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Enterprise resource planning (ERP) in improving operational efficiency: Case study

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Abstract

The research is an investigation into prospects of improving operational efficiency in a manufacturing system through enterprise resource planning (ERP). This was done on a South African company which is into linen manufacturing and making uniforms for the hospitality industry. This was achieved by improving effective communication among departments to meet delivery dates. ERP framework was designed to reduce work in progress on the shop floor and inventory. Integration of firm's activities, intra organizational communication and wider collaboration were some of the pillar considered in the process to achieve a reduction in working capital. Wastage in the form of material or energy, inventory, defects or wasted capacity, was eliminated for effectiveness. Reduction of product cycle times was done through minimizing set-up and delays, coordinating machine maintenance with production operations and optimizing space in order to better utilize workers, equipment and workstations.

Keywords: ERP; operational efficiency; wastage reduction; resource effectiveness

1. Introduction

Today's dynamic business is becoming increasingly complex with functional units requiring more and more inter departmental data flow for decision making, timely and efficient procurement of parts, management of inventory, accounting, human resources and distribution of goods. In this regard, efficient information systems would improve competitiveness through cost reduction and better logistics [1]. There has been also been emphasis of a greater interaction between the customers and suppliers, in order to achieve production of goods and services that conform to customer specifications [2,3]. Enterprise Resource Planning (ERP) is the strategic tool which synchronizes, integrates, and streamlines data and processes of the organization into one single system to gain a competitive edge in the uncertain business environment.

In developing countries, there is tendency for departments to work independently resulting in various sections competing rather than working together. This has compromised the operational efficiency of a greater number of manufacturing entities. Thus products produced cannot be competitive both within and beyond the borders of countries of origin in terms of cost, quality and delivery timeliness. A number of South African entities face this dilemma, including the case study company considered in this research work. The focus is more on monetary value of products to be manufactured neglecting the capacity that can be reached using the available resources and facilities.

2. ERP overview

2.1 ERP scope

According to the American Production and Inventory Control Society (2001), ERP is defined as a method for the

effective planning and controlling of all resources needed to take, make, ship and account for customer orders in a manufacturing, distribution or service organization [4]. Such an integration of functions, can be achieved through a software package solution offered by vendors to support the seamless integration of all information flowing through the company, such as financial, accounting, human resources, supply chain as well as customer information [5].

Traditionally, manufacturing entities treat each transaction separately, as they are built around strong boundaries of specific functions that a specific application is meant to cater for. ERP stops treating transactions as stand-alone activities and consider them as part of the interlinked processes that make up the business. It is premised on the principle that the whole is greater than the sum of its parts [5].

2.2 Basic ERP modules

The advancement in information technology (IT) infrastructure is the backbone of ERP system implementation in any manufacturing business operation. It is assumed the companies implementing ERP solutions may have multiple locations of operation and control. Hence on line data transfer is done across locations where enabling technologies are used such as Workgroup, Workflow, Groupware, Electronic Data Interchange (EDI), Internet, Intranet and Data warehousing, to facilitate transactions. This is to underline that ERP software is made up of many software modules selected based on both economical and technical feasibility for given manufacturing units. The basic modules normally incorporated are [7]:

ERP production planning module –this seeks to optimize the utilization of manufacturing capacity, parts, components and material resources using historical production data and sales forecasting.

ERP purchasing module – it streamlines procurement of required raw materials, as it automates the process of identifying potential suppliers, negotiating prices, placing orders to suppliers, and related billing processes.

ERP inventory control module – facilitates the process of maintaining appropriate level of stock in the warehouse through identifying inventory requirements, setting targets, providing replenishment techniques and options, monitoring item usage, reconciling inventory balances and reporting inventory status.

ERP sales module – its key functions are order placement, order scheduling, shipping and invoicing. This is key as revenues from sales are the live blood of the organizations.

ERP marketing module – it supports lead generations, direct mailing campaign and trends in customer tastes.

ERP financial module – this the core module of ERP software systems, as it gathers financial data from various departments and generate reports such as balance sheet, general ledger, trial balance as well as quarterly financial statements.

ERP human resources (HR) module – it routinely maintains a complete a complete employee data base to include contact information, salary details, attendance, performance evaluation and promotion of all employees. It is key in optimizing the utilization of the expertise of all employees.

Thus ERP software system is all encompassing as it affords one to manage all departments from production to distribution and accounting in one integrated system. In this regard, the process results in reducing operating costs, facilitating easy day to day management and enabling overall strategic planning of operations. With adequate training of employees on correct ERP, it will in turn promote proper operation of business processes and increase profits [6, 8].

It has to be noted that modules are integrated and provide seamless data flow among the modules, increasing operational transparency through standard interfaces. As the project is an opportunity to reengineer processes in line with the ERP adopted model, it is also the moment to rejuvenate the whole business for competitiveness.

2.3 ERP and business process reengineering (BPR)

BPR is reconsideration and radical redesign of organizational processes in order to achieve drastic improvement of current performance in cost, service and speed [9]. Now the organization should adopt the benefits of ERP solutions right through the BPR exercise. Re-engineering through ERP, has led to more drastic change for users as it comes with several tried and tested best practices. A BPR exercise has to precede ERP implementation, as ERP is there to consolidate the process adjustment and rejuvenation with a software package. Fig. 1 gives the ERP flow chart for various top down levels involved which are: top management, operations management, basic computer data and execution of plans.
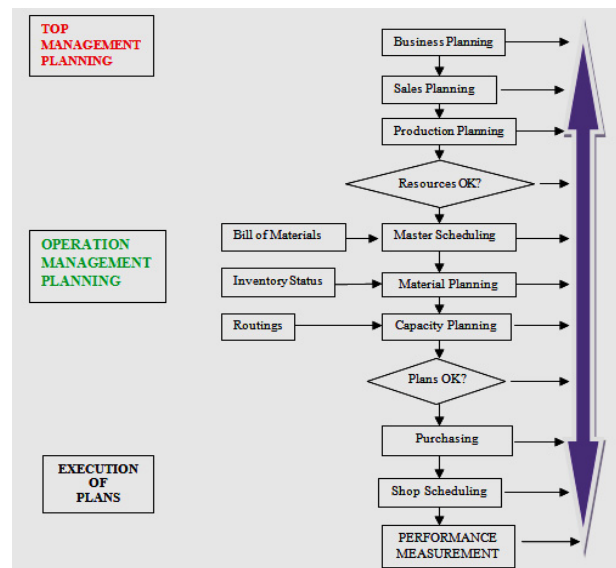

Fig. 1 Standard ERP flow chart

Business Planning comes up with objectives, followed by Sales Planning which gives the demand and product lines to be pursued. Production planning will ensure the availability of resources to meet the sales forecasts.

Master Scheduling will ensure the sequence of products on the production line. While Material Planning gives measures or specifics of materials into each of the product lines set to be produced. Capacity planning looks at both human and plant resources available to meet the set production targets.

Basic Computer Data like bill of materials, item parameters, inventory status and routing are critical for product costing.

Execution of plans are responsible for purchasing of material for implementation of plans, also shop scheduling to have an idea of product cycle time, as well as performance measurement for accountability for any suffering points which need urgent attention to be brought in line with the objectives.

2.4 ERP implementation

Implementing an ERP system will require significant changes on staff and work practices [4, 10]. Hence for cost effectiveness, it is recommended to use an external consultant with specific training in ERP implementation. The consultants are responsible for the initial stages, training of employees, workflow study, customized interfaces, trouble shooting and assistance with ERP issues. As so many changes take place that affect almost everyone in the organization, it is important to involve them in the project to make and use the ERP system as a success.

Measures to be closely monitored are capacity, utilization, efficiency and load percentage [10]. The best operating level is the percent of capacity utilization that minimizes average unit cost.

Capacity = (No. of machines / workers) x (No. of shifts) x (Utilization) x (Efficiency)

Where utilization is the percentage available time spent working.

$$Utilization = \frac{Actual\ hours\ charge}{Scheduled\ available\ hours}$$

And efficiency giving an indication of how well a machine or worker performs compared to standard output level

$$Efficiency = \frac{Standard\ hours\ earned}{Actual\ hours\ charged}$$

3. Methodology

A steering committee was of senior managers was formed including the General manager, Production manager, Information System (IT) manager and the Purchasing manager to formulate the project, integrate project resources and select suitable ERP system. Experience representatives of different user departments with expertise in particular fields were also chosen to participate in the project and as resource person. The grant objective was to improve operations quality and efficiency, to standardize and simplify operations flow and

reduce lead times. The work was based on existing information and direct observation in the work study. The productivity over a number of months was recorded for analysis. The clustered data was collected from archived records from January 2012 to June 2014 to develop an observed trend, the actual records were taken for November 2013 to April 2014.

4. Case study operations

The case study was done at a company manufacturing linen and uniform for hospitality industry based in Cape Town, South Africa. The major departments in the organization were: Design section, Pattern making section, Cutting section, production, and Technical Services section as given in Fig 2. The organization was facing challenges of meeting the delivery times, and traditional methods have been tried to solve these operational challenges with particular focus on the Manufacturing Department. ERP system was recommended to address this persistent problem at the organization.
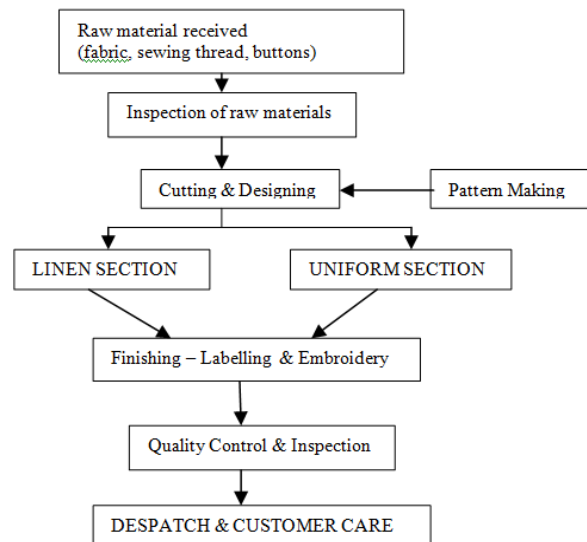

Fig. 2 Manufacturing process

5. Results and Discussion

The factory had two main product lines which were linen and uniform section both for the hospitality industry as given in the Table 1 below.

Table 1. Main product lines

LINEN	UNIFORMS
Table cloths & napkins	Chef jackets
Curtains	Chef pants
Cushions	Chef caps

Kitchen cleaning clothes	Aprons

The organization was using the conservative capacity lag strategy for its capacity requirements planning (CRP). This led to loss of customers due to failure to meet demand, as the capacity was only increased after demand had increased. This was causing delays during manufacturing process especially in the uniform section.

As the operations are not fully automated, when demand increased, new contract workers were hired. This meant training had to be done every time putting a strain on the production output as the just engaged casuals would not be familiar with product requirements.

Although the computer machines were all connected to the local network server, they were very few and a lot of paperwork would move among the departments taking a lot of time to take action. Quality control section which was under the Production Department had no computer, and all their operations were done manually.

The Linen section had the bulk of the full time workforce numbering 25 working one shift of 8.5 hours per day. Records showed that this section was constantly failing to deliver products in line with deadlines given on the Master Production Schedule due to human resources related challenges.

Table 2. Linen section production times

	Nov'13	Dec'13	Jan'14	Feb'14	Mar'14	Apr'14
Scheduled available hours	4 462.5	5 355	5 355	6 247.5	6 287.5	6 300.5
Scheduled hours earned	3 037.5	4 725	4 725	5 512.5	5 512.5	5 565.5
Actual hours earned	4 412.5	5 310.5	5 226.3	6 225.2	6 238.3	6 268.5
Load	4 455.8	5 340.7	5 330.7	6 240.5	6 240.5	6 285.7

Table 3. Linen section capacity data

	Nov'13	Dec'13	Jan'14	Feb'14	Mar'14	Apr'14
Efficiency	89.2	89.0	90.4	88.6	88.4	88.8
Utilization	98.9	99.2	97.6	99.6	99.2	99.5
Capacity	3 936.8	4 727.8	4 724.7	5 513.1	5 513.7	5 516.7
Load %	113.2	113.0	112.8	113.2	113.2	114.0

Table 4. Linen section: Quantity and duration data

Product Type	Product Qty	Duration per product hours
Table cloth	3	461
Napkin	1	495

Cushion	3	470

The efficiency and utilization were estimated to be 89.1% and 99% respectively on overage over a period of six months from November 2013 to April 2014 period. Table 2 shows the data obtained from time sheets and weekly individual reports for the Uniform Section. Table 3 gives load percentages above 100%, which means that the load schedules were beyond the capacity of labor resources in this section. Thus delivery delays would result for bulk of the orders, and unnecessary costs were incurred in overtime or hiring excess contract workers due to panic. This was caused by continuous scheduling beyond the existing capacity of the plant.

The uniform section had a staff complement of 9 full time workers who worked 8.5 hour per day, and were not adequate to meet deadlines as well.

Table 5. Uniform section production times

	Nov'13	Dec'13	Jan'14	Feb'14	Mar'14	Apr'14
Scheduled available hours	1 963.5	2 363.5	2 258.5	2 306.5	2 606.5	2 606.5
Scheduled hours earned	1 400	1 658	1 569.2	1 696.8	1 696.8	1 950.5
Actual hours earned	1 564.5	2 009.5	2 065.5	2 098.2	2 264.5	2 363.5
Load	1 645.5	2 020	2 005	2 039.2	2 071.8	2 185.2

Table 6 Uniform section capacity data

	Nov'13	Dec'13	Jan'14	Feb'14	Mar'14	Apr'1
Efficiency	89.5	82.5	76.0	80.9	74.9	82.5
Utilization	79.7	85.0	91.5	91.0	86.9	90.7
Capacity	1 400.6	1 657.4	1 570.6	1698.0	1 696.5	1 950.4
Load %	117.5	121.9	127.7	120.1	122.1	112.0

Table 7. Uniform section: Quantity and duration data

Product Type	Product Qty	Duration per product hours
Chef jacket	3	45.8
Chef pant	4	15
Chef cap	10	88.5
Apron	2	30

The efficiency and utilization is estimated to be 81.1% and 87.5% respectively considering the averages for the six months in Table 6.Table 5 shows the data obtained from time sheets and weekly individual reports for the Uniform Section. The load percentages in Table 6 are above 100%, this revealed that the resources could not handle the load assigned to it in the Master Production Schedule (MPS). Again there is need to hire more workforce for to build on the capacity.

The Uniform section had low values of efficiency and utilization compared to the same in the Linen section, this was attributed to internal inherent poor activity coordination resulting in delayed deliveries of uniforms.

6. Recommendations

In order to use ERP software, the computer hardware structure had to be upgraded to Pentium 4 (P4s) with large capacities, which were compatible with ERP software. Also the number had to be increased to appreciably reduce paper work, and improve faster flow of information and quick decision making processes. At the time of the study competitive software could be sourced from Oracle, who had to initiate expert training for the shop floor staff and supervisors.

 Load percentages have shown that the work schedule was beyond capacity of the Linen section, therefore capacity has to be adjusted upwards. Thus a number of workers to be added have to be calculated in order for the section to be sufficiently capacitated for the existing load. A permanent solution would be to hire 4 more permanent workers.

To address the problem at Uniform Section, capacity had also to be adjusted by hiring 1 more casual worker to work for 6 days a month to match the load.

Other areas that ERP could improve is the elimination of all resource wastages in form of material, energy, inventory, defects or wasted capacity, through labor control and work in progress control. The reducing of product cycle time could be achieved through minimization of waiting and processing time.

Waiting time could be reduced by better coordinating the flow of material(for example, intermediate products and finished products) in the Uniform Section, while processing time reduction is enabled by carefully optimizing the balance between changeover times and inventory costs.

Reducing cycle times is important when implementing ERP system. It is achieved by reducing setting up times and delays, coordinating maintenance by Technical Services, with production operation schedules, as well as optimizing space in order to better utilize workers, equipment and workstations.

7. Conclusion

The project has come up with the implementation framework for ERP, and it was shown how the implementation was going to improve the operational efficiency of the manufacturing system at this linen making company. The ERP system improved the employee efficiency as data and information could now be captured and updated at one point with no duplication of effort which could waste resources. Operational efficiency resulted from greatly improved communication and corporation from all departments. Online updates on inventory levels enabled informed decisions to meet the products' delivery dates. ERP requires consensus from the entire enterprise to re-engineer core business processes by taking advantage of software to automate information update and incorporate best practices to facilitate rapid decision-making, cost-reduction, and greater managerial control for improved organizational competitiveness.

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