

A Study of operations issues in a manufacturing firm using SAP-LAP analysis

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Abstract

To study the various operations factors in manufacturing of a product vertical in a Machinery Division using SAP-LAP framework. It identifies the key operations drivers in manufacturing of a product vertical so as to enhance the operational effectiveness.

Keywords: Operations, Manufacturing, SAP LAP

INTRODUCTION

The organization considered in this study is known as 'ABC (name disguised for technical reason)' which is one of the premium group companies in India with a leading business in steel, power, infrastructure and mining areas. In different locations of India, the firm has excellent manufacturing capabilities. The Anandgaon plant of ABC produces steel up to a capacity of 3.5 Million tonnes per Annum (MTPA). In another main vertical of ABC firm i.e. power generation, it contributes to the nation through generation of about 3405 MW power. ABC has been expanding its operations in Rajgaon to produce steel of 12.51 MTPA and generate power of 2600 MW in stages.

ABC - equipment plant

ABC firm has established a 'Equipment Plant' known as ABC - Equipment Plant' hereafter referred as ABC-EP in the vicinity of Tampur, India. ABC-EP manufactures products and equipment for engineering plants such as a) Steel Ladles to Cooling Bed Transfer Drive Assembly for steel & Power Plant Equipment b) Design, manufacture, erection and commissioning of cranes suitable for medium, heavy industrial lifting requirements across

various manufacturing process firms. c) Bulk material handling equipments like stacker reclaimers and conveyor structures. d) Pressure vessels and e) Ferrous Castings.

In various manufacturing companies, overhead travelling crane powered by electricity also known as Electric Overhead Crane (EOT) which hereafter referred as EOT or industrial crane is used for the movement of the bulk items of heavy gross weight in multi directions to support manufacturing, assembly, storage, warehousing and loading /unloading activities inside or outside the manufacturing facility. Some of the different types of cranes are EOT Single and Double Girder Crane, Single Girder Crane, Double Girder crane, Gantry Crane, Jib Crane, Box type Girder crane and Truss type Girder crane. The capacity of cranes manufactured at ABC-EP with respect to its load carrying capacity varies from 5 million tonne to 450 million tons.

ETO process attracts a high level of uncertainty with respect to various aspects such as product features, order receiving delivery lead times etc. Adrodegari et al. (2014) specified that for a better supplier and customer relationship, coordination and synchronization of Internal and external processes with vertical integration is quite essential. In the same lines, Haartman (2012) concluded that the manufacturing capabilities of the firm must facilitate efficient product development in collaboration with customers. Boyer et al. (1998) discovers that manufacturing unit must possess capabilities to interact with other elements of supply chain irrespective of the objective to reduce costs, improve quality, delivery/flexibility.

Although the products of high quality products cannot be manufactured at low cost, opportunities for reducing internal cost through factors like direct labor, materials, scrap, and rework need to be explored and the same has been discussed in detail in Hayes and Wheelwright (1984), Colotla et al. (2003), National Research Council (2000) and Hicks et al. (2000).

METHODOLOGY

Primary Data from the concerned authorities of the organization was collected through a semi structured interaction. The ABC-EP firm's EOT crane customer orders of last FY 14-15 were taken into consideration to identify the factors influencing the Internal and External supply chain in ABC-EP, and then SAP-LAP framework was used for the analysis (Sushil, 1997; Sushil, 2000; Sushil, 2001; Charan, 2012; Charan et al., 2013).

OPERATIONS ISSUES AT ABC-EP – SAP-LAP ANALYSIS

Although ABC-EP have different product verticals, this work only focus on the EOT Crane owing to its operational complexity in manufacturing, Uncertainty in customer demand and High order value. The present study hereafter discusses the operations issues at ABC-EP according to each term of SAP_LAP.

Situation

From the customer point of view, a strong belief is offered on the manufacturer without the visibility of actual product and similarly from the other end, the manufacturer is also receiving the customer order with conviction on its resources capabilities. The following six

situations are taken up for the study in this work so as to understand the operations and operational issues in ABC-EP in the manufacturing of EOT crane

Manufacture of EOT crane on Customer Order received

In general the customer not only specifies the product requirements but also defines the cost of the product and also mentions their preferred vendor from whom the raw material and finished bought parts need to be procured.

Uncertainty in the customer demand

The EOT crane customers of ABC-EP can be categorized as Internal and External customers. The internal customers are pertaining to the different plants of ABC-EP group companies while any other customer is considered as External customer to ABC-EP. Currently, ABC-EP has external and internal customers in the order of 37% and 64% respectively for the FY 14-15.

Realization of resources capability

ABC-EP being related to the reputed group and have other product verticals of manufacturing possess adequate machinery and manpower. It was observed that although the resources are utilized with respect to the time but those appeared to be less utilized in terms of producing the products of high order value.

Cost of Production of EOT crane

In ETO manufacturing approach, the cost of production play a significant role as the manufacturer have to produce the product within the limits of pre-defined cost taking all the factors influencing the cost such as increase of raw material and bought out parts, design complexity, wages of human resources etc.

Quality of EOT crane

Since the manufacturing of EOT crane also consist of assembly of bought out parts supplied by different vendors this may influence the quality in the performance of the product as a whole. It was observed that 22% of EOT cranes manufactured in the FY 2014-15 have encountered the quality issues from the customers primarily due to the fabrication and assembly defects.

In-time delivery of EOT Crane

Typically in this ETO approach, the information of production and design changes would be constantly exchanging amongst ETO firm and the customer. It was noted that 23% of EOT cranes have unfulfilled the timely delivery of the EOT crane manufactured in FY 14-15.

Actors

The Actors of ETO approach are the ones who influence the EOT crane business process at ABC-EP. It was found that the customers play an import role followed by the competitors in this business market, the employees, Equipment used to manufacture and raw material, bought out part vendors. In ETO approach, the competitors affect the business of the firms before the start of the production and therefore considered as one of the main actors. As per the published data (Storify, 2015), the Industrial crane market in India is around Rs.1500 crores/annum. In India, the customer demand of about 30% of cranes is from Public Sector Units (PSUs) and remaining 70% from Private sector units. It is expected that this industry grow by 15-20% YoY. Importantly some global majors have started their units in India with some of their Indian partners providing world class products.

The EOT crane assembly consists of many bought out parts and the supply of bought parts at the appropriate time to ABC-EP is highly desirable as these parts go into the assembly in the middle of the production process. And also, the selection of the suitable vendor as many bought out parts directly influence the quality of the EOT crane assembly.

Process

The manufacturing of EOT crane mainly consist of design, fabrication, machining, assembly and testing followed by Shot Blasting & Primer Painting. Unlike in the conventional supply chain, in the ETO supply chain, customer would be at the upstream end of the supply chain providing main input for starting the process. The supplier of materials and other parts connect in the middle of the supply chain and the manufactured products would be directly routed to the same customer at the downstream without any distribution channel consisting of retailers and other.

In ABC-EP firm, the Process flow of ETO manufacturing approach begins by the customer approaching the company with the Technical specifications of the equipment, delivery time, preferred vendor for several critical components and particularly the Cost of Purchase. Based on these inputs the marketing personnel estimate and set the cost of the production as 80 % of order value. ABC-EP will design the equipment in the form of drawings and on customer approval of GA Drawing, Planning department take the decision on the sourcing of products i.e either make or buy and accordingly raises the Purchase Requisition (PR).

Learning

The Learning phase forms the basis to propose suitable Actions to improve the performance of the process/system/organization. The Learning on the various issues taken up for the study is dealt as

Customer Demand

The supply of EOT cranes of ABC-EP is highly constrained to its group companies owing to the establishment and expansion of those plants. It is understood from the available literature that the EOT manufacturers of highest market share have its core competency in manufacturing of EOT cranes and also possess collaborations with world's best players like Hitachi, Mitsubishi, Kawasaki etc. of this business for a superior design and manufacturing capabilities. ABC-EP and its group of companies are highly reputed inside and outside the nation in the domain of steel and power. ABC-EP which manufacture EOT crane are in the EOT market under the brand of ABC which majorly focus on the customers pertaining to manufacturers of steel and power but less in other industry specific with respect to the EOT crane.

Machine Utilization

It is estimated that with the available men and machine resources, ABC-EP can produce a maximum of 12064 tonnes/year of EOT crane in terms of total weight of finished job from the Actual Production Man hours and Machinery available. Currently ABC-EP is producing 4647 tonnes/year of EOT cranes utilizing the available Machine and Man hours which indicate the scope of further realization of available resources to take advantage of the growth of EOT market.

The machining hours of various components of ETO crane was observed to be exceeding the estimated hours and thus influencing the cost of production.

Cost

In ETO approach for the cost of the product defined by the customer, the estimation of the proposed offer of the customer is vital which requires a thorough analysis of the customer requirements by integrating the inputs of departments such as engineering, procurement, manufacturing, planning and HR. In the fabrication phase it was learnt that the contractors of fabrication work follow the manual cutting using conventional tools as against CNC oxyfuel plasma cutting machine due to which the material utilization (Yield) was quite less which is therefore generating more offcuts and scrap of material. Importantly, the vendors specified by the customers of ABC-EP are charging heavily for the supply of bought out parts. This phenomenon is substantially effecting the cost negotiations by ABC-EP in sourcing of the parts and thus increasing the cost of production.

Quality

It was observed that the Poor workmanship by contractor workmen during the fabrication processes such as fitting and welding has resulted in poor quality of EOT crane in terms of misalignment and mismatch of parts during its assembly. Similarly the improper selection of the welding processes and consumables like electrodes was appeared to be a quality impact with forming of less strength joints.

Delivery

It was observed that the delivery of the product was affected due to release of drawings and sourcing of the material in phases. The phase wise sourcing might decrease the inventory carrying cost but affect the on-time availability of the material during production.

Action

It is the important phase of SAP_LAP framework as for the perused learning's, this activity recommends the action points for the betterment of the situations and process which are enumerated as under.

Marketing Perspective

The deep penetration into the market of material handling equipment with a specific brand of ABC-EP is instantly essential to increase the customer orders of EOT crane. And also, Vendor registration of ABC-EP firm for the supply of EOT cranes must be done with PSU's and MNC's in India and abroad so as to generate maximum enquiries.

Design Engineering Perspective

Research & Development should have

- Partnership with internationally reputed firms of EOT cranes in terms of technical collaboration is essential so as to augment the design features of the product
- ABC-EP firm need to equip the advanced Computer Aided Engineering modeling and simulation analysis tools and also an appropriate proficiency in developing the advanced materials with enhanced properties for various elements of EOT crane.

Resource Utilization

In order to enhance the realization of the resources and enhance the utilization of men, machinery, it is essential to identify the similar parts based on the geometry and material across the different customer orders and produce those parts at all times. Further the OEE of any equipment can be improved by

- Ensure the availability of drawing and operation process sheet (OPS) to the operator before the job is loaded on the machine
- Performing the rough machining of child parts in conventional machines
- Forming a Quality Circle team to analyses the losses of all machines and identify the delays through industrial engineering tools like Time study & motion study.

Cost Perspective

For the obligation of achieving pre-defined order value, ABC-EP shall have a Rate contract with identified potential suppliers and customer preferred vendors of the raw material and bought parts so as to have cost benefit and fast delivery of items. The planning and

manufacturing department needs to set the standard procedures and provide necessary training to the operators for the use of consumables like welding electrodes.

Quality Perspective

Predominantly in ABC-EP, the fabrication phase of EOT crane manufacturing need to be improved by providing the necessary training to the contractor's workmen of all levels as per their existing skill gap. Secondly, the training on understanding the assembly and detailed drawings is quite essential to the executives and operators in the production shop so as to avoid the faulty production and mismatch of assembly of parts. The quality of the product can further be improved by accurately sharing the design changes instantly and electronically so as to implement the changes effectively in the production process.

Delivery Perspective

Although ABC-EP use SAP but as the EOT crane follow ETO approach, the applicability of SAP is limited and therefore this work suggest for a SAP based software suitable for ETO approach so as to ensure the delivery of the product at the right time.

In order to fulfill the delivery time line of EOT crane, this work suggests the ABC-EP to design and implement Vendor Management Strategy (VMS) which should ease the process of selecting appropriate supplier. The design of VMS software or system must be based on the following parameters pertaining to the vendor

- Type of Material supply : Core /Auxiliary material/Bought out components
- Geographical Location of supplier
- Logistics Time & Approx. Cost per unit basis to reach ABC-EP firm
- Age of the supplier company
- Market share of the company in last FY
- Will the vendor supply raw material as own or outsource? If not which is outsourcing company
- Prominent Existing Customers of that company
- Cost of Material on unit basis
- Last period when the cost is modified
- R&D and Innovation capability on a scale of 1 to 5 (1 is Low, Five is High)
- Minimum and Maximum supply of material on unit time basis
- Human Resources standard of the company on a scale of 1 to 5 (1 is Low, Five is High)
- Accreditation to Quality Standard
- Any previous complaints due to material defects
- Any previous complaints due to delay in Delivery

ABC-EP through the data bank of VMS system must connect to the vendor's on quarterly basis and a distinct evaluation of vendors on certain key parameters mentioned above is to be made on regular basis.

Performance

This phase of SAP_LAP framework, predicts the outcomes of all the actions based on the learning's for the situations focused for the study. This work envisages the following betterments in the ETO approach of manufacturing EOT crane at ABC-EP.

Manufacturing Perspective

Forming the 'Quality Circle' team to identify the operational problems and nullifying 16 losses of TPM concept will certainly enhance the realization of machinery making OEE nearing to world class OEE. And also, with the availability of understandable operation process sheet (OPS) to the operators, MTTR of various machines will increase.

The supply of consumables to the contactors workmen on the basis of the product features and characteristics of welding as against existing tonnage basis reduces the excess supply of electrodes nearly 14 tons of amount approximately Rs.0.8 crore INR according to the previous year requirement and supply.

In fabrication, use of CNC plasma plate cutting increases the material utilization by approximately 10% and therefore saving of Rs.1.6 crore. This is evaluated based on last year production of EOT crane i.e. 4678 tonnes and considering a material savings of 468 tons.(10%) at a rate of Rs.35,000 per ton.

Managerial Perspective

Through interdisciplinary integration of the various departments of ABC-EP, the cost estimation of the customer order will enhance the setting up of competitive price to the customer thereby increasing the number of orders.

With separate brand image of ABC-EP and technical collaboration with international reputed firms, the existing proportion of external customer orders may increase by 10% to 15% and also increase the design competency of ABC-EP so as to position its EOT product vertical as differentiator in terms of design and on cost.

The VMS system help the ABC-EP to have a detailed classification and have a priority list of vendors which reduces the time to identify the appropriate supplier for bought out parts which further improves the delivery of final product and reduce the cost of production.

The coordination between the internal and external supply chain will enhance and therefore reduce the lead time at different instances of the flow of material and information.

CONCLUSIONS

The study so taken up has drawn the benefits in suggesting appropriate operations and operational strategies to ABC-EP using SAP_LAP perspective. Indeed, the SAP_LAP approach facilitated this work to investigate and understand the ETO approach/process in the manufacturing of ETO crane through its supply chain and operational drivers. In totality, the work herewith summarizes with the following submissions or suggestions to ABC-EP.

- A Distinct identity of ABC-EP as a Heavy Equipment Manufacturing shop will increase the customer demand for EOT cranes.
- Vendor registration of ABC-EP firm for the supply of EOT cranes shall be done with PSU's and MNC's in India and abroad so as to generate maximum enquiries and to make the product to reach the market following push strategy through frequent visits of Business development team to the customer to assess their requirements.
- Position the EOT cranes of ABC firm in the market as Differentiating product in terms of design and quality by having a partnership with internationally reputed firms of EOT cranes in terms of technical collaboration so as to augment the design features of the product .
- Strengthening of the design team competency with advanced Computer Aided Engineering modeling and Analysis tools and in defining the Operation Process Sheet, Quality Assurance Plan is essential so as to improve the quality and Delivery of EOT crane.
- The work suggests the ABC-EP to form a Quality Circle team to nullify the losses of TPM by improving the OEE of every machine at ABC-EP.
- ABC-EP shall have a Rate contract with identified potential suppliers and customer preferred vendors of the raw material and bought parts such as Gear Boxes, Brakes, Couplings etc. so as to have cost benefit and fast delivery of items.
- Implementing SAP based software suitable for ETO approach ensures the delivery of the product at the right time.
- Supply chain effectiveness of ETO approach can be enhanced by implementing the Vendor Management Strategy which facilitates the ease in sourcing the material from the suppliers at low lead times and also possessing inventory of few raw materials of regular use.

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