An Approach to Improve Productivity and Flexibility of Rice Mills in Kerala

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Abstract - *Rice is the staple food of the Kerala. The demand for the rice is never ending. The present rice requirement of entire Kerala is being fulfilled both by in house production, subcontracting and outsourcing. The percentage of outsourcing is higher than in house production .The production mills in Kerala have the capability to produce the demand, but the due to improper implementation and usage of machines and resources major share is outsourced. This study aimed to improve the productivity of rice mills in Kerala. A study was conducted to understand the market condition and processes involved in the rice production. Problems in the rice mills were identified. As a solution flexible manufacturing method is suggested. Simulation conducted on Arena v.14.70 software compared the performance of the company before and after implementation of flexible manufacturing system.*

Key Words: Productivity, Flexible manufacturing system (FMS), scheduling, simulation

1. INTRODUCTION

Rice is a vital food material for more than half of the world's population, the importance of which as a food crop has been increasing with increase in population. It is estimated that the rice requirement for Kerala is about 7500 tons per day whereas the production within the state at the current level is sub optimal, meeting only 15% of the requirement, and the remaining 85% requirement is met from neighbouring states of Tamil Nadu, Andhra Pradesh and Karnataka. Modern rice mills are scientifically up-to-date units, with most modern plant and machinery

Rice produced in a modern mill would be superior quality and thereby finding greater customer acceptance. Further, the bye-product of such mills, rice bran, could find great demand as raw material among solvent extraction plants. Paddy cultivation was part of proud culture of Kerala state. Rice is the most important cereal and staple food produced and consumed in Kerala. In Kerala you can see vast green paddy fields. Kuttanadu is called as rice bowl of Kerala because of rice cultivation. According to the state planning board, Kerala lost over 500000 hectares of paddy fields between 1980 and 2007. But due to serious intervention of Kerala government in the year 2010, 15000 hectors of land kept fallow for 2-5 decades brought under cultivation, paddy production increased by 1.25 lakhs tons, upland paddy cultivation started in another 1000 hectors. Kerala government has implemented noel schemes under food security programmers for special rice production areas like Kole, Pokkali, Kuttanadu, Onattukara, Purakkad, Kari, kattampalli, Palakkad etc. In the earlier days rice used to cultivated almost in all parts of Kerala in three seasons. They are Mundakan viruppu, and Puncha. In the present scenario it is difficult to do rice cultivation in the state due to high labour cost and shortage of labour mechanized transplanting is attracting more and more paddy farmers in Kerala. By adopting good quality seedlings ,adequate use of organic manure, integrated water and pest management Kerala farmers can increase rice yield and there by profit from it. Also paddy fields are slowly diminishing from Kerala, creating threat to food security of the state. At present, the paddy milling capacity available in the state is about 3000-3500 tons per day giving an output of only about 2000 tons of rice per day , leaving a huge gap which is being met by public distribution system PDS and by import of paddy /rice from other states. As per figures from rice mills owners association, there are about 125 rice mills operating in the state, out of which about 50% are modern sophisticated units with whitener and colour sorter machinery and others are partially modernized or upgraded from the traditional rice mills. The remaining units, having a capacity to process only about 10 tons of paddies, are met by PDS and from other states.

The major problems faced by the industry are heterogeneity in the composition of rice milling industry. Large variations are found in type, capacity, location, services rendered as well as in ownership of different processing units. Consequently investment requirement, cost and return also vary over a wide range. Heterogeneity in rice milling industry arise mainly from the widely varying economic activities made available to private rice millers in different areas and sectors of the country. Another common feature of rice milling industry is considered that its technical potential capacity is not fully utilized and this is because of the seasonal concentration and spatial spread of paddy production coupled with the existence of a number of diverse processing units competing with one another in supplying facilities. As these small mills generally do not purchase and store paddy on their own, their operations tend to be restricted to the paddy marketing season, and their installed capacity remained unutilized/underutilized during the rest of the period of the year.

2. METHODOLOGY

The methodology followed in the paper is stated below. Initially a market survey was conducted to identify the demand. The process for rice manufacturing was studied. A visit was conducted among the rice mills in Kerala to study the production. Among the visited one company is chosen for case study. From the literature review, flexible manufacturing system was chosen as a method to improve productivity. Also proposed changes needed for the existing production in the company. LINGO software was adopted for scheduling FMS and Arena simulation was done to compare the results.

2.1 Market survey

Market survey revise that the 15 type of rice verities available in Kerala. Among which 5 type rice are cultivated with in Kerala. All other verities are imported from other state. The state consumes 38-40 lakh tone per year. Jaya and Surekha (imported from Andrapradesh) account for at least 22 lakh tone of total consumption. Single mate, Ponni, Jaya, Jyothi, Surekha, Cherumani, Vadi, Unda, are the commonly available verity of rice and Unda, Vadi, Cherumany, Jaya, Ponni, are commonly used. More than 30 company products in market. Periyar, Nirapara, Pavizam, Nilavilak, Ponari are hold major market share in Kerala. Best usable period for processed rice has been 4 moths from the day of processing but in actual scenario 50% processed rice available in this quality range this shows the flow flexibility of rice mills to cope with changing demand for rice verities. Changing demand is related with multiple factors like government policies, festivals, regional factors, climate change etc. The important trend noticed during the survey is that the tendency to add preservatives and protection coting in processed grain is increasing drastically. Also the price of processed rice goes on increasing for the past two years in Kerala.

2.2 Company Study

In order to understand the production processes carried out in Kerala and also to study the process for rice production a company survey was conducted. The production process carried out in Kerala is almost like in a mass production system. Because of this the product gets accumulated more than the requirement. Currently only 4 - 5 varieties are produced in the company, even though there is a demand of about more than 10 varieties. Demands for the remaining types are fulfilled by outsourcing.
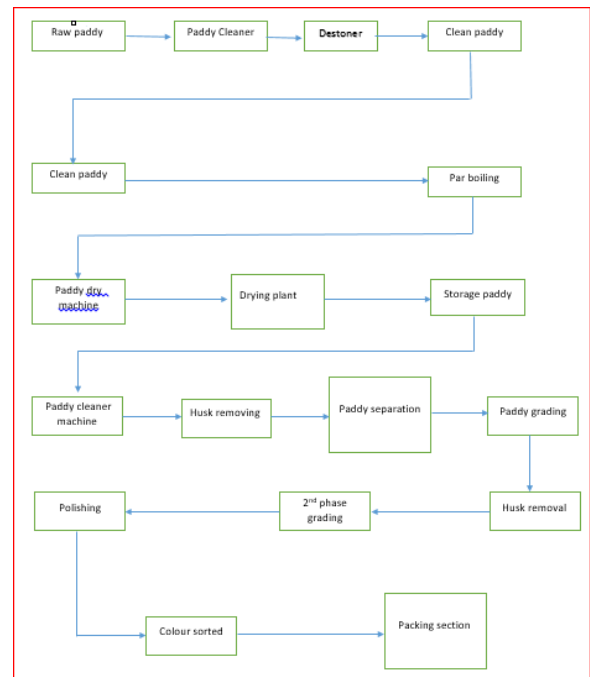

Fig -1: Rice production process

Common steps followed in the rice process are shown in Fig-1. Initially paddy is pre-cleaned. That means effectively separating coarse impurities such as pieces of straw, bag tapes, paper, pieces of wood and leaves, protecting downstream processing. After pre-cleaning paddy moves to de-stoner, stones and other high-density impurities such as metal and glass are removed. Then par boiling is done in which paddy is partially boiled. The three basic steps of parboiling are soaking, steaming and drying. These steps make paddy easier to process. Par boiled paddy is then stored and will be moved to milling station as per the requirement. Milling process involves various steps which include second phase de-stoning. After that paddy goes to Huller, the husk is separated from cleaned paddy. When husk is removed, the product is called brown rice. Then it moves to paddy separation which separate unhulled paddy from brown rice. Unhulled paddy moves for rework and brown rice goes to thickness grader. It's a grading technic to sort brown rice based on its thickness. Immature grain is removed from the process and set aside. Matured grain goes to whitening process .This stage removes the bran layer of rice, either removing completely or a part of the bran layer and germ from the brown rice. After completing this process second phase grading is carried out in which nicely broken rice and broken rice are removed using nice broken grader and drum grader respectively.. Then rice will move to polishing process. This stage the surface of rice is smoothened and it is given a shine by passing it through a series of rollers .After completing polishing process sorting is done where the rice is sorted. At last the sortex rice will move to final stage of Weighing and bagging.

Problems identified in the production system are:

- Products are produced bulky irrespective of demand which effects quality.
- Increase of unnecessary inventory.
- In companies 2-3 varieties are produced having almost similar process and use of machines, which decreases product varieties.
- In market there is a demand of more than 10 varieties, but in only 4-5 products are only produced in house.
- Increasing rate of outsourcing rate.

3. CASE STUDY

For studying deeply a company in Kerala is selected. In order to conceal the identity hereby it is referred as XYZ Company. XYZ Company is one of the leading rice production companies in Kerala. This venture started out with traditional methods of boiling sun drying and milling grew into one of the most modern rice processing house in India with the world class technology today. The facility is equipped with the latest technology world for processing of paddy right from cleaning, drying, diffusion bran removal polishing and finally sorting. The infrastructure worth around 25 crore of rupees is one of the largest in India. The company stands second in the market of rice in Kerala.

3.1 Production system

Section under study for the paper is the milling section of the company. Company have a product layout system .Production in company almost follows mass production mass production. Some products are also outsourced. The company has latest technologies also. Production layout of milling section of the company is given below:
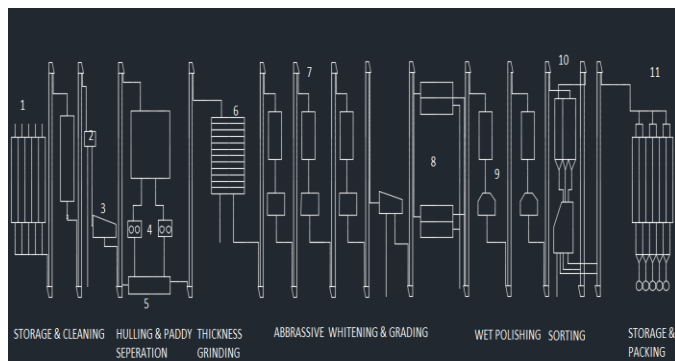

Fig-2: Current layout

In the layout, changes in the process for each variety can see only after parboiling. Present layout is designed for products of mainly three variety (Brown) having similar process with small setup changes. Here after parboiling paddy moves to destoner then to huller. After hulling, it goes to paddy separator. Until this process setup is same for all the three verity. After it goes to thickens grader where thickness are made accordingly needed for the variety. After thickens grading. whitening process is done using bran remover.

Then it moves to drum grader. In the next process, polishing is done using silky machine, in which processing time needed to change for different verity. Finally sortex machine will sort brown rice only.

From the study we can find that company has capability to produce more varieties than it is producing. But the company also has the problems that stated above. From the previous studies it is found that the company has capability to change into flexible manufacturing system. Flexibility can be made easily by introducing one or two new machines and making small changes in the machine. For making flexible system changes needed to bring in the current lay out are shown below.
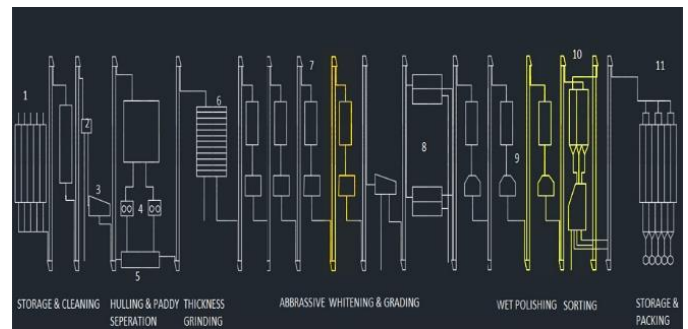

Fig-3: Proposed plant layout

In huller, for processing more varieties than current products a new set up has to be made to adjust blade thickness and processing time according to the nature of the rice. In the present layout three whiteners are arranged in series which only use for brown rice varieties. By installing one more ban remover for white rice more varieties can be produces. In silky machine, a setup is needed to bring for changing processing time or new machine can be installed if there is a problem of capacity, in the current machine there is a problem of capacity. So it is needed to install new machine .Present sortex machine only sort brown rice. By introducing programmable color sortex machine different varieties can be produced with less time. Changes in the layout are highlighted in yellow colour in Fig-3

3.2 Scheduling

In order to increase productivity with minimum make span scheduling has to be done on a flexible plant layout. There is always demand for all products at every time, so scheduling is need. Scheduling can be done using different soft wares. For an example LINGO SOFTWARE can be used. One of LINGO's most powerful features is its mathematical modeling language. LINGO's modeling language lets you express your problems in a natural manner very similar to standard mathematical notation. LINGO allows you to do things such as quickly express a series of similar constraints in a single compact statement. Your models are compact and easy to read. LINGO software can be used for sequencing products. Sequencing is done based on Johnson's algorithm. By imputing process time and setup time we get a sequence near to optimum.
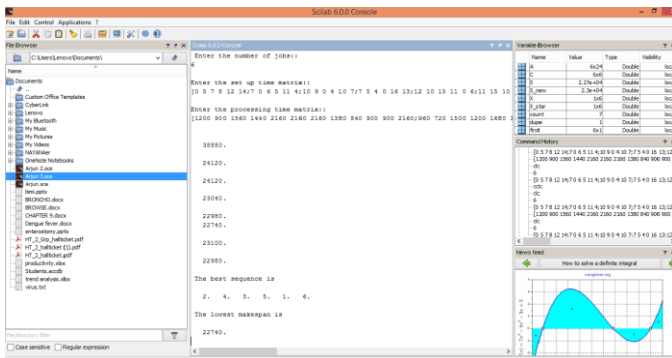
Fig -4: Scheduling using LINGO Software

4. CONCLUSIONS

After implementing the suggestions it is found that the problems listed above are solved and productivity is increased. By the improvements suggested products can be produced according to the demand. Inventory of produced products can get reduced even though the mill began to produce more varieties. Outsourcing also can be reduced significantly.

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