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THE FLEXIBILITY OF ORGANIZATION AND THE FLEXIBILITY OF PRODUCT – PREMISES OF ORGANIZATIONAL SUCCESS

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ABSTRACT: *Flexibility represents the ability of a manufactural system to adapt to some diversified tasks of production, thus to assure an economic efficiency – the rapport time/cost should be optimum, with insignificant structure changes within a long period of time. The central role of flexibility is to permit the survival and the success of the organizations in a turbulent circumstance, which is characteristic to the new world tendencies. The more flexible the organization becomes, the better it responds to the change. Firms, which are flexible, facilitate creativity, innovations and speed, all these being included into the organizational and coordination processes. In quick change conditions, flexibility is a competitive advantage. An organization should face both threats and inherent opportunities in an uncertain future and in an instable circumstance. Flexibility and promptitude are the qualities of the organizational success and the need to be flexible is an imperative of competition.*

The world market of consumer goods has known deep changes lately. In the last years, the production of big series has been confronting with numerous difficulties, because of the strong mobility of the market, of its requests from the viewpoint of both quantity and quality, which impose to the producers the growth of the capacity of accommodation and of quick change of fabrication. The growth of the production diversity has an impact over the fabrication process from an organizational and technological point of view, taking into account that a more frequent transition from the realization of a product to another one is requested. This leads to the necessity of the achievement of a great flexibility of product from a projective and technological point of view. These aspects appear especially at the production of unique things, small and medium series, production which otherwise has the biggest weight within the engineering works, reaching up to 80% of the amount of total production. That what constituted the virtue of the fabrication systems allocated to the big series, as, for example, type design, standardization, big lots of products of the same type manufactured in big series, have become their main deficiency. This led to intense preoccupations for the development of a new quality of fabrication – flexibility, which implies radical modifications both in the domain of technologies and management.

The change of the organizational typology has in the context of up-to-date averages an extremely increased dynamics.

Thus, a strong division of the production is found, especially at the level of some components of a command launched by a customer, or of the components of the complexity products.

In this context, the reality of a global competence with more and more cases is identified, the organizations interact. Some strong industrialized countries export to others, and the last export to the first ones. From exports, the organizations have become about 50% or more over. Reciprocal exports don't aim only at the finite products, but also at components, materials, services. It results that the organizations are in equal measure both importers and exporters.

It is also demonstrated the conception of the production division (Peter Drucker). In keeping with this, a product is conceived and financed in a country, the materials can be produced in many countries and sent to an organization from a country which assembles them and at last, sold to other countries. But the position on a certain phase of the process is changing. This position pursues to obtain the efficiency, in a competing system, and this means the success.

The constant of the entire process is the atrocious competition which contains the majority of the world and internal markets, because the borders don't offer protection anymore.

In the same time, the organizational strategies have an accentuated dynamics which follows the abatement of the dependency of the traditional markets, classical, and the identification of a new market etc., thus the profitability should be raised and constant at this level.

At the processed elements the turbulence of the processing averages is added, which in many organizations is of type four and five, and therefore permanent changes in the companies' offer are necessary from the viewpoint of the finite products and of their components.

All the states shown are supplied by the customers' aggressiveness, which in the up-to-date economy constitute the initial point in any productive process.

The flexibility of product consists in the easiness with which new marks can be added or substituted to the existing ones, or the ability of replacing rapidly and with no extra costs marks from the current production with other ones. This thing stands out the flexibility of product from the flexibility of products (or production) and from that of the process. The flexibility of product corresponds to the flexibility of the answer on demand, while the flexibility of product (or production) corresponds to the flexibility in the range of products. The flexibility of products (or production) comparatively with the flexibility of products, requires considerable reorganizations, but not necessarily supplementary investments of capital. From one point of view, the flexibility of products (or production) allows the firm to compete on a market in which, frequently, new products are being requested, because they minimize the time for implementation of the new products, or the necessary time for bringing some major changes to the existing products, at an operational level allows the diversity of the firm.

We can also say that the flexibility of product represents the system's ability of limiting the introduction cost in manufacturing of a product, using the resources already had, or, in other words, it offers to the system of manufacturing the possibility to realize diversified parts with the same equipments. On short term, this means that the system has the possibility of using small size lots to adapt to the requests of diversified products. On long term, this means that the system can be used for more life cycles of the product, thus, increasing the efficiency of investment.

Therefore, a product is requested to be flexible, that the reorganization should not imply increases of time and costs. The flexibility of product allows the organization to harmonize with the market requests allowing it to bring rapidly new marks on the market.

Some organizations adopt a competing strategy based on the flexibility of product which consists in the capacity of operating difficult commands which are not standardized and to introduce them in a new product. The flexibility of product is more important in the developing phase rather than in its mature phase. Therefore on the quick change markets, because of the incertitude in the life cycle of the product, the flexibility of the product obtained through the capacity of projection assisted by the computer, assures the company an extraordinary competing weapon. The flexibility of product also includes the flexibility of modifications or it can be found in the literature of speciality as the flexibility of new products.

The flexibility of product can be reached by having:

- an efficient and automatic planning of the production and a performance control system;
- the flexibility of the transfer system;
- the operational flexibility;
- an efficient interference CAD/CAM and CAPP.

By evaluating the flexibility of the product, it can be taken into consideration the time and costs necessary for the passing from producing a different marks system to another system, not necessarily of the same type.

The growth of flexibility of product can be measured on the base of new products introduction costs, for example: the cost of equipment and tools, the costs of the numeric command programs necessary for the manufacturing of the new product.

A generic measurement of flexibility is based on the premise that the flexibility of a system is determined by its sensibility to changes. The more decreased the sensibility is, the more increased is the flexibility. The increased flexibility brings to the system of fabrication three main advantages. It is considered that these advantages come from the different types of flexibility, which can be divided in three main categories:

- the flexibility of product;
- the flexibility of operation
- the flexibility of volume.

As the flexibility is inversely proportional with the sensibility of change, a measure of flexibility must, also, quantize the penalties due to the change (PC).

If the change can be implemented without penalties, than the system has a maximum of flexibility, and PC = 0. But, if the results of changes bring great wastages, than the system is very inflexible, and "PC" is very increased.

An important question in what concerns flexibility is: "How flexible should a system be now to encounter changes for the future?" This question refers to the future changes of the request, which cannot be anticipated exactly. To prevent the incertitude of prognosis, the indicator "PC" and the request for change probably settled should be taken into consideration. A system which cannot accommodate to the changes which will appear is not useful and should not be considered flexible.

The indicator "PC" represents the product between penalty and probability:

PC = Penalty × Probability

The more decreased the indicator "PC" is, the more increased is the flexibility. If the penalty for change is small, than the indicator "PC" will be decreased, indicating a big flexibility. If the probability to change is small, PC will be small, too, even if the penalty for change is relatively big. This reflects the fact that the system should not be considered inflexible when it has a big penalty for change and a small probability for the change to appear. Thus, a system should not be considered more flexible than another one when there is a minimal penalty of change and a small probability for the change to appear.

The value of "PC" indicator is based on two components: the penalty to the potential change and the probability of the potential change, where the change represents the transition from a state to another.

The nature of this state depends on the considered type of flexibility: for the flexibility of the produce, a state can be the type of the produce manufactured by the system; for the operational flexibility, it can be the operational state of the system; for the flexibility of volume, it can be the rate of the production request.

Penalty and probability could be seen as functions of a discrete variable "X" which represents the potential change. A value of "X" is noted with "X_i". For example, if we have three states A, B, C than the possible values of X will be: X_1 (A^0; A), X_2 (A^0; B), X_3 (A^0; C), X_4 (B^0; A), X_5 (B^0; B), X_6 (B^0; C), X_7 (C^0; A), X_8 (C^0; B) and X_9 (C^0; C), where (A^0; A) – signifies the

fact that the system remains in the same state A, (A^0; B) – the system passes from state A to state B etc.

The penalty to change (PC) can be defined:

$$PC = \sum P_n(X_i) \times P_r(X_i) \quad i = (1 \ldots D) \quad [u.m.]$$

where: D = number of the potential change;
X_i = a- "i" – a, potential change;
$P_n(X_i)$ – penalty for a_i – a, potential change;
$P_r(X_i)$ – probability for a_i – a, potential change.

The calculation of "PC" indicator can be seen as an application of a decision taken with incertitude, where X_i represents a future possible circumstance, $P_n(X_i)$ – the values attributed for each of these circumstances, and $P_r(X_i)$ – the probability for these circumstances to take place.

As it was seen, "PC" can be used to evaluate the flexibility of product, of volume and the operational flexibility. To understand how to use the indicator "PC", the following example is presented:

The flexibility of product is evaluated for two systems of fabrication A and B. The flexibility of product reflects the possibility of the system to make a variety of produces with the same equipment. It is assumed that there is a 70% probability that the following product which will be fabricated is the product 1, and a 30% probability for it, to be product 2. Also, it is assumed that product 1 is likewise with the product which is being fabricated at the moment and thus it can be processed in system A with changes which costs only 20 mil. u.m. beside product 2 which would cost 50 mil. u.m. System B is a system whose implementation would cost 80 mil. u.m. Evaluating flexibility as the product between penalty and probability we obtain:

→ PC_A = *20mil. u.m.* × *70% + 50 mil. u.m.* × *30% = 29 mil. u.m.*
for system A;

→ PC_B = *80 mil. u.m.* × *70% + 80 mil. u.m.* × *30% = 80 mil. u.m.*
for system B;

"PC" is more decreased for system A than for system B, which means that system A is more flexible than system B.

The flexibility of product is measured using the presented indicator (PC), and the formula:

$$FP = -\sum_{i=1}^{n} \frac{C_{pi}(xi).P_{pi}(x_i)}{(1+e)^a} \qquad [u.m]$$

where: a = 1, …, N – the number of years;
C_{pi} – the cost of the potential change, in year "a", of product "i" [u.m.];
P_{pi} – the probability for potential change of the product "i" in year "a" [u.m.];
e – the actualization coefficient.

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