HIERARCHICAL-TYPE STRUCTURES OF THE INDUSTRIAL ENTERPRISE

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ABSTRACT

The assessment of hierarchical structures has long been under examination by scientists for more than a hundred years. Hierarchical structures are significantly associated with effective management and bureaucratic decisions making. A wide range of problems exists on this subject, including the analysis of the most applied management models at the enterprises. These models describe hierarchical structures, and also permit the reduction in management expenses. Methodological basis of the real research are classical concepts presented in different branches of the management theory. The real research is based on methods of the functional and structural analysis, as well as on empirical observation method.

Adequate evaluation of hierarchical structures enables an achievement in efficiency of enterprise management. The importance of the research findings comprises the presented recommendations and in a new approach of hierarchical structures assessment. These results can be used by market-related institutes, e.g. insurance companies, banking institutions, auditor companies, etc.

JEL CLASSIFICATION & KEYWORDS

■ B40 ■ C61 ■ D24 ■ HIERARCHICAL STRUCTURE ■ MANAGEMENT EFFICIENCY ■ ORGANIZATIONAL COST ■ MARKET INSTITUTE ■ MULTIDIMENSIONAL ORGANIZATION

INTRODUCTION

With its own management system, each enterprise possesses a certain hierarchical structure and features of managerial decisions. Enterprise activity represents natural process of adaptation to environment factors.

If an enterprise successfully functions in the market, it means that this organization harmoniously interacts with its environment and adapts to its characteristics.

An environment represents conceptual, dynamic, stochastic, and unpredictable characteristics. Unfortunately, the environment casts a negative impact on the enterprises and significantly defines their management efficiency.

If the enterprise possesses low potential of adaptation and low degree of stability, in that case, the risk of financial losses will be significant.

We have found that the enterprise can avoid losses, to external factors, due to rational responses of hierarchical structures. For effective management of a hierarchical structure, the manager has to quickly and promptly receive all relevant information of the system, which he or she operates. Incompleteness of information (information asymmetry) can lead to some serious negative consequences, namely a loss of profit.

An assessment of management efficiency is more accurate when it is possible to define the reasons for unsuccessful decisions making and to easily execute rapid corrections.

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Complexity of management problems in the enterprise, especially regarding an efficiency assessment, inevitably demands application of new approaches. In the context of the management theory, it is possible to assess hierarchical structures and to investigate communications between hierarchical chains.

Features of hierarchical management structures in the enterprises

Traditional types of hierarchical structures are described in detail in monographs of well-known scientists, including Drucker (1992), Radchenko (2000), Milner (1999), and Sloan (2011). On the basis of more detailed hierarchical research, we offer a new structures classification. Table 1 summaries the characteristics of the different types of hierarchical management systems.

Table 1: List of hierarchical management structures	
Types of hierarchical structures	**Characteristics**
Arterial structures	Accurate system of mutual communication between elements of structures. Achievement of strategic objectives. High degree of flexibility and adaptation to situation change.
Secondary structures	Support function on service of the arterial structures. Fast reaction to "orders" of the arterial structures.
Tensor structures	Tensor structure can include the rules and regulations of strategic decisions making, financial planning, functional activities coordination, products and quality management, regional divisions and various corporate projects.
Symmetric/asymmetrical structures	Symmetry can be defined by architecture of the production line, and also by managers quantity and the workers
Multicomponent structures	Structures are typical for enterprises with a complex manufacturing cycle. In multicomponent production flow with the participation of highly specialized managers it is possible to lower management expenses considerably. The part of production flow doesn't demand intervention of managers as workers can resist a load. Standardization increases a share of production flows which aren't demanding intervention of managers.
Source: Author	

Typically, in the enterprise, there are some leading departments that work rather effectively. These departments would realize homogeneous tasks and carry out their main functions. The aforementioned departments are the arterial structure of the enterprise. Secondary structures act as necessary auxiliary "superstructure." Auxiliary structures are

engaged in services of the arterial structures and must always be ready to provide them with necessary support. Sometimes, it is reasonable to determine a load coefficient of the arterial structures and of the secondary structures.

However, total characteristics of the real organizational structure could not be presented precisely by using schemes or schedules. In fact, the real enterprise structure is multidimensional (tensor).

We presented the degree of subordination, established in the organizations, as shown in Table 1. Very important management decisions are made in accordance with the rules of procedure. For example, the budget adoption in the organizations is dictated by instructions. According to these instructions, each manager would assume certain amount of power and responsibility. All participants of work process, including the director general, rigidly submit only to the regulations. All the managers have no right to make any decision, which is contradictory to these regulations.

In the multidimensional organization, the question of strategic decision making is of a great importance. Consequently, it is important to define level and quantity of managers participating in the development of a long-term strategy for the enterprise.

Further, it is necessary to consider a wide range of functional directions on which the various levels of company management are focused. In particular, in the regional branch of the enterprise, for instance, a marketing department may serve under a branch director. At the same time, the marketing director in the main office is still the functional head who leads the coordination of marketing activities. Thus, the marketing department reports to two department heads. This matrix scheme is not always reflected in the scheme of links subordination. However, this scheme has functioned successfully at many enterprises. Similar matrix schemes exist in other functional directions, including financial, IT technologies, etc. Thus, the multidimensional picture is constructed. The general subordination scheme must include necessary instructions of strategic decisions, financial planning, and coordination of the functional directions. The description of organizational structure has to reflect all these aspects.

We also considered chord structures, which function as "transit points" and transfer information to the main center. For instance, when the main communication channel is overloaded or is out of service this chord structure would serve as the conductor of the operational information connecting the center to the relevant departments.

Symmetric and asymmetrical structures also take place within the enterprises. There are symmetric production lines and asymmetrical production flows, which depend on manufacturing cycle. For example, a certain type of raw materials can be transferred from one worker to another during different periods. Raw materials are often altered for use with various technological cycles.

Multicomponent structures are a characteristic for enterprises with a complex manufacturing cycle. The simplest example of multicomponent structures is the two-component technological cycle. This cycle includes raw material and information. In this situation, the manager spends a certain amount of material and, at the same time, transfers operational information to a hierarchical level.

Management expenses in hierarchical structures

Management expenses play a major role in each hierarchical structure. Every manager in the organization must be analyzed, evaluated and accounted for in management expenses. Here, it is necessary to consider not only a manager's salary, but also the expenses incurred from workplace preparation, maintenance, and various purchases of equipment and software.

Expenses depend on the volume of work, which is performed by the manager. Number of managerial decisions, which are made by the manager, will define the volume of work and expenses. According to Mishin (2004), the total volume of work and manager's expenses can be calculated using the following formulas. The total volume of work is defined by,

$$\mu_1{}^{\alpha} + ... + \mu_k{}^{\alpha} \tag{1}$$

and manager's expenses are defined by,

$$C(\mu_1,...,\mu_k) = (\mu_1{}^{\alpha} + ... + \mu_k{}^{\alpha})^{\beta} \tag{2}$$

Parametric variable "k" is the number of worker(s). Thus, this manager directs a group of workers from μ_1 to μ_k.

The hierarchical structures of management expenses can be summarized in Table 2.

Table 2: Management expenses classification
Management expenses in hierarchical structures
Linear management expenses depending on the size of the organization
Superlinear management expenses depending on growth of the organization
Manager work costs (offices rent, purchase of the computer equipment and multimedia equipment, maintenance costs of secretaries, assistants)
Management expenses depending on optimum span of control
Management expenses connected with growth by an atypical problems
Management expenses connected with specification of business plans and orders
Management expenses connected with asymmetry of information streams
Management expenses connected with retraining (reshaping) of employees
Management expenses of technological cycles (unicomponent, multicomponent)
Management expenses of two-level hierarchies, expense of multiple hierarchies
Source: Author

It is expedient to offer expenses reduction recommendations in the organizations.

Primarily, on the basis of empirical observation, it is necessary to construct mathematical function of the management expenses. Secondly, we have to define to what class the mathematical function is referred, e.g. homogeneous function, inhomogeneous function, monotone, suboptimum, etc. Next, it is necessary to define the optimum span of control; then, it would be possible to calculate expenses (C). Consequently, we can consider cost reduction measures.

In any organization, there will always be a question of how to find an optimum combination of employees who are experts in technologies and those who would be excellent managers.

See Table 3 on other page.

Depending on organizational specifics, e.g. its profile, requirements, clients and strategic growth prospects, the mosaic of the optimum combination of managers and workers can be built.

Table 3: Cost reduction methods	
Management cost reduction	**Description**
Employees professional development	In the manufacturing cycle costs can be cut by participation of new employees. Also new employees allows to reconstruct technological chains of management.
Change of managers specialization	Capital investment in professional managers development, management expenses decrease though the general of expenses of top management can grow up.
Change of managers quantity in the hierarchy	Qualification growth will lead to reduction of managers quantity in hierarchy, therefore expenses of certain tightly specialized managers will grow (more qualified managers are able to execute the work bigger volume).
Change of the span of control change	With growth of manager qualification increases also the optimum span of control (more qualified managers operate a large number of subordinates). With growth of management norm the number of managers decreases.
Increase of the information speed exchange between workers and managers	The manager has to process and detail the obtained order and bring it to the attention of the subordinates. For this purpose managers use certain information technologies (phone, the Internet, e-mail).
Reaggregation of hierarchical architecture	In certain cases existing hierarchical structures can be inefficient. (For example, sometimes the problem can be solved having appointed additional highly specialized managers in the set technological production chain).
Costs reduction of the workplaces	Search of cheaper offices rent, purchase of cheaper software and personal office equipment, computer equipment, decrease in maintenance costs of secretaries, assistants.
Source: Author	

The general indicators of optimum hierarchy depend on the type of mathematical expenses function.

Therefore, the expert opinion about the organization can be made only after the detailed analysis, of all features of hierarchical structure, is carried out.

Conclusion

Considering the hierarchical structures of industrial enterprises, it is possible to see that they represent quite a difficult system surrounding a certain set of parameters and characteristics.

The analysis of hierarchical structures allows us to offer new classification: arterial structures, secondary structures, and tensor structures. All of which enable use to consider the architecture and advantages of hierarchical structures in more details.

The manufacturing system represents the multidimensional matrix, which activity is concentrated on introduction of the more recent prospective programs and projects, economic achievement, and synergetics or other effects within the industrial enterprise.

The manufacturing system can be associated with the difficult dynamic system, having straight-line and nonlinear internal characteristics, which define work of its components.

Management expenses can be lowered by changing managers' profiles and also by increasing speed of information exchange between workers and managers.

References

Drucker, P. F. (1992). Reflections of a Social Ecologist. Society, 29(4), 57-64.

Mishin, S. (2004). Optimum stimulation in multilevel hierarchical. Automatic equipment and Telemechanics, 5, 97.

Milner, B. (1999). Organization theory: for students of the higher education institutions. [Textbook for higher education institutions]. Retrieved January 2, 2014, from http://bibliotekar.ru/teoriya-organizacii/index.htm

Radchenko, Y. (2000). Organization theory [Lectures for the student]. Retrieved January 5, 2014, from http://ftp.sibstrin.ru/management/theoryoforganization.pdf

Sloan, A. (2011). Sloan A. and the Triumph of General Motors. [Electronic resource]. Retrieved June 16, 2014, from http://textb.net/102/12.html