

TECHNOLOGY STRATEGIC PLANNING: "HOW TO DO IN HIGH COMPETITIVE SURPRESIVE MARKETS"

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Abstract

The paper presents an experimented model to cope with the problem of manufacturing systems design in high competitive-dynamic markets, the main challenge being to simultaneously manage short product and process life cycles, high productivity, flexibility and low inventory, some of them contradictory.

The paper goes along with the criteria of machines and systems flexibility and short product and process life cycles, but actively seeking high productivity standards in terms of as much automation as possible and, which is more crucial, of a very smart advanced organisational practices set.

Keywords

Technology, product life cycle, process life cycle, strategic-planning, product added value, process added value.

1. INTRODUCTION AND BACKGROUND

Surpresive markets proliferate everywhere. A surpresive market is that shooting extremely short product and/or process life cycles. In other words, more or less revolutionary product-applied technology and advanced new processes are permanently on their way. Never minded if dealing with own or customer's products, a trend is certified to spread simultaneously changes in both product and process technology.

Most companies are, in some way, immersed in this dynamic environment, and surviving there requires from them to be in a leading position (what means creating at least one product/process technological leaps), or alternatively contend in a place where the sucking effect from the leaders innovation is significant enough. That last means not at all to "copy ok and fast", but crafting self-innovation around.

Basically, companies in this last situation - the majority - have to demonstrate:

- An operative model for continuously re-aiming and deploying the technology strategy.
- A technology strategy which is sounded and flexible enough, requiring only stepped gradual changes.

What follows represents the model applied to redesign a multinational subsidiary basque country company based facility for attending the world-wide portable air conditioned market, being a newcomer regarding this particular high-competitive far-eastern coped activity.

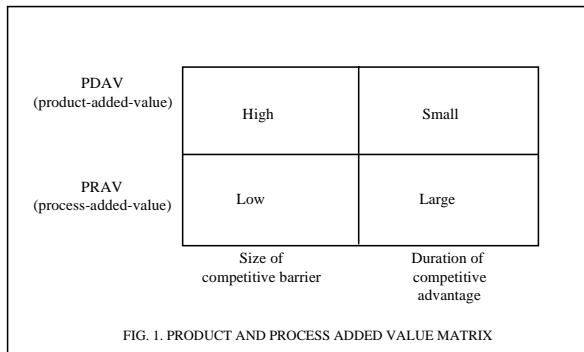
It is important to highlight the core assumptions used:

- * Identify product and process added value aspects and their influence in business profitability.
- * Create as much as possible "potential energy" and eliminate any significant drag in the organization for systematically doing the fastest innovation in product and process technology.
- * Make clear along that effective and faster innovation requires a well established permanent removal of manufacturing process non-added value activities: "Be fit to be able to leap".
- * To use a "smart logistics model" as the input for manufacturing strategy, thus giving a reference to be self-benchmarked in process added value and technology.
- * Identify strategies for marketing the technology strategies, as additional synergistic effect.

Let's go to examine all them separately.

2. PRODUCT ADDED VALUE

Matrix in FIG. 1 represents competitive barriers of product and process added value. In a mature product and market any significant innovation means a competitive barrier, but sooner or later patents pending are -if sense- easily violated, thus converting innovation in no more than current "value analysis" practices. We decided to create "potential energy" for innovation rather than trying to differentiate in product technology from the starting point. This is supposed to give us more opportunities to make continuous relatively market appreciable innovation leaps, and also concentrate in very effective value analysis activities oriented to increase the ratio "function value/function cost".



The mentioned "potential energy" creation is based on technology strategy and convenient suppliers development. The FIG. 2. is the supplier matrix, where they are classified attending product and process critical parts, a critical part being one that is related to the potential of differentiation in product function/cost or process cost/reliability in the future.

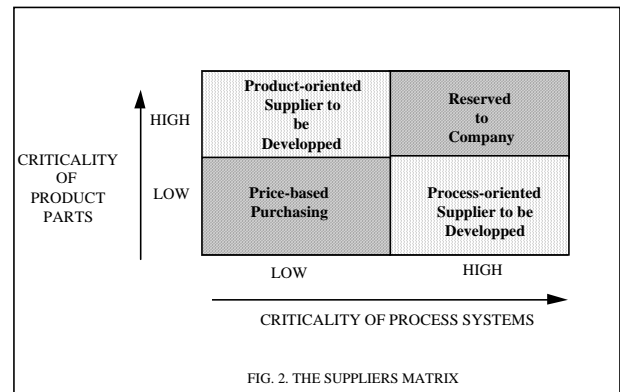
Two kinds of suppliers were selected to be developed in terms of technology; the product and the process technology related ones, but simultaneously protecting as the own core that areas where both product and process technology are considered critical. This aggressive approach is made taking care enough to the sort of suppliers dealing with, in all cases SME's with long-term agreements in terms of price-volume, price-time, number of technology suggestions from them, technology support from ours, and no concurrence with competitors. The suppliers are supposed to provide us with a contribution to a faster innovation and consequent release of own overhead costs.

Examples are (see FIG. 2):

- Reserved to company; final assembly, functional on-line tests, performance tests, condensation systems.
- Product oriented suppliers; copper piping, protecting handling and surface contamination.
- Process oriented suppliers; stampings and plastics related to external design.
- Price-based purchasing; sheet bending, small machined parts.

The R+D department organisation with two assignments in both product and process technology innovation is another important issue. A commercial-oriented manager was got in charge, with a short polyvalent product/process technology team able to manage own innovations and suppliers R+D contribution activities. Value analysis practices set as part of their tasks gives degree of more practical and sounded innovation decision as well as more frequent cost reduction results and team morale.

Finally, another significant product-added value oriented action was creating an innovative after sales technical service - AST - approach. AST commitment ranges from current customer orders and specifications reception and processing, to product installation and typical after sales field service. In this way, the AST department is first concernig with the product in engineering adaptations, reliability of solutions, and field originated value analysis suggestions, and in second term the customer has only one and consistent window of communication with the company along product contract and utilization cycle.



3. PROCESS-ADDED VALUE

How we create process added-value oriented potential energy?. We used three main commitments; eliminate non added-value cost pools activities, create added value to the customer by process differentiation, and finally increase the Sales/Assets (S/A) ratio with as less as possible direct and indirect labour.

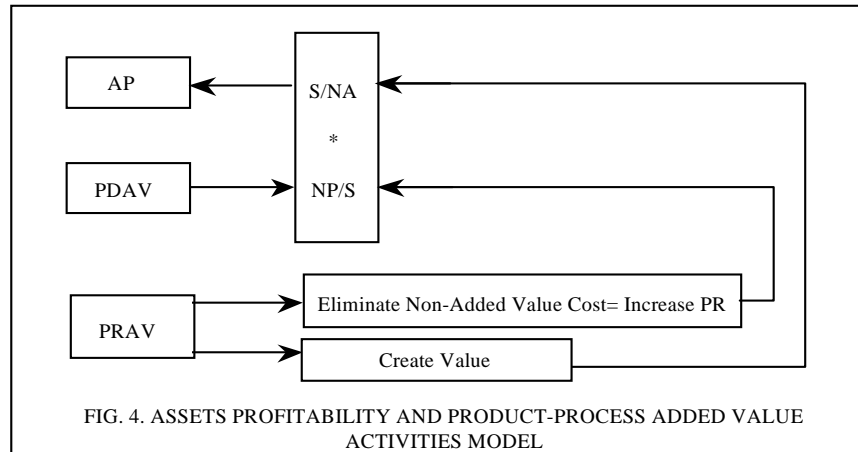
These were key processes, represented in form of table in FIG. 3. Now we will follow deeping on the logistic previous model, the manufacturing strategy components and the advanced organizational practices.

	Objective	Approach
Elimination of non added-value process activities	<ul style="list-style-type: none"> • Sistematic cost and manufacturing lead-time reduction 	<ul style="list-style-type: none"> • Smart logistic model is an input to a sounded defined manufacturing strategy. • Process-Management oriented staff organisation (PDM and work flow software) • Minifactories oriented shop-floor lay-out.
Add value by process differentiation	<ul style="list-style-type: none"> • Reduce delivery time. • Reduce time for industrialisation of product modifications. (Think and done) 	<ul style="list-style-type: none"> • Flexibility and polivalence of machinery. • An integrated process reliability program.
Increase S/A with low involved manpower	<ul style="list-style-type: none"> • Contribution to the shareholders value through assets profitability. 	<ul style="list-style-type: none"> • Flexibility and polivalence of machinery. • Soft-low cost manufacturing process integration. • An integrated process reliability program.

FIG. 3. HOW THE PROCESS ADDED VALUE IS CREATED

4. RELATED ASSETS PROFITABILITY

Assets profitability, given by the quotient AP (assets profitability) = NP (net profit) / NA (net-assets) is the most significant business and shareholders value contributor. Linking it with managerial practices is an interesting and practical issue for helping business-policy deployment along the organisation. One way to do that is factoring AP in Margin as NP/S (Sales) and Rotation as S(Sales)/NA, and relating them with strategies. In the case of the high-competitive matured markets a close relation does between Margin and product added-value activities, given that otherwise market prices' trend-to-decrease velocity is greater than the sole effect of continuous-improvement practices cost reduction results.



On the other hand, Rotation figures (supposing competitive direct manufacturing costs are well performed) are clearly influenced by process added-value activities.

The elimination of non-added value cost is symbolised by the productivity ratio (PR).

$$PR = \frac{US * FTOT}{CT}, \text{ where}$$

US = unites sold

FTOP = future technical optimal process time
(a constant with no technology changes)

CT = consumed time

This is the way in which Assets profitability and Technology strategy are clearly identified and related, giving a continuous-channel for communication and innovation-management along the organisation.

5. ELIMINATE NON-ADDED VALUE COSTS: SMART LOGISTICS FIRST, AND A SOUNDED MANUFACTURING STRATEGY

A smart logistic model and a correspondent manufacturing strategy are previous steps to successful elimination of non-added value cost, otherwise efforts becoming worthless. Current examples are found in programs for reducing machines set-up times beyond a convenient point, or trying to make a survivor of product changes of an extensive automated expensive machine, or the elimination of continuous-little breakdowns for another one high integrated asset piece.

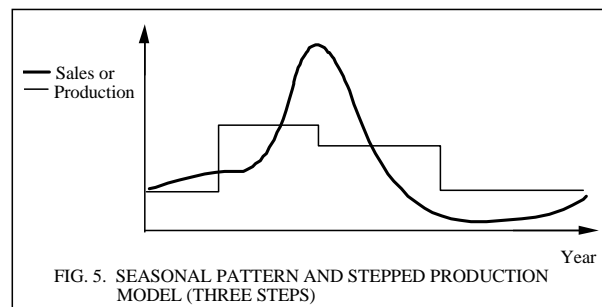
By "logistic first" we understand that the manufacturing strategy is coupled with a smart-realistic logistic model which implicit manages all type of very small scraps and inefficiencies.

The logistic model is established on the following items:

5.1. Regarding a seasonal demand pattern (typical from air-conditioned products), balance and optimize the monthly production:

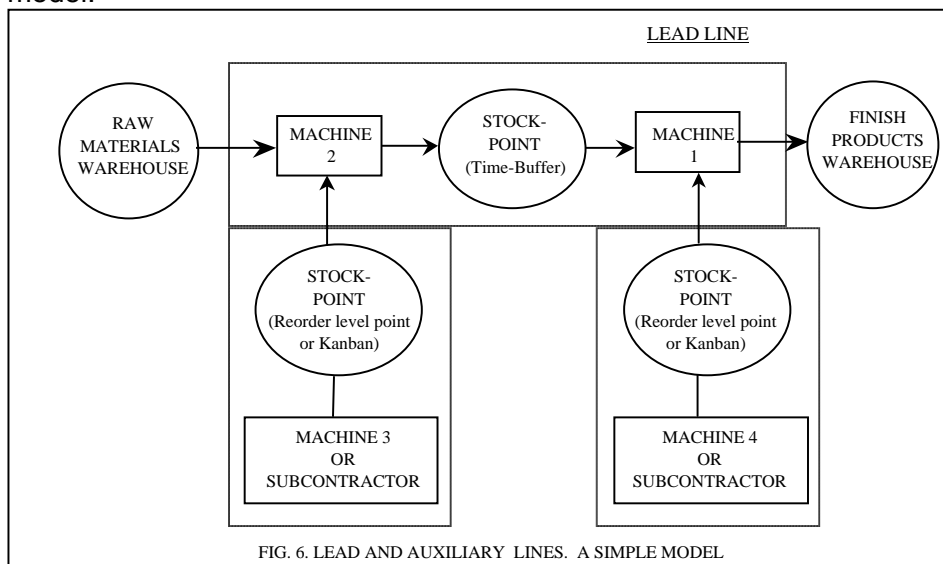
- near the demand: low inventory cost
- near the constant: low manufacturing direct cost

The solution is approximated by a combination of both by a very simple electronic-sheet simulation model given, in general, a result of "stepped production model" (Number of steps and production quantity) as seen in FIG. 5. for each item.



5.2. Decide from where in the process you are going to make ATO (assemble to order), thus confining the MTS (manufacturing to stock) area.

5.3. Define the lead and auxiliary lines (see FIG. 6.) considering critical product and process technology and the possibility of minifactories based organisation model.



The lead -line to be identified will have precise features:

- The stock points (between machine M2 and M1) in the example must be safety lead-times (time buffers), thus synchronizing both machines.
- Contains the MRP inverse calendar and the critical-path of the product, and in consequence the normal bottlenecks and the more technological processes.
- The flexibility of the manufacturing system is conditioned by this lead time.

Lead lines are going to be the scopes of the manufacturing strategies, containing on them all the product and process critical parts, and where the approaches deployed in FIG. 4, have priority to be fully implemented.

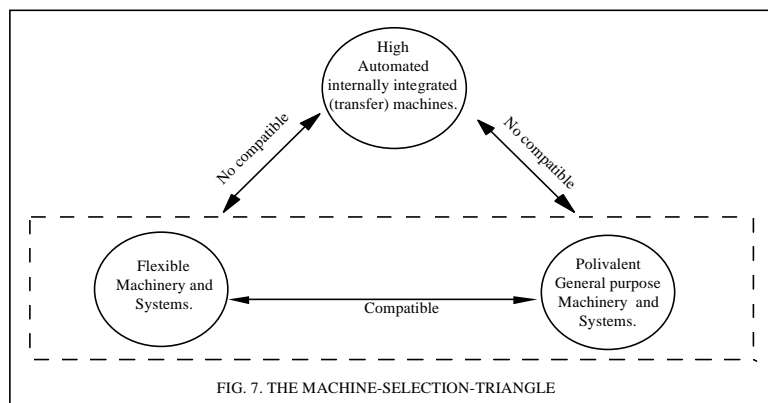
In the practical development, the lead-line is composed by the assembly of product base, tubing, welding, test and packaging, and auxiliary lines are sub-assemblies of tubing (welding) and electrical sub-assemblies.

5.4. Make production lot size equal to transfer lot size.

The transfer lot-size (the convenient quantity of product to transport or manipulate) is study with independence of the machines. Generally speaking, transfer lot size is smaller than production lot size, and overlapping of this last is normally used as a way of reducing lead-times. But overlapping just concerns one lot once it is in process, and does not manage the time of waiting in front of a machine. Then, policy is to make the machines at least as flexible as the transport process is making production lot size equal to transfer lot-size, and being this a crucial point in relation to the "machine-selection-triangle" given in FIG. 7.

6. A SOUNDED MANUFACTURING STRATEGY AND ORGANISATIONAL AGRESSIVE PRACTICES

First, we have the mentioned "machine-selection-triangle" as seen in FIG. 7. There is a compatibility between flexible (low set-up-time) and polivalent (product-changes surviving) machines and systems, and no-compatibility with high automated internally integrated ones, which are clearly rigid and become easily obsolete with product evolution. Clearly, we have to select flexibility and polivalence, what means to couple with the factors of add value by process differentiation that are reflected in FIG. 3.. This policy also protects from process obsolescence, and it is coherent with keeping Rotation high (S/NA). The point is how to do all that with the seen PR-productivity-ratio also keeping high. Policies and tactics are as follows:



- * Perform R+D process capabilities, designing proprietary solutions based on well tested commercial machinery parts.
- * Don't integrate operations internally in machines (transfers); instead of that do external low-cost-general-purpose-components based specifically engineered integration between also general-purpose machines, and then give automation enough for the most significative external handling.
- * Allow "by-passes" for manual operation along the integrated process. Frequently, that is only a matter of only a light-over in assigned floorspace.
- * Reduce all the elements of set-up time that are not concerned with the physical conception of machines and tools (they will be reduced by machine selection strategy). Process-tuning adjustments are in this category of items.
- * Adjust process off-machines, and if on, have the on-line monitoring facilities and computer-aided decision support systems to make "first part good".
- * Process technology domain is critical. Integrate management and capabilities concerned along with an organizational model that has a full-time integrated team for:
 - Some process innovation staff.
 - Maintenance and condition monitoring.
 - Quality engineering.

We call this the "process engineering team".

- * Apply I.T. (information technology) in the process in terms of on-line automated SPC integrate with on-line condition monitoring predictive maintenance systems. This is the information system by excellence for the mentioned process engineering team.
- * The number of breakdowns, and particularly small breakdowns in critical machines, are a symptom of the quality of process engineering work. Use the SPC-Predictive Integrated I.T. system to deep in root causes of failure. The proper rule is putting machines working as fast as possible, no matter if they are in a very high automated environment or not.
- * Design installations and aground systems carefully to allow a reliable yearly (every August) lay-out change. In practice, with the exception of very few critical machines, restrictions to the move are more concerned with installations and other stuff.

7. CONCLUSIONS AND HOW TO MARKETING TECHNOLOGY STRATEGIES

In high competitive-surpressive markets we need to make compatible continuous improvement managerial techniques with leaps in both product and process innovations, given that the former are not capable by themselves to compensate price reduction pressures. Creating "potential energy" in a fit organisation for facilitating product innovation leaps, and deploy a logistic based flexibility and polyvalence-oriented manufacturing strategy are the points to exploit.

Finally and closing the loop we need some strategies to marketing the adopted technology strategies. Is that possible?. We need to be realistic and the profitability of that kind of actions is not always enough. But when your customer values future, it is possible to get effects (more in sales, and never in price) giving perspective of facts he is interested in. Those facts that precisely create value in the product/process technology strategy: for example delivery time reduction.

The perspective for customer has to be marketed as follows:

- What have we done in the past.
- What is different from our competitors right now.
- What are we going to do in the future.
- How can technology strategies contribute.

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