PERFORMANCE IMPROVEMENT IN ENVIRONMENTS WITH MULTIPLE SUPPLY CHAIN PHILOSOPHIES: A CASE STUDY

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ABSTRACT

The current work is an analysis of strategy formulation for performance improvements in an environment with multiple supply chains. The work analyses the environments from the operational perspective, the business requirements, the demand perspective and the information technology perspective. The characterizations of the cases include multi-stage acquisitions of various units / companies that work on different philosophies, different information systems and different product offerings. The work concludes with the development of appropriate strategies for each of these cases.

INTRODUCTION

Supply Chain as used in this work is the linked set of resources and processes that begins with the sourcing of raw material and extends through the delivery of end items to the final customer. It includes vendors, manufacturing facilities, logistics providers, internal distribution centers, distributors, wholesalers and all other entities that lead up to final customer acceptance. The extended supply chain for a given company may also include secondary vendors to their immediate vendors, and the customers of their immediate customers. This is the definition of the Bridgefield Group [1].

The present case studies a company in the business of electrical steel (hereafter referred to as ES). The electrical steel industry has two main product offerings: non-grain oriented electrical steel (NGO) and grain oriented electrical steel (GO). The company has five plants in operation and these are located as follows: two in Germany, one in France, two in Italy and one in India. The product mix initially was as follows:

1. The plant in Bochum makes only NGO ES
2. The plant in Gelsenkirchen makes only GO ES
3. The plant in Isbergues makes GO ES
4. The plant in Terni makes GO and NGO ES
5. The plant in Mota Visconti has a slitting line.
6. The plant in Nasik makes GO and NGO ES

After an evaluation of the costs of production, it was decided to restrict the production of the Italian plant to GO ES and the Indian plant to NGO ES. Our analysis keeps this structure in the background.

Further, it must be noted that the marketing function is carried out through various offices: the corporate office in Germany and other offices based in India, Italy and France. In addition, various agents were appointed to look after domestic sales in various countries.

The Corporate Office in Germany holds central functions. The focus of our work is on the central supply chain function, also referred to as the OrderManagement. This function matches the production requirements with the orders being logged in the system.

BASIC ORGANISATION

The basic organization of the supply chain is given in Figure 1. As given in the figure, the customers interact with the KeyAccounts department, subsequently transferring the information in the form of orders, with the help of the OrderManagement, to the various production organizations. The production centres then produce and ship the product to the customers, as per the various orders. The subsequent invoicing is performed by the OrderManagement in most cases. Control of orders with respect to pricing and payments is exercised jointly by the accounting department, the controlling department and the KeyAccounts.

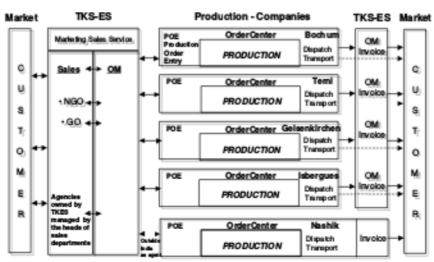

Figure 1. Organization of the company

INFORMATION SYSTEMS DESIGN

A multi-tier information system is operational at the company. This information system has interfaces defined at each unit. The Corporate Office uses a SAP platform. The plants in Germany and France also use the same. However, they use legacy systems for production planning and control. These are interfaced with the SAP system.

The companies in Italy and India use legacy systems for their operations. These are not interfaced with the SAP system. However, financial information from the Italian plant is incorporated in the SAP system at the company.

The legacy systems at France and Italy were shared with the previous parent company as there were common utilities at these plants, they being in the same compound / premise.

The various interfaces give rise to various problems as elaborated in [2]. Notable among them are:

1. Networked systems in operation leading to high configuration costs.
2. Operational complexities in the supply chain.

FOCUS ON THE CENTRAL SUPPLY CHAIN FUNCTION

As indicated, the department called OrderManagement performs the central supply chain function. The roles of the OrderManagement department include:

1. Planning
2. Order Processing
3. Logistics Co-ordination
4. Technical management of production centres
5. Transfer of market information to the plants
6. Co-ordination of production requirements with the marketing needs

The function, therefore, is a key link between the marketing and the production processes. It directs the procurement of raw-materials for the production through its planning. The order-processing ensures a fair deal of load balancing among the plants, and takes into account among other things, transfer of relevant information to the marketing function. As the KeyAccounts are spread over various areas, offices and geographies, the consolidation of information is carried out at the OrderManagement. Further, the downstream information supply is also the OrderManagement.

Thus, the OrderManagement is the central driving hub in the supply chain as shown in Figure 2.

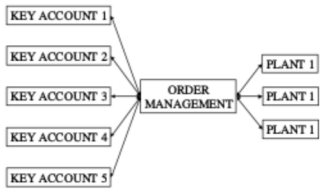

Figure 2. The Central Hub of OrderManagement

CHARACTERIZATION OF PRODUCTION CENTRES FROM A SUPPLY CHAIN PERSPECTIVE

The various production centres, have the following characteristics with respect to the predictability of the output for a given input material:

1. The NGO ES is manufactured through a process that has reasonably high predictability.
2. The predictability of the GO ES varies from plant to plant. In the French and the German plants, the distribution of the output is fairly stable (+/-10%). However, it is extremely sensitive to changes in the properties of the input material. In the Italian plant, the distribution of the output is less stable (+/-20 %). Due to the recent investments, the output is yet to stabilize. Hence, during this process, the predictability can be considered low.
3. Other significant factors include cultural issues like information handling, level of detailing required, etc. The French plant has a requirement for higher level of detailing as compared with the German and Italian plants.

OPERATIONAL STRATEGIES USED BEFORE THE MERGER

Principle strategies used by various plants are listed below:

1. The French plant used a strategy of incorporating forecasts in their legacy system. Hence, the total production load would be: Actual firm orders + Unreleased orders + Forecast orders.
2. The Italian plant produced all the tonnage, and hence, operated on an MTS strategy to avoid problems due to the low predictability.
3. The NGO plant operated on a MTO strategy through the entire supply chain.
4. The other GO plants worked on a push-pull interface with a delicate equilibrium of the MTS with the MTO.

OPERATIONAL STRATEGIES USED AFTER THE MERGER

After the merger, the NGO plant was made to continue to work on the MTO strategy. However,

there was a significant difference in the mode of operation of GO plants. Based on the technical feasibility, new operation strategies were proposed.

1. The planning time bucket used was week. This was different in different plants (before the merger).
2. All the plants were made to operate on budget-order equilibrium. The budget is a forecast for production. The orders are made to correspond to the budget.
3. The use of foreseen orders as formal tools was discouraged, although used in certain cases.

The budgets, thus, define the push-pull interface. However, in practice, the push-pull interface was not at the finished goods, but at the earliest point where the finished grade of the material can be determined. This is the WIP-I / WIP-II boundary.

Hence, the operational strategies are as given in the figures 3 and 4 below.

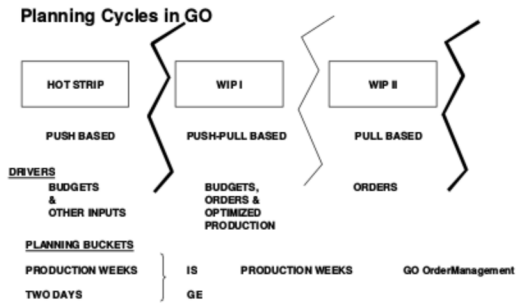

Figure 3: Planning Cycle in GO

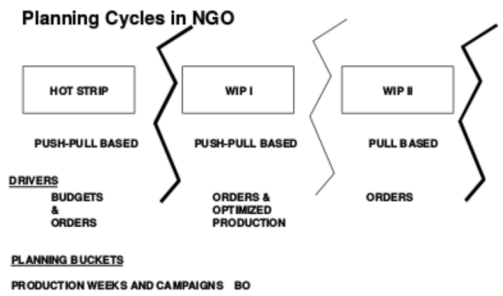

Figure 4: Planning Cycle in NGO products

Having a basic idea of the functioning of the business house, we now go to the specific cases of performance improvement.

CASES OF PERFORMANCE IMPROVEMENT

Case 1: Norms for Data concerning Dates

Order prioritisation is normally a function of the lead-time; more the lead-time, less the priority. Due to market pressures, the KeyAccounts normally keyed in dates closer than actual for customers which were on higher priority.

Each order contained schedule lines for various order items. As the schedule lines could be different, the dates of the schedule lines were critical. The interface with the legacy system in France allowed only Thursdays as confirmation dates. Further, the interface design allowed the confirmation date of the production time limit only. Hence, the shipment time limit was not confirmed (ex-works). Thus, in many cases, the orders would be advanced or postponed by weeks. This was not the case in the other plants. Further, due to the configuration of the interface with the legacy system, the travel lead-times could not be incorporated in order delivery dates at the time of order entry into the SAP system.

This implied that the order production time limits had to be confirmed to the customer. The direct fall-out was a system required defining norms for data concerning dates. This was absent. Further, the customized order that was used, didn't support storage of multiple dates that were required for monitoring of orders. Hence, the system failed to provide the basic support for an OrderManagement MIS.

The practice was the following way: A norm was defined and this was communicated to the KeyAccounts to ensure that the customer understanding was clear at the time of order booking. A single norm was defined for all the KeyAccounts for the same. Further, the customers would be sent documents (Order Confirmations) incorporating the applicable travel lead-time in order to ensure that the desired INCOTERMS were correctly incorporated. Reports in the OrderManagement would also incorporate this time to ensure that the data is accurate. However, the corrections were manually made and they would take a lot of time.

An alternative solution was to use the standard functionality of inquiry, quotations and contracts in SAP. That would enable the capture of additional information including the date requested by the customer, the date of the L/Cs, etc. Hence, this is a simple preferred solution. This solution is to be explored.

In addition, the use of one common norm would continue as has been currently implemented. Data constraints in the French plant were also to be considered explicitly. A list of affected procedures was identified and is in the process of implementation. This list is updated in real time and is distributed to the concerned immediately.

Incidentally, the system interface with the German plant was smooth and could account for the order shipment times and transport planning lead times.

Case 2: Metrics for Measurements

Critical metrics like the cost-volume-price relationships were not defined for various customers or aggregates of customers. This had serious implications on the net-earnings. This was a problem of multi-disciplinary nature involving the accounting information from the Controlling department and the Sales organizations. The existing reports were inadequate. The essential monitoring tool used was the production statistics, the sales statistics and the shipment statistics. Elaborate exercises involving analysis of widths, customers and grades were not carried out and controlled.

During the course of work, however, a significant contribution was the development of simplified tools and reports to monitor:

1. On-Time Deliveries
2. In-Full Deliveries
3. Backlog volumes

These metrics helped improve the synchronization of various OrderManagement activities with subsequent production planning and helped reduce the backlog volumes to near nil from around 10%. This report also facilitated the CRP at the plants.

However, the Cost-Volume-Price relationships were still to be worked out. As the OrderManagement was the distribution hub for the orders booked by the various sales persons, it would only be normal for the OrderManagement to exercise the control of these orders. However, this would require the following steps:

1. A systematic evaluation of current business needs.
2. A re-look at the customer evaluation.
3. A clear insight into the division of activities along the information flow channel of the supply chain.

However, from the functional structure of the organization, the controlling department performed this analysis, after the fulfillment of the order. So, it was always a case similar to a post-mortem strategy giving future action plans.

The current activity required a more responsive mechanism to control the flow of orders. With price fluctuations of up to 15%-20% in a quarter, it was important to re-assess the mode of implementation of these critical relationships. The modalities of such an implementation need to be worked out.

There are two possible modalities: (1) Re-defining the role in the domain of the OrderManagement or (2) Incorporating an additional step for credit checks with the Controlling department. Since the changes in the business cycles (shrinking of the cycle times) have been a recent phenomenon, a pro-active measure would involve a quick evaluation and the definition of an appropriate process for the same.

Further, a recent initiative to develop a process oriented management system was not mature enough to enable a check on the alignment of the metrics with the overall strategy of the organization. This would assist in designing norms for various metrics that would be used.

A strategic progression of the Supply Chain Function across various philosophies needs to be identified and the adequacy of the information system checked at each stage. The flexibility desired of each of the supply chains was also a critical factor with the French plant catering to developing markets like India and the Indian sub-continent, the German plant taking over quantities from the Italian plant due to technical and commercial considerations, etc. Hence, a robust system incorporating these variability, and yet, providing the flexibility of data handling was required. While the main platform SAP did handle much of the functionalities, the design used for the customization was showing severe shortcomings with time. This needs to be re-looked in the light of the strategy of the company. We re-look at this aspect later in this work.

Case 3: Predictability and Supply Chain Options

The NGO production was based on a process that had a relatively higher predictability of the product. The planning could, thus, be based on two distinct production philosophies as indicated earlier. One was the WIP I / WIP II philosophy which was based on ‘exact’ identification of the end-product physical stock with that of the orders. The second was the order-based system which earmarked material to the specific customer order right from the beginning. In such a system, it could be possible that the end-product doesn’t exactly conform to the order planned for. A safety stock

needs to be maintained in such cases for such contingencies.

One of the critical factors for consideration is the scrap in the slitting lines. Different customers, most times, order widths and quantities that need to be clubbed with other orders for minimizing the slitting losses. Details of the problem are explained in reference [3]. The scrap typically expected in the slitting lines is to the tune of 30-35% of the total scrap generated in cold-working of electrical steel. Much of this can be reduced, owing to significant gains that would ultimately add to the profitability of the ES business.

The conceptual framework critical in the case of ES is shown in Figure 5 and Figure 6.

PARAMETER	ORDER BASED	WIP1/WIP2
TOLERENCE BAND FOR COMBINATIONS REASONABLY CLOSE TO EACH OTHER		✓
ORDERS ARE SUFFICIENTLY CLOSE IN TIME		✓
MULTIPLE CUSTOMERS FOR SAME PRODUCT SPECIFICATION		✓
ORDERS ARE STABLE AND FORECAST ACCURACY IS HIGH		✓

BASIC REQUIREMENT: ROBUST ASSIGNMENT ALGORITHM

Figure 5: Choice of WIPI / WIP II Philosophy

PARAMETER	ORDER BASED	WIP1/WIP2
SPECIAL EFFECTIVE WIDTHS (DUE TO CONICITY, ETC. THAT CANNOT BE COMBINED WITH OTHER ORDERS)	✓	
ORDERS ARE NOT SUFFICIENTLY CLOSE IN TIME	✓	
SINGLE CUSTOMERS WITH THE PRODUCT SPECIFICATION	✓	
ORDERS ARE 'UN-STABLE' OR FORECAST ACCURACY IS LOW	✓	

BASIC REQUIREMENT: TECHNOLOGY TO INCORPORATE DIFFERENTIAL PRODUCTIVITY

Figure 6: Choice of Order Based Philosophy

An extensive analysis of the processes and the flow of orders indicated that optimizing the Order Based philosophy could give rise to a significant saving to the tune of This is being implemented at the company.

The predictability being lower for the NGO ES, it was not possible to use an Order-Based philosophy. Instead, intermediate inventory at the designated point was used as shown in Figure 7. In addition, attempts were also made to reduce inventory at other intermediate points in order to ensure better performance of the supply chain from a buyer's perspective (shorter delivery times, etc.). This was also required to ensure a higher return on capital employed (ROCE).

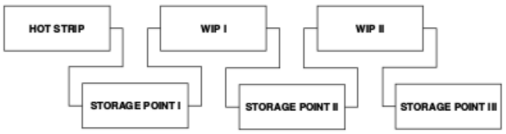

Figure 7: Storage points of interest

The OrderManagement would give the structure of the additional inventory (stock) at storage point II. The production units would monitor and control the same. This was a successful effort. Delivery times were reduced to less than 14 days, 7 days in some cases, along with an increased capacity for spot-businesses. This strategy was used in Germany and France.

In Italy, the predictability of the end-product was significantly lower than and this, therefore, required a high volume and also a balance in the ordered grades to ensure smooth operations in the supply chain. However, this was not achieved due to various market factors.

Case 4: Risk Hedging Strategies

These strategies are concerned with the servicing of customers with higher risks. These were primarily risks concerning payments, service levels and order placements. A systematic evaluation was required for the formulation of norms for risks. One of the simplest norms used was the inventory turns per customer per month. Certain customers were identified based on this norm and the inventory level was improved.

In certain cases, the payment behavior was studied and dummy orders were created to adjust the requirements to those of the customer's. These orders were also useful in gauging the inventory levels in certain grades. This helped balance the sales demands and priorities with the production. In particular, this was useful in those grades that had low relative production yield values.

However, a detailed study is recommended to consider all these issues in totality.

Case 5: Standardization of Final Products

In order to enable order leveling between various production locations, an initiative to standardize the various Final Products was undertaken. This had to be done for each customer. The exercise is in process.

However, an interesting fallout of this exercise was the quality benchmarking of the products which indicated significant differences in certain properties at the plants. Thus, most orders were not 'portable' or 're-assignable' to other plants. Hence, the order leveling algorithm had to consider this aspect carefully. This also meant that the Order Centres would actively be involved in the exercise, which was not very desirable from a holding company perspective. In particular, due to the fact that the production units were competitors before the merger / acquisition and so, these exercises were not very smooth in the handling.

A direct requirement, thus, was a technical orientation for the OrderManagement as against a purely commercial orientation as was initially proposed. This is also being implemented at this time.

Case 6: Slow Moving Products

In the NGO production facility in Germany, it was observed that around 25% of the WIP I stocks were slow moving. Although the predictability was high at this facility, the production volumes were considerably higher, thereby, making the quantity of WIP I stock significant. Hence, it was necessary to minimize this stock by pushing the material to the market. A suitable system was needed to be designed in order to enable the visibility of this stock to the concerned departments namely production, quality, planning and sales. The roles were defined as production identifying the material, quality and sales deciding on the customer / customer order to which this material would be assigned to and the planning department deciding on the schedules / subsequent production planning.

With multiple legacy systems being used at each system, the visibility of the material and the facilitation of the decision making process was becoming increasingly difficult.

The logical DFD was developed as shown in Figure 8. This was coupled with the definition of working groups for each inventory area in the plant with a main coordinator / process owner to whom the working groups would report to. The system was ultimately developed in a Unix-Windows interface based file system incorporating the functionalities envisaged in the DFD.

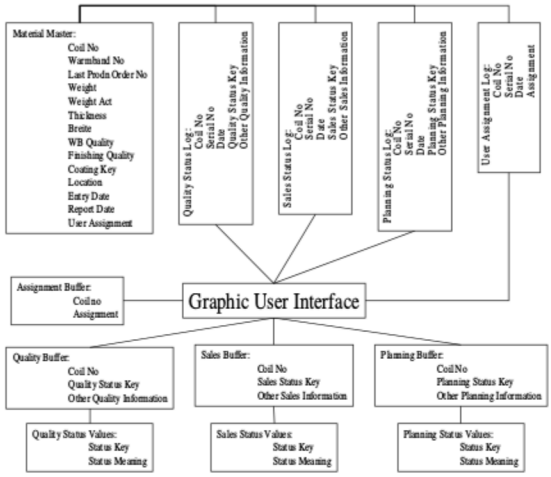

Figure 8: DFD for the IS for Inventory Control.

The implementation was successful. The gains evaluated out of this exercise are to the tune of 4 rox

CONCLUSION

While strategic considerations are essential for the proper design of the supply chain, it is also possible to generate value using basic thumb rules for various supply chains. In the present case, a strategy document was not formulated. However, continuous inputs of strategic nature were given so as to give a direction for operational development.

Advanced tools and techniques for critical areas like distribution and shipment optimization, production control and effective feedback for sales planning could not be implemented as these are based on long-term assumptions.

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