

ASPECTS REGARDING THE USE OF NEURAL NETWORKS IN THE ORGANIZATIONAL MANAGEMENT OF RESEARCH AND DEVELOPMENT OPERATORS IN THE NONCONVENTIONAL TECHNOLOGIES FIELD

Simona-Ioana Marinescu

“Lucian Blaga” University of Sibiu, “Hermann Oberth” Engineering Faculty, simona.marinescu19@gmail.com

ABSTRACT: The paper makes particular reference to the possibility of using neural networks in the existing human resources management, within the business operators with activities in the unconventional technologies field. In this context, adopting the analysis method using neural networks is based on the idea that these operators must show a permanent specific flexibility in making decisions regarding the necessary of organizational structures and human resources, given that the specific of their activities is oriented to small series and unique productions. In these conditions, the top management of the company must have permanent options of the specific organizational structure, both in the context of the analysis and of their own human resources, and of the variants of cooperation with third persons. All this primary information can be referenced by a pertinent analysis performed using neural networks.

KEY WORDS: neuron, artificial network, neural network, artificial intelligence, management

1. INTRODUCTION

The Biological Neuron is a specialized, impulse-conducting cell that is the functional unit of the nervous system, consisting of the cell body and its processes, the axon and dendrites.

The three parts that compile the neuron are represented in Figure 1 [1]:

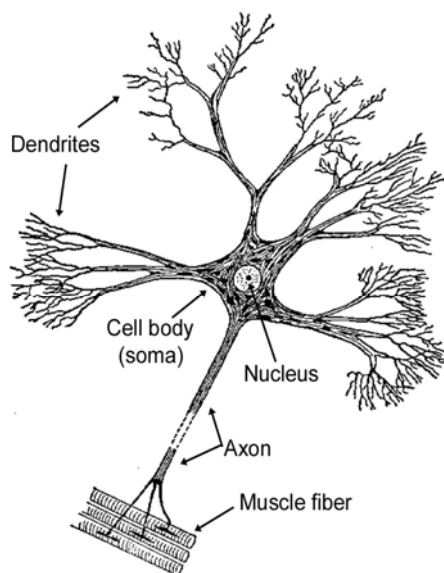


Figure 1. Components of a neuron

The neuron and its architecture describe how a network transforms the input data into output data.

Neural Networks have connections with a lot of fields, including: **Biology, Neurophysiology, Cognitive Psychology, Informatics** (Artificial

Intelligence, Data Mining), **Engineering** (Signal Processing, Adaptive Control), **Mathematics** (Linear Algebra, Numerical Analysis, Statistics, Differential Equations), **Economy** (Stock Prediction, Risk Analysis), and, as in any other field, the study of neural networks has also experienced periods of intense research, and periods of slighting [2].

Studies began the state in the late nineteenth century, early twentieth century, and those who issued the first theories in this area are Hermann von Helmholtz, Ernst Mach and Ivan Pavlov.

The first practical application, the perceptron appeared in 1959 - carried out by Frank Rosenblatt-used for character recognition [3].

Amongst the areas where the use of neural networks had good results, there are:

- Approximations of functions;
- Control of industrial robots;
- Classification;
- Recognition of patterns and voices;
- Financial projections;
- Market Research;
- Forecast of marketing;
- Medicine etc.

2. BIOLOGICAL NEURAL NETWORK AND ARTIFICIAL NETWORK

There is no clear definition of the terms "neural network" and "neuronal network". Thus, few people know the difference between the two networks: the fact that the neural network is related to a technical

system, while the neuronal network refers to a biological system, the neuron.

In neuroscience, a biological neural network (sometimes called a neural pathway) is a series of interconnected neurons whose activation defines a recognizable linear pathway [4].

Examinations of the human's central nervous system inspired the concept of neural networks. In an Artificial Neural Network (Figure 2) [1], simple artificial nodes, known as "neurons", "neurodes", "processing elements" or "units", are connected together to form a network which mimics a biological neural network.

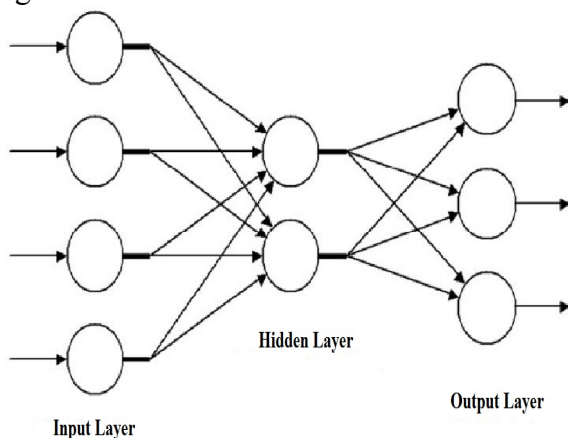


Figure 2. Artificial Neural Networks

Knowledge of how the human brain and the central nervous system function, allows us to understand how the artificial neuronal networks (neural networks) work and are developed.

The neural networks have a different structure than the neuronal networks, much simpler, composed of units with lower computing capacity than the neural networks [5].

The artificial neuron is a lot more simplified copy of the biological neuron and it represents the basic structural and functional element of the distributed information processing systems that imitate the operation of a biological neuron, with strong connectivity properties [6].

It is composed of a body, a set of n inputs and one y output. The x inputs are signals coming from other neurons or from the outside world and are represented through real numbers x_1, x_2, \dots, x_n [1].

There is no generally accepted definition for the neural networks, as most authors agree that these are some combinations of simple processing elements aimed at interacting with the environment in the same way as the biological brain and having the ability to learn, highly interconnected and operating in parallel.

A class of statistical models may commonly be called "Neural" if they possess the following characteristics:

1. consist of sets of adaptive weights, i.e. numerical parameters that are tuned by a learning algorithm, and
2. are capable of approximating non-linear functions of their inputs.

Simon Haykin believes that a neural network is a massive parallel processor, distributed, which has a natural tendency to store experimental knowledge and make them available for use [7].

Personally, I think that the neural networks represent a simulation (clone) of the capacity of the human brain, weaker, however, than the neuronal networks, with the power to learn, but only as much as they will be allowed by the person that schedules them (creates them).

Artificial Life - is the name given to a new discipline that studies "life" by attempting to recreate biological phenomena from the inside of the computers or other "artificial" environments.

In 1955 John McCarthy gives us the definition to be the most accepted for "artificial intelligence": "a machine which behaves in a way that could be considered intelligent if it was a man." [1]

Structure and classification of neural networks

The neural networks have a different structure, much simpler, composed of units with lower computing capacity than the neural networks.

Some of the criteria underlying the classification of neural networks are [8]:

- the number of layers of artificial neurons;
- the type of the used artificial neurons;
- the interaction and influence between neurons;
- the network topology;
- the type of learning;
- the symmetry of the connections, the number of layers;
- the evolution time of the network status, etc.

Properties and Characteristics of Neural Networks

The main properties of neural networks are: information and knowledge are distributed throughout the network (through synaptic weight values); neural networks provide a global response; possess learning (training) properties, adaptation, generalization, parallelism, robustness, fault tolerance and disturbance [9].

The neural network's characteristics are:

- *The Ability to Generalize*: if they have been properly trained, neural networks are able to give correct answers even for different inputs from those who have trained them, as long as these inputs are not very different;
- *The Ability to Summarize*: neural networks can decide or draw conclusions of their own, even when they are confronted with noisy information or inaccurate or partial information;
- *The Ability to Learn* (the main feature): neural networks do not require strong programs, but are rather the result of training on a massive set of data. Neural networks have a learning algorithm, whereupon the weights of the connections are adjusted on the basis of presented models; neural networks learn from examples.

3. ORGANIZATIONAL STRUCTURES FROM THE NONCONVENTIONAL TECHNOLOGIES FIELD, ANALYZABLE WITH NEURAL NETWORKS

The organization on every level of social life is constantly demanding dilemma caused by the conflict between the desire for freedom of the individual in the labor process and the systematic restriction of this freedom for individuals throughout the organization.

The dimensions of this conflict depend essentially on the chosen managerial perceptions, which can be grouped into two large categories, according to the following relationships between managers and subordinates:

- relationships based on authority;
- relationships based on trust and accountability.

Considering these two great managerial concepts, or possible mixtures between them, choosing the organizational concepts should take into account the following:

- the main objective of the organization;
- the level of education and training of the members;
- the realities of the working economic environment of the industrial organization.

The important role of the economic environment, in developing the activity, is reflected by the following factors that influence the organizational structure:

- factors from the external relations of the organization;
- factors from the internal relations of the company.

Once the influence factors have been identified and the general concept of organization has been established, the classic process of the functional and

structural organization of the enterprise can be conducted.

Through the organizational structure of the enterprise we understand, essentially, the way of distribution on structural units of the entire set of activities and, hence, their correlation to ensure an efficient operation under technical and economic aspects.

The concepts of embodiment of an organizational structure are classified in the state of the art, into two systems:

System-1 (classic bureaucratic, formalistic, mechanistic);

System - 2 (bureaucratic, information, organic).

Based on these two major systems (1 and 2), the classical organizational structure variants are classified, taking into account the function criteria, the product criteria and the matrix criteria.

Therefore, in this paper some organizational structures from the operators field in unconventional technologies will be presented, structures that, we believe, may be granted some managerial flexibility justified by using neural networks, namely:

- organizing the project centers;
- structural organization for "satellite" companies;
- structural organization of SMEs.

In practical terms, the matrix organization realizes the existence of some coordinator managers of activities functions, with the influences and the vertical linkages as well as coordinating some building products departments, also achieving a horizontal structure of the authority (there is also a compromise between the function organization and the product organization).

Specific to this organizational structure is the fact that, besides its classical compartments specialized on industrial organizational functions, the so-called "projects" are being organized.

"Project" means a group of people receiving tasks to handle the generation of a new product, equipment and technologies, each project being conducted by a manager.

So, each team member reports to the project leader and his or her supervisor, the essential advantage of the application of this type of organization results from the facility of coordinating the current activities and the renewing of the production and technology activities. We also have the disadvantage due to communication and control in dual subordination.

Product managers (project managers)

If the technological progress is strongly manifesting so that the new product development becomes a way of life in the industrial organization, project centers with a permanent role are created.

This raises, inevitably, a dual subordination with a diffusion of horizontal and vertical authority of the project team members, generating uncertainty (Figure. 3) [10].

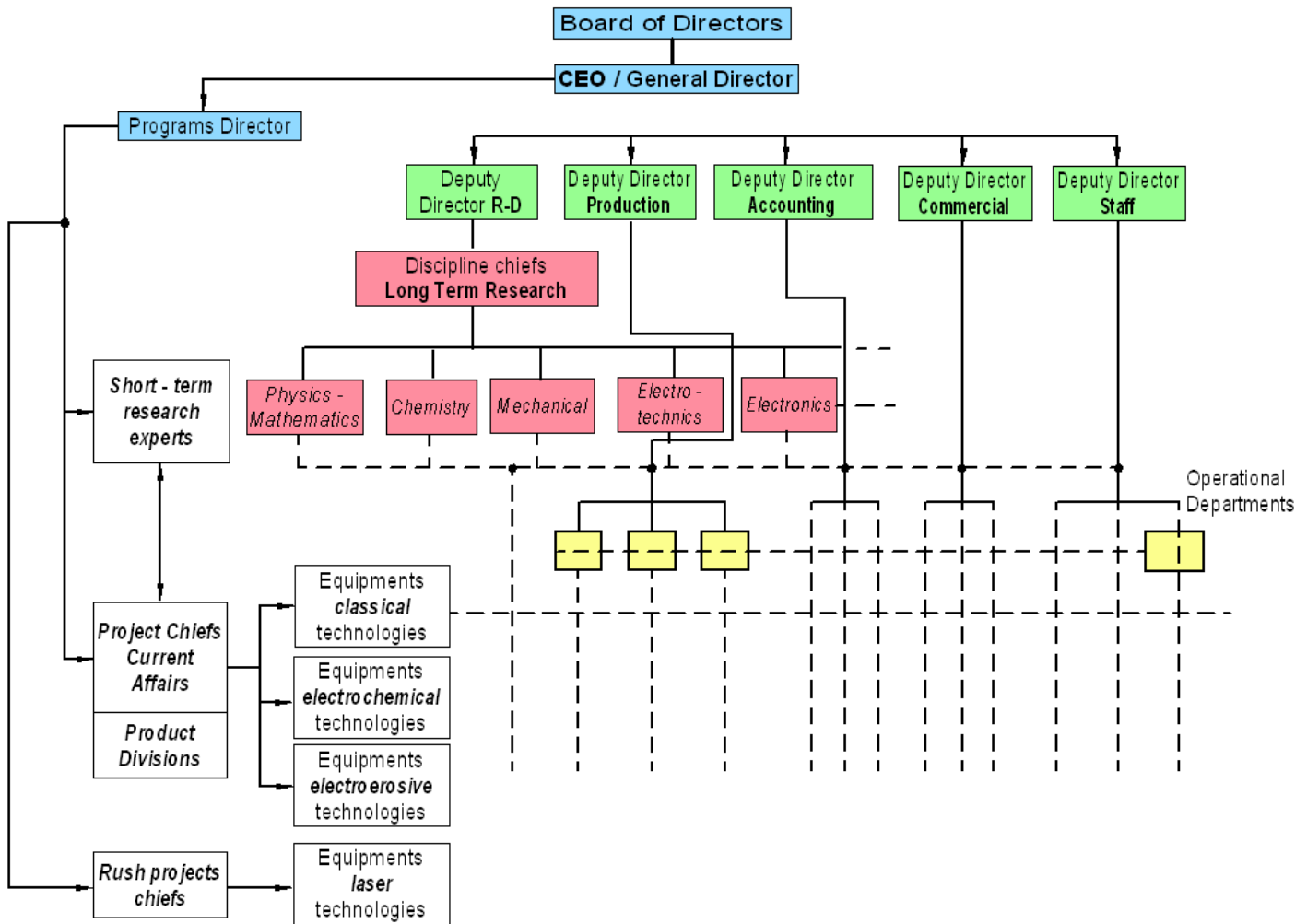


Figure 3. Organization on project centers

Worldwide, it is found that in the activity of large enterprises, appears daunting lack of innovation, of technical progress, unlike small businesses that receive higher economic research efficiency.

Consequently, a lot of powerful industrial organizations seek the development of new strategies to deliver the innovation, teamwork and mobility with their own qualities of stability and financial response.

The most answers to these strategic issues are focusing especially on the future adoption of the group structure (due to Schon) [5], in which the big companies are comprising a central unit, encompassing the sections focused on the functions of the organization (R-D, Pr, A, C, S), geared especially toward current activity (towards the

products that have caught the market and especially manufactured in large "Large Quantities", "Mass" production type quantities), surrounded by a group of satellite companies, with relative independence.

The types of satellite companies are oriented in two directions:

- small business "Satellite" companies oriented towards R-D;
- small business "Satellite" companies oriented towards Production.

Because these satellite companies, especially those geared towards R-D to high technology, present the very goal of their work, a high degree of risk in catching market risk over a certain percentage of the "mother company" (20 .. .40%), it manifests its control, in particular, the financial department.

The idea underlying this organization concept is that the "mother" company should benefit from innovation without divert managerial and organizational resources from the determined core business, but also assuming a common risk.

For example, in Figure. 4, an organizational structure proposal is presented, focused especially on the product, of a small satellite company, in the R-D field and (%) Marketing, having nonconventional technologies as activity object.

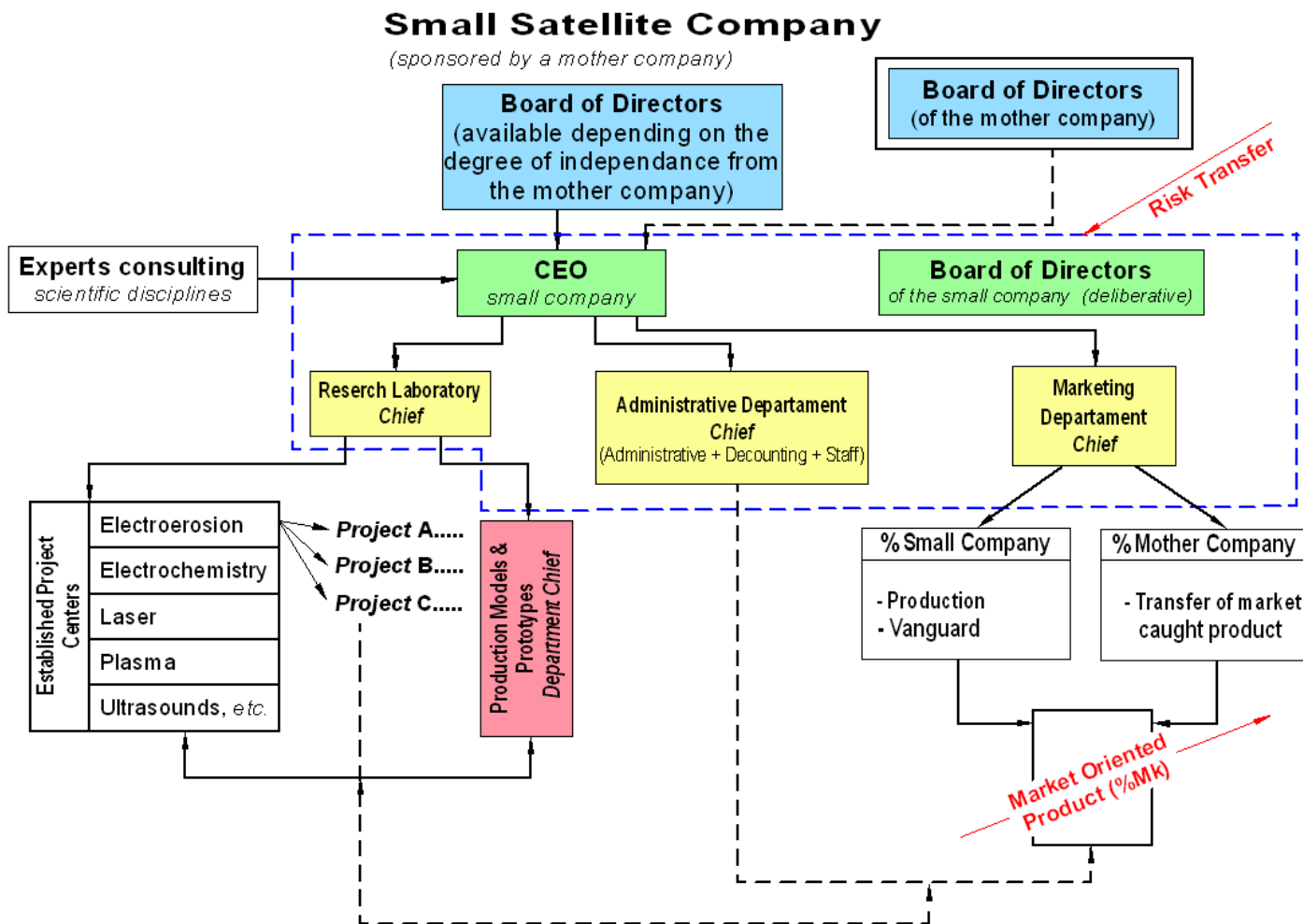


Figure 4. The organizational structure of a satellite company

Unlike a large company, in which even in a matrix organization the functions of the organization are distinctly, with the role of entering in action one at a time, according to the advancement of the project, in a small company, the matrix organization manifests only at R-D and Production.

The remaining functions (costumed) - Administration (Finance, Accounting, Personnel) and, especially Marketing, are working right from the start both over the project centers and over the department.

Specifically, however, for the market economy, in the industry field, is the necessity of the appearance of small firms, completely independent.

The possible organization of these types of small companies (Figure. 5) highlights the need for the marketing activity to direct strongly and immediately production activities.

The organizational structure will be able to partially adopt the matrix form, but oriented on a product based structure to confer itself flexibility according to market demands.

Small Company
fully independent
in the Nonconventional Technologies Field

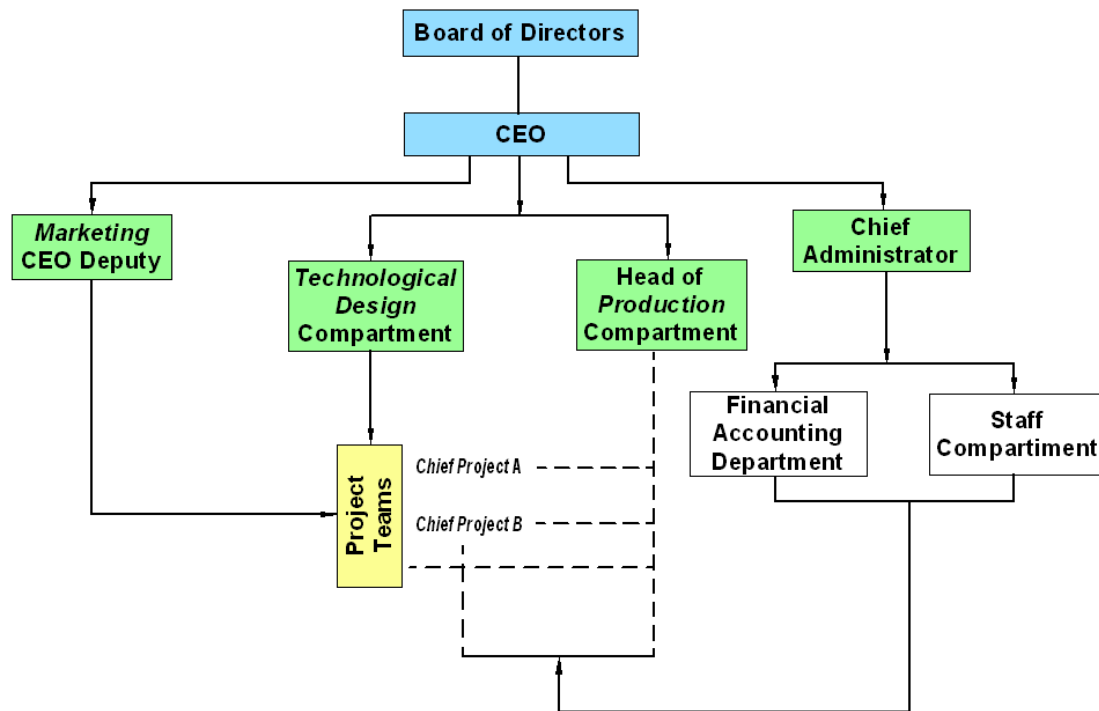


Figure 5. The organizational structure of a small specialized company

4. CONCLUSIONS

The managerial activity involves a continuous decision making process, consistently and sequentially. Thus, it was considered that the decision was in all of the management functions, and, hence, in the forecasting component, neural networks being of great help in this direction.

In the context of the performed analysis regarding the involvement of the neural networks in the organizational management, it was found that human resources are the most important category of resources for an organization. The success or failure of an organization (including for those with specific production) depends crucially on the quality of the available workforce, its degree of motivation etc., most of all in high-tech field, like nonconventional technologies one. In this context, neural networks can provide estimative data of real value to the organization management for making decisions.

In this framework (of forecasting), neural networks can provide very useful information for the top management for making decisions as fair and balanced as possible, with a margin of success.

5. REFERENCES

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