23

BPR, IN THE PRODUCTION SYSTEM, METHODOLOGY AND RESULTS

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Abstract
This paper presents part of the work carried out in an application case-study. The global project falls within the framework of what is known as Business Processes Re-engineering. To be exact, a strategic analysis of the production system of a tool manufacturing company has been performed.

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0. INTRODUCTION

Traditionally, flexibility has been considered the major advantage of SME's competing with large firms. The application of information technology and modern manufacturing philosophies in large firms has all but reduced this advantage. These technologies and philosophies should be tailored and applied to SME's, enabling them to regain their traditional advantage in the area of flexibility. By improving quality and manufacturing more cost effectively, they will enlarge their market share and boost employment levels. As present, employment levels are under threat from low labour cost locations.

1. METHODOLOGY

1.1. STRATEGIC ANALYSIS OF THE OPERATIONS SYSTEM

We understand Operations System as the group of value added activities: R&D, Quality Assurance, Engineering, Purchasing, Inbound Logistics, Production, Outbound Logistics, Installing, Supporting and Satisfaction Maintenance.

The steps to follow in Strategic Analysis are: Define the Desired Competence Profile, find out wether the Critical Activity in order to reach the desired profile is a transformation activity, if so, the action plan can be established, (BPR Project).

Define the desired competence profile. Developing a model based on some competitiveness criteria (Innovation, Time, Money, Range and Consistency) leads us to define and quantify the competitiveness level of a firm. The specific dimensions for each of the mentioned criteria must be defined from strategies and long term objectives, if they are explicitely defined, if not such objectives and strategies must be identified.

Identify the critical functions. In this step we must find out which functions from the operations system are the key functions in order to fit the desired competence profile, so that they must be redesigned.

Define the action plan. The action plan must be established in order to redesign the critical functions. The result is a range of projects to be carried out in the firm.

2. OUR WAY TO UNDERTAKE BPR IN TRANSFORMATION ACTIVITIES

According to the GRAI Model and self developed research, an operations system can be divided into three subsystems: The Physical System, the Decisional System and the Information System.

The physical system, involves manpower, machinery, materials and procedures, its own objective is to transform parts into finished goods.

The decisional system, it is a hierarchical system of decision making, so that decisions at a higher level (longer term decisions) create a decision context for the lower level decisions (shorter term decisions). Its aim is to develop the decisions which define the management commands to the physical system, it establishes what, how much, who, when, where and how.

On the other hand, the decision system, that is, the group of decision activities taken in a production system can be considered as two-dimensional (figure 1).

A functional dimension which defines the diferent existing functions in the production system.

A hierarchical dimension according to time criteria which establish levels for the decisions featured by the concept of **period** (period of time by the end of which every decision has to be questioned again), and the concept of **horizon** (period of time of influence of the decision).

Despite such concepts, the key for the decisional system is "Synchronism".

The information system, allows the information flow, treatment and saves the required information for decision taking and executing.

	PURCHASING	PRODUCTION	SALES
H=1.5 months **P=1 week**	Materials Planning		Sales Previsions
H=10 days **P=1 day**	Orders to Suppliers	Production Planning	
H=1 day **P=1 day**		Production Programming and Workshop data feedback	Generate Orders

FIGURE 1

3. CASE-STUDY

3.1. INTRODUCTION TO THE FIRM

The firm which is the subject of this case-study is an SME which manufactures tools for wood cutting, it employes about 50 persons, about 35 of them are direct labour.

Their main products are: Reversible blade heads, window groups, cutters, drills and saw blades.

They manufacture both special and standard products.

3.2. OBJECTIVES OF THE FIRM

- Reduce lead-time:

- Guarantee lead-times:

- Be able to process small batches (even one) with client specifications (special products) in a short time.

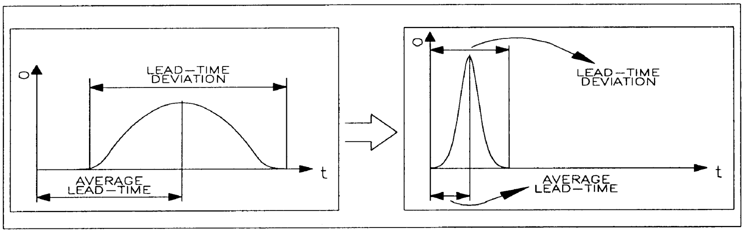
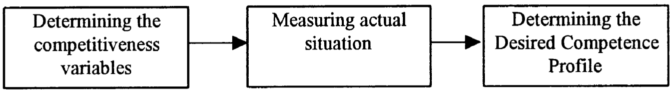


FIGURE 2

Once we get to this point, the firm must translate their objectives (their feeling) into something we can measure, identify, structure and formalize the way the want to compete by means of:



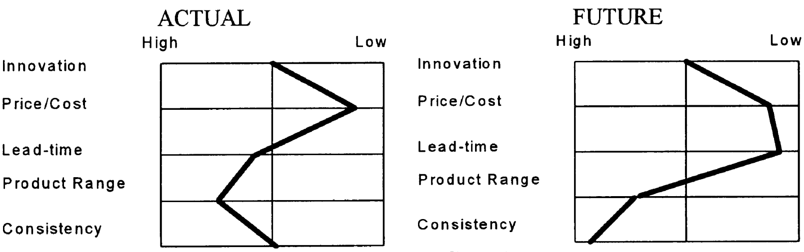


FIGURE 3

3.3. IDENTIFY CRITICAL FUNCTIONS

Analyse fuctions in the Operations System R&D, Quality Assurance, Engineering, Purchasing..., Find out which one is crucial for the proposed objectives.

The Production System had the following features, it was configured in functional groups, placed the way it seemed to be the correct order for product manufacturing, which seemed to be a good solution for simple management and short handling materials time.

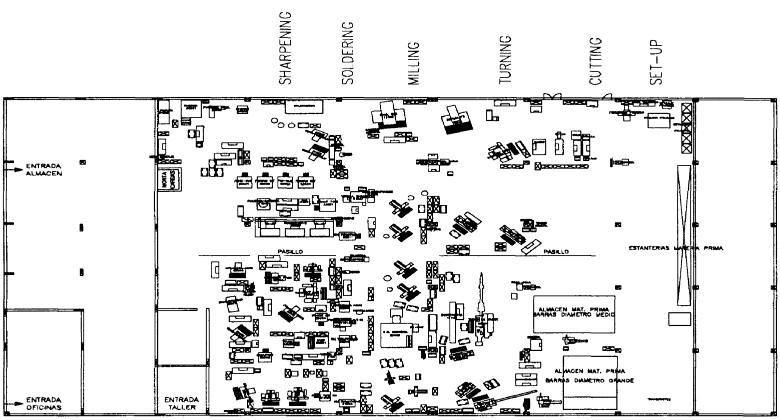


FIGURE 4

- The worker received the orders to manufacture, and he decided the scheduling.

- Proccess not totally determined: there was no established route (process.

That is why we considered the Production System as the critical function.

3.4. ESTABLISH THE ACTION PLAN.

Re-Engineer the Production System and its management in order to get next goals.

Serve: what the market demands, when the market demands it, as much as it demands, with the required price.

Decreasing: risk of obsolescence (products and facilities), cost, risk of investment.

Increasing: quality, Production System transparency.

Therefore we chose Group Technology, which is a philosophy for product-process rationalisation, with the objective of simplifying the Production System.

Simplify the Physical, Decisional and Information Systems, via creating small firms inside the global firm which work with absolute synchronism. And hence making it more lively, decreasing and determining for all of them the same **Programming Period** and **Production Cycle**.

4. PROJECT DEVELOPMENT

4.1. ANALYSIS

4.1.1. Product Analysis (Levels of Product)

Product analisis is carried out in order to measure the flexibility offered by the product (standard parts and components), and required technology for its aseptic transformation.

The variables which determine the flexibility of a product are as follows:

-Variety of finished products which have started from a semi-manufactured product.

-Relationship between operations prior to the semi-manufactured product and after it till it becomes a finished product.

Product analisis (always taking into account the process) has two main objectives: first to find out parts and components which can be manufactured or not by means of actual facilities, and second,to establish a product hierarchy, for which we proceed as follows:

- Put parts and components apart for each product analysing the diversifying effect they have over the final product.

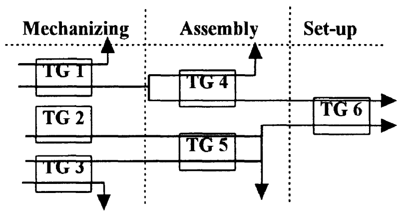
- Study relationships with other products.

These two points aim, first, to simplify the system and its management, and second to transform the commercial catalogue into the production catalogue. To do so, there is something else we must do; Product-Market analisis, which identifies the levels of the process where finished product appears, as different clients order products in different levels of the process.

From the production catalogue analysis we worked out:

a) The degree of flexibility of the product is very low, the product is diversified after very few operations, so it makes no sense thinking of a Production System based on semimanufactured products. It makes more sense to think of a short production cycle, as well as low supplying time.

b) The levels of product were identified as:



4.1.2. Process Analysis

Process analysis: The process analysis implies a detailed study of existing manufacturing processes in the firm, so, existing technologies, routes and flow diagrams.

Therefore, the first step in process analisis is determining the required facilities, own facilities and subcontractors, where they are and handling systems, (always looking at the materials flow from the beginning to the end of the process of each product).

We determined the manufacturing process of every single product in the production catalogue, these diagrams take into account:

- Products to manufacture
- Machine for each operation
- Operation (manufacturing or subcontracting)
- Technological constraints

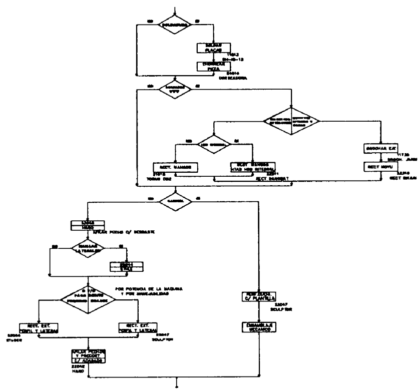


FIGURE 5

4.1.3. Product-Process Analysis

Product/Process analysis: this analysis gives the grouping of products into families according to the different processes, creating the base for the creation of the technological groups.

The aim of this analysis is to determine the product-process hierarchy which allows the market to be served, diversifying the product as late as possible, without excessive levels.

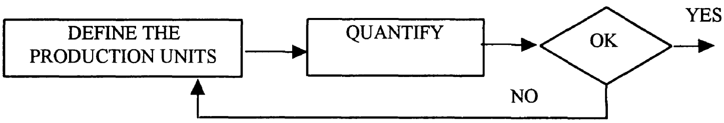
By determining these families, we are determining future technological groups.

4.2. DETERMINE THE FUTURE PRODUCTION SYSTEM

4.2.1. Define the Production Units or Technological Groups.

We have already defined the production families, and the different levels of the process, so we can go on to make our first attempt to define the production units, (we must remark there is always at least one critical facility in any unit).

What we mean by defining the production units is establishing the number and composition of them. Their lay-out, who is exactly going to work in it or where it is going to be placed is something we determine later.



We understand a production unit as an small firm with just one person responsible for manufacturing the finished product or component.

4.2.2. Models Generation

After the first definition, and once quantified the production units, we often find different possibilities.

*a) Investments:*It is quite common to realize that an investment could give our model either more simplicity or shorter lead-time. It is up to the firm to decide what to do, according to their possibilities and objectives.

b) Election: Once the technological groups are defined we must locate them in the factory, according to our defined processes and the physical constraints of the factory, (figure6) shows the four proposed possibilities.

FIGURE 6

*c) Macroprocess:*We have defined each product process, now once the technological groups are defined, we will look at it from a higher level. These macroprocess diagrams represent each technological group as a machine.

4.2.3 Determine the New Lay-out

We must determine the following aspects:

a) Physical lay-out of the technological group, and the product range, which is entirely going to be manufactured inside that group

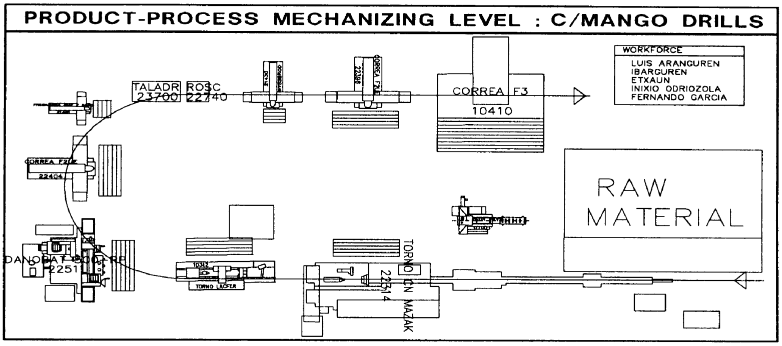


FIGURE 7

c) Required labour, who exactly, the final processes of the products to be manufactured, the person responsible for lead-time, quality, flexibility and stock.

d) Management of the group, that is determining the way labour is going to attend facilities and the scheduling criteria

4.2.4 Select the alternative and move

Once technological groups are totally determined we study the global lay-out.

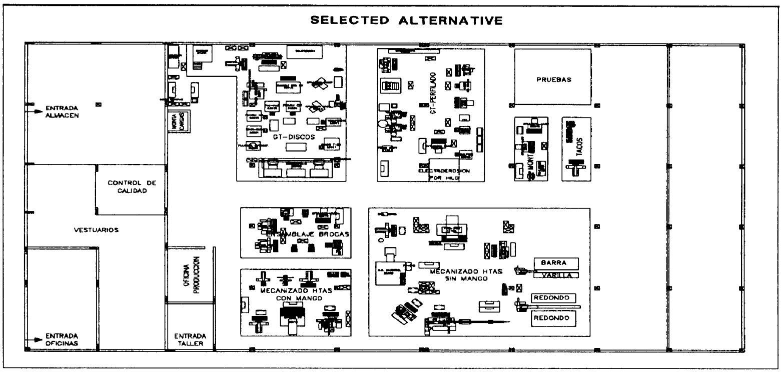


FIGURE 8

Facilities must be moved in order to start up with the new Production System

4.3. . DETERMINE THE DECISIONAL SYSTEM FOR THE PRODUCTION MANAGEMENT

From the value added functions (Purchasing, Sales, Production, etc.) we choose the ones directly connected with production management. We then determine the decision activities for each function, as well as their **period** and **horizon**.

Once the decision activities have been determined, we analyse each one in order to determine the required information. And we represent together the **decisional** and **information systems**.

4.4. PRODUCTION SOFTWARE

Once the production system is simplified according to the mentioned criteria, it is quite easy to manage it automatically, we understand management as workload/capacity planning and workshop programming, (figure 9).

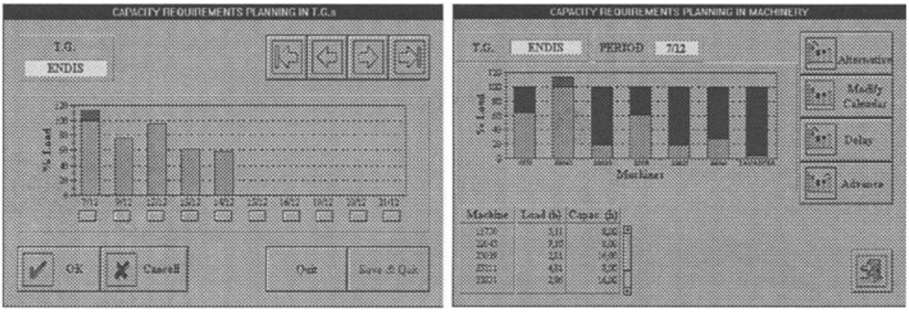


FIGURE 9

4 BIOGRAPHY

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