A study on Productivity Measurement System and its application in Ethiopian garment units (With special reference to Addis garment and Novastar garment industry, Ethiopia)

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ABSTRACT

The main focus of this research is to study the Productivity measurement system and its application to garment industries in Ethiopia. For the purpose of sample, this study is conducted with two major garment units named Novastar and Addis garment industry in Ethiopia. Productivity is defined as the ratio of output to input. The main objective is to study the problems related to productivity measuring system of garment companies and suggest the appropriate solution and to compare the productivity measurement system of the above two garment industries.

The suitable methods and necessary literature review are taped to conduct this study. Productivity measurement process is quite significant for many reasons. Based on the research it is identified the major factors that affect the productivity measurement system in Addis garment and Novastar garment industries are lack of skilled man power, low commitment of top management and department heads, shortage of material, shortage of capital, discontinuous production or shortage of market and lack of awareness of employee. Based on the findings the suggestions are specified by the researcher for the betterment of productivity measurement system of the garment units in Ethiopia.

Key words: Productivity, Garment, Measurement, Material, Capital, Shortage.

1. INTRODUCTION

1.1. Background of the Study

Garment industry is one of the industries that have a potential in developing an economy such likes Ethiopia. History depicts that this industry sector has been a base for many successful industrial developments and hence Ethiopian government has defined a policy where one of the tasks identified is rapid export growth through production of high value agricultural products and increased support to export oriented manufacturing sectors such as textile and garment.

Productivity measurement is a prerequisite for improving productivity. As Peter Drucker, who is widely regarded as the pioneer of modern management theory, said: "Without productivity objectives, a business does not have direction. Without productivity measurement, a business does not have control." Measurement plays an important role in your management of productivity. It helps to determine if your organization is progressing well or not. It also provides information on how effectively and efficiently your organization manages its resources.

Productivity measurement enables a garment industry to assess the efficiency of conversion of its resources to goods. Based on this assessment, the garment industry would know whether it is doing well or not and therefore could take the necessary action to produce more goods for a given amount of resources used. Measurement enables the garment industry to do resource planning and to set quantifiable objectives of productivity levels at which it ought to be operating. Productivity measurement also enables a garment industry to know whether it is improving its profitability through productivity or through price recovery.

The industries are characterized by poor productivity measurement system mostly, characterized by implementing productivity measurement on return on investment rather than such as quality measurement, employee performance measurement, customer satisfaction evaluation. Hence this research focuses on the productivity measurement system (PMS) of the Ethiopian garment industry units.

1.2. Statement of the Problem

The major problems identified with the Ethiopian garment industries are have low capacity utilization and high cost of production has made the industries less competitive in market. Moreover most of these industries have a working capital problem for purchasing good quality raw materials, purchase of modern equipment and personnel training that are essential for productivity enhancement and quality control. For solving the above problems this research has been conducted by the researcher.

1.3. Objective of the Study

- ✓ To study the productivity measuring system related problems with two garment companies
- ✓ To compare the productivity measurement system and suggest the appropriate solution for garment industries in Ethiopia.

1.4. Methodology used in the study

To collect the data, surveying method is used by the researcher. The random sampling technique is adopted for this research. Questionnaire, face to face interviews, direct observation and documentation are used to collect the required data. The data collected from two garment industries through primary and secondary source.

1.5 The Profile of Novastar Garment and Addis Garment Industry

Novastar garment PLCwas established in 2005 GC and produces polo shirts, t-shirts, uniforms and sport wears for children, juniors, females, males, corporate bodies and tourists. Novastar garment factory PLC is state of the art factory that is exporting its products to US and Turkey market. Novastar garment PLC has different departments like designing, cutting and spreading, sewing and finishing in addition to that production, finance, marketing and human resources. It employees more than 476 professionals and located outside the Addis industry zone in Gelan town of Finfine Area Special Zone of Oromia.

Addis garment PLC is the first garment factory in Ethiopia that is established in 1965EC by the name of Augusta garment factory in know days it is changed by the name of Addis garment factory. Before the few years this garment factory was governmental but knows it is changed in to private garment factory. Addis garment produces shirts, work wear and graduation gowns but the major product is shirt. Before the Company produces the product for foreign export but now a dayit produces for the local customer. In addition to this we were collect the data from each selected garment industries and the following data analysis and discussions are made.

2.0 Data analysis and discussion

Table: 1 Number of Employees working in Addis Garments

Sr. No.	Responsibility of employee	No. of Employee	Percentage
1	Designer	1	0.41%
2	Cutter and spreader	16	6.53%
3	Sewer	127	51.84%
4	Finisher	22	8.98%
5	Administrative staff	79	32.24%
Total		**245**	**100%**

Fig: 1 Number of Employees working in Addis Garments

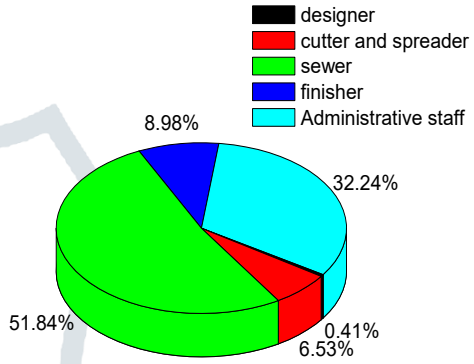

Table: 2 Number of Machines in Addis garment industry

Sr.No.	Type of Machine	No. of Machines
1	Sewing	150
2	Cutting	5
3	Finishing	20
4	Embroidery and printing	2

Fig: 2 Number of Machines in Addis garment industry

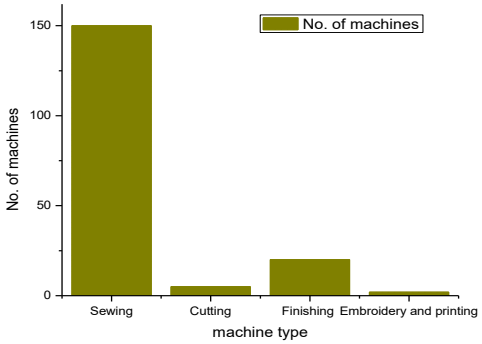

Table 3 Total Investment of fixed assets in Addis garment capital

S.No	Depreciation	ETB per Month
1	Machine	92700
2	Building	19300
3	Others	5500

Table 4 Energy used in Addis Garment industry

S.No	Energy	ETB per Month
1	Electricity consumption	5000

2.1. Calculation of Productivity measurement in Addis Garment industry:

- Total No. of Employees = 245.
- Total salary of employees = 274930 birr/month.
- Output = 1500 pieces of shirt/day.
- Material input: - fabric= 2700m, Thread = 1/15 of cone x1500 = 100 cone of thread.
- Buttons =11x1500=16500 pieces, Interlining=0.15x1500=225m.
- Cost of material input:-Fabric=50birr/mx2700m=135000ETB,Buttons=0.3birr/piece x16500pieces=4950ETB.
- Thread=25birr/cone x100 cone=2500ETB, Interlining= 8birr/m x 225m=1800ETB.
- Total cost of material input=135000ETB +4950ETB+2500ETB+1800ETB=144250 ETB
- Absenteeism = 15%.
- Sewers present =0.85 x 127 = 107.
- Non-sewers present = 0.85 x 39 = 33.
- Actual hours of work = 8 hrs.
- Price of shirt = 210 birr.
- Averagely Cost of wage paid per hour =274930birr/ [245*192] hrs. = 5.84birr/hr.
- Electricity daily average cost = 5000/24 =208.33birr/day= 310.41KW/day.
- 1KW= 0.67ETB or 1ETB=1.49KW.

2.2. Calculation of Depreciation:

- Building depreciation= 804.16birr/day.
- Machinery depreciation=3862.5birr/day.
- Other depreciation=229.16birr/day.
- Total depreciation= 4895.88ETB/day.

2.3. Using physical productivity measurement method:

$$\text{Labour productivity} = \frac{\text{Volume of output}}{\text{Total labour input}}$$

1) $\text{Direct labour productivity} = \frac{1500 \text{ pieces}}{107 \text{ workers} * 8\text{hrs.}} = 1.75\text{shirt/worker-hr.}$
2) $\text{Indirect labour productivity} = \frac{1500 \text{ pieces}}{33 \text{ workers} * 8\text{hrs.}} = 5.68\text{shirt/worker-hr.}$

3) Toatl labour productivity $= \frac{1500 \text{ pieces}}{140 \text{ workers} * 8\text{hrs.}} = 1.34\text{shirt/worker-hr.}$

4) Total hr. required $= \frac{1 \text{ hr.x } 1 \text{ shirt}}{1.34 shirt/worker-hr.} = 0.746$ hours or 44.76 minutes are required to finish one shirt.

The company's standard (SAM) for this shirt is 33 minutes which means

Output/day $= \frac{8\text{x}60\text{minute x } 140 \text{ workers}}{33\text{minutes/shirt}-\text{worker}} = 2036$ shirts/day

So the productivity in terms of efficiency becomes 1500/2036 = 73.67%. This expression may also be called 'productive efficiency'.

- Material Productivity $= \frac{\text{Volume of output}}{\text{Total material input}}$
- Material Productivity $= \frac{1500 \text{ pieces}}{2700\text{m} * 1.5\text{m}} = 0.37\text{shirt/m}^2$.
- Energy productivity $= \frac{\text{Volume of output/day}}{\text{Electricity cost in birr/day}}$
- Energy productivity $= \frac{1500\text{shirts/day}}{\text{ETB } 208.33\text{/day}} = 7.2\ shirts/ETB$

Or Energy productivity=7.2 shirts$/1.49KW = 4.83$ shirts per KW. means 0.14 ETB worth of electricity are used per piece of shirt.

Given that there are 107 sewers in the enterprise, the daily cost of electricity per machine is: $\frac{208.33 \text{ ETB}}{107 \text{ machines}} =$

1.947ETB/machine or 2.9 KW per machine

Total physical productivity index $= \frac{\text{Total volume of output}}{\text{TotalVolume of all input}} = \frac{1500\text{pieces}}{6540.08+144250+208.33+4895.88}$

Total physical productivity index $= \frac{1500\text{pieces}}{155894.29\text{ETB}} = 0.0096 pieces/ETB$

2.4 Using value productivity measurement method:

- Value of labour productivity index $= \frac{\text{Value of output}}{\text{Value of labour input}}$
- Value of direct labour productivity $= \frac{1500 \text{ pcs} * \frac{210\text{birr}}{\text{pc}}}{107\text{workers} * \frac{8\text{hrs}}{\text{worker}} * \frac{5.84\text{birr}}{\text{hr}}} = 63.01 ETB$
- Value of indirect labour productivity $= \frac{1500 \text{ pcs} * 210\text{birr/pc}}{33\text{workers} * \frac{8\text{hrs}}{\text{worker}} * 5.84\text{birr/hr}} = 204.31\text{ETB}$
- Value of total labour productivity $= \frac{1500 \text{ pcs} * \frac{210\text{birr}}{\text{pc}}}{140\text{workers} * \frac{8\text{hrs}}{\text{worker}} * \frac{5.84\text{birr}}{\text{hr}}} = 48.16 ETB$

That means that for every birr spent on labour, the garment industry earns 0.16birrs, which should cover overhead expenses and profit.

In absolute birr values, this is $140 \text{ workers} * \frac{8\text{hrs}}{\text{Worker}} * \frac{5.84\text{birr}}{\text{hr}} * 0.16 = 1046.528$ which represents the daily earnings of the enterprise.

$$\text{Value of material productivity index} = \frac{\text{value of output}}{\text{value of material input}}$$

$$\text{Value of material productivity index} = \frac{1500 \text{ pieces} * 210\text{birr/piece}}{144250\text{birr}} = 2.18birr$$

$$\text{Energy productivity index} = \frac{1500\frac{\text{pieces}}{\text{day}} * \text{ETB}210/\text{piece}}{\text{ETB}208.33/\text{day}} = 1512.02\text{ETB}$$

That means for every Ethiopian birr worth of electricity, 1512.02ETB of revenue are generated.

$$\text{Total value productivity index} = \frac{\text{Total value of output}}{\text{Total value of all input}} = \frac{1500\text{pieces}*210\text{birr}}{6540.08+144250+208.33+4895.88}$$

$$\text{Total value productivity index} = \frac{315000\text{ETB}}{155894.29\text{ETB}} = 2.02\text{ETB}$$

2.5 Data Analysis on Novastar garment industry

Table 5& Fig 3 Number of employees working with different

S.No	Responsibility of Employees	No. of Employee	Percentage
1	Designer	5	1.05%
2	Cutter and spreader	37	7.77%
3	Sewer	269	56.51%
4	Finisher	119	25%
5	Administrative staff	46	9.67%
	Total	476	100.00%

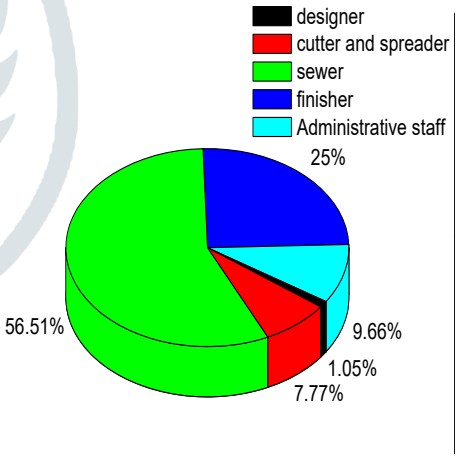

Table 6 & Fig 4 Machine in Novastar garment industry

S.No.	Machine type	No. of Machines
1	Sewing	230
2	Cutting	19
3	Finishing	44
4	Embroidery and printing	12

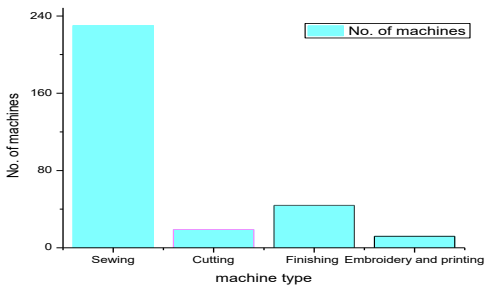

Table 7 Capital invested in Novastar garment industry

S.No	Depreciation	ETB per Month
1	Machine	48085
2	Building	91676
3	Others	18698

Table 8 Energy used in Novastar garment industry

S.No.	Energy	ETB per Month
1	Electricity consumption	9791

2.6 Calculation of Productivity measurement in Novastar garment company:

- Total No. of Employees = 476
- Total salary of Employees = 439858 birr/month
- SAM for baseball pant= 18 minutes
- Output = 2550 Pieces of sport wear baseball pant
- Material input per day:-Fabric=1.2mx2550=3060m and Width=1.5m, Thread= 1/16 of conex2550=160cones, Elastic=0.5mx2550=1275m.
- Cost of Material input per day: Fabric=38birr/mx3060m=16280ETB, Thread=25birr/Conex160cone=4000ETB, Elastic=2birr/mx1275m=2550ETB.
- Total cost of material input=16280ETB +4000ETB+2550ETB=22830ETB
- Absenteeism= 14%
- Sewers present =0.86 x 269 = 231
- Non-sewers present = 0.86 (476-355) = 0.86 x 161 = 138
- Actual hours of work per day = 7.66 hour
- Price of the sport wear baseball pant = 120 birr
- Averagely Cost of wage paid per hour =439858birr/ [476*183.84] hrs. = 5.03birr/hr.
- Electricity daily average cost = 9791/24days =407.96birr/day or 607.86KW/day

2.7 Calculation of Depreciation:

- Building depreciation= 3819.83/day
- Machinery depreciation= 2003.54/day
- Others=779.08/day

Total depreciation = 3819.83+2003.54+779.08= 6602.45/day

2.8 Using physical productivity measurement method:

$$\text{Labour productivity} = \frac{\text{volume of output}}{\text{Total labour input}}$$

$$\text{Direct labour productivity} = \frac{2550 \text{ pieces}}{231 \text{ workers} * 7.66 \text{hrs.}} = 1.44 \text{baseball pant/worker-hr.}$$

$$\text{Indirect labour productivity} = \frac{2550 \text{ pieces}}{138 \text{ workers} * 7.66 \text{hrs.}} = 2.41 \text{baseball pant/worker-hr.}$$

$$\text{Total Labour productivity} = \frac{2550 \text{ pieces}}{369 \text{ workers} * 7.66 \text{hrs.}} = 0.9 \text{baseball pant/worker-hr.}$$

$$\text{Total hr. required} = \frac{= 1\text{ hr.x } 1\text{ baseball pant}}{0.9\text{baseball pant/worker}-\text{hr.}} = 1.11\text{hours are required to finish one baseball pant.}$$

The company's standard (SAM) for this baseball pant is 18 minutes which means output/day $=$

$$\frac{7.66\text{x}60\text{minute x 369 workers}}{18\text{minutes/baseball pant}-\text{worker}} = 9421 \text{ baseball pants/day.}$$

So the productivity in terms of efficiency becomes 2550/9421 = 27.07%. This expression may also be called 'productive efficiency'.

1. Material productivity $= \frac{\text{Volume of output}}{\text{Total material input}}$
2. material productivity $= \frac{2550\text{pieces}}{3060\text{m}*1.5\text{m.}} = 0.556\text{pieces/m}^2$
3. Energy productivity $= \frac{\text{Volume of output/day}}{\text{Electricity cost in birr/day}}$
4. energy productivity $= \frac{2550\text{pices/day}}{\text{ETB } 407.96\text{/day}} = 6.25$ ball pant/ETB or 4.19 baseball pant/1KW

That means 0.16 ETB worth of electricity are used per piece of baseball pant.

Given that there are 231 sewers in the enterprise, the daily cost of electricity per machine is: $\frac{407.96 \text{ ETB}}{231 \text{ machines}} =$ 1.76ETB/machine

- Total physical productivity index $= \frac{\text{Total volume of output}}{\text{TotalVolume of all input}} = \frac{2550\text{pieces}}{14217.5+22830+407.96+6602.45}$
- Total physical productivity index $= \frac{2550 \text{ pcs}}{44057.9\text{ETB}} = 0.058$basebase pant/ETB

2.9 Using value productivity measurement method:

$$\text{Value of labour productivity index} = \frac{\text{value of output}}{\text{value of labour input}}$$

$$\text{Value of labour productivity index} = \frac{2550 \text{ pieces} * \frac{120\text{birr}}{\text{piece}}}{369 \text{ workers} * \frac{7.66\text{hrs}}{\text{worker}} * \frac{5.03\text{birr}}{\text{hr}}} = 21.52\text{birr}$$

That means that for every birr spent on labour, the garment industry earns 0.52birrs, which should cover overhead expenses and profit.

In absolute birrs values, this is $369\text{workers} * \frac{7.66\text{hrs}}{\text{worker}} * \frac{5.03\text{birr}}{\text{hr}} * 0.52 = 7393.09$ which represents the daily earnings of the enterprise.

$$\text{Value of material productivity index} = \frac{\text{Value of output}}{\text{Value of material input}}$$

$$\text{Value of material productivity index} = \frac{2550\frac{\text{pieces}}{\text{day}} * \frac{120\text{birr}}{\text{piece}}}{\frac{22830\text{ETB}}{\text{day}}} = 13.40\text{birr}$$

$$\text{Energy productivity index} = \frac{2550\frac{\text{pieces}}{\text{day}} * \text{ETB}120/\text{piece}}{\text{ETB } 407.96/\text{day}} = 755.63 \text{ ETB.}$$

That means for every Ethiopian birr worth of electricity, 755.63 ETB of revenue are generated.

$$\text{Total value productivity index} = \frac{\text{total value of outputs}}{\text{total value of all inputs}} = \frac{2550\text{pieces} * 120\text{birr}}{14217.5+22830+407.96+6602.45}$$

$$\text{Total value productivity index} = \frac{306000\text{ETB}}{44057.9\text{ETB}} = 6.95 \text{ ETB.}$$

2.10 Comparison of two organizations using Quantitative Productivity Measurement

S. No.	Factors	Addis Garment industry		Novastar Garment industry	
		Physical Productivity	Value Productivity	Physical Productivity	Value Productivity
1	Labour productivity	1.34shirt/worker-hr.	48.16 ETB	0.9 baseball pant/worker-hr.	21.52ETB
2	Material productivity	0.37shirt/m^2.	2.18 ETB	0.556baseball pant/m^2	13.40ETB
3	Energy productivity	4.83 shirts per KW	1512.02ETB	4.19 baseball pant/1KW	755.63 ETB
4	Total productivity index	0.0096shirts/ETB	2.02 ETB	0.058baseball pant/ETB	6.95ETB

3.0 Findings and discussions

- From the above analysis it is found that the labour productivity of Novastar is 21.52ETB which is less than 48.16ETB of Addis garment in terms of value productivity. This clearly says that Addis Garment used the labour efficiently and effectively than the Novastar Garment industry.
- The labour productivity of Novastar Garment is lesser because the Novastar garment company has used more number of non-sewers machines instead of sewer machines. In detail, the number of non-sewers used by Novastar is 37.4% and sewers are 62.3%, but in case of Addis Garment, they are using non-sewers machines 23.6% and sewers are 76.4% in their factory.
- By comparing Addis Garment and Novastar Garment, Novastar used more materials compare to Addis Garment. Inclear, the material productivity of Novastar Garment is 13.4ETB but Addis Garment's material productivity is 2.18ETB. From this it is clear that the Novastar garments were used the material effectively.
- From the calculation it is identified that the Addis garment used more energy compare to Novastar garment because Novastar garment allotting extra duty to their employees for garment production purpose.
- From the analysis it is very clear that the total productivity of Novastar Garment is higher than Addis garment.
- Total productivity indicates the overall productivity of the company but the partial productivity indicates the single ratio of output to one class of input. Generally, Addis garment use more effective in labour productivity and energy productivity whereas Novastar Garment Industry used more material productivity. But specifically in terms of quantitative the Novastar garment is more productive than the Addis garments.

4.0 Recommendations

There are different factors that affect the application of productivity measurement system in selected garment industries. Based on this, the following recommendations are put forth into consideration.

- The organizations may consider training for the whole employers about the benefits of productivity measurement, indicators of productivity measurement, method of productivity measurement, procedure of productivity measurement and the parameter of productivity measurement.
- The production department may implement the productivity measurement system using the productivity measurement procedures. The productivity measurement procedures shall be in the subsequent order that select for the main products, define outputs and inputs, identify the critical operations in the production process, decide which productivity factors are significant and are useful for implementing continuous productivity improvements, decide on the frequency and level of productivity computations, select a base period, design a data collection system including forms, data sources and data flow, assign and train at least one person to handle data processing, evaluation, monitoring, graph preparations and trend analysis, explain to all workers the reasons for productivity measurement and give performance feedback using productivity data.
- The management may apply the productivity measurement system using the parameters of productivity measurement.
- The management may consider applying the appropriate model or form of productivity measurement check list developed by the researchers.
- The top management shall utilizing the recent technology for implementing systems of monitoring the machine time, calculation of productivity by machine and establishing priorities in investments that will avoid situations where important resources are not used. The productivity measurement system is considered necessary for production cost minimization and increase of efficiency of resource utilization.
- The top management and other employers shall change the perception with the measurement of customer satisfaction and controlled feedback mechanism that will ensure the effective implementation of productivity measurement system. With hard work and continuous efforts, an achievement can be attained. This includes: increased market continuity, improved productivity and efficiency; improved customer satisfaction, better utilization of the resources, and development of reliable and good supply of raw materials.

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