A WAY TO OPTIMIZE THE ORGANIZATIONAL STRUCTURES

Radu D. STANCIU

University POLITEHNICA of Bucharest, School of Entrepreneurship, Business Engineering and Management, radu.stanciu@upb.ro

Abstract—Individuals and groups operate within a framework of larger groups described as organizations. The way of employees grouping, the relationships established between them represent the organization's structure. There are different types of structure, each of them with advantages and disadvantages, but the general trend is to change those structures in order to better adaptation to a changing environment and to improve the organization performance. The necessity of change rises when the organizations are faced with some specific problems like failure in achievement of planned objectives, slower decision process and poor decision quality, decreasing of employees' moral, managers fatigue appearance, increasing of operations and total costs. The paper presents a way of optimizing the organizations structure by resizing the span of control and the number of management levels.

Keywords—organizational structure, span of control, management level

I. INTRODUCTION

WITHIN the management process, the organizational structure represents a tool that may intensify the efforts for company's objectives fulfilment.

The organizational structure represents the way the employees group and establish formal relations between them.

The way the resources – people, materials, money – are combined is decisive not only to the efficiency of the activities necessary to meet the objectives but also to the quality and the promptness of the decision making process, the configuration and the function of the informational system, the diversity of management and organizing methods and techniques, the economic environment features. [1], [2]

The organization's structure is part of the organizing process of a company. That process involves also some other activities like decision making, communication, etc. that combined may lead to the desired level of profit and to the fulfilment of company's objectives. [3]

The importance of the organizational structure consists mainly in conditioning the level of profit as a fundamental component of and influences the function of the management system.

The organizational structure is the skeleton of the management system. Nor only because of its impact on economic results of the organization but also because its importance for the level of work satisfaction and labour climate. [4], [5]

One may identify some assessment criteria for an organizational structure that generate specific effects on the economic results of the company [6], [7]:
1) facilitation of the human resources specialization (can lead to an increasing of productivity and work satisfaction of the individuals)
2) reasonable management costs
3) the coordination difficulty at the company and departments level
4) the response time of the system
5) the flexibility of the adaptation to change.

When a company has poor economic results is a sign for its management that a change must occur in its structure. Some of the symptoms that may lead to the idea of the necessity of structure modifications are [6]:
1) non-fulfilment of the planned objectives
2) the decision making process is slow and the quality of the decisions is low
3) the decreasing of the employees involvement
4) managers' fatigue
5) management costs increasing
6) total costs increasing.

II. THE MAIN ELEMENTS THAT INFLUENCE THE EFFICIENCY OF AN ORGANIZATIONAL STRUCTURE

The basic elements of an organizational structure are the following:
1) job position
2) labour compartments
3) span of control
4) chain of command
5) management level, and
6) organizational relations (connections)

Even if, all the elements are important for an organization, its structure may be characterized by two parameters – n, number of management levels, and x, the

span of control size (number of persons subordinated to a manager that depends on the nature of jobs managed).

In the same time, the number of management levels influences the efficiency of the management work. Less number of levels generates a larger area of control and, as a result, a greater coordination and control efforts

A greater number of levels conduct to a decreasing of the responsibilities and no correlation between decision and reality.

Because of their strong interaction between the number of levels and the span of control, the modification of any of those two parameters will influence the value of the other one. The positive effects from a certain point of view (for example, the reducing of the number of levels and therefore the reducing of the indirect expenses) may lead to negative consequences from the other point of view (for example, the increasing of the employees subordinated to a manager).

Equation (1) illustrates the relation between the number of employees, N, and those two parameters as average values.

$$N = 1 + x + x^2 + x^3 + ... + x^{n-1} = \frac{x^n - 1}{x - 1} \qquad (1)$$

where x^{n-1} represents the number of employees, the rest of the terms are representing the number of managers.

As a rule, the span of control decreases from the bases of the management pyramid to its top because of the increasing of the importance and the complexity of the management problems. In the top of the pyramid must be solved the most important problems that affect the organization as a whole, while at the bases are common, routine, day-to-day problems and therefore the span may be larger.

The span of control may also influences the number of relations between a manager and his or her subordinates. For strong interactive groups where manager's assistance is continuous, the number of relations may be determined by using Graicunas's relation (2)

$$R = X \cdot (2^{X-1} + X - 1) \qquad (2)$$

where R represents the number of relations between a manager and its subordinates

As one may observe, an arithmetic increase of the span of control may generate a geometric increase of the number of relations.

Going back to (1), if one considers N as a constant, increasing or decreasing the other two parameters can modify the management pyramid: n and x. That indicates a possibility to find an optimal solution for the structure. [6]

III. THE OPTIMIZATION OF AN ORGANIZATIONAL STRUCTURE

In order to optimize the structure of an organization one may have to take into consideration the variable costs determined by the management system which are influenced mainly by the span of control. Those costs can by group in two categories: $C_1(x)$ – costs generated by the management wages and other benefits; $C_2(x)$ – costs generated by the increasing of the span of control or by diminishing of the system's coordination and control. The result is a function that must be minimized (3).
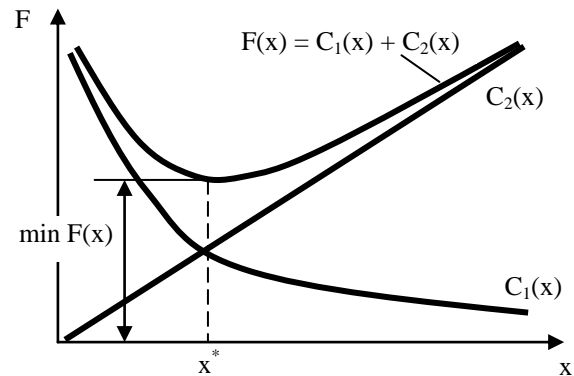

Fig. 1. Management costs variation with the size of control area.

$$\min F(x) = C_1(x) + C_2(x) \qquad (3)$$

Fig. 1 illustrated the graphical representation of the function.

The term $C_1(x)$ can by write as:

$$C_1(x) = \overline{W} \cdot (1 + x^2 + ... + x^{n-2}) = \overline{W} \cdot \frac{x^{n-1} - 1}{x - 1} \cong \overline{W} \cdot \frac{N}{x} \qquad (4)$$

where $\overline{S}$ represents the management annual average wage.

The term $C_2(x)$ can by written as in (5).

$$C_2(x) = a \cdot x^b \qquad (5)$$

where a and b represent the regression coefficients calculated through the least-squares method used in the case of some competing companies and illustrated by (6).

$$\sum_{j=1}^{m} [C_2^j(x) - a \cdot x_j^b]^2 = \min \qquad (6)$$

where m represents the number of analysed companies. Then by allying logarithm, results (7).

$$\sum_{j=1}^{m} [\ln C_2^j(x) - \ln a - b \cdot \ln x_j]^2 = \min \qquad (7)$$

By analysing the partial derivatives with respect to a and b, one can obtain (8).

$$\begin{cases} \sum_{j=1}^{m}[\ln C_2(x_j)] = n \cdot \ln a + b \sum_{j=1}^{m} \ln x_j \\ \sum_{j=1}^{m}[\ln C_2(x_j) \cdot \ln x_j] = \ln a \sum_{j=1}^{m} \ln x_j - b \sum_{j=1}^{m}(\ln x_j)^2 \end{cases} \quad (8)$$

The function F(x) becomes (9).

$$F(x) = C_1(x) + C_2(x) = \overline{S} \cdot \frac{N}{x} + a \cdot x^b \quad (9)$$

During the optimization process we have to take into account at least the restrictions: x^{n-1}= constant and x and n are nonnegative variables.

In order to minimized F(x) we have to determine its derivative (10)

$$\frac{dF}{dx} = -\frac{\overline{S} \cdot N}{x} + a \cdot b \cdot x^{b-1} = 0 \quad (10)$$

that leads us to relation (11).

$$a \cdot b \cdot x^{b-1} = \frac{\overline{S} \cdot N}{x} \quad (11)$$

The experiment took place in six different industrial companies. Table I synthesizes the information regarding the structures parameters.

TABLE I
THE STRUCTURE'S PARAMETERS FOR THE ANALYSED COMPANIES

No	Company	N	No of managers	$\overline{W}$ lei/year	C_2 lei/year	x	n
1	A	286	31	120×10^6	10^9	9.22	3.51
2	B	1730	80	72×10^6	3×10^9	21.62	3.41
3	C	75	16	132×10^6	0.4×10^9	4.68	3.64
4	D	570	40	72×10^6	2×10^9	14.25	3.36
5	E	576	51	72×10^6	2×10^9	11.29	3.58
6	F	248	37	132×10^6	1.7×10^9	6.70	3.81

The values for the average annual wages and for the costs generated by the increasing of the control area or by diminishing of the system's coordination and control were found in the accounting records of each company.

The average span of control was determined as a report between the number of employees and the number of managers.

The average number of management level was determined by using (1).

Table II presents the systematization of the computations for determination of a and b.

TABLE II
SYSTEMATIZATION OF THE COMPUTATION FOR PARAMETERS A AND B

No	Company	x	$C_2(x)$	$\ln C_2(x)$	$\ln x_j$	$\ln C_2(x) \cdot \ln x_j$	$(\ln x_j)^2$
1	A	9.22	10^9	20.72	2.22	45.99	4.92
2	B	21.62	$3 \cdot 10^9$	21.82	3.07	66.98	9.42
3	C	4.68	$0.4 \cdot 10^9$	19.80	1.54	30.49	2.37
4	D	14.25	$2 \cdot 10^9$	21.41	2.65	56.73	7.02
5	E	11.29	$2 \cdot 10^9$	21.41	2.42	51.81	5.85
6	F	6.70	$1.7 \cdot 10^9$	21.25	1.90	40.41	3.62
	$\sum_{j=1}^{m}$	67.76	$10.1 \cdot 10^9$	126.41	13.80	292.41	33.20

As an example for computation of the optimum control area is presented the case for company A. The equation is:

$$1.2 \cdot x_1^{0.2} \cdot 0.0886 \cdot 10^9 = \frac{120 \cdot 10^6 \cdot 286}{x_1^2} \Rightarrow x_1^* = 13.8 \, \text{persons/manager}$$

By introducing that value in (1) we obtain also the optimum number of management levels which, in our case is 3.15.

By doing the same computation for each analysed company we obtained the optimum value for the control area, as shown in table III

TABLE III
THE REAL AND THE OPTIMUM SPANS OF CONTROL FOR THE SIX COMPANIES

No	Company	Size of control area		No. of management levels	
		Real	Optimum	Real	Optimum
1	A	9.22	13.8	3.51	3.15
2	B	21.62	24.9	3.41	3.30
3	C	4.68	7.87	3.64	3.03
4	D	14.25	15.03	3.36	3.31
5	E	11.29	15.10	3.58	3.32
6	F	6.70	13.56	3.81	3.08

After determination of the optimum span of control and management levels (as average values) is the moment to redesign the organizational charts for each company.

Fig. 2 illustrates the logical scheme of the optimization process.
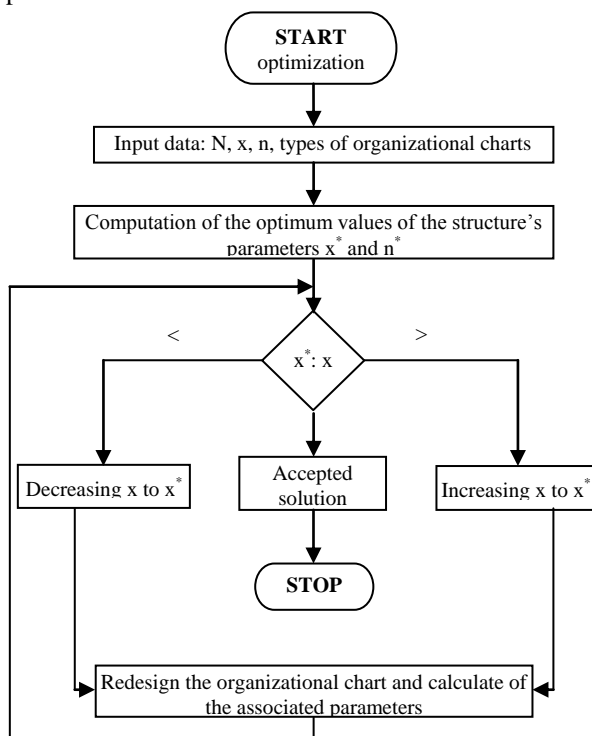

Fig.2. The model of optimizing organizational charts through iterative method

After some iteration, each time redesigning the organizational chart we succeeded to obtain the optimum one for each company. Table III illustrates the real and the optimum number of manager.

In conclusion, comparing with real values of the control area and the number of management levels the optimum values had significant differences. That is why is absolutely necessary to redesign the organizational chart in order to improve the quality of the management process and to obtain substantial benefits for the companies.

IV. CONCLUSION

The role of an organizational structure must not be limited only to the organizational premises assurance for the economic objectives fulfilment at lower costs.

Because of its importance in the general view, one may take into consideration also the human factor. To put in other words, the organizational structures must lead to objective fulfilment with the lowest economic and social costs.

A lower social cost, reflected in the employees satisfaction regarding the working conditions, relations with their supervisors, the quality of the social services, etc. may increase the economic efficiency of a company. In this way, the organizational structure contributes to a balance between group and individual interests.

The analytical method presented in the paper can help the management of the analysed companies to optimize their structures by using and iterative algorithm.

In developing the iterations is very important to know the specific for each department. If control and coordination requirements do not justify the number of managers, some of them can be moved in other department that needs more managers. If the costs of a department are high, one can divide it in smaller departments each of them with their own managers.

However, this kind of optimization process needs well-trained persons with large management, technical, sociological and psychological knowledge.

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