

Improving Production Capacity through Efficient PPC System: Lesson from Leather Manufacturing

Mengist Hailemariam, Silma Yoseph

Abstract—A well designed and executed Production Planning and Control (PPC) system is one of the key levers for superior performance in the current manufacturing set-up. Hence, measuring the PPC system performance has become a necessity for long term success. The present study examined PPC related issues which impact the production capacity and productivity of leather companies with special focus on Kombolcha Tannery Share Company (KTSC), Ethiopia. Physical observation, interview, and questionnaire were used to generate necessary information from the respondents and reach valid conclusions. Company annual reports were referred and analyzed to triangulate primary data. Consequently, the study revealed that KTSC runs below its capacity due to its inefficient PPC system being in use for which the root causes were identified. The study thereby conceptualizes a PPC system improvement framework comprising three pillars viz., management culture, internal capability and performance measurement together with key considerations in each case. The study findings enable the company to recognize the importance of efficient PPC system as a source of competitive advantage. It also aid managers in evaluating various PPC execution schemes to enhance productivity.

Keywords—Ethiopia, Leather manufacturing, Production planning and control, PPC improvement framework.

I. INTRODUCTION

NOWADAYS' industries are facing challenges of market competition owing to the global changes taking place. Production management practices have undergone rapid transformation in streamlining production activities through different strategies to act in response to the challenges and improve productivity. PPC has been one of the most strategic areas of responsibility in most firms to attain this attempt.

PPC integrates all production activities. Hence, various activities are supported by PPC such as demand and materials planning, purchasing, inventory control, capacity planning, scheduling and sequencing of jobs [1]. The main concern of PPC is to anticipate possible difficulties of production. It involves deciding in advance as to how a series of functions are coordinated and the activities should be carried out in a best and economical way for efficient use of plant facilities.

Industries should ensure that their PPC system is well designed and executed in a predictable manner so that production goals are attained. Therefore, measuring the performance of a PPC system is critical [2].

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In view of this, a study was conducted to examine and identify the PPC system related issues impacting production capacity and productivity of a lather company in Ethiopia.

II. THE CASE COMPANY

KTSC was founded in 1967 by five Italian investors in Kombolcha town about 375Kms from the Ethiopian capital, Addis Ababa to the North. In 1978 it was restructured as a state owned company parallel to the then regime's economic policy. Yet, following the down fall of the old command economic policy, the company was privatized in 2013. As a leading semi-finished and finished leather products manufacturer and exporter, the company has been engaged in the collection, production and processing of the goat and sheep skin [3]. It has an attainable processing capacity of approximately 3,000 pieces of goats and sheep skins per day.

The company has about 55 permanent and 10 temporary employees. These figures comprises of semiprofessionals and mid-level technicians of which 55 (84.6%) are males and 10 (15.4 %) are females. As per the information gained from the company, at present, 80% of KTSC's semi-finished products (crust, shoe uppers and lining) are exported to Italy, India, China and Germany while 20% are sold in domestic market as finished product for shoe and garment factories. It envisions to produce 100% finished leather in the future aligned with the Ethiopian Government plan to export high value-added (finished) leather products instead of low value-added skins so as to ensure rapid and sustainable growth of the sector.

The tannery production process flow is illustrated in Fig. 1.

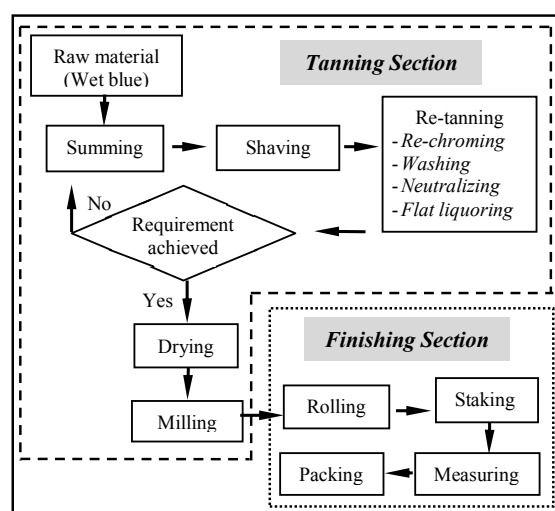


Fig. 1 KTSC's tannery process flow

As depicted in Fig. 1, the tannery production consists of a series of processes to convert the skin to leather.

In the tanning section the protein of the raw skin is converted into a material which will not putrefy and made to be suitable for a wide variety of end applications. The moisture content is reduced during summing and the thickness is made to be even and precise during shaving.

KTSC uses the most commonly used tanning material, chromium which leaves the leather once tanned a pale blue used color called "Wet blue" (skin) as a raw material. This raw material is acquired from its local sister company, Haik Tannery S. C. The chemicals are imported from Italy, Germany and India.

Re-tanning gives the material the required uniform fullness and ability to retain its consistency then allowed to dry which reduces the moisture content from 70% to 20-22%. The company uses vacuum drying toggle frames and overhead chain. Milling is done to improve the softness of the leather and to give the grain a more precise design.

In the finishing section, rolling is done following milling to spread out the skin under tension on the toggle frame and allow drying in a hot air tunnel for a short period of time. Finally, staking makes the hide softer and more pliable. The skin is measured and the finished product is packed for delivery.

KTSC has a number of PPC related problems that impede its productivity. The investigation identified the fact that PPC principles are the least used in the company and the production is below its capacity due to:

- i. inefficient resources utilization (machine, labor and material),
- ii. lack of proper raw material planning, purchasing and supply system,
- iii. lack of smooth work flow in the shop floor, and
- iv. lower effort to adapt new technology in the production process.

Ensuring an effective PPC system is a requirement for KTSC. Therefore, there is a need to study the PPC system of this Company.

In the following sections, an overview of the research methodology is discussed followed by results and discussion. A frame work for improved PPC system of the company is proposed next. Finally, conclusions are presented.

III. MATERIALS AND METHODS

The underlying motive of the investigators to undertake the study was to explore the current PPC system of KTSC and identify the PPC related problems that impede its production capacity. To achieve this, primary and secondary data were solicited from the company in two phases following [4], [5]. First, qualitative research methods such as physical observations and structured interview were conducted with ten employees to conceptualize and interpret KTSC's PPC system. Then, based on observation and interview findings quantitative research, survey was conducted for prediction, explanations and generalization using numerical data [4]. The

targeted groups for resources of data include Machine operators, Production Head, Technical Manager, General Manager, Finance and Personnel department. The participants were selected based on their experience on leather industry and involvement in the PPC system. To generate secondary data, documents such as annual reports and logbook were reviewed. Accordingly, five years data (2008/9 to 2012/13) were used. The raw data collected through qualitative approach were analyzed thematically by reviewing common ideas reflected and key points related to the research objectives. On the other hand, the data collected from questionnaire were tallied, tabulated, and analyzed using percentage value.

The investigation of the case study was directed by specific research issues concerning the PPC practices as follows:

- i. What challenges are encountered by PPC system of KTSC?
- ii. What possible measures should KTSC take to improve the PPC system?

IV. RESULT AND DISCUSSION

The analysis of data collected by qualitative and quantitative methods is presented in this section.

A. Qualitative Data Analysis

The following summary gives an overview of key findings from physical observation, interview and company documents.

During physical observation shortage of qualified workers, shortage of material and shaving machine (only one is available despite all products must pass through this process), wastage of working hours, high down time of machinery (because of spare parts shortage), unavailability of material handling equipment, high lead time of material movement, inappropriate shop floor layout, poor shop control, use of outdated machines, unavailability of PPC software and ordinary computer programs were identified as major contributing factors for inefficient PPC system at KTSC.

Besides, face to face interview was conducted with the General Manager, Technical Manager, and Production Head with respect to product specification, capacity planning, resource utilization and controlling, use of forecasting, PPC and related principles, etc. during the production process, and customer satisfaction in the service and products delivered.

Based on the interview conducted it was found out that the production plan of the company is done at the end of the budget year by committee from different functional units and compiled as a module by Production department. The module is approved by the Technical Manager and then submitted to the General Manager for final approval.

The interviewees believe that the company did not make use of PPC principle and strategies such as demand forecasting, material requirement planning and production scheduling to enhance its production capacity. The use of modern technology and different software in the company is also minimal. Concerning customer satisfaction they disclosed that there is no quantitative data in this respect but interviewees estimated that customer satisfaction is

approximately 60% and the rest 40% is not achieved due to low quality and shortage of raw materials used.

Based on company documents, machine availability was assessed and tabulated in Table I.

TABLE I
AVAILABILITY OF MACHINES

Type of Machines	Qty (Pc)	Capacity Design	Capacity Actual	Processing Time (Min/Pc)	Actual Pc/hour	Efficiency (%)
Summing	3	1,860	1,200	7	171	64.5
Shaving	1	2,100	1,250	7	179	59.5
Re-tanning	3	3,000	2,100	24	2100	70
Milling	2	1,000	850	9	850	85
Rolling	1	1,860	1,200	7	171	64.5
Staking	1	856	780	7	111	91
Measuring	1	4,000	3,650	7	521	91.3

It is revealed from Table I, design and actual capacity that all the 7 machines are used below average capacities indicating low machine utilization.

A five years production performance report i.e., plan vs. actual for the each of the three products (Upper, Crust and Lining) is illustrated in Fig. 2.

Referring to Fig. 2 there is variation between the planned and actual production level in each of the products in the past five years. This is because there is no appropriate demand forecasting procedure which is based on previous year's data

In sum, the qualitative analysis has revealed that there are many challenges in the KTSC which contribute directly to the inefficient performance of the PPC system.

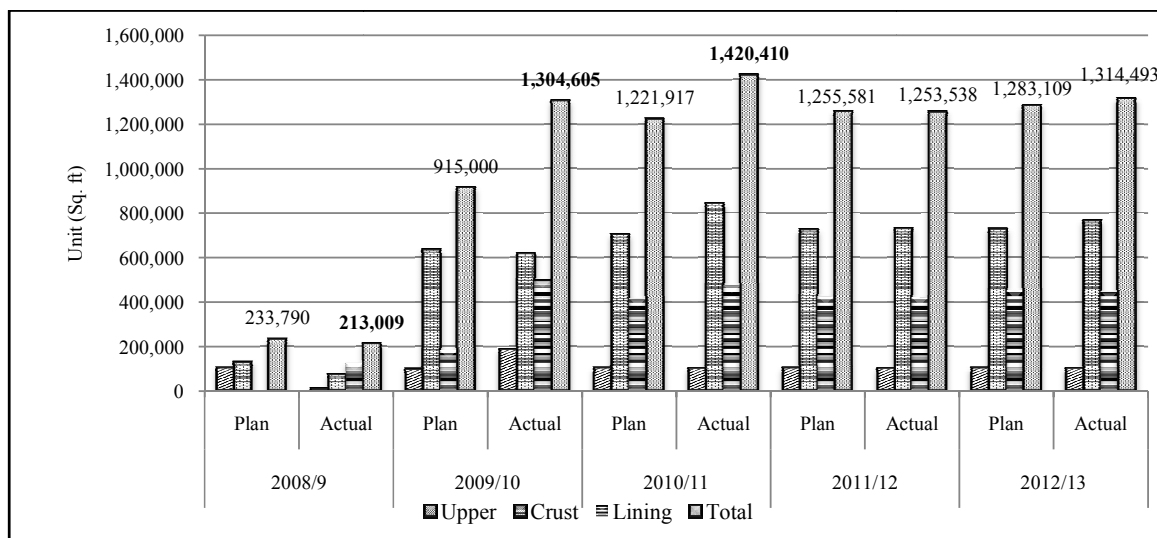


Fig. 2 Five years performance of KTSC

B. Quantitative Data Analysis

In order to understand the factors contributing to inefficient PPC system and hampering the company from achieving the full potential of PPC, a survey instrument in the form of questionnaire (in English and Amharic) was designed based on the findings from qualitative data. Out of 65 workers of KTSC, 41 respondents (63%) were purposively selected because of their involvement in the production process, PPC function and their influence on the productivity of the company. Table II shows the profile of respondents.

TABLE II
RESPONDENTS' PROFILE (n=41)

Business function	Respondents	No. of responses	%
Production Dept.	30	28	80
Personnel	4	3	0.086
Finance	4	2	0.057
Purchasing	3	2	0.057
Total	41	35	100

Accordingly, 35 questionnaires were returned among 41 distributed, with all valid responses implying an overall response rate of 85.37% which is satisfactory indicating validity of the results [6]. The other 6 were not returned.

Nine major factors were identified from the survey data which contributed to inefficient PPC system and tabulated in Table III.

TABLE III
MAJOR FACTORS CONTRIBUTING TO INEFFICIENT PPC SYSTEM (n=35)

Factors	No. of Responses	%
Employees' low motivation	28	80
Unsatisfactory payment	20	57
Management problems	13	35
High machine downtime	30	85.7
Poor quality/shortage of materials	25	69.6
Inconvenient production system	10	26
Low involvement in PPC activity	15	42.9
Poor /one way communication	24	68.6
Skill and expertise gap on PPC	17	50

Root causes that are the basic reasons behind the PPC problems the company is facing are summarized in five headings i.e., Human, Method, Management, Materials, and

Machines. These are presented in the Cause and Effect diagram shown in Fig. 3.

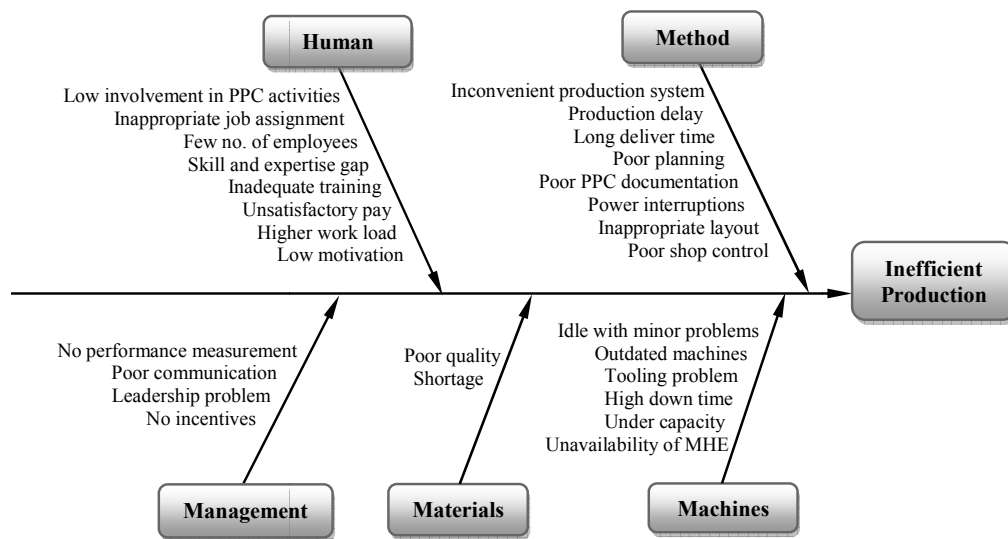


Fig. 3 Root causes for inefficient PPC system at KTSC

A rank order of the major factors affecting production capacity is shown in Fig. 4. As it is evident from Fig. 4 and the root causes given in Fig. 3, about 86% of the respondents viewed “High machine downtime” as a major cause of inefficient PPC system followed by “Employee’s low motivation” (80%).

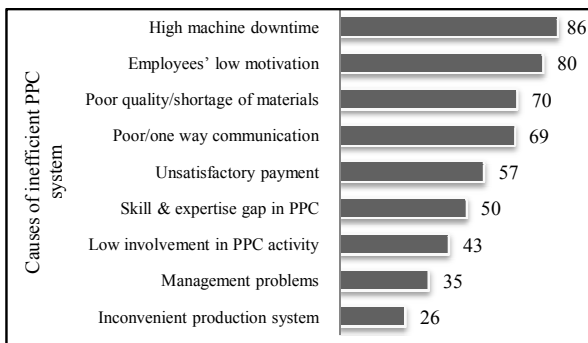


Fig. 4 A rank order for causes of inefficient PPC system (%)

The reasons mentioned by respondents for high machine downtime are unavailability of raw materials (86%) and stock out due to improper planning, in turn caused under capacity in machine utilization as well as longer product deliver time. 57% of respondents also have expressed that unsatisfactory payment compared to other similar companies in the country and as per other 35% of the respondents management problems are the causes for employees' low motivation. They also believe that these problems are revealed by absenteeism, longer break during shift change and lunch time, making machines idle with minor problem, etc.

Furthermore, majority of respondents (70%) viewed “Poor quality/shortage of materials” and “Poor/one way communication” among the major causes. 68.6% of the respondents viewed information sharing in the company as one directional i.e., top to bottom type as management sends order without discussion and getting feedback or information from the employees (bottom to up). As a result, employees feel that they are alienated in planning production and in the overall activities of the company.

The study findings indicated that there are many challenges in the PPC system of KTSC which need to be addressed. The company has to ensure that it does production activities better than competitors. This can be ensured by practicing PPC activities such as demand forecasting, materials planning, purchasing, inventory control, capacity planning, scheduling of machine and people, coordinate customer orders efficiently in order to accomplish the production goal.

V. A FRAMEWORK FOR PPC IMPROVEMENT

In order to overcome the challenges contributed to inefficient PPC system, the company needs to identify the approach to employ PPC strategies efficiently. Hence, it is critical to initiate programs with a holistic approach to achieve production excellence and enable continuous improvements. Accordingly, a PPC system improvement framework consisting of three core pillars is conceptualized for KTSC with key considerations and illustrated in Fig. 5.

A. Description of the Framework

The first pillar is KTSC's working culture, how management perceives PPC system in its day to day operation, where it serves as a basic condition for the improvement

initiatives to be carried out. The second dimension is the capability of individuals in PPC and processes, and their leverage to enable the company achieves the planned production capacity targets. The third dimension is measuring

performance to understand how the company does relative to plans and the past as well as relative to other competitors, or both [7].

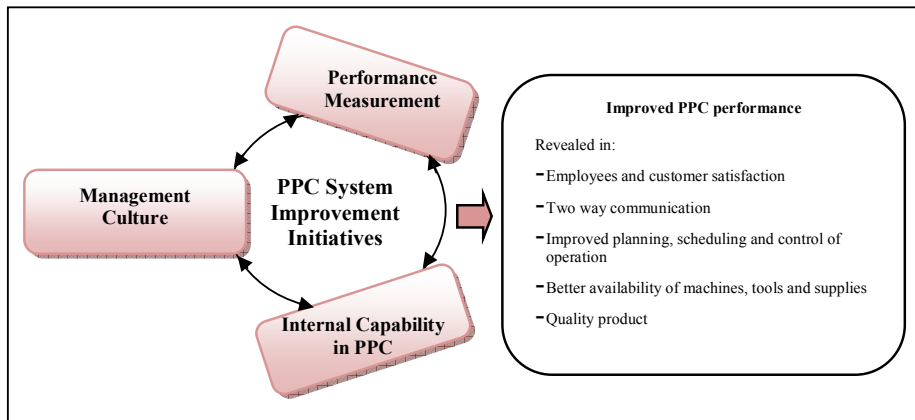


Fig. 5 Proposed PPC system improvement framework

Table IV summarizes improvement dimensions for the three pillars along with illustrative elements for considerations and their descriptions. According to the study findings, the three

core pillars together and key considerations would have a crucial role to play in the improvement initiatives of the company's production performance.

TABLE IV
IMPROVEMENT PILLARS AND CONSIDERATIONS

Core Pillars	Considerations	Description	Source
Management culture	Leadership development	- Top management commitment to initiate key changes in processes and/or products. - Forward looking and participative management in planning processes and products.	[8]-[10], [12]
	Employee empowerment	- Employee involvement and autonomy in decision making. - Staff association and staff suggestion schemes.	
	Team building and coordination	- Supporting multiple levels of decision making and giving a clear view of the flow of products, services and information.	
	Communication	- Developing long-term relationships with supplier and customer (internal and external).	
	Resource availability	- Information sharing (timely and accurate) on the business plan, performance targets and strategy of information.	
	Flexibility and creativity	- Improve scheduling/ planning system by increasing equipment/system availability and provide the necessary resources.	
		- Lean manufacturing, quality circles/TQM and Kaizen approaches.	
Internal capability	HR management practices	- Ensure workers possess required level of skill and knowledge, thus it plays vital role in performing jobs at high performance, achieving stable operation, committing low mistakes, and up-keeping process system.	[8], [10], [11]
	Multi-skilled flexible workers	- Develop capability of employees by involving them in problem solving and decision making.	
		- Develop skill in PPC activities such as demand forecasting, materials planning, scheduling, etc. - Sharing of knowledge, engagement and commitment.	
Performance measurement	Metrics, targets, monitoring and reward	- Develop agreed up on, effective and achievable work plans and schedules. - Place targeted level (only achievable or optimum level) of process, efficiency, performances of equipment, employee and production, measure and how tasks are being performed. - Develop appropriate metrics. - Measure performance of processes and individual employee and address improvement ways in the PPC activities. - Rewards and recognition for better performance.	[10]

VI. CONCLUSION

Due to the dynamic competition inherent in local and global lather products' markets, lather industries need to continually strive to achieve production excellence by building PPC system capability. In this study, the PPC system of KTSC has been studied. A PPC system capability was conceptualized as a strategy the company might leverage to perform better than its local and foreign competitors. Nine PPC related issues are

identified impacting production capacity of the company along with their respective root causes. By identifying problem areas, the study helps significantly to the PPC system improvement prospect for the case company and other similar industries.

The findings of the study permit the company to recognize the importance of efficient PPC system as a source of competitive advantage to enhance its production capacity.

Based on findings, the paper has conceptualized a PPC system improvement framework having three core pillars KTSC and other manufacturers can take to address PPC system issues in leather manufacturing and achieve success in their production. The framework can be integrated with KTSC's existing operational model. These measures, if put into action, possibly can lead to tangible outcomes such as an improved resource utilization, smooth flow of material and information by avoiding bottlenecks in the production and minimizes employees' dissatisfaction thereby increased production capacity.

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