.

**Table 5.4: Rank of PERSONAL PROBLEMS**

FACTOR	RII (%)	RANK
PERSONAL PROBLEMS	73.49%	4

It can give us that the life conditions of each construction workers may affect directly on their productivity if we make a comparison between them volumes of productivity in normal day in the same city of project with volume of labor productivity in some days when the personal

problems are appeared to the construction workers. Personal problem is one of the mian issues that ensure impact on labor productivity.

5<sup>th</sup> RANK: MISUNDERSTANDING AMONG LABORERS

the rank of misunderstanding among laborers factor is (73.49%) as shown in the table below:

**Table 5.5: Rank of MISUNDERSTANDING AMONG LABORERS**

FACTOR	RII (%)	RANK
MISUNDERSTANDING AMONG LABORERS	73.49%	5

The construction industries and construction sectors are suffering from the level of understanding among construction workers. The fact information from construction firms refer to the construction laborers are not in the same level of understanding among them. When we look around the all ranks under human factors we find out that the ranks of personal problems and misunderstanding among laborers are same rank figure both of them are carried out (73.49%) through the survey results.

6<sup>th</sup> RANK: AGE: The rank of this factor is (70.48%) as shown in the table below.

**Table 5.6: Rank Age**

FACTOR	RII (%)	RANK
AGE	70.48%	6

Many previous studies indicated the ages of construction workers and they give the rang between (18-50) years for each workers in both categories skilled workers and unskilled

workers. In Iraq, the ages of construction workers are under the same rang and almost so many workers are between (18 to 40) years old. If there are availability of construction workers then, the local firms (contractors and subcontractors) try to avoid to hire the persons their ages above 50 years because they believe productivity of these persons in construction works are less than others young construction workers.

7<sup>TH</sup> RANK: ALCOHOLISM:

The Rank of alcoholism factor in this study is (68.98%) as in the below table.

**Table 5.7: Rank of alcoholism**

FACTOR	RII (%)	RANK
ALCOHOLISM	68.98%	7

This factor is prohibited under any construction organization manuals.

8<sup>TH</sup> RANK: WORK ACCIDENTS

The rank of this factor is (68.17%) as the table below shows it.

**Table 5.8: Rank of work accidents**

FACTOR	RII (%)	RANK
WORK ACCIDENTS	68.17%	8

Based on many opinions from the technical persons and the contractors which they ensure that construction works is one of the difficult places everywhere in the world. One of challenges

which the contractors are faced it that how put best plan to protect their employees and every person are associated with construction activities to minimize the risks in construction projects. The construction organizations should use evaluated safety plan or other plans that minimize the work accidents to obtain qualified environmental work for construction productions.

**9<sup>TH</sup> RANK: LACK OF COMPETITION BETWEEN LABORERS**

The rank of lack of competition between laborers is (65.36%) as shown in the table below:

**Table 5.9: rank of competition between laborers**

FACTOR	RII (%)	RANK
LACK OF COMPETITION BETWEEN LABORERS	65.36%	9

One of the magnificent matters for any construction companies either local or international is how to create a competition between laborers by using any smart strategy of competition to reach to required construction productivity.

**10<sup>TH</sup> RANK: DISLOYALTY** : The rank of disloyalty is (62.35%) as shown in the table below:

**Table 5.10: Rank of Disloyalty**

FACTOR	RII (%)	RANK
DISLOYALTY	62.35%	10

Disloyalty factor reflect the commitments of construction workers in any construction companies which they work under their umbrella. Loyalty is associated with required construction labor productivity for long term.



## **5.2-SECOND GROUP: EXTERNAL FACTORS**

In this study the external factor consist of 11 factors. In order to show their impact on labor productivity in Maysan city based on their rank level in the results of the questionnaire we start in this discussion as following:

### **1<sup>st</sup> RANK: PAYMENT DELAYS**

The current result indicates if there are any delay in the payment form clients to contractors or subcontractor that affect directly on workers productivity in any construction sites.

As the table show that payment delays obtain the first rank and highest impact on labor productivity according to the analyze all data of survey.

**Table5.11: Rank of Payments Delay**

FACTOR	RII (%)	RANK
PAYMENT DELAYS	82.23%	1

The table shows that payment delay is the most important factor for target groups as it is part of the external factor. As the local contractor and experienced engineers focused see if there are no delays in payments to construction labor that will facilitate their work to accomplish all required jobs in specific time because labor productivity of the construction workers are completely done as the construction contractors are planned it in site of the projects.

When the contractors have not enough cash flow to cover all required payments for all construction workers in the time without any delays then the productivity of construction workers stay in the same level at least. While the local contractor are not honoring completely in their commitments with their employees then the delay in payment may happen at any period of life project. In this case of local contractor do not match with required payment; construction labor productivity had been affected negatively at that particular period of construction project.

## 2<sup>ND</sup> RANK: TRAINING SESSIONS

This indicator give us that lack of training session is one of the high significant factor which impact on productivity aspects and levels. As shown in next table.

**Table5.12 Rank of lack in training sessions**

FACTOR	RII (%)	RANK
Lack of TRAINING SESSIONS	81.63%	2

The developing valuable training program by each local construction companies such as safty, vocational, and technical training...etc that will minimize the highest affects on construction workers and ensure that they work in best level of productivity. If the local contractors plan to do the training at least one training per year then they find out more benefits and keep their employees to do the various kind of job in high quality.

In complex and huge construction projects, the training programs will be every effective way. And it is a tool needs more attentions from local contractors and subcontractors to obtain completely qualified construction workers.

3<sup>RD</sup> RANK: WEATHER CONDITIONS: The rank of weather condition factor is (81.33%), as shown in the table below. **Table 5.13: rank of Weather conditions**

FACTOR	RII (%)	RANK
WEATHER CONDITIONS	81.33%	3

Weather condition one of the biggest factors that makes impact on labor productivity and increasing losses for any construction activities/events because this factor is out of contracting parties' hand. In Iraq, the construction sector are facing the variations in weather conditions

during the year. The disparities in the extent of the temperatures are seeing during the both main season's winter and summer. Also, the rainfall is second tangible matter which affects daily labor productivity negatively.

4<sup>TH</sup> RANK: DESIGN CHNAGES

The rank of the design changes is (75.3%), as shown in the table below:

**Table 5.14: Rank of Design Changes**

FACTOR	RII (%)	RANK
DESIGN CHNAGES	75.30%	4

The contacting parties should use the same contracted design to minimize its impact on labor productivity in any construction tasks.

5<sup>th</sup> RANK: INCOMPLETE DRAWINGS: The rank of incomplete drawing is (71.99 %), as shown in the table below. **Table 5.15: Rank of incomplete drawing**

FACTOR	RII (%)	RANK
INCOMPLETE DRAWINGS	71.99%	5

Completed all drawing is required under any construction contract because i completed all required drawing in any particular project then that reflect negative impact on labor productivity and minimize the level of productivity of construction workers because of the required drawing incomplete in the time when needed to start and finish the activities in planned period.

6<sup>th</sup> RANK: COMPLEX DESIGNS IN THE PROVIDED DRAWINGS

The rank of complex design in the provided drawing is (71.08 %). As shown in the table below:

**Table5.16: Rank of complex design in the provided drawing.**

FACTOR	RII (%)	RANK
COMPLEX DESIGNS IN THE PROVIDED DRAWINGS	71.08%	6

When provided drawing be easy and more understand from both skilled workers and unskilled workers that will make them achieve their job in required quality and no losses in labor productivity if there are no complex design in the provided drawing no negative impact on labor productivity if not then the situation is versa and high negative impact of labor productivity as the study shows this in the result of survey.

7<sup>TH</sup> RANK: VARIATION IN THE DRAWINGS

The rank of variation in the drawing is (71.08%), as shown in the table below:

**Table5.17: Rank of variation in the drawing.**

FACTOR	RII (%)	RANK
VARIATION IN THE DRAWINGS	71.08%	7

Any variation in drawing then lead to negative impact on labor productivity as the contractors, subcontractors and experienced engineers try to avoid the variation in any drawing.

8<sup>TH</sup> RANK: SUPERVION DELAYS:

The rank of Supervision delays is (70.48%), as shown in table below.

FACTOR	RII (%)	RANK
SUPERVION DELAYS	70.48%	8

The delays in any level of supervision that make the construction laborers are less committed in doing their jobs. This factor affect on daily activities of construction laborers which reflect a minimum level of construction labor productivity.

9<sup>TH</sup> RANK: REWORK: The rank of rework factor is (68.67 %), as shown in the table below:

**Table5.19: Rank of Rework.**

FACTOR	RII (%)	RANK
REWORK	68.67%	9

Rework is a factor associated with quality control and quality assurance these two important issues which reflect if that work acceptable or unacceptable from internal inspectors and external inspectors. If there are some wrong, errors, defects in any construction items then that need repeat the work again to rectify the errors in that particular items and in this case of rework construction productivity may come down while there are many reworks in site of construction projects. The local contractors and subcontractors are interested to do best efforts to avoid rework to ensure their employees are completely matched with required construction labor productivity.

10<sup>th</sup> RANK: INSPECTION DELAY FROM THE AUTHORITIES: The Rank of inspection delay from the authorities is (68.07 %), as shown in the table below.

**Table5.20: Rank of inspection delay from the authorities**

FACTOR	RII (%)	RANK
INSPECTION DELAY FROM THE AUTHORITIES	68.07%	10

During the stage of inspections the construction activities should be done properly. Also, the delays during the stage of inspection specially from authorities that impact negatively on production or local construction workers and may lead to make theses construction workers

under foil situation also, the local contractors feel losses in volume of labor productivity because of inspection delay from the authorities.

#### 11<sup>th</sup>: RANK, IMPLEMENTATIONS OF GOVERNMENT LAW

The rank of implementation of government laws factor is (67.77 %), as in that table below:

**Table 5.21: Rank of implementation of government law**

FACTOR	RII (%)	RANK
IMPLEMENTATION OF GOVERNMENT LAWS	67.77%	11

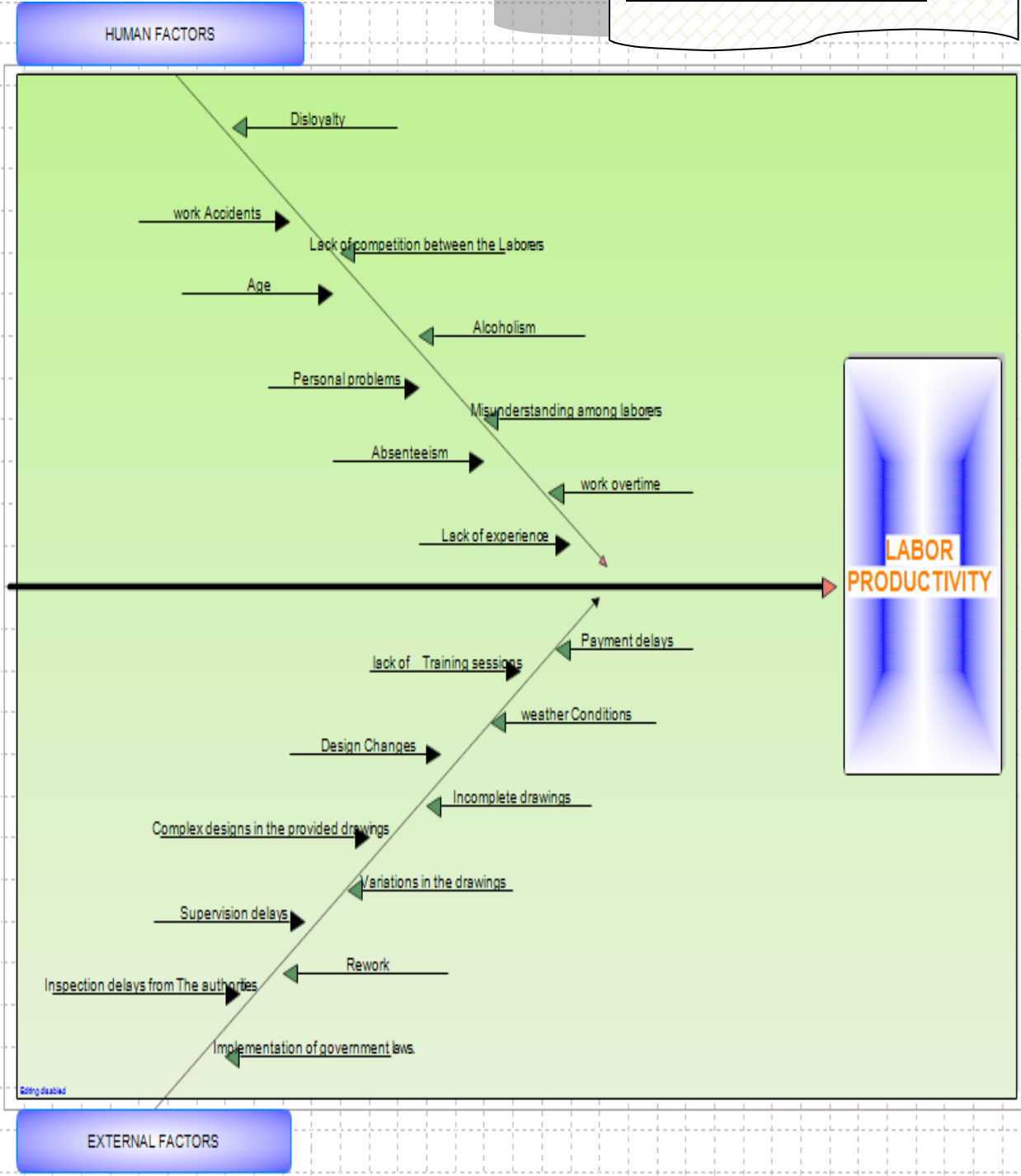
This factor is almost associated with central and local governments, and some of construction companies see this factor is out of control, but the fact, each construction company should do best efforts to match with all local regulations and law to avoid the losses in construction labor productivity.

#### **5.3-Presentation of Human and External Factors on Ishikawa Diagram:**

Many researchers are relied on using Ishikawa “FINSHBON” diagram to present any factors associated with main issue or matter. As this diagram is easy to understanding and give best ideas about the human & external factors are associated with construction labor productivity. This diagram is to show all those factors after completing the discussions of each factors based on their ranks in this section of the study.

The following figure shows the Ishikawa Diagram which draw by using RFFlow Flowchart software

**Fig 5.2: Ishikawa Diagram**



**Figure5.5: Presentation of Human and External Factors on Ishikawa Diagram**

#### **5.4-Comparison with Previous Studies:**

The comparison had been done for the top three factors with previous studies to selected studies from the Middle East countries and India. The following table includes this comparison based on their rankings:

**Table5.22: Comparison with previous studies based rankings.**

RANKING	KUWAIT Jarkas& Bitar (2012)	EGYPT El-Gohary & Aziz (2014)	INDIA Mistry & Bhatt (2013)	IRAQ Ryad & MRS. P.R.Adavi (2015)
1	Clarity of technical specification	Laborer experience and skill	Payment Delay	Lack of experience
2	The extent of Variations/Changes orders during execution	Incentive program	Skill of Labor	Work overtime
3	Coordination level among various design disciplines	Availabilities of materials and their easy of handling	Clarity of Technical Specifications	Payment delays



### 5.4.1-Presentation of the comparison:

By presenting the above comparison on following figure to be easy understanding them:

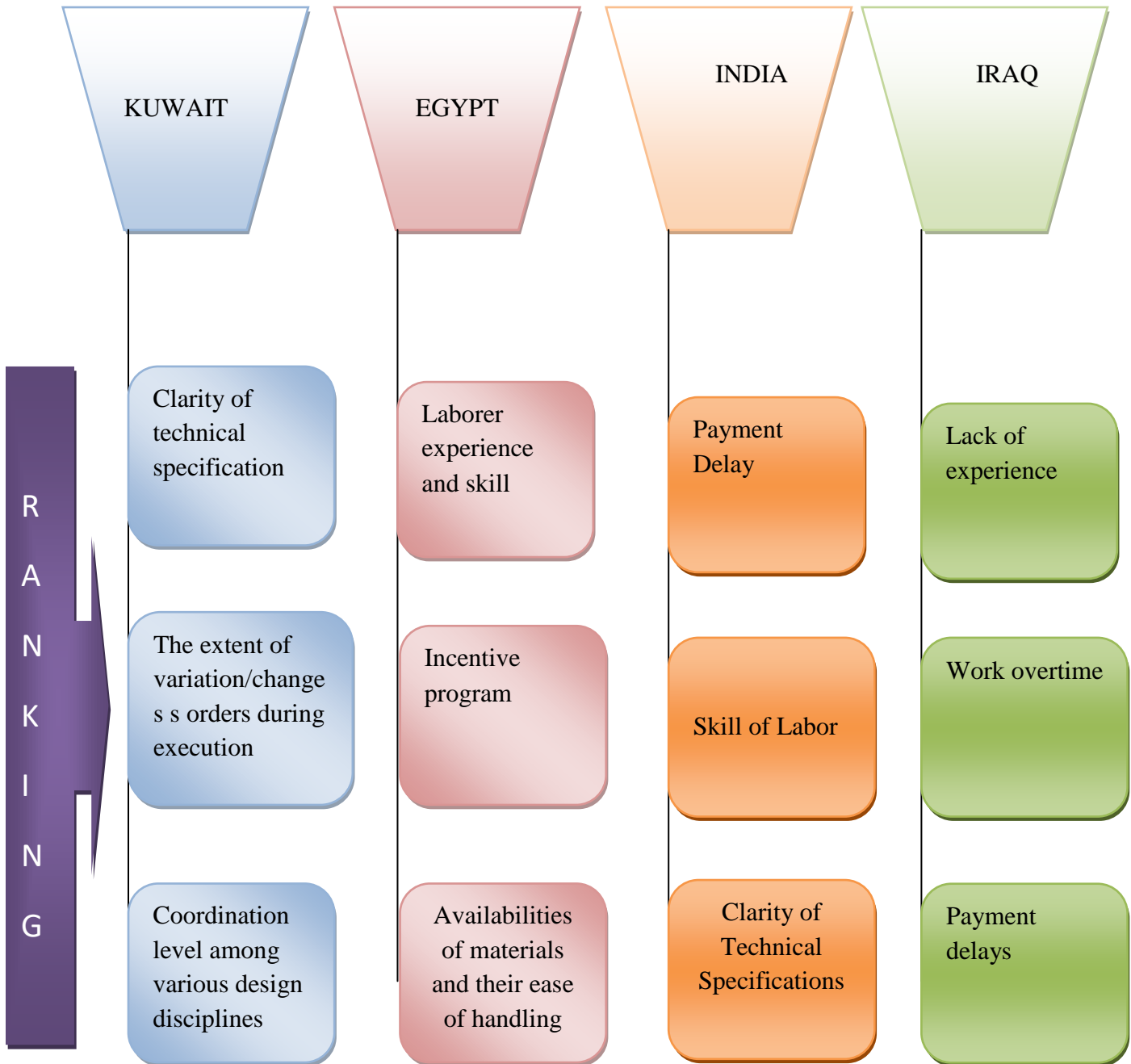


Figure 5.6: Presentation of the comparisons with previous four studies

**CHAPTER SIX**  
**“STATISTICAL**  
**TESTS”**

## **6. SCOPE OF STATISTICAL TEST:**

The statistical steps and tools in this study are used to give corroborate and propped for the analysis and interpretation of the data. While sample size is (N) biggest or more than 30, then Large Sample test on Hypothesis is used for population proportion within (2-tailed tests). The percentage population is usually made in content of probability of success for binomial distribution (MC Clave, 2006).

Depend on the *Test Formula* as in the following assumptions:

The test formulated as:

$H_0: P = P_0$	And	$H_a: P \neq P_0$
----------------	-----	-------------------

Where,

P = population proportion

P<sub>0</sub> = null-hypothesized Proportion

The statistical test:

By using z-scores or values statics as in the following formula:

$$Z = \frac{\text{Sample proportion} - \text{null-hypothesized Proportion}}{\text{Standard Deviation (SD) of sample proportion}}$$

Rejection Region as in  $H_a : P \neq P_o$ .

Reject  $H_o$  if T-test is:  $\left\{ \begin{array}{l} \text{Greater than } Z (0.05 \text{ level}) +1.96 \text{ (positive Region)} \\ \text{or} \\ \text{Less than } -1.96 \text{ (negative Region)} \end{array} \right.$

The results shows in the table of overall ranks that give us full ideas about all T's that is bigger than 1.96 mean significant impact of these factors on construction labor productivity in the area of the study.

Reflecting the levels of both criteria: Significant and Non-significant Factors

### **6.1-Test the level of significant and non-significant of the factors:**

Based on the survey data from different level of the targeted groups in the specific area of the study we try to test the areas of significant under four ranges/levels. By using formulas that mentioned in below to calibrate the severity indicator for each sub criteria as part of main criteria of two groups "Human and external" groups.

The formulas as in the following: (Kadir, et, al, 2005, pg 47) & (Nabil Ailabouni,et, al , 2012, pg 40).

$$\text{Frequency Indicator (FI)} = \frac{3M1 + 2M2 + M3}{3(M1 + M2 + M3)}$$

$$\textit{Severity Indicator (SI)} = \textit{RII} \times \textit{FI}$$

Where,

**M1** = Number of responses for “High” frequency in responses occurrence.

**M2** = Number of responses for “Medium” frequency in responses occurrence.

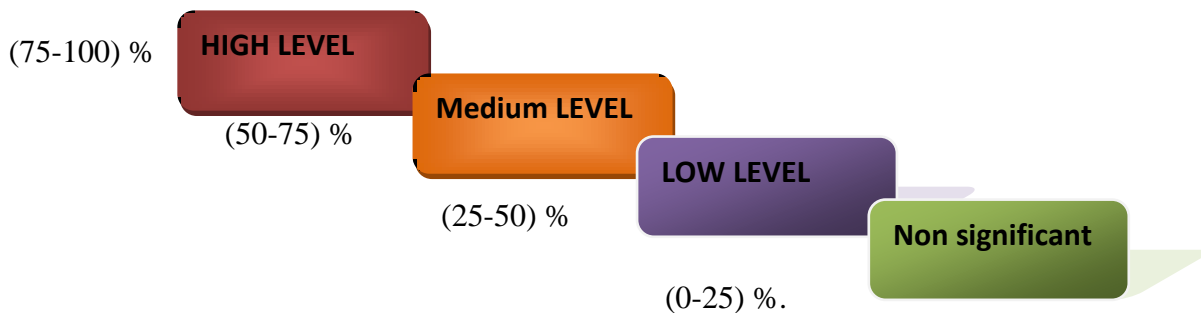
**M3** = Number of responses for “Low” frequency in responses occurrence.

**M1, M2, and M3:** are under weight of 3, 2 and 1.

Through using the above formula to test the percentage of indicator of severity to each factors to check then the level of significant for each sub criteria via the four levels significant these are:

- 1- High significant based on the severity indicator ranged from (75-100) %.
- 2- Medium significant based on the severity indicator ranged from (50-75) %
- 3- Low significant based on the severity indicator ranged from (25-50) %
- 4- Non significant based on the severity indicator ranged from (0-25) %.

The next figure6.1: shows percentages from high significant to non significant gradually:



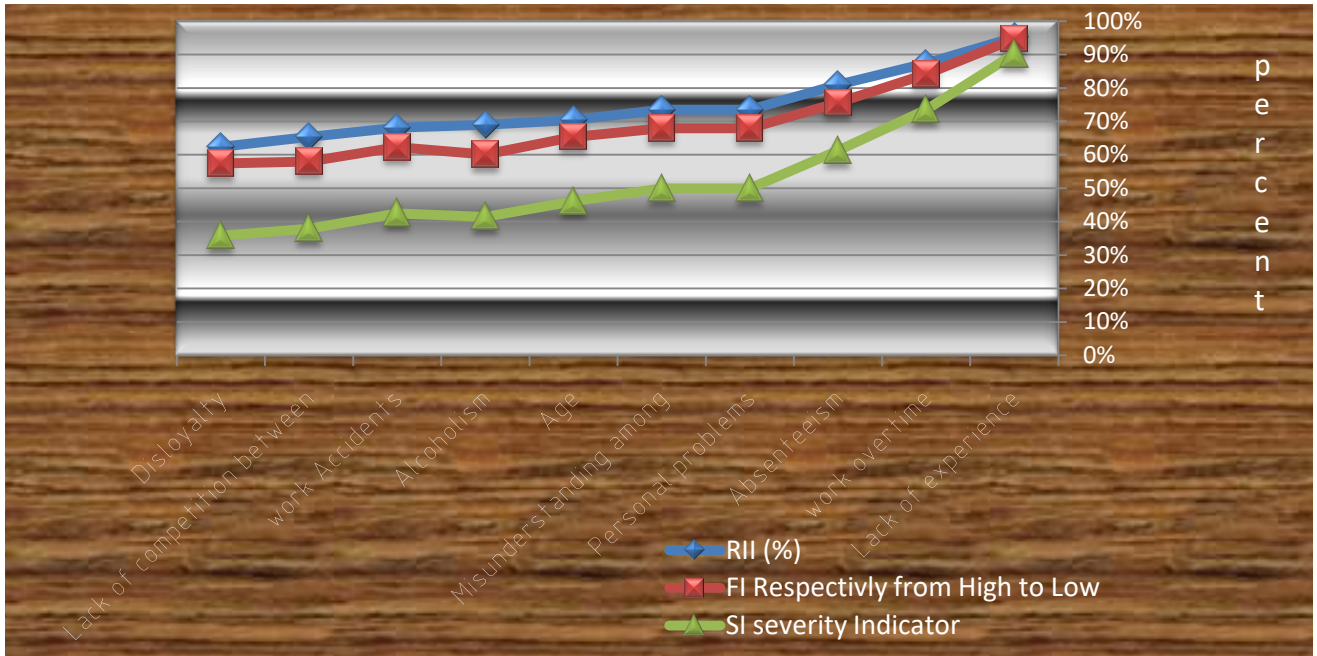
**Figure6.1:** shows percentages from high significant to non significant gradually

**Table6.1: indicates to all factors under test of severity indicators:**

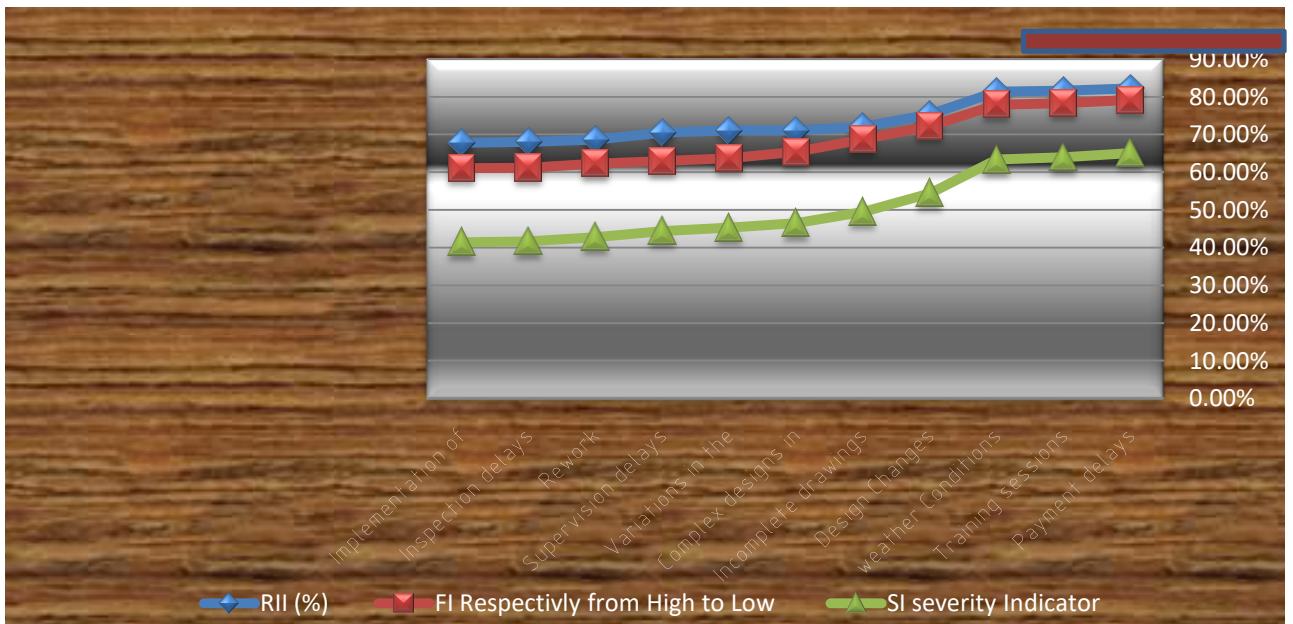
Criteria	Sr. of factor in Ranks	Sub Criteria	RII (%)	FI Respectively from High to Low	SI severity Indicator	Level of significant			
						High (75-100)	Medium (50-75)	Low (25-50)	non-significant (0-25)
HUMAN FACTORS	1	Lack of experience	95.18%	95%	90%	√			
	2	work overtime	87.35%	84%	74%		√		
	3	Absenteeism	81.02%	76%	61%		√		
	4	Personal problems	73.49%	68%	50%		√		
	5	Misunderstanding among laborers.	73.49%	68%	50%		√		
	6	Age	70.48%	65%	46%		√		
	7	Alcoholism	68.98%	60%	41%			√	
	8	work Accidents	68.17%	62%	42%			√	
	9	Lack of competition between the Laborers	65.36%	58%	38%			√	
	10	Disloyalty	62.35%	57%	36%			√	

Criteria	Sr. of factor in Ranks	Sub Criteria	RII (%)	FI Respectively from High to Low	SI severity Indicator	Level of significant			
						High (75-100)	Medium (50-75)	Low (25-50)	non-significant (0-25)
EXTERNAL FACTORS	1	Payment delays	82.23%	79%	65%	√			
	2	Training sessions	81.63%	78%	64%		√		
	3	weather Conditions	81.33%	78%	63%		√		
	4	Design Changes	75.30%	72%	54%		√		
	5	Incomplete drawings	71.99%	69%	49%		√		
	6	Complex designs in the provided drawings	71.08%	65%	46%		√		
	7	Variations in the drawings	71.08%	64%	45%		√		
	8	Supervision delays	70.48%	63%	44%			√	
	9	Rework	68.67%	62%	43%			√	
	10	Inspection delays from The authorities	68.07%	61%	42%			√	
	11	Implementation of government laws.	67.77%	61%	41%			√	

The above results were indicted to 100% of the “human and external” factors under significant level and no one from them under level of non-significant then all the studied factors have reflected various level of severity and different aspects of their negative impact on construction labor productivity in Iraq.



**Fig6.2: Comparative between three percentages of indexes “Human factor”.**



**Fig6.2: Comparative between three percentages of indexes “External factor”.**



**CHAPTER.**  
**SEVEN**  
**“CONCLUSION”**

## **7. CONCLUSION**

The structure of this chapter is comprised from not only the general conclusion, but it is focused on the some important required actions for the first highest three from sub criteria.

### **7.1 Action required improving construction labor productivity:**

As we are aware, there are some actions required to improve labor productivity in any construction projects. The actions are represented part of the overall solutions to enhance the system of construction sectors.

The study is focused in this section about the actions required to improve labor productivity for the highest first three factors. The following tables indicate the required actions.

#### **7.1.1- Actions on Human Factors:**

**Tables7.1: display actions required on human factor to improve labor productivity**

<b>GROUP NO.</b>	<b>Criteria</b>	<b>Sr. of Factors Based Ranks</b>	<b>Sub Criteria</b>	<b>Action required for improving construction labor productivity</b>
<b>FIRST GROUP</b>	<b>HUMAN FACTOR</b>	1	<b>Lack of experience</b>	To improve this factor the construction organizations have to interest in some workshops minimize the negative impact of lack experience and these required workshops are they: <ol style="list-style-type: none"><li>1. reinforcement concrete works</li><li>2. bricklayers and bricks works</li><li>3. wooden works</li><li>4. Tiling works such as Ceramic</li><li>5. Plastering works</li><li>6. Increasing the experiences about operation works of construction</li></ol>

			equipments such as (concreting pump, mixer, vibrators...ect)
		<i>work overtime</i>	<p>To avoid overtime then the action required from all contracted parties:</p> <ol style="list-style-type: none"> <li>1. Use valuable scheduling and planning for overtime to avoid its affect on production and workers' health.</li> <li>2. Using realistic schedule time initially to meet with all objectives of projects and minimize overtimes.</li> <li>3. Avoid repeating the overtime for the same team during the life cycle of the project.</li> <li>4. The contractors and subcontractors have to use "award" policies to make their construction team work in the same levels during overtime to be these awards as part to motivate them.</li> </ol>
		<b>Absenteeism</b>	<p>To avoid absenteeism then to improve labor productivity through:</p> <ol style="list-style-type: none"> <li>1. Enhancing the work conditions in the site of any constriction project.</li> <li>2. Listing to the requests of vacations.</li> <li>3. Using a reliable plan and policies in Human resource about: Sick leaves, Annual leaves.</li> </ol>

**7.1.2- Actions on External Factors** as in the following tables:

**Tables7.2: display actions required on external factor to improve labor productivity**

GROUP NO.	Criteria	Sr. of Factors Based Ranks	Sub Criteria	Action required for improving construction labor productivity
FIRST GROUP	EXTERNAL FACTOR	1	<b>Payment Delays</b>	<p>To improve life conditions of any construction employees &amp; workers that reflects high labor productivity. the contractors and subcontractors need to take some actions to avoid payment delays:</p> <ol style="list-style-type: none"> <li>1. By increasing the cooperation with client to ensure there are no delays in payments from clients side. Of the contractors receive the payments in the time then they pay to the salaries/wages to workers without delays.</li> <li>2. The local construction companies should depend on reliable plans about the time of payments.</li> </ol>
		2	<b>Lack of Training sessions</b>	<p>The following action will help to avoid lack of training :</p> <ol style="list-style-type: none"> <li>1. The construction organizations have to have annual work plan within training sessions with suggested time and cost of each required training.</li> <li>2. The suggested training as: quality &amp; quality control aspects, initial</li> </ol>

			<p>understanding about site management, required tests for construction materials, site safety and health training session, training about the construction sequence about some important items such as piling in different size and types to understand the hazards around this items and improve the quality aspects.</p> <p>3. Each construction firms should focus on some important construction vocational training.</p>
	3	<p><b>Weather Conditions</b></p>	<p>To improve labor productivity in any construction projects then each contractors and subcontractors have to use some reliable techniques and methods to minimize the impacts of weather conditions on workers and their construction works. To minimize weather conditions negative impacts by following:</p> <ol style="list-style-type: none"> <li>1. Each construction company have to establish data base about weather conditions and update it monthly with metrological offices.</li> <li>2. Give clear instructions to supervisors to ensure that all construction workers to get address the required uniforms such as the uniforms which supposed to be used during rain seasons and extra.</li> </ol>

## **7.2- Conclusion:**

In the present study, there are total 21 factors which cause the impact on labor productivity. This study identified these factors based on using Ranks and % RII. It was clear from the rank figures calculated for the first group (Human factors), that “Lack of experience” ranked first. This reflected how the “lack of experience” is one of the significant factors for contracting parties and engineers. One of the important tasks for contractors and construction companies is to ensure more training for their workers. It is necessary to enhance their knowledge periodically to make sure these workers are up to date in their knowledge for using a new technology and increasing their experience level for any field job.

In the second group (External Factors), payment delays and lack of training sessions were very close and ranked as top two factors based on % RII. These figures refer to the responses obtained from contractors, sub contractors, project managers and experienced engineers who observed that their workers need more support in payment and they should be paid in time (daily/ weekly/ monthly) as these payments will make the construction workers more focused on their jobs.

In order to increase the profits in a construction industry, it is necessary for the contractors and their construction partners to motivate and train the workers to obtain best outcomes of the construction productivity, so that there are no delay and losses.

Through this study we recommend to build valuable relationships between the construction companies and vocational training centers to help the workers to develop their skills and minimize the gap between the experience of a worker and requirement of the industry and that will lead to increase in construction labor productivity.

Construction contracting parties and the main players in any construction sectors, they should take some important precautions impartially and logically about human and external factors during all the project life cycle to overcome all troubles at once. Some of these precautions we mentioned them in above section in this chapter under “required actions”.

When the construction contracting parties try to initiate the precaution procedures they must focus on the main objectives these are:

- Protection of construction workers and design reliable and flexible plan to protect the workers.
- Enhancing of their lives conditions in any the site of the projects.
- Motivating of all employees and take high interested by using both types of motivation: intrinsic and extrinsic. As the motivation is one of valuable mechanism to increasing labor productivity or at least match with required volumes of production.
- Taking some measurements in site of construction projects to minimize the negative impacts from external factors even some of them are out of control.
- Focusing on compensations for construction workers.
- Increasing of levels of the inspections from local governments and relative departments about working conditions and workers conditions.
- In any construction firms, Human Resource Department or Managers (HRM) should review HR manual and regulations. Also, they should give high priority for overtime schedules reviewing to ensure there are no time loads on some crews continuously and maybe other crews there are no overtime totally. Because overtime causes many problems for workers and work itself.
- Understanding completely the importance of each mentioned factor in this study and their impacts as shown in pervious analysis on all construction labor productivity aspects.
- Highlighting on impacts of human and external factors to overcome on losses in construction production bases, and then move on preparing multi-options in each site of projects to improve labor productivity because maybe those effects are not in same negative levels on any construction project as it is differential from countries to others.

### **7.3-Contributions of the Present Study:**

This study had been contributed on different levels in construction sectors:

1. It gives a valuable idea about construction labor productivity in the area of the study. As the limited studies are available in archive of construction industrials in the targeted areas of the study.
2. A collected data and analysis base in the study has been done through the survey technique, which is considered a sign for construction firms to increasing their interesting about one of the significant matter in construction sectors that is construction labor productivity. To minimize impact of human and external factors on labor productivity.
3. A detailed results and graphical has been measured on various targeted groups in this research, which is contributed to contemplate the range of various levels of point of views from directs construction players/professional persons in construction field.
4. A specific and detailed discussion about each factors, which is made the contracting parties use realistic and reliable actions to improve levels of labor productivity in several of site projects.
5. A general process of this study has been indicated about the negative impacts of the several and different factors on construction productions in the site of projects via construction workers.
6. This research can donate and give the local governments to hints to depend a new legal or modified old legal to meet with situations of construction workers. As this human wealth is affected directly on national economic sector.
7. Attending of workshops about leadership and management to enhancing and increasing the knowledge about how to make project partnering work together to minimize negative impact about some factors associated with them on construction workers and labor productivity.



**CHAPTER.**  
**EIGHT**  
**“FUTURE SCOPE”**

## **8. Future Scope and Recommendation Points:**

This Chapter is highlighted on the some elevated points from the study. Future scopes and recommendations can assist the researchers who are interested to deal with same topics in directly or non-directly with objectives to overcome the challenges during their research methodologies.

### **8.1 Future Scope:**

The following points indicate features of future scope:

1. Exploring extra factors which make the impacts on construction workers' life and labor productivity.
2. Preparing useful Database (DB) via construction firms about the construction workers and site condition which will help and support any next studies that related with labor productivity. And updating the DB regularly.
3. Give high priory for construction labor productivity to decrease its impact on economic sector.
4. Enhancing of life conditions of construction workers and take in consideration “females” workers/employees by giving equality in work opportunities.
5. Increasing the relationship and cooperation between the construction government institutes and local construction firms especially in Iraq, this will reflect on improvement of construction workers skills.
6. Identifying and ranking the factors causing losses in cost and time delay which are associated with labor productivity in all types of construction projects in Iraq.

7. Using a new technology and information technology, these will help all construction firms to achieve their goals in the time and it will contribute to raise level of labor productions and increasing their knowledge.
8. It is an invitation to local governments and central government to review all legal and instruction related with construction workers specially the part of law associated with companions and overtime parts to enhance the life conditions of construction workers that will impact positively on construction productivity.
9. Increasing the knowledge of construction contractors in construction works' law to follow up and apply them in best level. The increasing their knowledge via workshops.
10. Giving high priorities for social security and medical insurance to make the workers to achieve their jobs within comfortable levels.
11. Minimizing burdens on construction workers through creating a suitable work environment and minimizing all barriers as possible. As those burdens and barriers certainly affect on the production level of construction workers.
12. In Iraq, the local construction firms needs to spend large sums on construction sector to overcome the damages during three decades of conflict as well as enable to the country to profit from increased investments in this important sector. However, it will enhance the life conditions of construction workers everywhere/locations, inside Iraq.

## **8.2-Recommendation:**

The construction contracting partners is the main responsible to improve all aspects which associated with increasing and rising levels of construction productivity. They are responsible to create and enhance a friendly environment between the construction workers and their direct supervisors within increasing the communication levels with project managers to defeat all challenges and barriers that drive the construction wheelers to match with optimum sequence and maximum management for resources. The main recommendation for construction firms to give high priority to human and external factors and their sub criteria through building variables and advanced trainings, paid the wages in the time, minimize impact of overtime schedules on workers, use technical and logical measurements to stop completely the impacts of work accidents to protect construction workers as they represent the main and greatest worth for any construction forms.

Recommendation to other researchers is to take more care about study and exam the main significant factors associated with consequences of construction productivities to reach advanced outcomes and help them to convey all data to relative peoples of their study in best way to be easy understanding at the end.

**LIST OF  
REFERENCES  
&  
WEBSITES**

## REFERENCES

- Books & Journals

[1] Association for the Advancement of Cost Engineering (AACE), International Recommended Practice No. 25R-03 (2004). Estimating Lost Labor Productivity in Construction Claims.

[2] Abdul Kadir, M. R., Lee, W. P., Jaafar, M. S., Sapuan, S. M., and Ali, A. A. (2005). "Factors affecting construction labor productivity for Malaysian residential projects." Structure Survey, 23(1), 42-54.

[3] Adrian, J. (1987). Construction Productivity Improvement. Elsevier Science Publishing, Amsterdam, Netherlands.

[4] Adrian, J. (1990). Improving Construction Productivity Seminar, Minneapolis, MN. Association of General Contractors of America.

[5] Alarcon, L. F Borcharding, J. D., and. (1991). "Quantitative effects on construction productivity." The Construction Lawyer, American Bar Association, 11(1), 35-48.

[6] Alum, J., and Lim, E. C. (1995). "Construction productivity: Issues encountered by contractors in Singapore." International Journal of Project Management, 13(1), 51-58.

[7] Abdul Kadir, M. R., Lee, w. P., Jaafar, M. S., Sapuan, S. M., And Ali, A. A. (2005). "Factors Affecting Construction Labour Productivity For Malaysian Residential Projects." Struct. Surv., 23 (1), 42–54.

[8] Bernstein, Harvey M., and Lemer, A. C. (1996). Solving the Innovation Puzzle: Challenges Facing the U.S. Design and Construction Industry, New York: 35, 1, 37-50.

[9] Besim U.Balci, "a case study on improving labour productivity in civil engineering projects, July-2004. Page, 59, 60.

[10] Bohrnstedt, G, and Knoke, D (1994). Statistics for Social Data Analysis (3rd Edition). F.E. Peacock Publishers, Inc., Itaska IL.

- [11] Borcharding, J. D Chang, L.-M., and. (1985). "Evaluation of craftsman questionnaire." Journal of Construction Engineering and Management, 111(4), 426-439.
- [12] Borcharding, J. D, and Liou, F.-S. (1986). "Work sampling can predict unit rate productivity." Journal of Construction Engineering and Management, 112(1), 90-103.
- [13] Bramble, B. B., and Callahan, M. T. (2000). Construction Delay Claims. Aspen Publishers
- [14] Cheung, S. O., Suen, H. C. H., and Cheung, K. K. W. (2004). "PPMS: A web-based construction project performance monitoring system." Automation in Construction, 13(3), 361-376.
- [15] International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-4, April 2013.
- [16] Kadir M R Abdul, Lee W P (2005) Factors affecting construction labour productivity for Malaysian residential projects, Structural Survey, Vol 23, No. 1, 2005, pages 42-54, Emerald Research website, [www.emeraldinsight.com/0263-080X.htm](http://www.emeraldinsight.com/0263-080X.htm).
- [17] Leslie Kish (Author), Survey Sampling, February 6, 1995- at <http://www.amazon.com/Survey-Sampling-Leslie-Kish/dp/0471109495>.
- [18] Mechanical Contractors Association of America (MCAA) and other organizations.
- [19] Mistry Soham, Bhatt Rajiv, 2013, " Critical Factors Affecting Labour Productivity In Construction Projects: Case Study Of South Gujarat Region Of India" , International Journal of Engineering and Advanced Technology (IJEAT) ISSN: 2249 – 8958, Volume-2, Issue-4, April 2013.
- [20] Nabil Ailabouni,et, al , 2012, pg 40 from "FACTORS AFFECTING EMPLOYEE PRODUCTIVITY IN THE UAE CONSTRUCTION INDUSTRY".
- [21] SINGAPOREAN Journal Of business Economics, And management Studies (VOL.1, NO.6, 2013).

[22] Sumanth, D. J. (1984). *Productivity Engineering and Management*. McGraw-Hill, New York, NY.

[23] Sherif M. Hafez, Remon F. Aziz, Enas S. Morgan, Madeha M. Abdullah, Eman K. Ahmed. Critical Factors Affecting Construction Labor Productivity in Egypt. *American Journal of Civil Engineering*. Vol. 2, No. 2, 2014, pp. 35-40. doi: 10.11648/j.ajce.20140202.14.

[24] Shaughnessy, J.; Zechmeister, E.; Jeanne, Z. (2011). *Research methods in psychology* (9th ed.). New York, NY: McGraw Hill. pp. 161–175.

[25] Thomas, H. R. (1991). "Labor productivity and work sampling: The bottom line." *Journal of Construction Engineering and Management*, 117(3), 423-444.

[26] Thomas, H. R., and Kramer, D. F. (1988). "The manual of construction productivity measurement and performance evaluation." Source Document 35, Construction Industry Institute, The University of Texas at Austin.

[27] Thomas, H. R., and Oloufa A. A. (1995). "Labor productivity, disruptions, and the ripple effect." *Cost Engineering*, 37(12), 49-54.

[28] Thomas, H. R., Riley, D. R., and Sanvido, V. E. (1999). "Loss of labor productivity due to delivery methods and weather." *Journal of Construction Engineering and Management*, 125(1), 39-46.

[29] Wen Yi1\* And Albert P.C. Chan2” Critical Review Of Labor Productivity Research In Construction Journals (2013) *Journal Of Management In Engineering*.”

[30] Zahra Ehsanbakhsh Mostahsan1- Seyedeh Somaiye Mirzaee2 M.A Student of International Business Management, Islamic Azad University of Guilan-Rasht. SINGAPOREAN JOuRNAL Of buSINESS EcONOmIcS, ANd mANAGEmENt STUDIES VOL.1, NO.6, 2013



### Websites References:

- [1] [https://www.academia.edu/5500010/Labour\\_productivity](https://www.academia.edu/5500010/Labour_productivity) uploaded to web by Monaamee hassan. June, 2014
- [2] <http://www.slideshare.net/atvisun/construction-productivity/> Oct,2011
- [3] [http://www.hbs.edu/faculty/Publication%20Files/09-040\\_146640ac-c502-4c2a-9e97-f8370c7c6903.pdf](http://www.hbs.edu/faculty/Publication%20Files/09-040_146640ac-c502-4c2a-9e97-f8370c7c6903.pdf)/2009
- [4] [htt://www.bls.gov/oes/current/oessrci.thm#23](http://www.bls.gov/oes/current/oessrci.thm#23)(June,2011): U.S. Department of labor, Bureau of Labor statistic, Occupational Employment Statistic,” May 2010 National Industry – Specific Occupational Employment and Wage Estimate,
- [5] <http://www.intrans.iastate.edu/reports/hispanic-workforce4.pdf>/Dec,2007
- [6] <http://www.intrans.iastate.edu/reports/hispanic-workforce4.pdf>
- [7] [www.ijetae.com](http://www.ijetae.com) (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 5, May 2014).

# **Appendixes**