



Adama Science and Technology University

School Of Architecture and Engineering

Department Of Civil Engineering

Post Graduate Program: Construction Management

**PRODUCTIVITY IMPROVEMENT TECHNIQUES: APPLICATION
IN ADDIS ABABA SAVE HOUSING DEVELOPMENT ENTERPRISE.**

**A Thesis/Dissertation Submitted In Partial Fulfillment Of The
Requirements For The Degree Of Master Of Science In Civil Engineering**

Construction Management

By: - Aniley Asfaw

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Abstract

Any Developing Country like Ethiopia has a problem of house. To solve this problem the government is working on building the houses Condominium. But these projects are delayed from their completion time means many projects built under Addis Ababa Saving House Development Enterprise (AASHDE) are delayed.

The main objective of this paper was assessing productivity improvement techniques by identifying factors affecting productivity in AASHDE projects. The Study includes literature review, questioners, site study as the primary data and to refine gathered data from primary data this study also is uses archival data.

The questioners which are 41 questions from factors affecting productivity and 48 questions from productivity improvement techniques were distributed for 70 randomly selected samples from directly participating 151 contractors, 9 consultants and 76 clients superintendents. 67 Questionnaires were returned from 70 sampled Questioners which is around 96 % of distributed Questioners were returned. The analyses for data from samples were analyzed through ranking the top categories and individual variables. The top Factors affecting the productivity in AASHDE were identified in rank which were Management related, Resource related, Project related, Force majeure, Healthy and safety related and policy and regulation related factor affecting the productivity. And the analysis was assessed top and main productivity improvement techniques from 48 variables under five main categories; which were adapted and used in AASHDE projects.

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1 INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Housing is one of the basic necessities for human survival; despite it remains for long period as a critical problem of most of the cities of developing countries. This is the main feature of Addis Ababa, which is the capital city of Ethiopia. Housing supply of the last 30-40 years could not manage to the fast increase need. In addition the government residence system drives more than 40% of the housing stock to non-reparable and inhabitable state. The availability of basic infrastructural facilities and amenities is also very limited. Addis Ababa City Administration is Proclaim the Housing Program under Integrated Housing Development Program (IHDP). One branch of this program is 40/60 Condominium Project under Addis Ababa Saving House Enterprises (WWW.aashde.gov.et, 2016).

The projects under Addis Ababa Saving House Development Enterprise (AASHDE) are facing serious criticism for delaying the delivery of condominiums due to projects lagging behind from their schedule. Most of the projects are reportedly lagging behind from their schedule. From many problems faced in those projects the productivity is one. (WWW.aashde.gov.et, 2016).

Productivity is considered as one of the most important factors for this worth and the success and overall performance of every construction. Productivity is simply a measure of the ratio between the output of a process and the input of resources needed for it. It is

usually expressed as output divided by input. Output can be expressed in terms of units or volume and this unit have usually been determined for production planning purpose. Inputs are the resources (man power, Machinery, Materials, Money) which processed and give production (Durdev, 2011).

Any improvement in construction productivity would, consequently, assist the industry and the country to make significant financial savings. However, improvement cannot be achieved without identification of the causes of the project productivity problem. There are different factors which affect the productivity either on input (Resources) or during processes (methods). There are different studies conducted previously regarding productivity and productivity improvement techniques on other countries which indicate the factors affect productivity. The factors that influence productivity may be separated into three factors: industry-related, labor-related, and management-related (Adrian, 1987).

But getting related studies in Ethiopia especially on building construction productivity and productivity improvement techniques is difficult due to the fact that there are no published papers under 40/60 condominium projects.

This study attempts to address and assess productivity and productivity improvement techniques in projects under the Addis Ababa Saving House Development Enterprise (AASHDE) by identifying factors that affect construction productivity and improving techniques for those factors.

1.2 STATEMENT OF PROBLEM

As central statistics agency; the population which lives in Addis Ababa is around 3.5 million; from those population 40% are unemployed, 350,000 peoples have not house; and 70% of population lives in sum with inhuman and unhygienic condition according to (UN HABITAT,2008). So Addis Ababa City administration aims to change image of the city in millennium development goal (requires a total of 2,250,831 units, which equates to a considerable 225,000 houses per annum). This goal is done through acquiring homes and promoting cost efficient housing; alleviating urban poverty and empowering citizens. So Addis Ababa Saving House Development Enterprise (AASHDE) is handling the responsibility for 40/60 condominium building. Addis Ababa Saving House Development Enterprise (AASHDE) is executing many projects in different areas and now aiming to build 75,000 40/60 new condominiums building and plan to build 15,000 residents in Addis Ababa in next five years. But the projects are facing different problems from those delays of the projects is one.

1.3 QUESTION AND OR HYPOTHESIS

This paper answers the following questions;

- What are the factors which affects the productivity of the projects which constructed under Addis Ababa Saving House Development Enterprises?
- Which productivity improvement techniques are currently used under Addis Ababa Saving House Development Enterprises projects?

1.4 PURPOSE OF STUDY

The purpose of this study is to provide assessments on productivity improvement techniques in Addis Ababa Saving House Development Enterprise projects by identifying factors which affect the productivity on construction project and assessing the improvement techniques for those factors in order to increase the productivity.

1.5 GENERAL AND SPECIFIC OBJECTIVES

1.5.1 GENERAL OBJECTIVES

The general objective of this paper is to assess productivity improvement techniques for Addis Ababa Saving House Development Enterprise and identifying the factors affecting the productivity.

1.5.2 SPECIFIC OBJECTIVES

- 1 To assess current productivity improvement techniques in selected Addis Ababa Saving House Development Enterprise projects.
- 2 To identify factors affecting productivity in selected Addis Ababa Saving House Development Enterprise projects.
- 3 To Rank and differentiate productivity improvement techniques in selected Addis Ababa Saving House Development Enterprise projects.
- 4 To recommend the productivity improvement techniques

1.6 SIGNIFICANT OF THE STUDY

The finding would be valuable for Addis Ababa saving House Development Enterprise as they focus to improve the productivity in order to complete their projects on schedule and deliver the condominium in time. This will assist the stakeholders to minimize the cost overrun on project by assessing productivity improvement techniques.

1.7 DELIMITATION OF THE STUDY

This study is cover building projects under Addis Ababa Saving House Development Enterprise (AASHDE).

2 LITRATUR REVIEW

2.1 INTRODUCTION

As United Nations projects the world's urban population will increase by 2.6 billion people, up from 3.6 billion in 2011 to 6.3 billion in 2050 (UN, 2012). Despite this, almost 1 billion people are thought to live in urban slums without proper housing and amenities (UN, 2002). By 2025, nearly half of Africa's population will live in cities as a result of sustained urbanization, putting pressure on the formal housing supply.

Urbanization being twentieth century demographic phenomena, more and more people are changing residence from rural to urban areas. Studies have shown that increasing proportion of the population prefer large cities, big towns and a nearby administrative capitals. The growth of an urban center can take place in different forms: by growth of the existing urban localities, by classification of cities (from rural to urban) and annexations of new territory to existing cities. The other main factor which determines the growth of an urban center is the demographic change i.e. natural increase (difference between crude birth rate and crude death rate) and migration effect. Some of the urban centers in Ethiopia have already faced and others eventually will face one of these types of growth or a combination of them. In 1984 the urban population of Ethiopia contributed only 11.2 percent to the total population of the country (CSA, 1987). Over the ten years between the two census, the proportion grew to 13.7 percent (CSA, 1999).

According to the United Nations population projection the proportions of urban population in the Ethiopia will be 26 percent by the year 2015 and 34 percent by 2025. (CSA, 1987). These all growth of an urban center definitely demands infrastructural developments. This includes roads, schools, hospitals, health centers, housing, water supply, sanitation, and waste disposal, light...etc. In Ethiopia, especially in urban areas, shortage of housing is one of the major problems that call for immediate action. The majorities of houses in Ethiopia are below qualitative standard and lack adequate space. The lives and health of people living in housing of such poor quality and with such inadequate provision for water, sanitation, and drainage are under continuous threat. However, in the developing world in general and in least developed countries like Ethiopia in particular the number of people living in such conditions is increasing every year. Studies have shown that without major improvements in housing markets and in the expansion and improved provision of infrastructure and service, it is certain that the population living in such environmental expand very rapidly (Robert, 1997).

Ethiopia's housing deficit is between 900, 000 and 1,000,000 units in urban areas, and an estimated 225, 000 housing units are required a year to meet the Millennium Development Goals (requires a total of 2,250,831 units, which equates to a considerable 225,000 houses per annum) by the 2015 and that only 30% of Ethiopia's total housing stock is in fair condition, while the remaining 70% is in need of total replacement. As a result, Addis Ababa city administration has started an ambitious of housing construction and inner city up grading program (UN-Habitat, 2011).

Addis Ababa City Government Data indicates on archival data's; like many other fast growing cities, Addis Ababa faces a severe shortage of affordable formal housing. It is estimated that Ethiopia's current housing need (deficit) in urban areas is about a million units, and that only 30 percent of the current housing stock is in a decent condition. Many of the capital city's inhabitants live in sub standard housing conditions without access to important urban services. In order to address this shortage of housing supply, and to ensure that the poor are able to access decent housing conditions, the Ethiopian government has implemented the Integrated Housing Development Program (IHDP) to provide condominium housing at subsidized rates to eligible urban households, on an enormous scale. Through this program, the government has been implementing a large scale condominium housing project, targeting at low- and middle- income households. The project is financed by the city government. So far the city administration of Addis Ababa distributed at least 140,000 houses to the beneficiaries. Addis Ababa Saving House development Enterprise is established to handle 40/60 condominium Projects under Proclamation No. 361/2003.

2.2 BACKGROUND OF CITY GOVERNMENT OF ADDIS ABABA SAVING HOUSES DEVELOPMENT ENTERPRISE

The 'Urban Development Policy' of Ethiopia which indicates that urban development involves multi-sectored activities that include inter-related and coordinated developments of the industrial, commercial, infrastructure and service sectors. In order to aim at general and holistic direction of these common development goals, the formulation of this policy

was indispensable. Besides widespread shortage of Residential Houses and dilapidated of urban villages was taken as the basic constraints related to development of unbans & good governance. Hence, special attention will be given to '**housing**' in urban development activities.

Thus, the Addis Ababa City Government Cabinet, in accordance with Article 23(1) of the Addis Ababa City Government Revised Charter Proclamation No. 361/2003, issued regulation No. 58/2014 so as to establish Addis Ababa Saving Houses Development Enterprise (AASHDE). So, AASHDE carried out its mission and act accordingly.

Addis Ababa Saving House Development enterprise is set to see the residents of Addis Ababa improving their saving culture in changing the slum areas and making them owners of their houses in a well planned city in the year 2020 by Enhancing the Saving culture of the society, Rectifying housing problems, strengthening the capacity of construction industry, creating job opportunities.

As pointed in Proclamation No. 361/2003, The Main objectives of AASHDE are:-

- Overcoming the scarcity of residential houses phase by phase and to resolve the problem forever,
- Improving the saving culture of the societies to capacitate the sustainable national development of the country,

- Creating a job for unemployed citizens so as to improve their income level and life style,
- Strengthening the construction industry,
- Having equitable & fair wealth distribution between the citizens, and
- Supporting rehabilitation & repairing of dilapidated houses & villages in changing the images of the city.

2.3 PEOPLE REGISTERED FOR 40/60 HOUSING DEVELOPMENT PROGRAM

As the Archival data; the people who are in need of housing schemes were registered in demanding one, two or three bedrooms as per the income level. During the given registration time 164,779 people were registered for all bedroom types. From these, 16,547 were registered for one bedroom, 75,793 for two bedrooms and 72,439 were demanding for three bedrooms. Therefore, AASHDE have been working day and night for satisfying the demands of these citizens in focusing on the given duties and responsibilities and the strategic plan as well.

2.4 FINANCING THE HOUSING PROJECTS

Archival data of AASHDE shows, the mechanism for financing the project is Bank loan that follows the procedure of first the government borrowed through bond modalities and build the housing schemes in a different typologies then the residents who are in need of the houses are expected to save 40% of the total construction cost for the given housing

units registered and are allowed to take the rest 60% from a Bank as a loan and so then they are benefited to receive the house they registered for. The Enterprise takes as a loan from Commercial Bank of Ethiopia to handle its projects. Thus, the source of finance for the construction of saving houses could be revolving on fund of the Commercial Bank of Ethiopia (CBE) and saving by the beneficiaries.

AASHDE Archive data confirm; so from those who registered in this program around 156,932 people are actively saving on their special account until now. The total saving amount within (2 years ago) or these 2 years has reached to above 11 billion ETB. Being the owner of saving houses, the registers should necessarily save 40% of the overall cost of the demanding bedroom. However, people will be encouraged to save more than the initial saving amount (40%) up to the overall cost (100%) of each bedroom types.

Height of Building	Types of Bed Rooms	Total average for each area (m2)	Duration of Saving time (40%)	Credits return time (60%)
G+7	1 Bedroom	55	5 years	15-20 years
G+9				
G+12	2 Bedrooms	75		
G+15				
G+18	3 Bedrooms	100		

Table 1. The Housing Area and Expected saving amount including the rooms

2.5 THE CURRENT HOUSING CONSTRUCTION PROGRESS

The archival data shows; based on the Millennium Development Goals (MDGs) and the Growth and Transformation plan of the city, AASHDE has been planned its work and implement it accordingly. As a result, for the last two and half years the enterprise has above 39,229 housing schemes are on progress under construction in different 13 sites in the inner city of Addis Ababa for around 126,319 peoples. 1,292 housing units are expected to be delivered to the residents this year after few months and the rest will be transferred at the beginning of next year depending on the start & duration of the building contractual agreement of project.

በ40/60 የቤት ልምት ፕሮግራም በ13 የግንባታ ሳይቶች በመገንባት ላይ ያሉ የህንፃ ዓይነትና የቤት ብዛት እስከ መስከረም ወር 2009 ዓ.ም የደረሰበት ደረጃ														
የግንባታ ቦታዎች እና የሳይት ስም	ሎት	የሳይቱ ስፋት	የሚገነባው የህንጻ ክፍታ	የህንጻ No of blocks	የቤት ብዛት						ለግንባታው የተሰጠ ጊዜ ገደብ	የግንባታ ደረጃው የደረሰበት ደረጃ	ይኖራሉ ተብሎ የሚጠበቀው የህዝብ ብዛት	
					የመኖሪያ ቤቶች			types of residents						
					ባለ 1 መኝታ	ባለ 2 መኝታ	ባለ 3 መኝታ	ጠቅላላ የመኖሪያ	ለንግድ ቤት	ጅምር				
Project sit's name		Areas of the sit	No of buildings		1 bed room	2 bed room	3 bed room	Total houses	Houses for business	Grand total houses	contractual agreement time	building progress	Expected population of residential	
ሰንጋ ተራ/ልደታ/Senega	lot 1	2.2	2B+G+12	5	100	100	100	300	110	410	18 ወር	98.93	1260	
ክራውን/አቃቂ ቃሊቲ/	lot 1	5.9	B+G+9	14	224	224	224	672	210	882	15 ወር	96.12	2822.4	
አህል ንግድ/ehele negede	lot 1	2.75	2B+G+12	6	120	360	120	600	192	792	18ወር	90.37	2520	
አስኮ/Aseko	lot 1	5.4	2B+G+13	13	284	850	284	1420	416	1836	18ወር	56.63	6006	
ቦሌ/ህንፃ አቅራቢ	lot 1	3.45	2B+G+13	8	176	528	176	880	256	1136	18ወር	78.71	3696	
ቦሌ/ቱሪስት/tourist	lot 1	4.36	2B+G+18	11	528	1056	352	1936	407	2343	19 ወር	59.66	8131.2	
ቦሌ ቡልቡላ1 /bole bulebula	lot 1	11.2	B+G+13	20	440	1320	440	2200	620	2820	15 & 18	86.39	10164	
			B+G+7	8	0	48	144	192	96	288			806.4	
			ቦሌ ቡልቡላ 2/bole bulebula	Lot2	9.3	2B+G+15	15	390	1170	390	1950	465	2415	15 & 18
2B+G+13	1	22				66	22	110	31	141	7644			
B+G+9	8	0				64	192	256	96	352	940.8			
ቦሌ/መሪ ሎቂ/Meri loke	Lot 1	4.96	2B+G+13	14	308	924	308	1540	448	1988	18ወር	59.5	6468	
ቦሌ አያት 1/Bole Ayate 1	Lot 1	3.88	B+G+8	14	0	98	294	392	168	560	13 & 15	55.83	8316	
	Lot 2	13.84	B+G+8	20	0	140	420	560	240	800			11760	
			B+G+10	18	288	864	288	1440	594	2034				
	Lot 3	12.92	B+G+8	32	0	224	672	896	384	1280			9408	
			B+G+10	9	144	432	144	720	297	1017				
	Lot 4	17	B+G+8	14	0	98	294	392	168	560				
			B+G+10	8	128	384	128	640	264	904				
			B+G+13	18	396	1188	396	1980	594	2574				
ቦሌ/ሰሚት/ Semite	Lot 1	4.2	B+G+8	10	0	70	210	280	120	400	13ወር	31.56	1176	
ቦሌ በሻሌ/Bole beshale	Lot 1	41	2B+G+15	22	572	1716	572	2860	682	3542	18ወር	21.74	12012	
			2B+G+13	15	330	990	330	1650	480	2130			6930	
			B+G+9	21	0	168	504	672	252	924			2822.4	
ቦሌ አያት2/Bole Ayate 2	Lot 1	33	2B+G+15	15	390	1170	390	1950	465	2415	18ወር	24.13	8190	
			2B+G+13	33	726	2178	726	3630	1056	4686			15246	
ጅምር		140.1		372	5566	16430	8120	30118	9111	39229			126319	

Table. 2. Types and No. of houses constructed with in 13 sites of 40/60 housing program

2.6 JOBS CREATED UNDER THE PROJECT

As soon as the program was launched officially, the AASHDE began the construction of saving houses immediately and creating permanent and temporary job opportunities for citizens in various fields. Micro and small enterprises, professional or non professional construction workers are participated in this regard. It is significant that focusing on promotion of micro and small business institutions and provide holistic and integrated support for the expansion of MSEs and enhance their competitiveness. The fields of works created in the project for MSEs are production of precast beam and Hollow Concrete Blocks (HCB), electrical and sanitary installation, metal works, food preparation and loading and unloading services. Contractors are also creating jobs for many people in different interrelated fields such as engineers or other professionals' foremen, time keepers, operators, carpenters, electricians, etc. Data's from Archive documents shows; Due to this, more than 55,000 citizens have found jobs in last budget year and above 272 million ETB market opportunities have been made so as to increase the income level of 500 MSEs.

2.7 CONSULTANTS, CONTRACTORS AND MSEs INVOLVEMENT

The number of consultants and contractors involved in the project are 9 and 151, respectively. As well as micro and small scale enterprises who are involved in the project now are 500.

2.8 STAKEHOLDERS UNDER THE PROGRAM

AASHDE can achieve its mission if and only if the following stakeholders perform its part. Though the stakeholders involving in the project are many, the key activities in the housing development will be carried out mainly through the participation & coordination of the stakeholders mentioned below:-

- The Ministry of Urban Development Housing,
- City Government of Addis Ababa
- National Bank of Ethiopia
- The Ministry of Finance & Economic Development
- Commercial Bank of Ethiopia
- Addis Ababa Saving Houses Enterprise (AASHDE)
- Ministry of Foreign Affairs
- Micro and Small Enterprise (MSEs) Development Bureau

2.9 PROBLEMS FACED IN ADDIS ABABA SAVING HOUSE

DEVELOPMENT ENTERPRISE

Addis Ababa Saving House Development Enterprise is facing serious Problems on criticism for delaying the delivery of condominiums due to projects lagging behind from their schedule. Most of the projects are reportedly lagging behind from their schedule. (WWW.aashde.gov.et, 2016).

For instance as archival data shows the projects under Addis Ababa Saving House Development Enterprises are elapsed from their project time as shown below:

No.	Site	Date of contract	Duration	Date of completion	To date completed (%)	Time Elapsed
1	Seniga Tera	Jan.2013	18 month	June 2014	86	19 month
2	Kality Crown	May 2013	15 month	June 2014	85	19 month
3	Ihil Nigid	Nov. 2014	18 month	July 2015	38	6 month
4	Ihil Nigid 2	Oct. 2014	18 month	July 2015	64	6 month
5	Hintsa Akirabi	Jan. 2014	18 month	June 2015	55	7 month

Table 3. Sample of the projects on progress under SHADE

As the above table shows the projects are goes over their schedule as elapsed time shows.

So in order to finish the started and future projects within schedule, we need to give emphasis on the projects productivity; so differentiate and assessing the factors and improving techniques for those factors.

3 CONSTRUCTION PRODUCTIVITY AND FACTORS AFFECTING CONSTRUCTION PRODUCTIVITY

3.1 DEFINITION OF PRODUCTIVITY

Productivity is a measure of the ratio between the output of a process and the input of resources needed for it. It is usually expressed as output divided by input. Output can be expressed in terms of units or volume and this unit have usually been determined for production planning purpose. Inputs are the resources (man power, Machinery, Materials, Money) which processed and give production (Durdev, 2011).

As Productivity discussed on (Tefera, 2014) the meaning of productivity encompasses the notion of avoiding wastes through properly utilizing input resources, maximizing out puts in usable form or quality with minimum competitive price that customers can afford it, make maximum profit and job security of the workers can be insured with better income. By doing this, the well being of the enterprises and the nation development can be maintained.

European Cooperation defines productivity as “the quotient obtained by dividing output by one of the factors of production”. Or, in another words, “the same as efficiency, which is defined as the ratio output energy divided by input energy”.

Generally; Productivity = $\frac{\text{Out put}}{\text{Input}}$ ----- {1}

The benchmark for comparison is critically important because productivity outcome in itself is meaningless except if it can be compared with a benchmark (Durdev, 2011).

As it is cited in (ILO, 1986) Productivity has been defined as the ratio of output to input. An increase in productivity means an increase in output that is proportionally greater than increase in input. Productivity may be measured either on an aggregate basis or individual basis. On aggregate basis, output is compared with all inputs taken (added) together. This is called as total productivity. On individual basis, output is compared with any one of the input factor and this is called as partial productivity or factor productivity.

$$\text{Total productivity index} = \frac{\text{Total output}}{\text{Total inputs}} = \frac{\text{Total production of goods and services}}{\text{Labour} + \text{Material} + \text{Capital} + \text{Machine}} \dots\dots\dots \{2\}$$

This index measures the productivity of the entire organization with use of all resources. It is a way of evaluating efficiency of entire plant or firm. It has been said that the challenge of productivity has become a challenge of measurement. Productivity is difficult to measure and can only be measured indirectly, that is, by measuring other variables and then calculating productivity from them. This difficulty in measurement stems from the fact that inputs and outputs are not only difficult to define but are also difficult to quantify.

3.2 CONSTRUCTION PRODUCTIVITY

Construction operations are the actual work that it takes to build the project which includes doing every task in project. As the construction moves forward, the ultimate goal is to keep the project on schedule, within budget, and of high quality. In order to do this, the on-site construction management team must give attention and concern with productivity, which is one issue from several issues like job site safety, material and equipment handling, subcontractors coordination, quality control (Berbera, 2004).

It is important to indicate the input and output to be considered when calculating productivity because there are many inputs, such as labor, material, equipment, tools, capitals, and design relating to a construction system. Transforming input into output is also complex. This process is influenced by the technology used, by many externalities such as government regulation, weather, unions, economic condition and management, and by various internal environmental components (Fisk, 2000).

Productivity is an effective utilization of the resources to achieve set objectives. Increase in productivity correlates well with increased profitability, competitiveness, achievement of key stakeholder propositions as well as long-term growth and sustainability of a company, an industry and a nation (Durdev, 2011)

In most of the research works, generally productivity is described as a measure of how well resources are used to achieve set objectives or desired outputs. This is a definition that fits well with different perspectives; it emphasizes creativity and innovation, which target

achieving more outputs with less resource, inputs by re-engineering the production or service delivery process and optimizing the resource use.

3.3 FACTORS AFFECTING PRODUCTIVITY

Productivity constraints to the construction industry of New Zealand under eight broad categories which are project finance, workforce, technology/process, project characteristics, project management, statutory compliance, unforeseen events and other external factors (Durdev, 2011).

As pointed in (Anton, 2011); and Enshassi et al. (2007) classifies factors affecting productivity in the construction into 10 groups, namely: factors associated with the internal workforce, factors associated with leadership, factors associated with work motivation, factors associated with time, factors associated with materials and equipment, factors related to supervision, factors related to project characteristic, factors related to security, factors related to quality, and external factors.

(Wubishet, (2016)) Categorized causal factors for low performance under four themes, namely:

- **Policy/Regulatory related:** - Fragmentation of construction industry; Procurement regulations; contract condition& contractual agreements; composition regulation.
- **Capacity related:-** Scarcity of resource; Weak organization; Poor information management system

- **Attitude related:** - Weak stakeholders' relationships; Poor Project Definition & Monitoring; Self-interest service practices.
- **Force majeure issues:** - War & Hostilities; adverse weather & drought.

According to the (Anton, 2011); Factors affecting productivity are grouped into 15 groups based on their characteristics, namely: Factors associated with design; Factors associated with implementation of planning; Factors related to the material; Factors associated with equipment; Factors associated with labor; Factors related to occupational safety and health; Factors related to supervision; Factors related to working time; Factors associated with the project conditions; Factors related to quality; Factors associated with financial; Factors related to the coordination and leadership; Factors associated with the organization; Factors related to the owner / consultant; Factors associated with external factors.

The following factors mainly affect the productivity of building construction. (Sherif, 2014), (Mistry, 2013), (Odesola, 2013), (Nithya, 2015)

- Management related factors: Communication, Work method
- Resource related factors: Material delivery, Labor related factors, Tools and equipments, Drawings
- Government related factors: Rules and regulations, System related
- Project related factors: Project uniqueness, Site condition
- Environment related factors: Rain, cold, heat

- Other related factors: Inspection and supervision, Demolishing and Rework

Based on previous researches, this study identifies different factors affecting productivity in Addis Ababa Saving House Development Enterprise's projects under different groups by relating the factors with construction inputs, and process; namely:

1. Resource related factors: Labor, Material, Equipment and tools, Finance, Drawing
2. Policy and regulation related: Procurement, Contract condition and Contractual agreements, Compensation regulation, Government rule and regulation.
3. Management related: Weak system of organization, Poor information Management system, Poor coordination and leadership, Inspection and supervision
4. Project related: Project uniqueness, Site condition
5. Force majeure related: Poor weather condition

4 CONSTRUCTION PRDUCTIVITY IMPROVEMENT TECHNIQUES

Productivity is dependent on many factors, some of which are unpredictable, such as Environmental factors like weather, laws, and regulations; other factors are controllable, such as resource related factors, like material delivery, labor related factors and others. Improving productivity is possible by focusing on the affecting factors. Productivity improvement in construction is best understood when the construction process is visualized as a complete system. The system is made up of the construction project to which material; personnel, equipment, management, and money. They are consumed by the system in the process of producing the construction unit. Control of the system is achieved by collecting and processing information about the rates at which production is attained.

As it is stated in (Anton, 2011) Problems in increasing productivity has long been a concern to the researchers, in which the identification and evaluation of the factors that affect productivity have become critical issues faced by stakeholders in order to increase productivity in construction . Various factors have been generated in past research, including: factors associated with management; factors relating to the method of construction and weather; factors associated with working hours arrangements; and factors related to characteristics of labor (Anton, 2011).

As written in (Jergeas, (2009)) “Top Ten Targets for Improving Construction Productivity” targets being investigated.

- Highly motivated, and satisfied workforce
- Best practices model for supervision
- Better working relationship between subcontractors & main contractor
- Efficient materials, tools, and equipment management
- Tool time optimization by adopting best work practices
- Optimize work practices and workplace planning
- Information technology based on-site communication framework
- Better integration between site and office management
- Weather related issues
- Project stakeholder issues – owner, architect, changes.

The report which was written on productivity improvement in Canada oil and Gas Company shown in (Jergease, (2009)) as Top 10 areas for Construction Productivity Improvement in the Oil and Gas Industry Labor Management, Conditions and Relations

- Project front-end Planning (Loading) and Work Face planning
- Management of Construction and Support
- Engineering Management
- Effective Supervision and Leadership
- Communication

- Contractual Strategy and Contractor Selection
- Constructability in Engineering Design
- Government Influence
- Modularization, Prefabrication, Pre-build in Shops

4.1 JAPANESE PRODUCTIVITY IMPROVEMENT TECHNIQUES:

Productivity improvement techniques can be applied effectively in enterprises of any size, from one-person companies to corporations with thousands of staff. Japan developed number of productivity improvement techniques after World War II (Imai, 1986).

Some of the selected Japanese Productivity Improvement techniques are below:

- Eliminating defects by changing the participants from a manual process to a mechanized process.
- Focuses on achieving consistent levels of production. It is defined as “distributing the production of different [body types] evenly over the course of a day” It incorporates the principles of line balancing by attempting to equate workloads, leveling demand out by creating an inventory buffer and replenishing that buffer.

(Imai, 1986) Defines total quality control as ‘organized kaizen activities which involving everyone in a company managers and workers; in a totally integrated effort toward improving performance at every level’. Which shows Kaizen as Continuous improvement

is a management supported employee driven process where, employees make a great number of continuous improvement efforts.

4.2 WORK STUDY AS A PRODUCTIVITY IMPROVEMENT

TECHNIQUE:

Work study is an important management tool to achieve higher productivity. It is related to human work, method of doing work and standard of performance. The survival of any organization is dependent on use of latest technology and efficient methods of production. To improve efficiency of production it needs effective utilization of plant, equipment and labor. This can be achieved by using work study which studies method and evaluate the performance. It divides work into smaller elements, studies it, and rearranges it to get same or greater efficiency at reduced cost. International Labor Organization (ILO) defines work study as the technique of method study and work measurement employed to ensure the best possible use of human and material resources in carrying out a specified activity. It is also a management service based on method study and work measurement used in examination of human work leading to investigation of all the resources that effect efficiency and economy of situation to affect improvement.

Further ILO states that work study is to minimize cost either by designing the work for high productivity or by improving productivity in existing work through improvements in current methods by reducing ineffective and wasted time.

As written and presented in (Wubishet, (2016)) eight themes for construction industry transformation due to their interdependency with construction productivity are:

- Construction industry governance along its:-
 - Organizational system, and
 - Regulatory frame work
- Construction industry capacity building along its:-
 - Technology
 - Human resources
 - System development framework
- Construction industry stakeholders' attitude change along its:-
 - Documentation, planning, and monitoring capacity
 - Professional and business ethics
 - Stakeholders' relationship perspectives

Researchers generally agree that productivity is driven by: quantity and quality of built capital, quantity and quality of human resources, and technology. Specifically, productivity will be improved by: improving the quality of human resources through education and workplace environment, improving the quantity and quality of capital through investment, and improving technology through the commitment, quality management and a strong pursuit for innovation so improving any one of capital, labor or technology will feed back to improving the others (Nelson, 1981).

4.3 LEAN CONSTRUCTION TECHNIQUES

Lean construction is a way to design production systems to minimize waste of materials, time, and effort in order to generate the maximum possible amount of value. Lean Construction is using the same principles as lean production to reduce waste and increase the productivity and effectiveness in construction work. The most important determinants of construction are supposed to be workflow reliability and labor flow, but lean construction has changed the traditional view of the project as transformation, and embraces the concept of flow and value generation. Similarly, it shares the same objectives of lean production, e.g., cycle time reduction, elimination of waste, and variability reduction. Continuous improvement, pull production control, and continuous flow have been the direction for the implementation of lean construction ([Leinonen, 2002](#)).

Some define Lean as “doing more with less” or “increasing efficiencies.” Lean’s focus is on making a process more efficient, gaining capacity, and increasing speed.

Lean construction is composed of the following techniques (O. Paez, 2005):-Concurrent Engineering; Last planner; Daily cluster meetings; The Kanban System; Plan Conditions and Work Environment in the Construction Industry; Quality Management Tools; Visual Inspection

4.4 THE 10 STEPS FOR PRODUCTIVITY IMPROVEMENT

As shown by (Thomas, 2001) good Performance in Construction Industry real productivity improvements is essential. So here are 10 Steps for Productivity Improvement:

- Management commitment.
- Training and empowerment
- Fabric saving
- Work Study
- Measuring performance
- Line Balancing
- Quality
- Personnel Management

4.5 WAYS TO IMPROVE PRODUCTIVITY IN THE WORKPLACE

As written in (WWW.clearbooks.co.uk, 2015) today there's ever increasing competition from challenger companies and research consistently shows that employees perform better if they feel like their work is valued. This means it's important to keep productivity high by motivating and supporting employees to push your business to achieve more. So the best ways to increase and maintain productivity, while making sure that staff are motivated, happy and engaged, which leads to consistently developing the best products and providing excellent service for our customers.

4.6 FRAME WORK FOR PRODUCTIVITY IMPROVEMENT IN CONSTRUCTION

As it written by Research Council in Canada Productivity improvement in construction is best understood when the construction process is visualized as a complete system as shown in Figure 1 below. The system is made up of the construction project to which material; personnel, equipment, management, and money are inputs. They are consumed by the system in the process of producing the construction unit. Control of the system is achieved by collecting and processing information about the rates at which production is attained. To improve labor effectiveness, various factors can be addressed, including motivation, job safety, environmental factors, and physical limitations. Management practices include scheduling, planning, data collection, job analysis, and control. Material timeliness is ensured by proper procurement scheduling, site layout, and other issues (Dozzi, 1993).

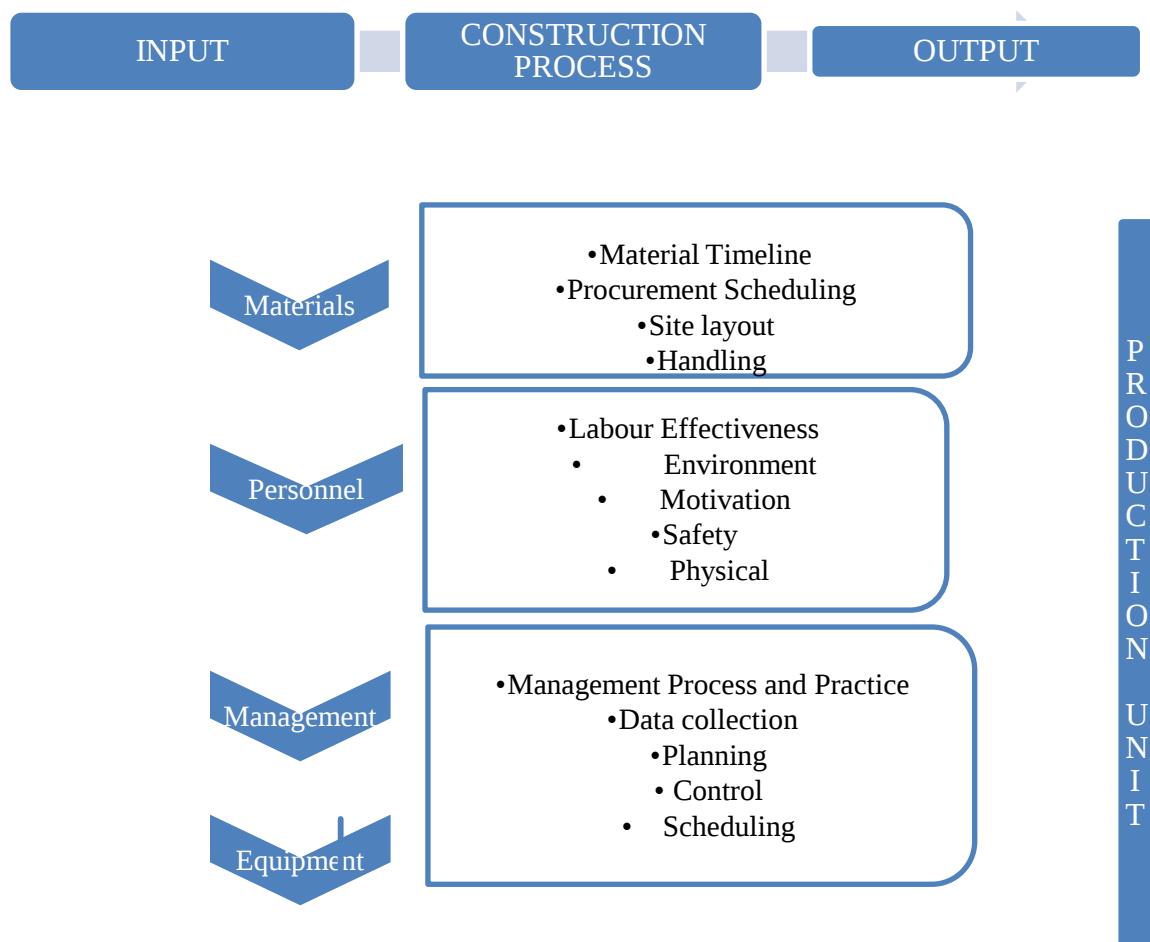


Figure 1. Framework for productivity improvement

(Source: National Research Council Canada 1993)

5 METHODS AND PROCEDURES

5.1 RESEARCH METHODOLOGY

The research methodologies in this study consisted of a literature review, question survey, a field study a desk study. A list of productivity factors and their improvement techniques collected from the review of literature and developed into question. The question comprised of both structured and open ended questions. The question survey is distributed and conducted among the construction practitioners (contractors, consultants, and owner) participated in AASHDE to assess the perception of the factors affecting the productivity, the problems arise due to low productivity and improvement techniques for productivity factors. This is in order to collect a detail and all round data. It also provides sufficient, complete and accurate information without bias which maximize reliability of data. The field study involve observations of construction operations at several projects and ask questions the practitioners in order to refine the primary data collected and gather in questioner. In addition, the study incorporates secondary data. The information for secondary data gathered from different office documents which helps the study. Other questions which enable to achieve the objectives of the research be developed; and the research design is based on questioner survey, field study and different office documents.

5.1.1 SAMPLING

According to Archival document AASHDE has built 372 blocks of buildings are built in Addis Ababa under 40/60 condominium buildings project which is located in thirteen different sites under four different lots. These projects include different stakeholders; which includes 151 contractors, 9 consultants and 500 small and middle enterprises as indicated above on table 2. This research uses clients', contractors and consultant's participants due to their direct involvement in projects productivity. So here there are around 160 populations (Contractors and Consultants) participating directly and 500 SME participating indirectly in AASHDE 40/60 Condominium projects.

Only directly participating populations companies (Contractors and Consultant and Client superintendents) are used for analysis of this research. So the population considered includes 151 contractors, 9 consultants and 76 Clients Superintendents totally 236 populations.

Kish (1965) showed that the sample size can be calculated as following equation for 95% confidence level. $n = n' / [1 + (n'/N)]$ ----- {7}

Where:

N = total number of population

n= sample size from finite population

$n' = \text{sample size from infinite population} = S^2/V^2$; where S^2 is the variance of the

population elements and V is a standard error of sampling population. (Usually $S = 0.5$ and $V = 0.05$) (Israel, 2003).

So, for 236 populations on Projects of AASHDE:

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

$$n' = S^2 / V^2 = (0.5)^2 / (0.05)^2 = 100$$

$$N = 236$$

$$n = 100 / [1 + (100 / 236)] = 70$$

This means that the questionnaire should be distributed to 70 directly participated stakeholders (Contractors, Consultants and Client Superintendents) in order to achieve 95% confidence level.

This paper conducts 70 samples among 236 populations which are key participant in the AASHDE projects by random sampling in order to get a representative data of the enterprise.

The responders included in this research are from all stockholders (Client, contractors, and consultants) in Saving House Development Enterprises. So the questions will be distributed for those stakeholders who participate in AASHDE projects (contractors, consultants, employer superintendents) randomly.

5.1.2 DATA COLLECTION

Before conducting data collecting permission is obtained from the stakeholders. After permission is granted, the questionnaire is distributed. The study has used the data sources to produce the following basic documents: respondents' documents and archival documents. The respondents' documents were collected using questionnaires from selected sample of stakeholder's clients (project owners), contractors and consultants. There are two basic types of survey questions from which to choose: open-ended and closed-ended. This questionnaire survey has both open-ended and closed-ended questionnaires. This research also use Archival documents to gather tangible information about completed, on progress and future projects.

Data's from the site study is conducted observing the site on how they act for productivity in order to match with responded questioner. If needed, this research conducts desk study for higher department after responding the questioners.

5.1.3 DATA ANALYSIS

This research use both descriptive and inferential statistics analysis method to analyses and infer collected data. This research use descriptive analysis to reduce the data in to a summary format both quantitative and qualitative approaches or to make collected data to be represented, grouped and coded and make it ready for analysis. Here the software SPSS analyze the data and then interpret the analyzed data by using data tables, charts and graphs. This research also use inferential statistics to infer the collected data; if this research has time correlation between data from stakeholders is done.

Questionnaire survey response rate

Quantitative data for the study were collected through questionnaire surveys stakeholders who participate on Addis Ababa Saving House Development Enterprises. Respondents to the study were Contractors, Consultants and Clients. The construction experience of the selected respondents for the quantitative section of the study was sufficient to be capable of providing valid results for the subject under study. Seventy (70) questionnaires were hand delivered to respondents. From this number, Sixty seven (67) which is around (96%) questionnaires were properly completed and retrieved and rests were not returned.

Data measurement

In this research, five point scales were used. Five point scales is used to ranking or a rating data in ascending or descending order. There are 40 Questions are identified and prepared to assess the Factors affecting the productivity based on five point scale where;

1 – Does not affect it; 2 – Does affect it in least; 3 – Affects it; 4 – Highly affects it;
5– Very highly affects it and

48 key questions were identified from literature to assess Productivity improvement techniques based on five point scale where;

1 –Do not use it; 2 – Do use it in least; 3 – Use it; 4 – Highly Use it; 5 – Very highly use it

The relative importance index is computed due to its best fit for this study in order to rank what productivity improvement techniques were used highly or not.

$$RI I = \sum W / (A * N) \text{-----} 8$$

W is the weight given to each factor by the respondents and ranges from 1 to 5

A = the highest weight = 5

N = the total number of respondents

5.1.4 GENERAL INFORMATION ABOUT RESPONDENTS AND QUESTIONS

5.1.4.1 Question Returned and Participant Companies.

The participant companies involved in the study include

Company	No. of Question Distributed Company	No. of Question Returned Company	Total returned (%)	Participant Company From Total (%)
Contractor	30	30	100	44.7
Consultant	22	21	95.94	31.34
Client	18	16	88.89	23.96
Total	70	67	95.7	100

Table 4. Question returned & Participant companies

Out of 70 Questions Distributed 67 Questions were returned, thus going to be a total of 95.7% were returned.

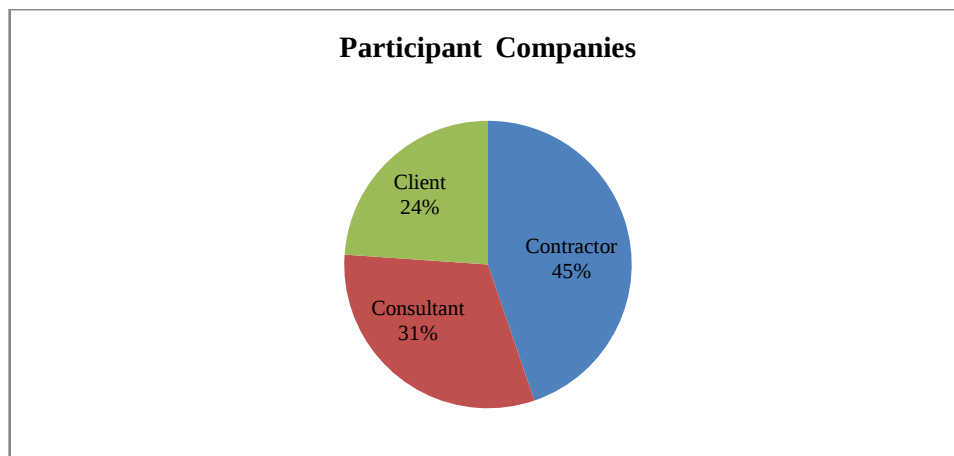


Figure 2. Participant Companies

As shown in table 4 and Figure 2 the respondent in this study are 44.77% Contractors, 31.33% Consultants, and 23.9% Clients.

5.1.4.2 Education Background or qualifications

The formal qualifications obtained by the participants in the study.

Table 5. Educational background

Educational background	Total Number	Total (%)
Diploma	10	14.93
BSC	48	71.64
MSC	9	13.43
Total	67	100

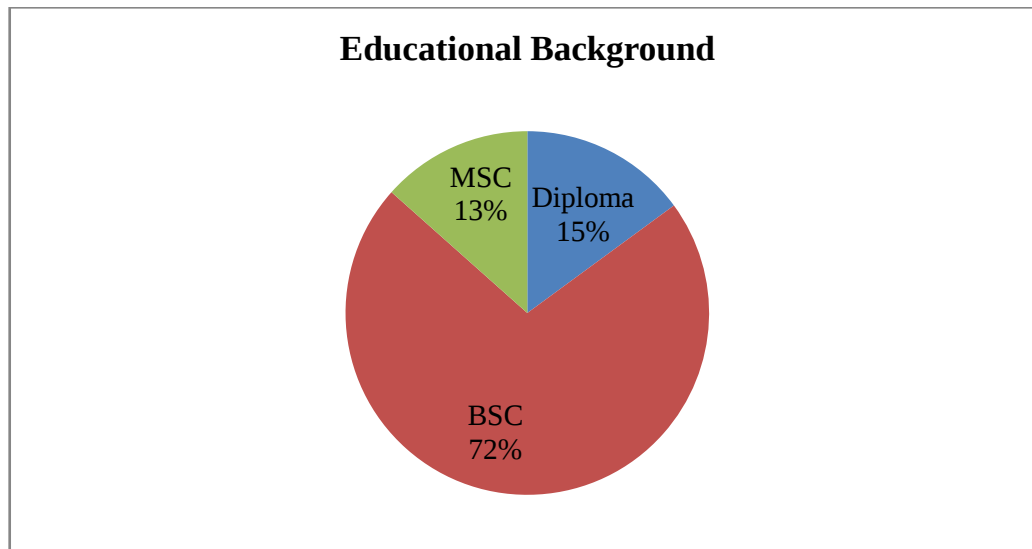


Figure 3. Educational Background

As shown in above table 5 and Figure 3 the educational background of Respondents which are participated in this study having diploma are (14.93%), bachelor degrees in Science are (71.64%) and Master's degrees in Science are (13.43%).

The above result shows that a majority of professionals in the survey were qualified personnel.

5.1.4.3 Experience of Participants

Table 6. Site experience of the respondents

Site Experience	Total Number	Total (%)
0-5	39	58.2
6-10	16	23.88
11-15	12	17.92
Total	67	100

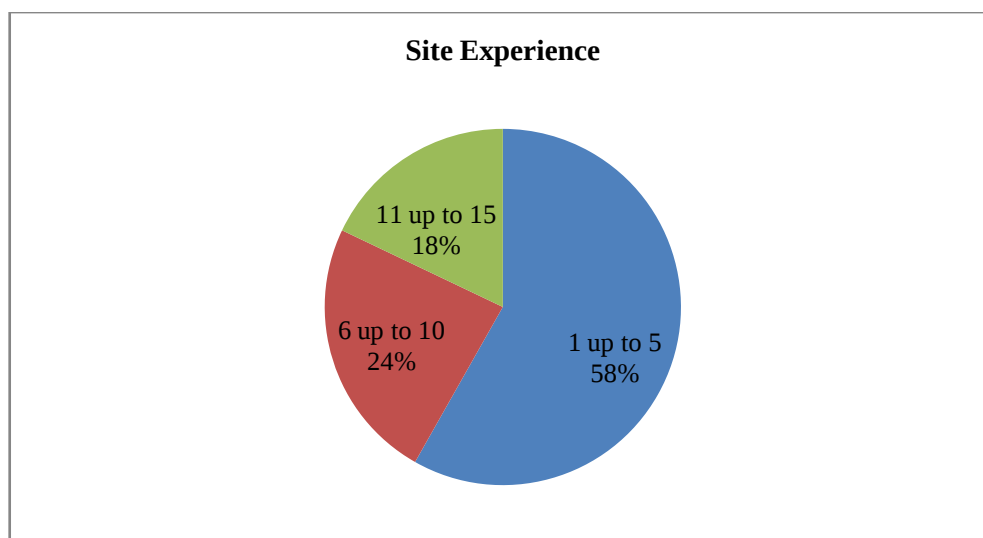


Figure 4. Site Experience of respondents

As Table 6 and Figure 4 shows the distribution of the respondents according to number of years of site experience. Most (58%) of the respondents had 1 up to 5 years of experience, 24% had between 6 years and 10 years experience, and 18% had between 11 years and 15

years of site experience. This could demonstrate that the respondents have good and adequate knowledge on Addis Ababa Saving House Projects on which they had participated. Thus, it can be concluded that the result from the survey is relatively accurate and reflects the actual situation in the Productivity improvement techniques adapted in Addis Ababa Saving House Projects.

5.1.5 FACTORS AFFECTING PRODUCTIVITY

There were about 41 identified factors affecting productivity of construction in Addis Ababa Saving House project from literature. These 41 factors were categorized under six major groups as Resource related factors, Policy and regulation related, management related factors, Project related, Force Majeure and Safety and Healthy related factors. The respondents were requested to rate for each of 41 factors under each category based on their experience on construction projects. The results of the respondents then analyzed using relative importance index (RII).

5.1.5.1 RESOURCE RELATED FACTORS

Table 7 Rank of Resource Related Factor affecting Productivity

NO.	FACTOR AFFECTING PRODUCTIVITY IN AASHDE	Group	RII	RANK
1	RESOURCE RELATED	Average	0.642	1
	Low Productivity of laborers.	Labor	0.905	1
	Failure of tools and/or equipment's.	Equipment	0.823	2
	Material storage location and condition.	Material	0.788	3
	Quality of material	Material	0.729	4
	Lack and unavailability of required tools and/or equipment's.	Equipment	0.729	4
	Shortage of contractor finance	Finance	0.705	5
	Incomplete design and contract documents.	Design & Drawing	0.705	5
	Lack and late supply of materials from contractor side.	Material	0.694	6
	Late designs review and approval.	Design & Drawing	0.694	6
	Lack of experience among laborers.	Labor	0.67	7
	Lack and late supply of materials from client side.	Material	0.67	7
	Delay Payment to contractor	Finance	0.67	7
	Delay Payment for sub contractors and suppliers	Finance	0.658	8
	Increase in the price of materials in the market.	Material	0.647	9
	Discrepancy in Design documents.	Design & Drawing	0.647	9
	Shortage of client finance	Finance	0.635	10
	Shortage of Labor.	Labor	0.611	11
	Material and Labor Price & Wage Escalation	Finance	0.611	11
	Lack of competition b/n the Laborers.	Labor	0.588	12
	Personal Problem & Accident to Laborers.	Labor	0.576	13
	Variations (change) in the design	design & Drawing	0.553	14
	Dispute and Bad Behavior among Laborers.	Labor	0.505	15

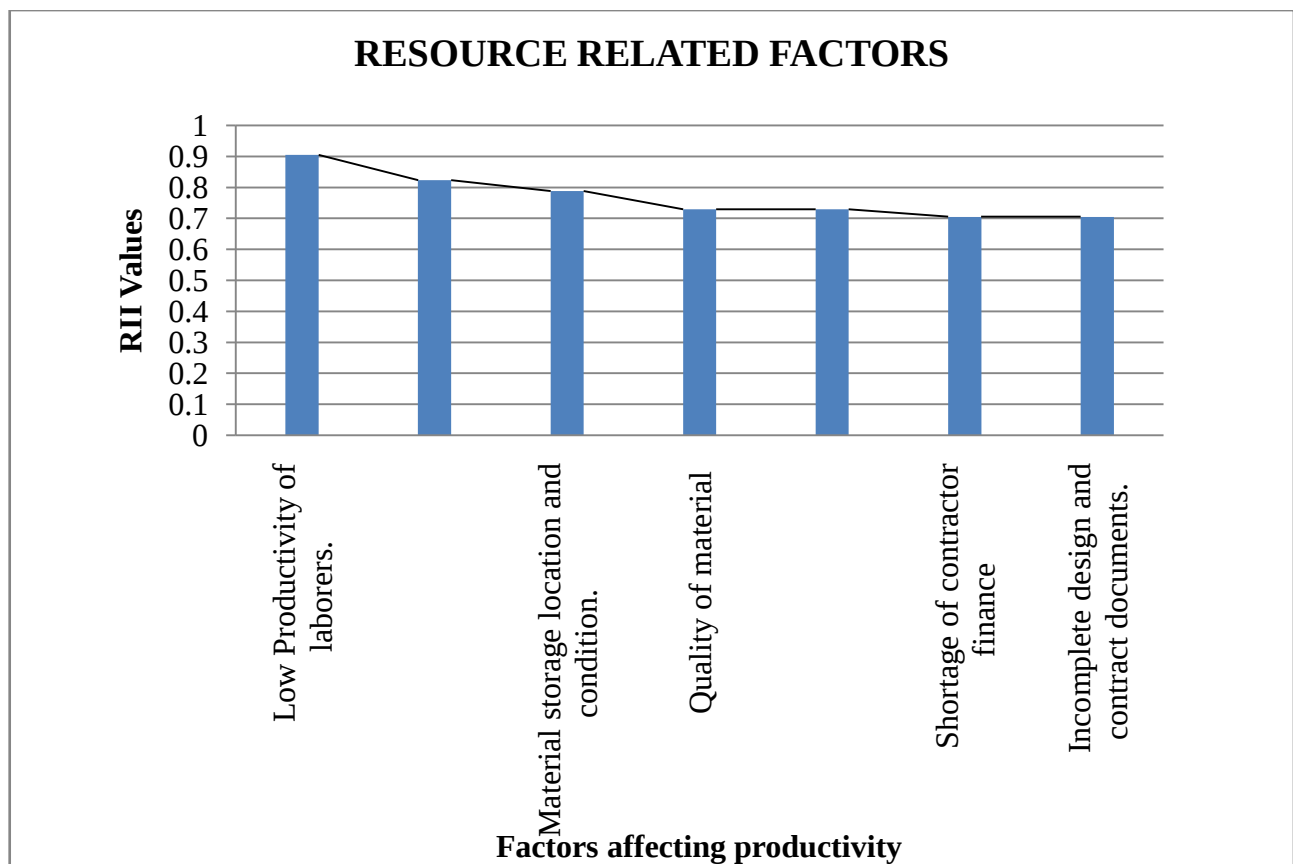


Figure 5. Top Resource related factors

As the above analysis shows in Table 7 and Figure 5; The Resource related factor grouping variable was ranked the Second factor affecting the productivity with **Average RII value 0.642** in Addis Ababa Saving House Enterprise Projects by the respondents.

Individually, the top five Resource related factors which affect the productivity are

- Low productivity of laborers with **RII value of 0.905**
- Failure of tools and equipments (mixer, vibrator...etc) with **RII value of 0.823**
- Material storage location and condition with **RII value of 0.788**

- Lack and unavailability of required tools and/or equipment's with **RII value of 0.729**
- Qualities of material with **RII value of 0.729** are ranked the highest variable under resource related factors.

From above rank Resource related factors are the main factors which affect the productivity in AASHDE projects mainly low productivity of labors so the projects stake holder must give attention on this factor due to direct involvement of resources in any production of the projects.

5.1.5.2 MANAGEMENT RELATED

Table 8 Rank of Management Related Factors

NO.	FACTOR AFFECTING PRODUCTIVITY IN AASHDE	Group	RII	RANK
3	MANAGEMENT RELATED	Average	0.6511	
	Inadequate construction method	Weak system of organization	0.788	1
	Poor coordination and leadership in sites	Poor coordination and leadership	0.764	2
	Inappropriate organizational mgt and poor site management	Weak system of organization	0.67	3
	Ineffective planning and scheduling of project	Weak system of organization	0.6588	4
	Rework	Poor coordination and leadership	0.623	5
	Poor in using different reporting and communication formats of construction	Poor information Management system	0.6	6
	Lack of communication between stakeholders	Poor information Management system	0.588	7
	Organizational change	Weak system of organization	0.517	8

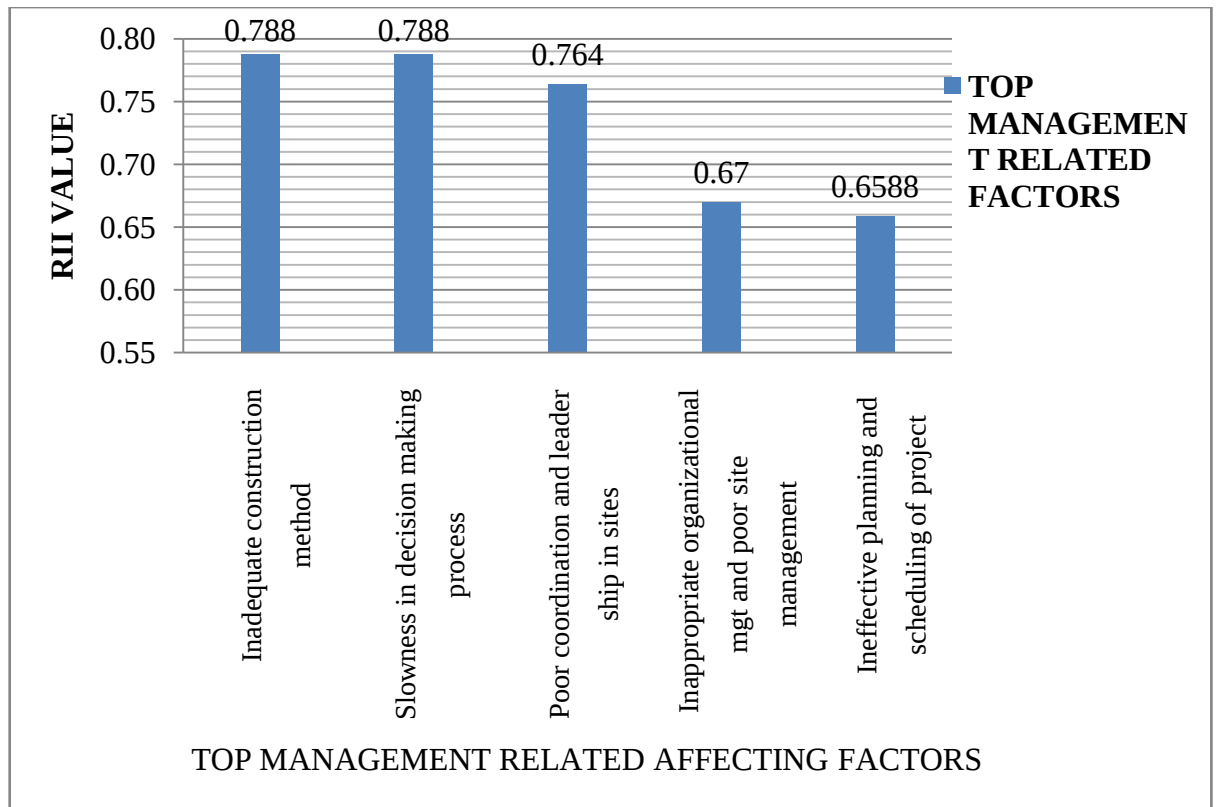


Figure 6. Top Management related factors

The respondents ranked variables shown above in Table 8 and Figure 6 which are listed under the management related factors as the First factor affecting productivity with **Average RII value of 0.6511** in Addis Ababa Saving House Projects. Individually, the top five factors affecting the productivity which are the highest variable under management related factor are:

1. Inadequate construction method, with **RII value of 0.788**
2. Slowness in decision making process with **RII value of 0.788**
3. Poor coordination and leadership in sites with **RII value of 0.764**

4. Inappropriate organizational mgt and poor site management with **RII value of 0.670**
5. Ineffective planning and scheduling of project with **RII value of 0.6588**
6. Rework with **RII value of 0.623.**

According the above rank, management related factors are the major and the most critical affecting factor which affects the productivity of projects those are constructing under AASHDE; Under management related factors variables; Inadequate construction method, and Slowness in decision making process are the most affecting factor critical and mainly productivity affecting variables.

5.1.5.3 PROJECT RELATED

Table 9 Rank of Project Related Factors

NO.	FACTOR AFFECTING PRODUCTIVITY IN AASHDE	RII	RANK
4	PROJECT RELATED	0.61533	3
	Poor site conditions	0.647	1
	Poor access within construction job site	0.611	2
	Poor site management system	0.588	3

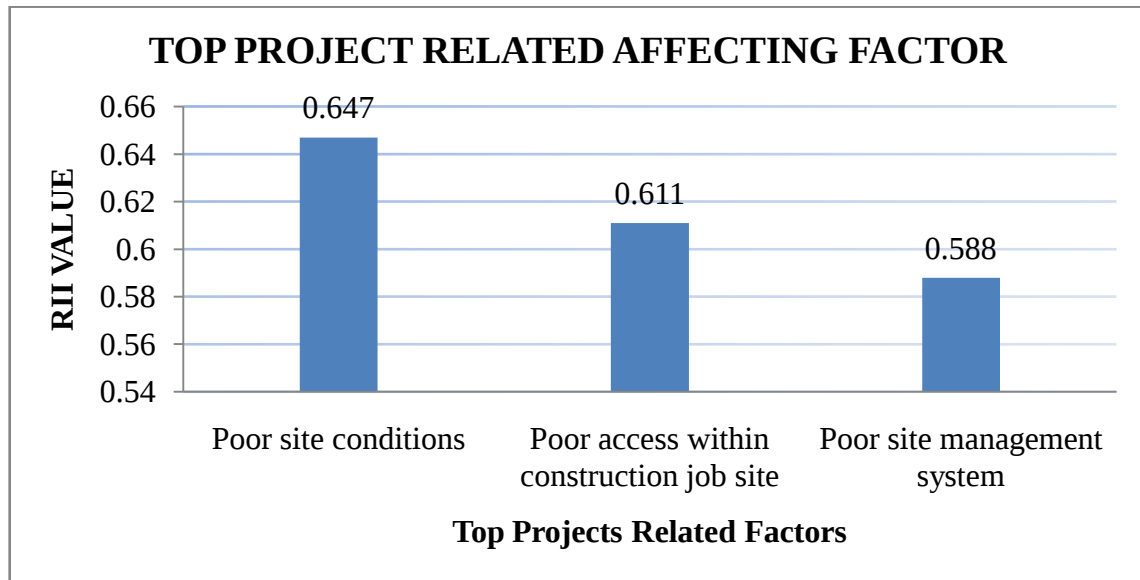


Figure 7 Top Project related factors

The respondents ranked variables which are listed under Project related factors as the third factor affecting productivity in Addis Ababa Saving House Projects in respect of its effect on construction productivity with **Average RII value of 0.61533**.

Individually, the highest variable under Project related factors are:

1. Poor site conditions with **RII value of 0.647**
2. Poor access within construction job site with **RII value of 0.611**
3. Poor site management system with **RII value of 0.588**

5.1.5.4 OTHER FACTORS

Table 10 Force majeure and Healthy and safety factors

NO.	FACTOR AFFECTING PRODUCTIVITY IN AASHDE	RII	RANK
5	FORCE MAJUERE	0.576	5
	A) Bad weather condition	0.576	1
6	HEALTHY AND SAFETY	0.611	4
	B) Healthy and Safety related factories	0.611	1

Healthy and safety Force majeure and are fourth and fifth factors which affect the productivity in Addis Ababa Saving House Projects with **RII value 0.611 and 0.576** respectively.

5.1.5.5 POLICY AND REGULATION RELATED

Table 11 Policy and regulation related factors

NO.	FACTOR AFFECTING PRODUCTIVITY IN AASHDE	RII	RANK
2.	POLICY AND REGULATION RELATED	0.540	6
	A). Procurement	0.623	1
	B). Contract condition and Contractual agreements	0.611	2
	C). Government rule and regulation.	0.388	3

Policy and regulation related factors are sixth factors which affect the productivity in Addis Ababa Saving House Projects with **Average RII value 0.540**

5.1.6 PRODUCTIVITY IMPROVEMENT TECHNIQUES

There were about 48 identified as productivity improvement techniques of construction in Addis Ababa Saving House project from literature. These 48 factors were categorized under five major groups as Resource related techniques, Site and Store related techniques, methodology related techniques, management related techniques, and Safety and Healthy related techniques. The respondents were requested to rate for each of 48 factors under each category based on their experience on construction projects. The results of the respondents then analyzed using relative importance index (RII).

5.1.6.1 RESOURCE RELATED TECHNIQUES

Table 12 Resource related Productivity Improving Techniques

No.	PRODUCTIVITY IMPROVEMENT TECHNIQUES IN ADDIS ABABA SAVING HOUSE DEVELOPMENT ENTERPRISES	Group	RII	Rank
1	RESOURCE RELATED		0.667	1
	Using precast and pre fabricates in the projects	Material	0.735	1
	Get materials from suppliers to site Just In Time	Material	0.722	2
	Keeping machines in good working condition through systematic maintenance.	Equipment	0.722	2
	Motivating and Satisfying the Workforce	Labor	0.688	3
	Continuous Quality assurance system for materials.	Material	0.688	3
	Providing even work load for all employees.	Labor	0.655	4
	Collects materials from preferred suppliers to the operational site	Material	0.655	4
	On time supply of materials from client side.	Material	0.655	4
	Performing a set up operation in lesser amount of time.	Equipment	0.655	4
	Employ the responsible person or group for different tasks and production	Labor	0.633	5
	Giving Training about new technology and best practice for workforces	Labor	0.6	6
	Optimize work practices and workplace planning	Labor	0.6	6

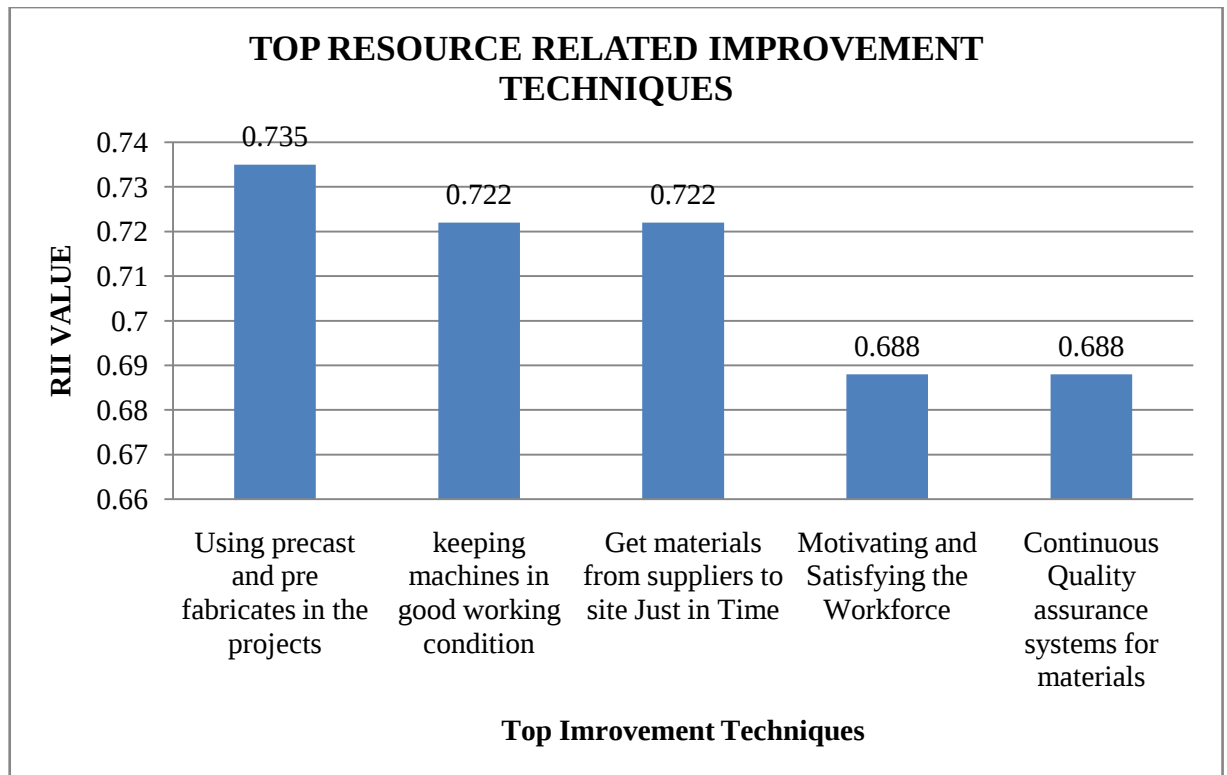


Figure 8 Top Resource related Productivity improvement techniques

The Resource related techniques are ranked as the first productivity improvement techniques in Addis Ababa Saving House Enterprise Projects by the respondents with **Average RII value of 0.667.**

Individually,

1. Using precast and pre fabricates in the projects with **RII value of 0.735**
2. keeping machines in good working condition through systematic maintenance with **RII value of 0.722**
3. Get materials from suppliers to site Just in Time with **RII value of 0.722**

4. Motivating and Satisfying the Workforce with **RII value of 0.688**
5. Continuous Quality assurance systems for materials with **RII value of 0.688** are ranked the highest variable under resource related techniques.

5.1.6.2 METHODOLOGY RELATED TECHNIQUES

Table 13 Methodology related Productivity improvement techniques

No.	PRODUCTIVITY IMPROVEMENT TECHNIQUES IN ADDIS ABABA SAVING HOUSE DEVELOPMENT ENTERPRISES	RII	Rank
3	METHODOLOGY	0.649	2
	Executing the required tasks just in time.	0.722	1
	Minimizing defects or practicing Zero defects.	0.688	2
	Adapting Pre casted, Prefabricated materials.	0.688	2
	Preparing of individual tasks at the operational level	0.677	3
	Executing various tasks in parallel by multidisciplinary teams.	0.655	4
	Producing only what is needed, when it is needed and in needed quantity.	0.655	4
	Detecting and correcting production defects.	0.633	5
	Changing the process from a manual to a mechanized process.	0.633	5
	Apply work study continuously and improve the process.	0.622	6
	Using advanced technology in work methodology	0.611	7
	Development of new process and installation of modern plant and equipment.	0.577	8

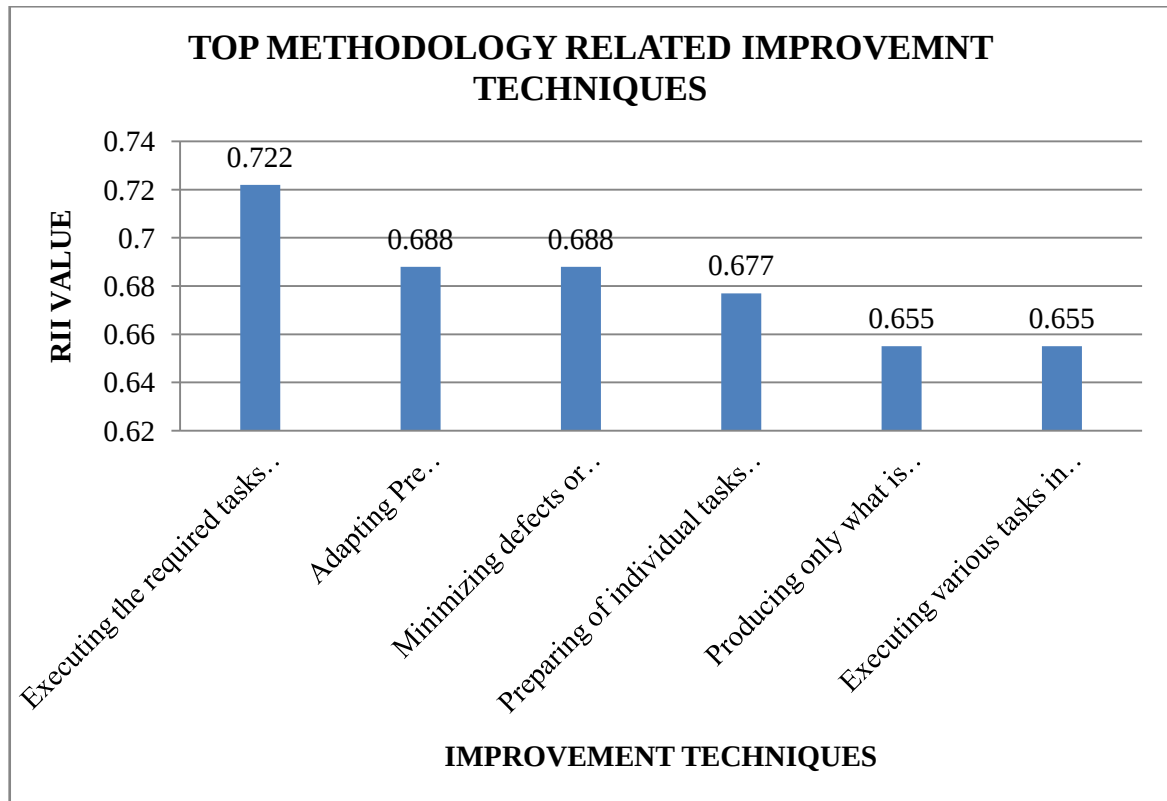


Figure 9 Top Methodology related Productivity improvement techniques

The respondents ranked variables which are listed and showed above the methodology related techniques as the second productivity improvement techniques in Addis Ababa Saving House Projects with **Average RII value of 0.649**

Individually, the highest variable under methodology related techniques are

1. Executing the required tasks just in time with **RII value of 0.722**
2. Adapting Pre casted, prefabricated materials with **RII value of 0.688**
3. Minimizing defects or practicing Zero defect with **RII value of 0.688**

4. Preparing of individual tasks at the operational level with **RII value of 0.677.**
5. Producing only what is needed, when it is needed and in needed quantity with **RII value of 0.655.**
6. Executing various tasks in parallel by multidisciplinary team with **RII value of 0.655.**

2.1.1.1. SITE AND STORAGE RELATED

Table 14 Rank of Site and storage related productivity improvement techniques

No.	PRODUCTIVITY IMPROVEMENT TECHNIQUES IN ADDIS ABABA SAVING HOUSE DEVELOPMENT ENTERPRISES	RII	Rank
2	SITE AND STORE CONDITION	0.629	3
	Arranging items (materials, tools, gauges) systematically for easy catching.	0.655	1
	Eliminates the wastes in Stock.	0.655	1
	Keeping work place carefully clean fresh and neat	0.644	2
	Scheduling regular cleaning and clearing out operations	0.611	3
	Getting rid of unnecessary items.	0.577	4

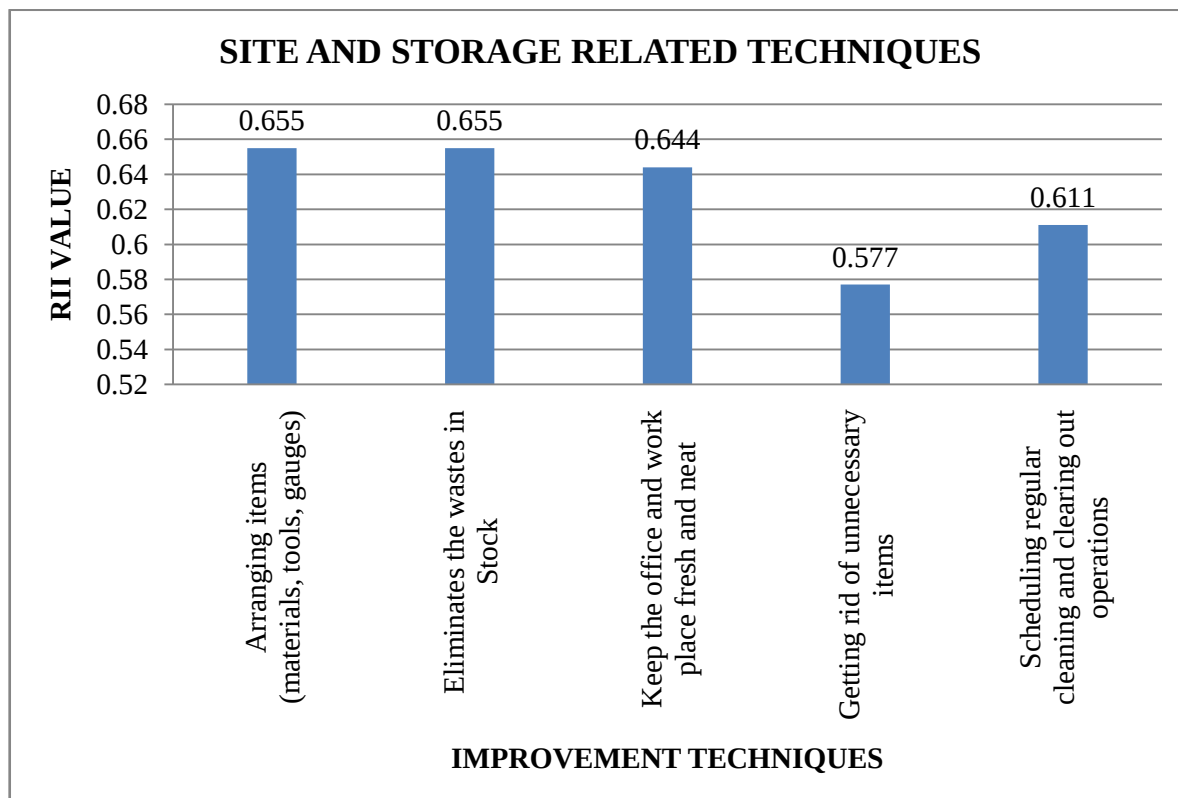


Figure 10 Top site and Storage related Techniques

The respondents ranked variables which are listed below site and storage related techniques as the third productivity improvement techniques in Addis Ababa Saving House Projects with **Average RII value of 0.629**

Individually,

1. Arranging items (materials, tools, gauges) with **RII value of 0.655**
2. Eliminates the wastes in Stock with **RII value of 0.655**
3. Keep the office and work place fresh and neat with **RII value of 0.644**

4. Getting rid of unnecessary items with **RII value of 0.577**
 5. Scheduling regular cleaning and clearing out operations with **RII value of 0.611**
- are the highest variables under site and storage related productivity improvement techniques simultaneously.

2.1.1.2. MANAGEMENT RELATED

Table 15 Rank of management related Improvement techniques

No.	PRODUCTIVITY IMPROVEMENT TECHNIQUES IN ADDIS ABABA SAVING HOUSE DEVELOPMENT ENTERPRISES	RII	Rank
4	MANAGEMENT	0.6188	4
	Better integration between site and office management	0.688	1
	Visual inspection for material, equipments, and work and information flow.	0.677	2
	Follow the scheduling of project by network analysis (CPM and PERT)	0.644	3
	Providing Better working relationship between sub-contractors and the main contractor	0.644	3
	Using different formats of construction in project.	0.633	4
	Empowers employees to take full responsibility for their role.	0.633	4
	Enforce regular breaks and Ensure people enjoy their work.	0.633	4
	aims to promote a rapid response to customer demand while minimizing inventory	0.622	5
	Arrange separate meeting areas for different kinds of work.	0.611	6
	giving emphasis on process of achieving the results	0.611	6
	Using Work standards to minimize variations in output, quality, work-in-progress and cost.	0.611	6
	Provides Daily group meetings	0.6	7
	Estimating duration and resource requirements for each piece	0.6	7
	Information technology based on-site communication framework	0.58	8
	Recognize and encourage employees' good work	0.577	9
	Plan of health and safety into the project	0.577	9
	Manage the project by breaking it into pieces	0.577	9
	Inviting employees for suggestion	0.544	10

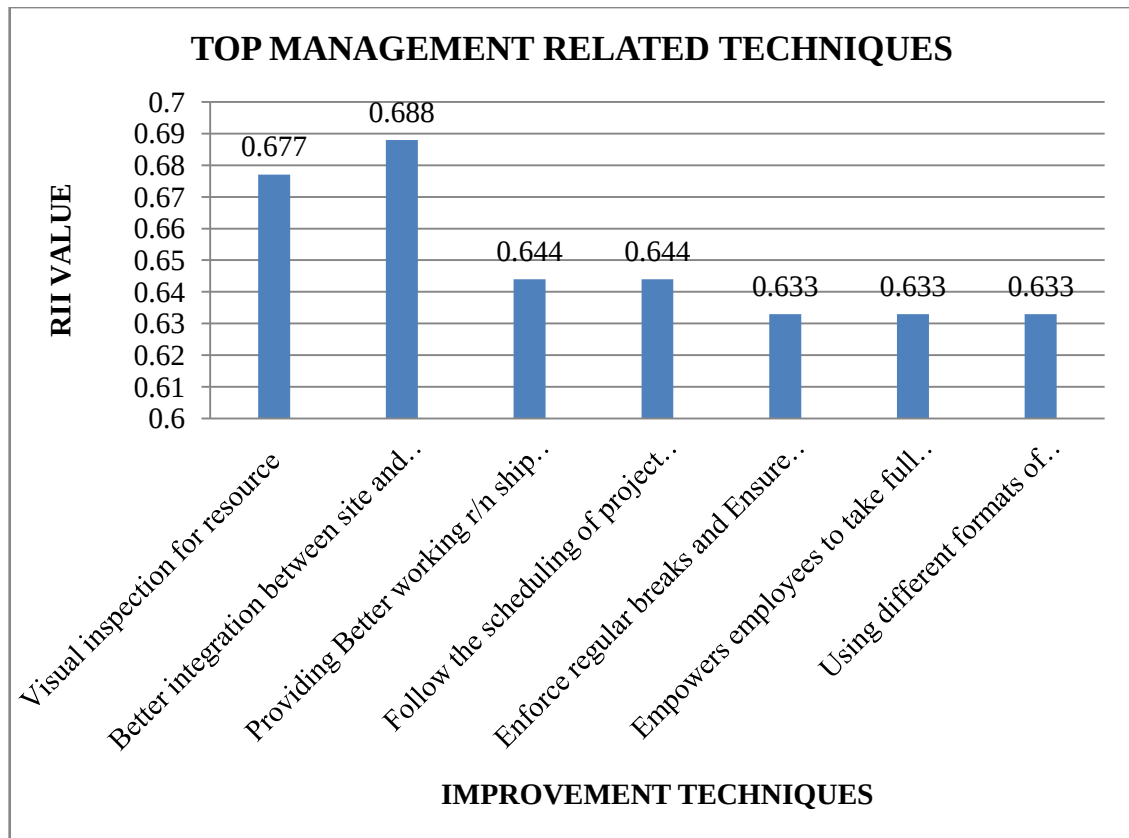


Figure 11 Top management related productivity improvement techniques

The respondents ranked variables which are listed below management related techniques as the fourth productivity improvement techniques in Addis Ababa Saving House Projects with **Average RII value of 0.6188**

Individually,

1. Visual inspection for material, equipments, and work and information flow with **RII value of 0.677**
2. Better integration between site and office management with **RII value of 0.688**

3. Providing Better working relationship between sub-contractors and the main contractor with **RII value of 0.644**
4. Follow the scheduling of project by network analysis (CPM and PERT) with **RII value of 0.644**
5. Enforce regular breaks and Ensure people enjoy their work with **RII value of 0.633.**
6. Empowers employees to take full responsibility for their role with **RII value of 0.633.**
7. Using different formats of construction in project with **RII value of 0.633** are the highest variables under management related productivity improvement techniques.

2.1.1.3. HEALTH AND SAFETY RELATED

Table 16 Rank of Healthy and Safety related Improvement techniques

No.	PRODUCTIVITY IMPROVEMENT TECHNIQUES IN ADDIS ABABA SAVING HOUSE DEVELOPMENT ENTERPRISES	RII	Rank
5	SAFETY AND HEALTHY	0.6	5
	i. Healthy and safety issues	0.6	1

The respondent's ranked variable which is listed below health and safety related technique as the fifth productivity improvement techniques in Addis Ababa Saving House Projects with **RII value of 0.6.**

6 CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

The general objective of this paper is to assess productivity improvement techniques for Addis Ababa Saving House Development Enterprise and identifying the factors affecting the productivity. This study was done by ranking the variables for each Factors affecting productivity and productivity improvement techniques in the projects of Addis Ababa Saving House Development Enterprises.

The Top 15 critical factors from analysis; which affect the productivity from different groups are identified; which are:

- Resource related
 - Low productivity of laborers
 - Failure of tools and equipments
 - Material storage location and condition
 - Lack and unavailability of required tools and/or equipment's
 - Qualities of material
- Management related
 - Inadequate construction method
 - Slowness in decision making process
 - Poor coordination and leader ship in sites
 - Inappropriate organizational mgt and poor site management
 - Ineffective planning and scheduling of project

- Rework
- Project related
 - Poor site conditions
 - Poor access within construction job site
 - Poor site management system

The Top 21 main productivity improvements techniques which are currently Addis Ababa Saving House Projects use are identified from different groups; which are:

- Resource related
 - Using precast and pre fabricates in the projects
 - keeping machines in good working condition through systematic maintenance
 - Get materials from suppliers to site Just in Time
 - Motivating and Satisfying the Workforce
 - Continuous Quality assurance systems for materials
- Methodology related
 - Executing the required tasks just in time
 - Adapting Pre casted, prefabricated materials
 - Minimizing defects or practicing Zero defect
 - Preparing of individual tasks at the operational level
 - Producing only what is needed, when it is needed and in needed quantity
 - Executing various tasks in parallel by multidisciplinary team

- Site and Storage related
 - Arranging items (materials, tools, gauges)
 - Eliminates the wastes in Stock
 - Keep the office and work place fresh and neat
 - Getting rid of unnecessary items
- Management related
 - Visual inspection for material, equipments, and work and information flow
 - Better integration between site and office management
 - Providing Better working relationship b/n sub-contractors and the contractor
 - Follow the scheduling of project by network analysis (CPM and PERT)
 - Enforce regular breaks and Ensure people enjoy their work
 - Empowers employees to take full responsibility for their role

6.2 RECOMMENDATION

From result of this study; the following recommendation was given to reduce and protects the factors affecting productivity and improve the productivity with different techniques:

1. The companies which are involved in Addis Ababa Saving House Project must give attention labours output to get good productivity from labours due to their direct involvement in any process.
2. Since the equipments are the main to produce the output in construction site The equipments be maintained in several time and must handled in a good manner

3. To produce Construction unit just in time the quality of material and appropriate location of material is factor so any companies which are participating in Addis Ababa Saving House Projects must give emphasis on material quality and location which they handle and store.
4. On construction project adjusting and showing the construction methods for a crews involved in construction with good coordination and leadership and giving the right decision at the required time is good to have better output from crews
5. In order to produce good output the labors must move freely from place to place in site; so the site condition must be assessable and comfortable.
6. The companies need to focus on using precast and pre fabricates in the projects, Get materials from suppliers to site Just in Time, Motivating and Satisfying the Workforce, Continuous Quality assurance systems for materials are the main tools and techniques which were described in this study.

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APPENDENCE-RESEARCH QUESTIONARY



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Adama Science & Technology University

Dear respondents;

At present, I am working the research on title of Productivity improvement techniques in Addis Ababa Saving House Development Enterprise projects for a thesis/dissertation submitted in partial fulfillment of the requirements for the Degree of Master of Science in Civil Engineering (Construction Management) at Adama Science and Technology University. The main objective of this research is to assess productivity improvement techniques for Addis Ababa Saving House Development Enterprise by identifying the factors affecting the productivity. To meet the research objective, it is necessary to have the stakeholder's response on questionnaire.

The accuracy of your answers is very vital for reliable, true and successful output of the research data analysis. And your immediate response helps to finish the research on time. I confirm that your response is kept in confident and be only used for the purpose of this research.

Looking your exact and urgent response,

Aniley Asfaw

Advisor: - Dr. Girmaye Kahasay

If you have any question or comment and any clarifications on questionnaire, please contact me on

Phone no.:- 0912288783 or email: - ano_asfaw2000@yahoo.com

Thank you very much for your volunteer cooperation

1. General Information about Participant and Project

Name of Project		_____
Project Location		_____
Your Education Level		☐ Diploma ☐ Bsc ☐ Msc ☐ Phd ☐ others
Your Position in Organization		_____
Type of Organization you are working		☐ Contractor ☐ Consultant ☐ Client ☐ others
Your Work Experience		_____ Years
Number of building		
Size of building		
Project	Cost	_____ Million ETB
	Contract time	
	Start Day	
	Completion Day	
Project Progress	Physically	
	Financially In (%)	

2. Please indicate and tick to what extent the following factors affect productivity at your construction site

1 – Does not affect it;

2 – Does affect it in least;

3 – Affects it;

4 – Highly affects it;

5– Very highly affects it

No.	FACTORS AFFECTING PRODUCTIVITY IN ADDIS ABABA SAVING HOUSE DEVELOPMENT ENTERPRISES	MEASUREMENT SCALE				
		1	2	3	4	5
1.	RESOURCE RELATED					
	A. Labor					
	a) Shortage of Labor.					
	b) Lack of experience among laborers.					
	c) Low Productivity of laborers.					
	d) Lack of competition between the Laborers.					
	e) Personal Problem & Accident to Laborers.					
	f) Dispute and Bad Behavior among Laborers.					

	g) Material					
	a) Lack and late supply of materials from client side.					
	b) Lack and late supply of materials from contractor side.					
	c) Increase in the price of materials in the market.					
	d) Material storage location and condition.					
	e) Quality of material					
	h) Equipment and Tools					
	a) Lack and unavailability of required tools and/or equipment's.					
	b) Failure of tools and/or equipment's.					
	i) Finance					
	a) Shortage of client finance					
	b) Shortage of contractor finance					
	c) Material and Labor Price & Wage Escalation					
	d) Delay Payment to contractor					
	e) Delay Payment for sub contractors and suppliers					
	j) Design and Drawing					
	a) Variations (change) in the design					
	b) Late designs review and approval.					
	c) Discrepancy in Design documents.					
	d) Incomplete design and contract documents.					

2.	POLICY AND REGULATION RELATED					
	a) Procurement					
	b) Contract condition and Contractual agreements					
	c) Government rule and regulation.					
3.	MANAGEMENT RELATED					
	A)Weak system of organization					
	a) Organizational change					
	b) Inadequate construction method					
	c) Ineffective planning and scheduling of project					
	d) In appropriate organizational mgt and poor site management					
	B)Poor information Management system					
	a) Poor in using different reporting and communication formats of construction					
	b) Lack of communication between stakeholders					
	C)Poor coordination and leadership					
	a) Rework					
	b) Poor coordination and leadership in sites					
	D)Inspection and supervision					
	a) Poor Inspection and Supervision					
	b) Payment delays.					
	c) Slowness in decision making process					

4.	PROJECT RELATED					
	a) Poor site conditions					
	b) Poor site management system					
	c) Poor access within construction job site					
5.	FORCE MAJEURE					
	a) Bad weather condition					
6	HEALTHY AND SAFETY					
	a) Healthy and Safety issue					

3. Please indicate and tick to what extent your company uses the following techniques at your construction site under 40/60 Condominium Projects.

1 –Do not use it;

2 – Do use it in least;

3 – Use it;

4 – Highly Use it;

5 – Very highly use it

No.	PRODUCTIVITY IMPROVEMENT TECHNIQUES IN ADDIS ABABA SAVING HOUSE DEVELOPMENT ENTERPRISES	DATA MEASUREME NT SCALE				
		1	2	3	4	5
1	RESOURCE RELATED					
	A. Labor					
	i. Motivating and Satisfying the Workforce					
	ii. Giving Training about new technology and best practice for workforces					
	iii. Employ the responsible person or group for different tasks and production					
	iv. Providing even work load for all employees.					
	v. Optimize work practices and workface planning					
	B. Materials					
	i. Collects materials from preferred suppliers to the					

	operational site					
	ii. Get materials from suppliers to site Just In Time					
	iii. On time supply of materials from client side.					
	iv. Continuous Quality assurance system for materials.					
	v. Using precast and pre fabricates in your projects					
	C. Equipments					
	i. Keeping machines in good working condition through systematic maintenance.					
	ii. Performing a set up operation in lesser amount of time.					
2.	SITE AND STORE CONDITION					
	i. Getting rid of unnecessary items.					
	ii. Arranging items (materials, tools, gauges) systematically for easy catching.					
	iii. Keeping work place carefully clean					
	iv. Scheduling regular cleaning and clearing out operations					
	v. Eliminates the wastes in Stock.					
	vi. Keep the office and work place fresh and neat.					

3.	METHODOLOGY					
	i. Development of new process and installation of modern plant and equipment.					
	ii. Using advanced technology in work methodology					
	iii. Apply work study continuously and improve the process.					
	iv. Executing various tasks in parallel by multidisciplinary teams.					
	v. Preparing of individual tasks at the operational level					
	vi. Minimizing defects or practicing Zero defect.					
	vii. Executing the required tasks just in time.					
	viii. Detecting and correcting production defects.					
	ix. Adapting Pre casted, Prefabricated materials.					
	x. Changing the process from a manual to a mechanized process.					
	xi. Producing only what is needed, when it is needed and in needed quantity.					
4	MANAGEMENT					
	i. Follow the scheduling of project by network analysis (CPM and PERT)					
	ii. Provides Daily group meetings					
	iii. Using different formats of construction in project.					
	iv. Visual inspection for material, equipments, and work and information flow.					

	v.	Better integration between site and office management					
	vi.	Empowers employees to take full responsibility for their role.					
	vii.	Recognize and encourage employees' good work					
	viii.	Enforce regular breaks and Ensure people enjoy their work.					
	ix.	Arrange separate meeting areas for different kinds of work.					
	x.	Plan of health and safety into the project					
	xi.	Manage the project by breaking it into pieces					
	xii.	Estimating duration and resource requirements for each piece					
	xiii.	Providing Better working relationship between sub-contractors and the main contractor					
	xiv.	Inviting employees for suggestion					
	xv.	Information technology based on-site communication framework					
	xvi.	giving emphasis on process of achieving the results					

	xvii. aims to promote a rapid response to customer demand while minimizing inventory					
	xx. Using Work standards to minimize variations in output, quality, work-in-progress and cost.					
5	HEALTHY AND SAFETY					
	i) Healthy and safety issues					