

## ENVIRONMENTAL CONTEXTS OF PROGRAMMER'S PROFESSIONAL SELF-DEVELOPMENT THROUGH LEARNING: ECOLOGICAL AND SYNERGETIC APPROACH

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**Abstract.** Nowadays one of the important tasks of education, including vocational education, is to help to every human as an individual of the society, to a company as an organization and to the society on the whole get on with existing changes, accept them and find opportunities for self-development, thus facilitating also competitiveness. Knowledge is the value that turns into good investment into the development of society, a company and each specialist from the present and future perspective. Therefore, many IT companies become knowledge organizations and at the same time – the educational environment for the programmers working at such companies. Alongside with the information society, the context of knowledge society also becomes topical. On the basis of ecological approach and synergetic approach in the educational sciences, own experience, as well as the results of the research performed earlier the authors of the article have developed "The Environmental Model of Programmer's Professional Self-Development" that provides a wide range of perspectives for the interdisciplinary research. The aim of the article: to substantiate the contexts of the multilevel environment of a programmer's professional development. The developed model ensures the wholeness view regarding the programmer's professional self-development in his/her multilevel and multi-contextual environment, where there are both aspects important: 1) the environment of an IT company, which is not only the environment of a programmer's professional performance, but also the educational environment – a knowledge organization; 2) two important contexts of society as social environment: information society and knowledge society. A programmer's professional self-development through learning is at the centre of this model, because the programmer is an integral part of an IT company and also of all society on the whole.

**Keywords:** IT company, programmer's learning, knowledge organization, professional self-development, information and knowledge society.

### Introduction

The present globalization processes are full of new challenges at the level of state, institutions and individuals. These challenges are especially related to the IT specialists. One of the indications of the globalization process is the rapid development of ICT and the introduction of the latest technologies into all spheres of human activities. These processes cause changes in all society that becomes the reason for the necessity to acquire these latest technologies and to use them in everyday life, and vice versa, – IT specialists by their professional competence and creative activities promote, initiate, introduce several innovations by being the authors of such innovations. According to this aspect, modern information and knowledge society becomes the society of risk and venture, as well as the society of new opportunities, which requires flexibility of specialists' thinking, performance and communication, including mutual communication and communication with clients.

A programmer's professional development is a process of professional self-determination and career management, which takes place both vertically and horizontally. The career development at an IT company most often is a linear process; however, the programmer's lifelong professional development is a non-linear process [1].

Only continuous lifelong educational process can ensure an ongoing programmer's professional development. The continuous self-directed learning how within the professional self-development process is formed and developed the programmer's professionalism, which is an indication of competitiveness, and vice versa – high-level competitiveness is an indication of high-level professionalism. Only a high-level professional, who is a self-sufficient and competitive personality, is ready to live and work in the continuously changing world. A high-level professional as a competitive specialist is able to adjust to the environment and also to change it by introducing innovations, to think independently and untraditionally, while making a choice and taking decisions, being responsible for the consequences of these decisions and own actions before oneself and society. So that a programmer would be a competitive specialist, the following aspects are essential as well: creativity, readiness to think and act in an untraditional and innovative manner. In order to ensure own competitiveness, an individual also needs flexibility in thinking, communication and professional performance both at the

IT company and in the labour market on the whole. Programmers need also critical thinking and an ability to forecast. Everything mentioned above facilitates the programmer competitiveness, including marketability and employability in the labour market [2-6].

Nowadays one of the important tasks of education, including vocational education, is to help to every human as an individual of the society, to a company as an organization and to the society on the whole get on with existing changes, accept them and find opportunities for self-development, thus facilitating also competitiveness. Knowledge is the value that turns into good investment into the development of society, a company and each specialist from the present and future perspective. Therefore many companies, including IT companies, become knowledge organizations and at the same time – the educational environment for the specialists working at such companies. Alongside with the information society, the context of knowledge society also becomes topical.

Thus, the environment is very important for the programmers' professional development. The important contexts of a programmer's continuous self-directed learning and professional self-development are: an IT company as a knowledge organization, as well as information and knowledge society.

### Materials and methods

The development of the philosophical – methodological basis of our research is based on two transcendental scientific paradigms: *ecological paradigm* and *synergetic paradigm* [7-8] that have come into our modern educational sciences and complementary supplement each other and provide a wide range of perspectives for the interdisciplinary research. Both these paradigms result into also two conceptual approaches: *ecological approach* and *synergetic approach*.

Programmer's professional development takes place within the interaction with the surrounding environment, therefore, environment is of great importance for the facilitation of a programmer's professional development.

On the basis of ecological approach and synergetic approach in the educational sciences, own experience, as well as the results of the research performed earlier [4; 6] the authors of the article have developed *The Environmental Model of Programmer's Professional Self-Development* (Figure 1) that provides a wide range of perspectives for the interdisciplinary research, ensuring the wholeness view regarding the programmer's professional self-development in his/her multilevel and multi-contextual environment, where there are important both aspects: 1) the environment of an IT company, which is not only the environment of a programmer's professional performance, but also the educational environment – a knowledge organization; 2) two important contexts of society as social environment: information society and knowledge society. A programmer's professional self-development through learning is at the centre of this model, because the programmer is an integral part of an IT company and also of all society on the whole. Education (including continuous self-directed learning on the basis of experience and creative, competent solution of problems) is an important means for the facilitation of a programmer's professional self-development and competitiveness.

One of the types of the manifestation of *ecological approach* is systemic thinking, on the basis of which many authors have developed the multilevel environmental system models: environmental oversystem and environmental subsystems comprises by oversystem are showed as environmental concentric circles [7; 9-15], but the human as a personality, an individual is an integral part of the environment.

Ecological approach has one more type of manifestation in the development of environmental models, namely, scientists identify several environmental contexts or dimensions [7; 11; 16-18]. Initially these environmental contexts or dimensions were called environmental components. Scientist L.L. Bernard was the first, who in human ecology developed the classification of environmental contexts and substantiated each component of it [16].

Thus, ecological approach integrates both systemic approach and multidimensional approach. Ecological approach in both its manifestations was used also for the development of *The Environmental Model of Programmer's Professional Self-development* (Figure 1), where there are identified several environmental levels and at the same time also several environmental contexts.

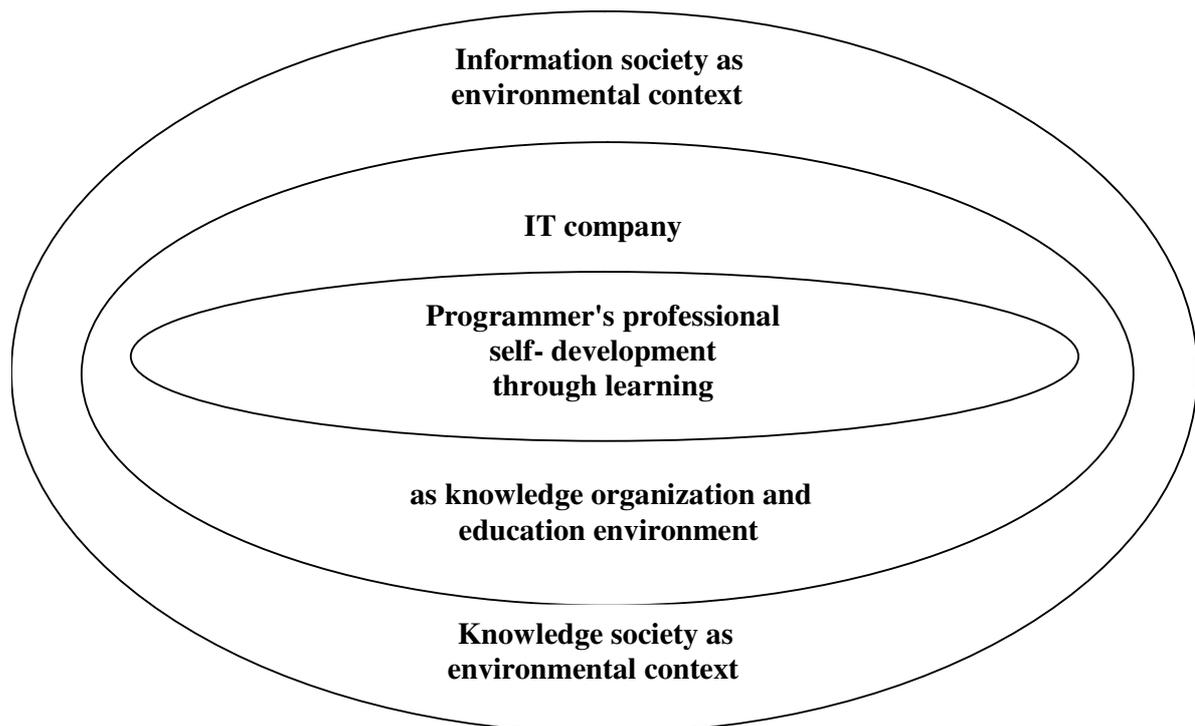


Fig. 1. Environmental Model of Programmer's Professional Self-Development (adapted and modified from [4; 6])

Nowadays *synergetic paradigm* and *synergetic approach* are characterized by concepts *dissipative structure, open system, self-development, self-organization, viability, non-linear development, synergy, bifurcation (branching, when the new manifestations, features, functions of system take place), fluctuation, changeability* [19-22].

The significance of synergetic paradigm in the natural sciences and later also in social sciences, including modern education, has been substantiated by the founders of synergetics: Belgian scientist of Russian origin Ilya Prigogine and German scientist Hermann Haken, who, thanks to their studies in natural sciences, on their own had discovered a new, transdisciplinary paradigm [23-25]. Synergetic approach (like ecological approach) identifies as the basic principle the following: *systemic thinking*, studies of the functioning, changeability and development of different types of systems *in time* and *space/environment* on the basis of developmental regularities and principles of open systems discovered in synergetics.

Synergetic approach in social sciences, including educational sciences, enables to substantiate a learning IT company as a synergetic organization that is able to cooperate, to change inner structure according to particular aims and tasks of performance to ensure own sustainability. Learning together through cooperation is one of the indications of a knowledge organization. Synergy at a synergetic organization manifests not only through learning together, but also through joint, purposeful professional actions [26-28].

As a result of synergetic approach, it is possible to substantiate also the programmer's professional self-development as a process of professional self-determination and career self-management, where there is important the self-organization and self-evaluation of own activities, as well as within the self-directed learning interaction with the changing environment: IT company on the whole [1; 5], as well as the team of programmers, of which the programmer himself/herself is a member.

Since a programmer's professional self-development from the point of view of synergetic theory is a non-linear process, then within this process there might be both high and low peaks, therefore the programmer shall not only strive for achievements and success, thus experiencing satisfaction and joy for professional development and growth of own career, but he/she shall be ready also in crisis to find

strength for a new developmental period (cycle), for example, when he/she faces professional burnout [1].

**The aim of the article:** to substantiate the contexts of the multilevel environment of a programmer's professional development.

**The methods of the research:** 1) studies, analysis and evaluation of scientific literature, 2) reflection on experience; 3) modelling.

## Results and Discussion

### *Information Society as Environmental Context*

Nowadays the changes are an integral part of modern society's development. The changes take place on an ongoing basis, therefore society on the whole, organizations as social subsystems, each specialist as a professional in his/her field shall get along with these changes and shall ensure own viability in the changing environment under such changing conditions, but shall also find new opportunities for development, including professional development, in future.

Changes mostly are related to globalization processes, which are facilitated by development of science, including information and communication technologies, and its introduction into all fields of human activities. Therefore, the conception of *information society* (Figure 1) has become popular. Unlike other societies, the substantiation of the growth of which, including economic growth, is mainly industrial or agrarian, the tools of information society are computers, availability and rapid exchange of information. Information society may be characterized from 5 aspects: technological, economical, professional, spatial, and cultural. The development and continuous changing of information and communication technologies becomes the basis for rapid and continuous changes in the life of society; the new technologies are used for work, including business, education, research, as well as for leisure activities. The appearance of the latest information and communication technologies (ICT) in the everyday life of people is: 1) the reason for continuous learning and obtaining of new experience in ICT field; 2) in indicator that the latest information and communication technologies become tools to be used for learning [29-37].

The changes that take place in information society provide for programmers as IT specialists new opportunities for professional development and at the same time they bring danger to viability and competitiveness into the continuously changing IT industry environment and an IT company as the environment of professional activities. Due to the changing information society, which continuously develops, and due to the fact that the needs and demands of this society increase more and more in the IT field, the IT companies need to think about their sustainability, they need to change, sometimes even change the spectrum of their activities.

Since an IT company is the environment for the programmer's professional development and professional activities that continuously changes according to the changeability and development of information society, then the programmer as an IT specialist shall also continuously change, perfect his/her professional skills and develop. The reverse processes also take place – as a result of the creativity and high-level professionalism of IT specialists, there are created new information and communication technologies that appear in the everyday life of our society. Thanks to that, the society adapts these innovations in the ICT field, learns to use the new ICT technologies, the new instruments in the everyday life and for professional purposes, thus all information society also changes and develops, and the needs of this society change.

The changes that take place in the information society are so powerful that the traditional companies are being pushed out or beaten, all production and life spheres are more and more taken over by information technologies. Considerable changes take place also in the work environment: knowledge becomes outdated more and more rapidly, which, in its turn, requires more often cooperation and responsibility from each employee engaged in the process. In the information society there increases the need for lifelong learning that enables to introduce up-to-date management systems, new technologies that envisage higher level of employees' professionalism and personal responsibility. The basis for the viability and development of information society is *information and knowledge* [31; 38-39].

Thus the important second context of a programmer's professional self-development environment – *knowledge society* – becomes topical (Figure 1).

### ***Knowledge Society as Environmental Context***

Both *knowledge society* and *information society* are two modern paradigms, which simultaneously exist in social sciences, including educational sciences. Sometimes simultaneous existence of several paradigms could be explained by the fact that, thanks to multidisciplinary studies, there exist several views on the phenomenon under research, which results from different scientific disciplines: 1) the emergence of *information society* paradigm is related to the IT sector and computer sciences, 2) but the origins of *knowledge society* paradigm can be found in educational sciences.

The scientific substantiation of knowledge society's essence could be found in many scientific publications [40 - 49].

Substantiation of knowledge society in the publications of many authors differs by the interpretation of the concept *knowledge society*. The following are some examples.

R. Edwards offers his interpretation of knowledge society's essence [41]:

- knowledge society as well-educated society;
- knowledge society as a market of the diverse supply of education;
- knowledge society as a learning network, but learning is interpreted as a process for the cognition of life and professional activities by introducing the concept *a learning approach to life*.

As emphasized M. Tight, the conception of *knowledge society* is based on the conception of lifelong and lifewide education and the conception of a learning organization/knowledge organization [47].

But Russian scientist A. Mitina interprets *knowledge society* even broader than it was at the end of the 20<sup>th</sup> century, because the conception of knowledge society comprises several other educational conceptions that were developed parallelly, complementing each other, for example [49]:

- conception of lifelong and lifewide education;
- conception of adult education;
- conception of formal, non-formal and informal education;
- conception of a learning organization/knowledge organization
- etc.

In knowledge society there is ensured the availability of education to all society. In knowledge society there are learning all: adults and children, the young and the old. In knowledge society sharing of experience takes place both vertically (the older generations share their knowledge with the younger generations) and horizontally (each member of society may have several social roles in education: in one sphere one and the same person may be a learner, in another – an educator). In knowledge society lifelong learning, including adult education, is of great importance. Knowledge society not only applies different type of knowledge, but also creates new knowledge. In knowledge society there is characteristic the transforming learning.

Thus, we can draw a conclusion that information society and knowledge society are the environmental contexts important for the professional development of a programmer as a specialist at an IT company.

One more significant conclusion stems from the results of theoretical studies – ***the paradigms of knowledge society and information society are interrelated and complement each other for the facilitation of society's sustainable development.***

### ***IT Company as a Learning/Knowledge Organization***

In order to ensure own competitiveness in the modern information and knowledge society and sustainable development in future, many institutions, companies are forced to change their thinking and performance strategy, thus recognizing the great importance of education and knowledge.

In modern social sciences, including educational sciences, knowledge within the context of society's sustainability there was developed the conception of *a knowledge organization* or *a learning organization* [49; 50-57], because in modern knowledge society, where lifelong learning, as well as formal, non-formal and informal education is important, education is obtained not only at different types of educational institutions, but also at non-governmental organizations, different societies, professional unions and associations, and also at workplaces. Everybody learns, and learning takes place everywhere (Figure 1).

The origins of the conception of a learning organization could be found already in the mid-twentieth century. The conception is based on the conclusion that knowledge organizations have better possibilities for survival and development in the unpredictable, continuously changing world than it would be in the case of others. The theoreticians of organizations of 1950s emphasized the significance of systemic thinking at the knowledge organizations. But 1960s and 1970s was the period, of the development of the ideas of learning organizations. This overlapped with the beginnings of the activities of scientific management consultants' schools that became dominant in the United States of America and Great Britain. In the second half of 1970s the ideas of *action learning* started to develop in Great Britain. The movement of *a learning organization* started to become more and more active. In 1990s there was a conclusion drawn that a learning organization is an ideal organization that possesses an ability to learn efficiently and to self-develop while learning [58-60].

The rapid development of the concept of a learning organization took place 1980s [49], however, the most popular this conception became at the end of the 20<sup>th</sup> century (in 1990s) and in the 21<sup>st</sup> century.

Nowadays the conception of a knowledge organization is being developed further within the framework of interdisciplinary studies.

The conception of a knowledge organization more and more often could be found in the substantiation of the activities of IT companies [38; 61-65], because *education is one of the important means for the facilitation of development*, by means of which an IT company as a self-developing system (organization) can get on with the changes that take place in the environment and it can ensure its own viability under the condition of modern changing environment and sustainability in future. It is important for the programmer as a specialist of an IT company to accept these changes and to find own potential, inner strength and opportunities, different types of resources, including time, for the self-development and self-perfection to ensure own competitiveness and the competitiveness of all IT company. Besides, it is important not only to accept the ongoing changes, but also to become an initiator of such changes by introducing different types of innovations in the activities of IT company, which is the result of continuous self-development and self-perfection.

The experience proves that learning at an IT company as a knowledge organization takes place at three levels: 1) all organization learns as a united, whole organism (the total learning), 2) the groups (teams of programmers) learn through cooperation, learning takes place also at an individual level (every programmer learns, what is necessary for his/her professional activities by fulfilling his/her duties and functions).

The programmer's professional self-development at the IT company takes place not only thanks to professional performance. The main means for facilitation of professional self-development is continuous self-directed, experience-based and problem-based learning [5; 66-69]. Thus, it is possible to say that professional development occurs as a result of learning (Figure 1).

The experience proves that a programmer's self-directed learning takes place during the professional activities and, at the same time, also at the courses for the improvement of professional skills, seminars for sharing experience and at conferences specially organized by the IT company.

Due to the ongoing learning process, not only the programmer's professional self-education takes place, but also the raising of the competitiveness level.

## Conclusions

1. Both ecological and synergetic paradigms provide a wide range of perspectives for interdisciplinary studies by ensuring the view of wholeness:

- regarding a programmer as a personality and a specialist, who, as a result of own professional and self-directed learning, self-develops and self-perfects own skills professionally at an IT company;
  - regarding an IT company, which is:
    - an educational environment system that facilitates a programmer's professional activities, learning and thus also the professional development;
    - an alive system (a social system) that performs self-evaluation and self-organization, self-education to self-development; it is open to changes by becoming a learning knowledge organization, and learning at such an organization takes place at three levels: 1) all organization learns as a united, whole organism (the total learning), 2) the groups (teams of programmers) learn through cooperation, learning takes place also at an individual level (every programmer learns, what is necessary for his/her professional activities by fulfilling his/her duties and functions);
  - regarding information society and knowledge society as important environmental contexts.
2. A programmer's learning at an IT company is a self-directed and meaningful process based on both own experience and experience of colleagues, and is oriented towards the solution of problems or problem tasks in the professional activities.
  3. Programmer's self-directed learning takes place during the professional activities and, at the same time, also at the courses for the improvement of professional skills, seminars for sharing experience and at conferences specially organized by the IT company.
  4. Due to the ongoing learning process, not only the programmer's professional self-education takes place, but also the raising of the competitiveness level.

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