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VALUES-ORIENTED LEADERSHIP IN DIFFICULT TIMES

Christiane von der Heiden

Abstract*: Digitalization is one of the current changes extending dramatically. It is expanding and penetrating all areas of life, but above all the work life. Digitalization and the Internet of Things are issues that affect all companies, regardless of size, industry or business model.*

In times of such a dramatic change a clear and thoroughly defined set of organizational values is inevitable in order to keep orientation. The following article introduces and describes the Synercube leadership theory that enables an organization to use its corporate power in order to achieve excellence on the basis of three fundamental orientations: results, people and corporate values. Based on the Synercube Theory, the guidance of change under consideration of psychological and behavioural effects empowers to continuously and effective change.

Keywords*: Synercube, Leadership, Leadership Style, Digitalization, Values-oriented leadership, values-oriented behaviour, Change, Organizational Culture.*

ITHEA Keywords*: J.1 Administrative Data Processing: Business*

Introduction

"Business as usual" no longer works. Even politics have just realized that things change. What about companies? What kind of challenges do companies, managers and employees face today? Demographic change, the increasing shortage of skilled workers and digitalization are only three of them.

Taking a closer look at digitalization: Digitalization is expanding and permeating all areas of life, but above all the working world and thus the values foundations of companies. Digitalization and the Internet of Things are issues that affect all companies, regardless of size, industry or business model. All industries, from manufacturing to retail to healthcare and service, can meet and respond to the challenges that leverage opportunities and actively change.

This change requires companies and the employees working in the company to face this changed situation and to be ready for this change. Only this enables a healthy corporate culture.

The question companies and especially corporate management have to face is how they can transfer the newly generated values, norms and demands by the increasingly interconnected world into their own corporate culture and maintain or develop their values foundation.

Through the changes named above, we are experiencing a fundamental paradigm shift that needs to be addressed. Businesses need to be able to work with leaders AND employees to meet their economic, political and social needs. However, this is only possible using two clear priorities:

1. Optimization of internal processes and structures;
2. Adaptation of the company to the environment.

The optimization of internal processes and structures must come first. Here, internal conflicts are solved and the company is developed into an integrated, purposeful community. Only then the organization is able to adapt to the environment. A foundation of clear values as a compass for daily action is essential.

Adapting to the environment means taking into account the new values that have developed from digitization within the company. This is because these values form the backbone of the necessary change for the company. They thus represent the foundation of the corporate culture. The values that have arisen from digitalization and are relevant today include:

- Candid communication,
- Transparency,
- Flow,
- Participation,
- Customer orientation,
- Authenticity,
- Empathy,
- Diversity
- Agility.

This does not mean that companies should throw their own existing and established values overboard. Instead, new values that will be important in the future must be in line with existing values.

Two questions are relevant in order to align the new values with the existing ones:

1. What shapes people?

- Experience;
- Up-bringing;
- Personal values;
- Culture;
- Personal goals;
- Believes;
- Social environment.

2. What shapes organizations?

- Hierarchy;
- Values;
- Culture;
- People;
- Environment/market;
- Competition;
- Goals;
- Experience & traditions;
- Norms & standards.

These aspects amongst others need to be merged because personal behaviour is always a function of the human being himself and the environment in which the human being moves. If the intersection between the two is particularly small or absent, these positive and motivating factors do not occur. Thus, you will not be able to deliver top performance and make a real contribution.

With a large intersection between the individual values and the values of the company "you feel at home", or "you feel that you belong", "you feel as part of the whole". The company provides meaning!

Therefore, the point is to open the culture of the company towards the necessary changes. In our example this means to open the company's culture towards the digital environment, to incorporate digitalization into the corporate culture and thus anchor it in the company. This requires visionary leadership, which is:

- Meaningful for the employee,
- Involve the people affected, and
- Transferring and taking responsibility.

In the end, the core elements of a corporate culture come from three areas:

- Corporate values that provide orientation and form the ideal framework for action
- Usage of power to implement and develop the actual corporate culture
- Behaviour that makes the actual corporate culture tangible or makes it clear to what extent and to what degree the desired culture is actually being lived

Every company has a culture. The question is whether the corporate culture is an ethical culture that can meet the challenges outlined above. Or, is it an insufficient culture that is not able to do that?

Synercube – A framework for ethical leadership

The challenge for leaders who have been educated and grown in thinking of performance and control is great.

Leaders who have been participatory and cooperative for a long time find it easier to create a corporate culture that is transparent, promotes open communication, and that is authentic, empathetic and flexible.

However, if we want to exploit the opportunities offered by digitization for us, it is necessary and possible to orient the organizations and above all the people in the organizations to this. The scientifically founded Synercube concept offers the possibility to define the behaviour on the basis of a theoretically sound founded method that limit or strengthen the performance, always taking into account the standards and demands that apply today and in the future.

In the future too, an essential corporate goal will be optimizing the results in the sense of the company - in compliance with the intended corporate values. This is achieved by overcoming fundamental, internal and external conflicts in companies, such as:

- Organizational goal vs. Individual goal;
- „Work-Life-Balance“;
- Striving for profit vs. Striving for ethical norms;
- Corporate values vs. personal values;
- Orientation towards the future vs. Orientation towards the past.

Synercube targets the personal attitudes and behaviours of executives and employees. It is about reconciling personal aspirations with the company's aspirations and acting accordingly.

Each behaviour can have a more self-centred or business-oriented values orientation.

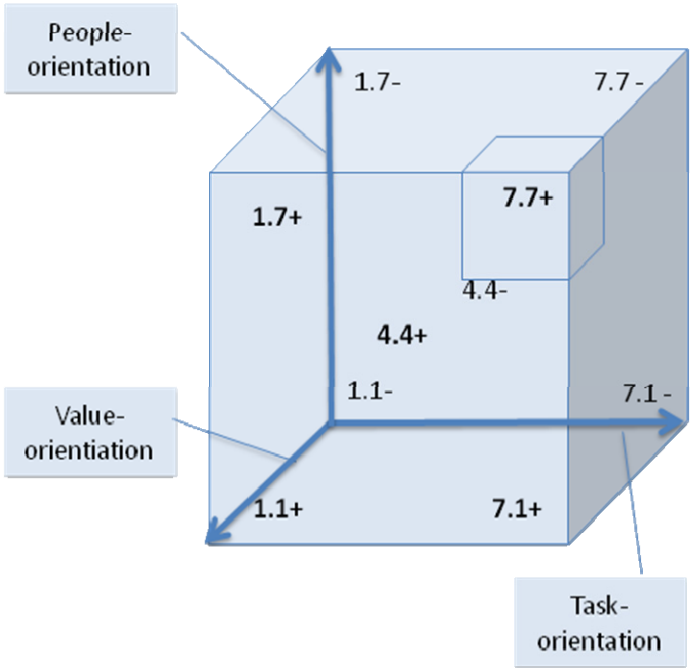

Figure 1. Three-dimensional leadership cube "Synercube"

1.1- Indifferent, cynic
A low focus on the outcomes and on people, indifference, and negative attitude towards everything. Tendency to distance oneself from responsibility for the outcomes, desire to avoid organizational problems and any involvement in organizational activities. Being pressed by organizational requirements, he adopts a protective and aggressive attitude that emphasizes the uselessness and futility of any action. His role, performed within the group/organization, seems quite satisfying to him.
1.1+ Inhibited, unfulfilled
A low focus on the outcomes and on people. Interest is concealed behind the mask of indifference, unrealized desire to contribute to the common cause. Disappointment associated with the inability to provide benefits, the desire to avoid political games and conflicts. Withdrawing into oneself. In a critical situation, possesses the ability to discard doubts and fears and to take an active and constructive attitude, aimed at overcoming the crisis. His role, performed within the group/organization, seems depressing to him.
1.7_ Adulator (How can I help you?)
Low focus on the outcomes, high focus on people, and indifference towards the work of the organization, the desire to please everyone. The desire to get along with people at all costs, adjusting to the situation. Avoidance of conflicts and tensions, lack of sincerity, flattery, and servility for their own personal purposes that man himself is not always understood.

1.7+ Weak-hearted enthusiast
A low focus on the outcomes, a high focus on people. He is not indifferent to the work of the organization and wants to create an atmosphere of friendship and encouragement. The prevalence of fantasies over real plans and actions. All kippers and curtains. He motivates colleagues to focus on positive aspects of work.
7.1- Dictator, authoritarian.
High focus on the outcomes, low focus on people, indifferent or negative attitude towards people, who are regarded by him as tools to achieve results. Expecting obedience and diligence, total control and constant pressure onto subordinates. A rigorous and strict adherence to the rules.
7.1+ Paternalist
High focus on the outcomes, low focus on people, not indifferent towards work and organization. Treats subordinates as immature and in need of care. Mentoring, protective position.
4.4- Conservative, formalist.
Average focus on the outcomes, average focus on people. Indifferent, formal attitude towards work and organization, the fear of change and innovation. Contentment with the status quo, defending the usual views and approaches. A rigorous and strict adherence to the rules and procedures that ensure stable and smooth functioning of the organization.
4.4+ Tradition-oriented patriot of the organization (a backbone).
Average focus on the outcomes, average focus on people. Concerned with the work of the organization, desires to create an atmosphere of stability and reliability. Respecting and upholding organizational traditions and values. Devotion and loyalty to the organization.
7.7_ Opportunist.
High focus on the outcomes, high focus on people. Indifferent, pragmatic attitude towards work and organization. Ability to work with people and to achieve results that provide personal benefit. Lack of sincerity, declarative adherence to higher values, the ability to manipulate.
7.7+ Ideal, visionary.
High focus on the outcomes and on people as well as a positive attitude towards work and the organization. A desire to create an atmosphere of commitment and involvement. Recognizing the importance of each employee, striving to achieve the highest standards of performance. Search for and adoption of optimal solutions that are supported and shared by everyone. Committed to development and improvement, while respecting organizational traditions and values.

With 7.7+ behaviour, a company is able to recognize and exploit the opportunities that digitalization brings with it. High result and people orientation combined with a focus on adhering the company's

values form the framework for action. Traditions, norms and standards, and achieved results are questioned with the aim to make the company successful in the long term. 7.7+ helps those affected to participate. Commitment, engagement and personal identification with the company are increasing. Communication is precise. Enthusiasm, self-esteem and und team cohesion are typical characteristics. Ideas, suggestions, doubts and fears are spoken out and heard promptly.

Values among others that reflect this behaviour are:

Trust
Trust is the basis for effective cooperation today and tomorrow. People trust in their own performance, that of others and of the organization.
Fairness
Motivation is related to the results achieved. Clear criteria help people address mistakes and insufficiencies fairly and equitably.
Integrity
Integrity, honesty and candour are the basis for trust and effective collaboration. Integrity supports people in setting clear goals, planning processes, organising work and measuring results.
Commitment
Commitment derives from clear and sound organizational goals and the awareness of the impact of the people's contribution to achieving them.
Social responsibility
Taking responsibility for relationships among employees, customers and suppliers, and also for the environment and sustainability is part of the organization's culture. People's actions are based on that. People act as a role model.

For executives, another important factor is the use of power.

The understanding of power according to 7.7+:

Punishment
Punishment is the justified consequence for actions that repeatedly controvert general standards or implicate loss for the organization.
Reward
Reward is the recognition of punctual and good work. It is linked to previously formulated criteria. This way, reward activates the achievement of top results.

Position
Mutual relations are aspired with professionalism, enthusiasm and active positioning playing key roles. The hierarchical status aims to represent, explain and defend the organization's interests outwards.
Information
Unlimited access to information is the most important condition to achieve best results and overcome conflicts. Participation in active exchange of information is inevitable.
Expert
In today's world, knowledge is always limited. Therefore, the individual competence of all is essential. In order to come to the best decision, experts are consulted when necessary.
Referent
Referent means distinctive charisma, strong self-confidence, modesty, and persuasiveness. Actions are authentic and goal-oriented and emphasize the bond with the organization.

The Synercube concept enables the consideration of relationship quality at the individual, group and company level. Each style represents concise, characteristic leadership behaviour. On a different level each behaviour enables or hinders the opening towards the digitalization.

The question „What is right?" and not "who is right?" is at the centre. Synercube provides a framework for implementing change as it offers a way to define effective and ineffective behaviour. The Synercube concept serves as a guide to achieving mutual understanding, which promotes solidarity with the company and realizes goal-oriented cooperation.

Behaviour under 7.7+ aspects includes:

Conflict resolution
People conduct research regarding the cause of a disagreement or conflict and encourage the open and candid debate of differences. To find a sound solution, People focus on facts and not on people.
Communicative Competence
People actively seek for information and question it. People promptly and adequately inform the people involved. People foster new ideas and different opinions and listen actively. In doing so, People constantly question their personal view.
Active Positioning
People define their position clearly and confirm it with arguments. People encourage others to do the same. As long as there are no better arguments stated, People adhere to their opinion.

Decision-Making
People make sound decisions based on understanding, agreement and the resources available. People question opinions by means of ambitious standards, and People don't avoid difficult decisions.
Constructive Critique
People encourage open and candid critique, which describes the impact of incidents and behaviour. People constructively and promptly reflect upon processes and invite critique and feedback. People use critique for continuous development and improvement.

Conclusion

In order to take advantage of the tremendous changes that occur currently and in the future, a profound values system that guides all corporate actions as a compass is inevitable. The Synercube Theory supports organizations to systematically transfer a certain set of values into day-to-day business activities and hence makes behaviour measurable. By this a values system enables organizations to face change as an opportunity to grow and develop.

References:

Creusen U, Bock R, Thiele C (2013) Führung ist dreidimensional. In: Crisand E, Raab G, Crisand N (eds) Arbeitshefte Fuehrungspsychologie, vol 69. Windmuehle Verlag, Hamburg

Lewin K, Lippitt R (1938) An experimental approach to the study of autocracy and democracy: a preliminary note. Sociometry

Zankovsky A, von der Heiden, C. (2015): Leadership mit Synercube – Eine dynamische Führungskultur für Spitzenleistungen. Springer Vieweg, Heidelberg.

Schumacher S (2014): Leadership Dimensions: An Empirical Integration. Universität Osnabrück

Seggewiß N (2015): Explizierte Werte zur Kommuinkation der Organisationskultur – Welche Werte postulieren börsennotierte Unternehmen? Universität Osnabrück

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Major Fields of Scientific Research*: Organizational Behaviour, Organizational Culture, Synercube Leadership.*

DIGITAL ECONOMY AND PSYCHOLOGY

Anatoly Zankovsky, Leo Surat

Abstract*: The paper is devoted to the study of the new challenges for psychology in digital economy. The main focus is on the virtual organization – a new organizational model that evolved due to the development of informational and communicational technologies. The aim of the paper is to outline the specific characteristics of virtual organization, its differences from traditional organizational models, as well as, to analyze the organizational and psychological problems that arise in digital management.*

Keywords*: organizational psychology, digital economy, virtual organization, digital management, values, managerial functions, communication, leadership.*

ITHEA Keywords*: J.1 Administrative Data Processing: Business; J.4 Social and Behavioral Sciences - Psychology*

Introduction

In recent decades, the organizational world and work experience dramatic shift to digital economy that pose a completely new psychological problems and challenges (Zankovsky, 2015, etc.). These challenges are, first of all, connected with the active introduction of new information and communication technologies (ICT), which creates a fundamentally new digital environment and changes the system of those requirements that have traditionally stood in front of the individuals and organizations in the recent past.

These trends are vividly seen in a completely new organizational form previously unknown to mankind – a virtual organization (VO) that has become a popular subject of both scientific research and public debate in recent years. The definition of "virtual" was borrowed from computer technology, which uses the term virtual memory, which is understood as a specific method of managing the memory of the computer, that allows user to run programs that require more memory than is available on the computer (Ebrahim et al., 2009). Similarly, a virtual organization strives to use not only its internal resources, but also external, virtual resources that do not belong to it, to achieve its goals. This new organizational

form, inextricably linked to ICT, has completely new structural and functional characteristics, which pose many new questions, problems and challenges to the psychology and management.

The virtual aspect of the organization

The interpretation of the virtual aspect of the organization is extremely broad: different and even opposing organizational and group concepts are often discussed under the same name (Riemer et al., 2012). The overwhelming majority of definitions emphasize the fact that VO is a dynamic, open system, uniting independent economic agents (subjects), allowing in a single information space to unite the capitals and key competences of the participants for faster and effective satisfaction of business requests (Ivanov, 2003; Ebrahim et al., 2005; Riemer et al., 2012). At the same time, apparently, being under the influence of a few, but striking examples of the successful use of ICT (most often, in the virtual space), such as the creation of Facebook, Google, Wikipedia, open-source software, etc., the researchers put a special emphasis on spontaneity, volunteerism and independence of economic agents, who, uniting, are able to effectively and efficiently create products, services, information, etc.

Indeed, profits, for example, of Facebook in 2016 amounted to more than $ 10 billion, and the company's website is among the most visited in the world, bringing together billions of users. However, spontaneously arising virtual communities are only one and, in our deep conviction, not the most popular and important organizational form in a virtual environment. Therefore, despite of the desire to give in to hopes that soon any virtual business will be as successful as Facebook, in order to understand this issue, it is necessary to refer not to individual, exceptional examples, but to an adequate scientific analysis of VO. Traditionally, an organization is defined as a consciously coordinated social entity with defined boundaries, functioning on a relatively continuous basis to achieve a common goal (Zankovski, 2012, etc.). Based on the main features of the organization, on the basis of extensive scientific literature, we identified three main types of VO: 1) Network, multi-agent; 2) Distributed, outsourcing and 3) "Virtual offices".

1. ***Network, multi-agent VO***, as a rule, is a network of small and medium-sized organizations that realize their narrow professional competence, uniting with other companies in order to respond quickly to market demand. In fact, it is not a full-fledged organization, but a partnership focused on the implementation of a specific project. This type of VO is characterized by a decentralized type of management, in which all management processes are carried out only through local interactions of network participants. The organizational structure has a variable, non-fixed form. VO of this type have a

temporary nature, they arise with the emergence of market opportunities or facing some market/social demand and usually fall apart after the first run. To consolidate orders and ensure this organizational form greater stability new special support communities, pools, web platforms, networks of freelancers, groups of open-code software developers, etc. have been evolved.

2. ***Distributed outsourcing VO*** is an organizational form that parent companies create in order to transfer part (sometimes even the main) of their business functions to the network of suppliers. To this end, a network of external partners is being established and coordinated through ICT. Such VOs have a distributed type of management carried out through a common focal point and represent a set of independent or dependent agents acting on a contractual basis in accordance with pre-defined rules and norms of conduct and interaction. They have a flexible but pre-defined organizational structure. The VOs of this type are of a permanent nature, they are focused on the constant search and receipt of orders in a certain field of activity. One of the participants manages the network and performs the overall coordination of orders. Typical examples of such VOs can serve such companies as Dell, Benetton, Nike, Puma, Apple, etc.

3. ***A "virtual office"*** is an internal VO that operates within a particular corporation. On the basis of ICT, the organization creates a network of virtual interaction of individuals, teams, departments and branches of the company, which can be widely distributed in space and time. These represent a set of dependent agents, united by a fixed hierarchical organizational structure and chain of command of rigid vertical connections. This type of VO, as well as distributed VO, are constant, focused on constant search and receipt of orders in a certain field of activity, but the network itself and the implementation of orders are centrally managed. A typical example of such VO is a large transnational corporation.

VO's general and specific psychological problems

Each type of VO is characterized by both general and specific psychological problems. Common problems, such as control, motivation, trust, or personal problems, have a pronounced specificity for network, multi-agent VO due to the "flat", dynamic organizational structure, short-term functioning and uncertainty of the market orders. This calls, for a study of very specific virtual phenomena like "rapid" trust, without which the functioning of such organizations faces serious challenges.

Nevertheless, the psychological problems of virtual organizations, largely due to the intensive use of ICT, are closely related and can be divided into several groups:

1. Management problem.
2. Communication problems.
3. Conflict resolution problems.
4. Problems of work motivation.
5. Problems of values and organizational culture.
6. Problems of organizational adaptation and socialization of employees.

The format of this article allows us to identify briefly these groups of psychological problems and outline some directions of their research.

1. ***Management problems*** are primarily associated with the implementation of basic management functions: planning, organization, leadership, control, etc. In the absence of direct interaction each of these functions requires a qualitatively new realization from essential and formal sides. How to set a task so that it is properly understood and becomes the main focus of the employee's activity even in the absence of constant interaction with the manager? How and what support should be given to the staff member in terms of organization and self-organization? How to coordinate effectively the efforts of the members of the virtual team, not being able to see in real interactions specific features of their personalities and behavior? How can employees be monitored if they are working at home, on a different continent or in a different time zone?

2. ***Communication problems***. This group of psychological problems of VO probably belongs to the most studied today (Riemer et al., 2012; Pink, 2011). Virtual interaction makes it difficult to establish personal informal relations typical of traditional organizations. The lack of personal information about an employee, contractor or manager makes it difficult to form a coherent image of a person and prevents the effective exchange of information.

In virtual communication, usually there is no non-verbal information, which complicates the correct perception of basic information, leads to distortions, misunderstandings and conflicts. When

communicating in person, the partners read nonverbal information and adjust their behavior in accordance with it. In virtual teams, limited communication channels often have a negative impact on the establishment of business and personal relationships and reduce the effectiveness of the organization. Members often mistakenly assess the intentions of their colleagues when, for example, they do not receive a timely response by e-mail, incorrect assessment of the content and emotional orientation of written communications are rather frequent, etc.

3. ***Conflict resolution problems***. A separate and particularly acute problem is the management of the conflict in the VO. The latent phase of the conflict may be a long time unnoticed and/or misinterpreted by employees even in direct communication. However, their negative impact in a virtual environment can have more destructive consequences. Prevention, diagnosis and constructive conflict resolution, in our opinion, is extremely relevant not only for the VO, but also for the entire virtual space as a whole.

4. ***Problems of labor motivation***. Motivational issues are a cross-cutting theme for all types of VO. Being out of sight of the leader and social influence of the group, short-term labor relations (in the network), the lack of social facilitation and charismatic influence of leaders have a negative impact on the motivation of the staff, requiring the development of new methods and means to maintain it. In this context, particular attention is drawn to new models of motivation based on autonomy, creativity, mastery and purpose (Pink, 2011).

5. ***The problem of values and organizational culture***. Perhaps most acute are the problems of trust, openness, responsibility and commitment related to the inability to meet the staff member personally and to ascertain the extent to which he or she shares those values. This problem is particularly important for interactive virtual groups, where the outcome of the activity is born in the process of interaction and depends on the integrity and performance of each of the employees. The problem of values in the VO becomes particularly relevant in view of the fact that the lack of trust, openness, responsibility and commitment can have a negative impact and even blocking the open information exchange, without which effective work in the virtual space is simply impossible.

Mediated relationships between the employee and a manager can increase subjective distortion in the interpretation of the correspondence of the employee's contribution and organizational rewards that he/she receives. Such situations can be perceived as violations of organizational justice and have a

negative impact on the motivation of VO personnel. In addition to the axiological conflict and the potential decrease in motivation to work, it can be difficult to adopt and translate the principles of organizational culture in cases where the VO consists of a large number of isolated virtual teams. The specificity of the VO imposes restrictions on the formation and maintenance of a common organizational culture, which requires the development of new approaches in this area. In general, virtual forms of work are recommended to be preceded by a sufficient period of adaptation and socialization, during which employees can get acquainted and accept the norms and values of the virtual company.

In addition, crossing all borders, VO can include employees of different cultures, faiths and worldviews. Lack of understanding due to cultural differences in perceptions, thinking, social norms and roles is often a major impediment to the work of virtual groups. Negative impact on efficiency of VO can also have language barriers, differences in experience, age, internalized the principles of corporate culture, etc. These moments, above all, make it difficult for members to form a close understanding of the mission, strategy and overall objectives of the VO.

6. ***Problems of organizational adaptation and socialization of employees***. It is known, that when faced with the inability to meet their social needs in the real world, people are trying to find such an opportunity in the virtual world. The impossibility of regular and full communication with colleagues can lead to social disadaptation of VO employees, to an even greater sense of isolation and affect the indicators of efficiency, satisfaction with work and mental health. The way out of this situation can be a specialized professional selection and introduction of a probationary period, during which it is possible to determine how effectively a potential employee is able and suitable to work in the VO. The uncertainty and short duration of the employment relationship, the high level of competition at which the vacancy can be filled by candidates from any country, frequently changing requirements and tasks create the conditions for stress and neuroticism of the individual. In addition, there is a possibility of the so-called technophobia: VO employees often do not have the necessary technical skills for remote work, do not have sufficient professional skills for the use of certain software products. All of this can also have a negative impact on their motivation and performance.

Conclusion

The lack of direct interaction and control places entirely new demands on the self-organization of the staff member. He/she should have sufficient skills to plan, organize and implement his/her own activities, demonstrate advanced self-monitoring. Studies show that it is impossible to fully compensate individual self-organization shortcomings by mediated managerial impact.

Thus, at present, both organizations and labor activity are experiencing significant changes that affect the basic principles of the functioning and development of the organization and change the system of those requirements that have traditionally stood before individual and organization in the recent past. The virtual organization – a new organizational form based on the use of information and communication technologies that poses a lot of acute issues, problems and specific tasks for psychologists. These problems can be divided into several generalized spheres. There is every reason to believe that the study of virtual organization becomes one of the most promising directions of development of modern organizational psychology and psychology in general.

Refernces

1. Занковский А.Н. Психология организационного лидерства: в поисках корпоративной синергии. М: Литера, 2015.

2. Занковский А.Н. Организационное лидерство в пространстве корпоративной культуры. Дис. на соиск. уч. степени докт. психол. наук/Институт психологии РАН. Москва, 2012.

3. Иванов Д.А. Виртуальные предприятия и логистические цепи. - СПб.: Изд-во СПбГУ-ЭФ, 2003.

4. Культура и поведение в организации: российский опыт/ Отв. ред. С.П. Дырин, А.Л.Журавлев, Т.О. Соломанидина. М., 2008.

5. Ebrahim, N.A., A.Shamsuddin and T. ZAhari, 2009. Virtual Teams: a Literature Review. Australian Journal of Basic and Applied Sciences, 3 (3): 2653-2669.

6. Riemer K., Vehring N. Virtual or vague? A Literature Review Exposing Conceptual Differences in Defining Virtual Organizations in IS Research. Electronic Markets, Aug. 2012.

7. Pink D.H. Drive. The surprising truth about what motivates us. NY: Riverhead Books. 2011.

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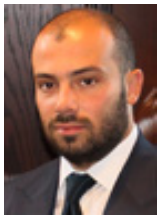
Major Fields of Scientific Research:



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Major Fields of Scientific Research:

OVERVIEW AND ANALYSIS OF THE MAIN LEADERSHIP CONCEPTS, DEFINING THE MODERN MANAGEMENT OF THE BUSINESS ORGANIZATIONS

Veselin Milanov

Abstract*: The new challenges faced by the business organizations required knowledge of the main leadership concepts applied by the management in the management process. The article provides a theoretical overview of the key leadership concepts in business organizations management in the 20th century. An analysis of the multifactorial models of the leadership, defined by the theory in the first quarter of the 21st century has been made. As key factors in the leadership management concepts in the 21st century are synthesized the organizational dynamics, the impact of the environment and the effectiveness of leadership in the management process.*

Keywords*: leadership, concept, business organizations.*

ITHEA Keywords: *J.1 Administrative Data Processing: Business*

Introduction

Since the emergence of the first theory of leadership in 1840 - the great man theory, the leadership concepts have changed, built up, based on different specific characteristics of the personality or the situation, but remain an indisputable factor supporting the study and the determination of leadership style applied by the manager. This kind of development and upgrading of the conceptual foundations of the leadership leads to the development of a number of two-, three- and even six-factor models defining the leadership style of management applied in the business organizations.

The variety of concepts defining the leadership requires their research, analysis and assessment of their strengths and weaknesses, advantages and disadvantages affecting their full application in the business environment. The critical analysis of the existing leadership concepts provides a basis for synthesizing their weight and relevance in defining the leadership style of the management in the business organizations.

The essence of the problem

The essence of the problem is related to the fact that the leadership is directed towards the realization of goals in which certain relationships in the business organizations between the leader and the team or teams arise, the basis of which are power, influence and control. At different times, in different circumstances, the leadership includes one or more of the listed elements and seeking answers to this fundamental question leads to the development of many leadership concepts, some of which will be addressed in this article.

By its nature, the leadership is a complex phenomenon and is often referred to as "Directorship". In the business organizations this directorship is generally associated with the existence of formal authority and legitimate governance, including management planning, organization, motivation and control functions.

The topic of this article is actual and significant, as the leadership by its nature is a compound and complex phenomenon and it is one of the mechanisms for influencing the team work in order to achieve synergic organizational results.

The object of the study in this article is the concepts of leadership applicable to the modern business organizations management.

The subject of the study is the main distinctive characteristics of the different leadership theories defining the different leadership styles applied by the managers in the organizational environment.

The main objective of the study is the critical analysis of the different leadership concepts applied in the business organizations in the first quarter of the 21st century.

In the fulfillment of the above stated objective, the following main tasks have been solved in the article:

- ✓ a theoretical overview of the main concepts of the leadership in the business organizations in the 20th century has been made;
- ✓ the multi-factorial leadership concepts specific for the business organizations management at the beginning of the 21st century have been analyzed;
- ✓ a critical analysis of the main advantages and disadvantages of applied conceptual models for leadership in modern business organizations has been made.

Theoretical overview of the main concepts of the leadership in the business organizations in the 20th century

One of the first concepts of the leadership – the trait theory is developed by Gordon Allport. According the theory the leaders possess stable overtime personal traits that make them distinct from other

people. Gordon Allport assumes that personality traits are strictly individual and on this basis determines the uniqueness of the leader.

In 1939 Kurt Lewin, Ronald Lippitt and Ralph White developed the concept for the leader participation. According the theory there is a certain relationship between the leadership style, applied by the manger and the effectiveness, productivity and the results. The concept determines three leadership styles:

- ✓ autocratic – the leaders make decisions themselves;
- ✓ democratic – the leaders and the teams make decisions together;
- ✓ laissez-faire – the leaders leaves the team to make decisions.

In 1947 Max Weber developed the concept of the charismatic leadership. According to this concept the management and the charm of the leader, as well as winning followers, are due to the innate qualities of the leader called charisma.

The two-factor definitions of the leadership style of the manager was founded in the 1940s by scientists at the universities of Michigan and Ohio, and in 1960 D. Katz and R. Khan [Handy, 1999] assume that the leadership is influenced by two orientations – concern for contributors and concern forjm tasks in the business organizations.

In 1964, Robert Blake and Jane Mouton [Blake, Mouton, 1964] formulated a grid that identified five leadership styles based on the concern for people and the concern for production:

- ✓ 1,1 – low concern for both people and production;
- ✓ 1,9 – high concern for people and low concern for production;
- ✓ 5,5 – middle concern for both people and production;
- ✓ 9,1 – high concern for production and low concern for people;
- ✓ 9,9 – high concern for both people and production.

The concept of situational leadership assumes that the effectiveness of the management in the business organizations is directly related to the manifestation of a particular situation and its various situational variables.

In the 1970s, the concept of transactional leadership was formulated. It assumes that the position of the leader as a result of his power leads to authority and influence over the collaborators. According to this concept, the leader is empowered to evaluate collaborators through incentives and penalties.

The concept of transformational leadership was developed in the 1970s and assumes that the leader's influence on collaborators leads them to participate in the transformation process of the organization.

The attribution leadership concept was created in 1967 by Harold Kelley. It assumes that the leader's management is a consequence of the collaborators' behavior.

The GRID leadership concept is developed in USA by Rachel McKee and Bruce Carlson in 1990s. This concept builds up the grid of Robert Blake and Jane Mouton to seven styles:

- ✓ 1,1 – low concern for both people and production;
- ✓ 1,9 – high concern for people and low concern for production;
- ✓ 5,5 – middle concern for both people and production;
- ✓ 9,1 – high concern for production and low concern for people;
- ✓ 9,9 – high concern for both people and production
- ✓ Patriarch – combining styles 1,9 и 9,1;
- ✓ Opportunist – combining all leadership styles.

The leadership as formulated by GRID concept is the first step towards personal development, flowing as a result of a synergy that is shared by the entire business organization. GRID leadership concept offers a method by which the quality of relationships, both at a personal level and at a team and organization level, can be investigated and measured. [Temelkova, 2017]

The multi-factorial concepts defining the leadership in the business organizations at the first quarter of 21st century

In 2001 Jim Collins formulated the Level 5 leadership. [Collins, 2001]. According the concept the leader from level 5 has predefined qualities:

- ✓ strong will;
- ✓ modesty;
- ✓ fearlessness;
- ✓ continuity;
- ✓ responsibility.

Anatoly Zankovsky in 2015 developed Synercube leadership concept. The basis of this concept is the leadership theory of Blake and Mouton and the GRID model. According the concept the model of the organizational leadership should include not only the behavioral factors but also dimension for values, i.e. it should de three-dimensional. [Zankovsky, Heiden, 2015] The concept has 10 leadership styles:

- ✓ Indifferent cynic - low concern for production and people, indifference and negative attitude to everything;

- ✓ 1.1+ Inhibited, blocked, unfulfilled - low concern for production and low concern for people, interest hidden behind the mask of indifference, unrealized desire to contribute to the common cause;
- ✓ 1.7- Adulator - low concern for production, high concern for people, indifference towards work and organization, eager to please everyone and enjoy positive attitude;
- ✓ 1.7+ Soft-Hearted Enthusiast - low concern for production, high concern for people, the attitude towards work and the organization, eagerness to create an atmosphere of friendship and trust;
- ✓ 7.1- Dictator - high concern for production, low concern for people, indifferent or negative attitude towards people;
- ✓ 7.1+ Paternalist - high concern for production, low concern for people, positive attitude towards work and the organization, patronizing the treatment of subordinates that are perceived as immature and in need of care;
- ✓ 4.4- Formalist - moderate concern for production and people, indifferent and formal attitude towards work and organization, fear of change and innovation;
- ✓ 4.4+ Patriot - moderate concern for results and people, an emphasis on the work of the organization and the desire to create an atmosphere of stability and reliability;
- ✓ 7.7- Opportunist - high concern for production and people, indifferent pragmatic attitude towards work and organization;
- ✓ 7.7+ Ideal, Visionary - high concern for production and people, don`t have indifferent attitude towards work and organization, desire to create an atmosphere of commitment and involvement.

Hogan assessment system of the leadership and the leader`s potential of the human resource uses the scientific achievements in the area of impact of the personal development on the business success. Hogan's leadership implies the development of a cultivated leadership team to help business organizations to achieve better financial results. [Hogan, 2017]

In 2017 Miglena Temelkova [Temelkova, 2017], [Temelkova, 2018] published a theory of a new type of leadership – SMART leadership, which:

- ✓ specifically identifiable in the internal and external organizational environment;
- ✓ measurable, according to certain characteristics;
- ✓ consistent with strategic organizational directions;
- ✓ realistically reflecting the changes and the challenges of the environment;
- ✓ time limited by the global economic, social, technological, innovation dynamics, which is accompanied by over-riding for resources and over-competition.

The SMART leadership concept is six-factorial, based on six interrelated dimensions:

- ✓ orientation to the result;
- ✓ orientation to people;
- ✓ orientation to the organizational culture;
- ✓ orientation to the external environment variables;
- ✓ orientation to the internal environment variables;
- ✓ orientation to the identification of the leader with the organization.

As a result of the combination of these orientations, it is concluded that there may be 3,628,800 different leadership styles. [Temelkova, 2017]

Conclusion

As a result of the theoretical overview and the analysis of the different leadership concepts, it could be summarized:

- ✓ the main principles of the different theories of leadership in the 20th century are searching the best and most effective management style by focusing on the personality traits and skills of the leader and the analysis of the situation and defining its key factors;
- ✓ the concepts of the leadership in the business organizations in the 20th century do not pay enough attention to organizational dynamics, different organizations have specific needs and problems in the different phases of their evolution;
- ✓ In the first quarter of the 21st century, the leadership concepts focus on effective leadership in the business organizations, highlighting the elements of the leader's personal and professional qualities;
- ✓ the new approaches to leadership are in essence integrative, multifactorial and focusing on the relationship between the leadership style and management efficiency.

Bibliography

[Темелкова, 2016] Темелкова, М. Екипното взаимодействие в работна среда – предпоставка за развитие на лидерския потенциал на организацията. Българо-френска научно практическа конференция «Иновативен фирмен и персонален мениджмънт». септември, 2016. ISSN 2412-5210.

[Темелкова, 2017] Темелкова, Миглена. Лидерство в бизнес организациите от сектора на услугите. Колор принт. Варна, 2017. ISBN 978-954-760-433-9.

[Aditya, House, Kerr, 2000] Aditya, R., House, R., Kerr, S. Theory and Practice of Leadership: Into the New Millennium. C. Cooper, E. Locke (Eds.) Industrial and Organizational Psychology. Linking Theory with Practice. Blackwell. Malden, Massachusetts, 2000.

[Blake, Mouton, 1964] Blake, R., Mouton, J. The managerial grid. Gulf Publishing Company. Houston, 1964.

[Collins, 2001] Collins, J., Good to Great. 2001.

[Handy, 1999] Handy, C. Understanding Organizations. Penguin Books. London, 1999.

[Hogan, 2017] Hogan, R. Personality and the Fate of Organizations 1st Edition. Psyhology Press. New York, 2017.

[Temelkova, 2016] Temelkova, M. Korrelative Untersuchung der Faktoren, die die Unternehmensführung bestimmen. Journal L´Association 1901 "SEPIKE", Osthofen - Deutschland, Poitiers – France, Los Angeles – USA, Ausgabe 13/2016. ISSN 2196-9531.

[Temelkova, 2017] Temelkova, Miglena. A Model determining Leadership in the Business Organizations under the Conditions of the Forth Industrial Revolution. Current Scientific Resarch - Collection of scientific articles. Monreal, Canada, 2017. ISBN 978-617-7214-49-5.

[Temelkova, 2018] Temelkova, M. From hierarchical structures to networked business models based on team collaboration. GE-International Journal of Management Research, Volume 6, Issue 2, February 2018. ISSN (O): 2321-1709, ISSN (P): 2394-4226.

[Temelkova, 2018] Temelkova, M. The Relation "Swarm Management – Smart Leadership" in Contemporary Decentralized Ccrypto Economy and Communication. Science and education - Collection of scientific articles. Ascona Publishing, United States of Amerika. 2018.

[Temelkova, 2018] Temelkova, Miglena. Studying the Leadership Style of Business Organizations' Management under the Conditions of the Fourth Industrial Revolution. Asia Pacific Journal of Resarch in Business Management, Vol. 9, Issue 2, February, 2018. ISSN 2229ß4104.

[Zankovsky, Heiden, 2015] Zankovsky, A., Heiden, C. Leadership mit Synercube. Springer. Berlin, 2015.

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Major Fields of Scientific Research: management, leadership

INNOVATION, DIGITALIZATION AND INTEGRATION IN THE BALKAN REGION

Rossitsa Chobanova

***Abstract**: The paper attempts to characterize innovation, digitalisation and integration of enterprises in the Balkan region on the case of a survey of 1941 enterprises from the forestry sector on cross border region between Bulgaria and Macedonia taking place in 2017. The data used meets general requirements of OECD and EUROSTAT OSLO Manual. it draws conclusions about dominated companies' profile by size, by ownership and legal status, by connectivity, and by activity according to NACE Rev.3; about R&D and export intensity of studied enterprises in the cross border region as characteristics of innovation and cooperation potential; about innovation activity and innovation policy of that firm; its digitalization and export intensity level.*

***Keywords**: Innovation, Digitalization, Integration, Bulgaria, Balkan Region.*

***ITHEA keywords:** J.4 Social and Behavioral Sciences: Economics*

Introduction

The regional integration is a precondition for sustainable development and competing in global economy. Innovation and digitalization characterize potential for such integration. In this respect the paper applies bottom-up approach to analyses of data, resulted from a survey of 1941 enterprises on cross border region between Bulgaria and Macedonia in the frame of the project "Innovative cooperation initiatives in cross border region (ICI)", INTERRREG project CB006.1.31.070. As methodology for collecting and interpriting technology innovation data was used a methodology developed in Economic research institute at the BAS, which meets the general requirements of the OECD and EUROSTAT Oslo manual. The paper interpritates the data collected from the point of view of clarifying potential for economic integration on the Balkans. The topics of interest for study are as follow: socio-demographic structure of respondents and company profile, innovation and digitalization level and policy, R&D and export intensity support.

1. Socio-demographic structure of respondents

The socio-demographic structure of respondents from Bulgaria and Macedonia is characterized by their demographic structure and by the position in the enterprise they represent.

1.1. Demographic structure

As could be expected the male dominate among employees in forestry sector, but Macedonian male respondents are prevailing Bulgarian ones. About 35% of the surveyed people were female (Figure 1).

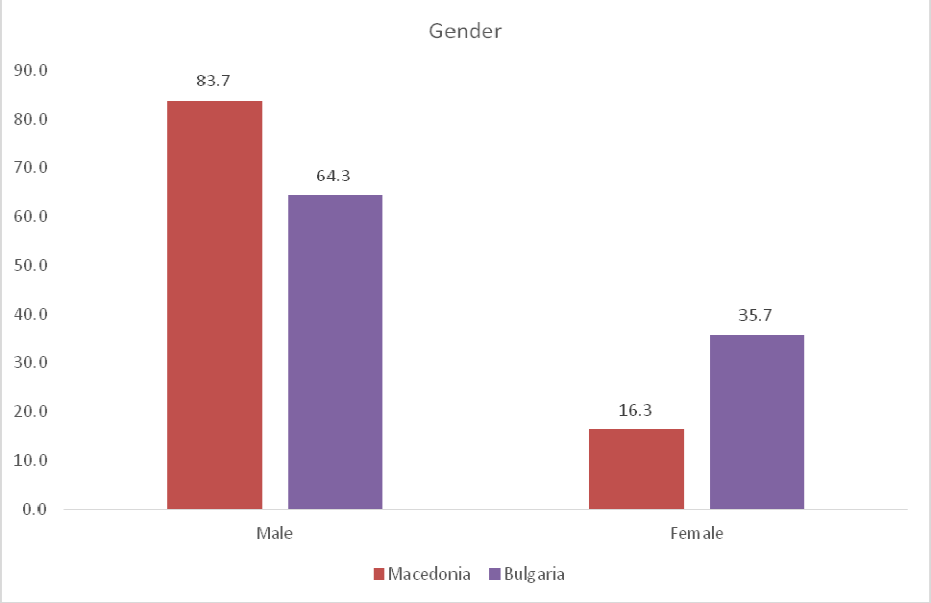


Figure 1

Ageing employees is the second demographic characteristics of respondents in both of the regions, Blagoevgrad and Kyustendil in Bulgaria and Northeastern, Eastern and South-eastern planning regions of Macedonia In Bulgaria, the largest share – one third of respondents, belongs to the age group of the age 51 and above, while in Macedonia the same share is occupied by the people from the group of 41 and 50 (38,3%).

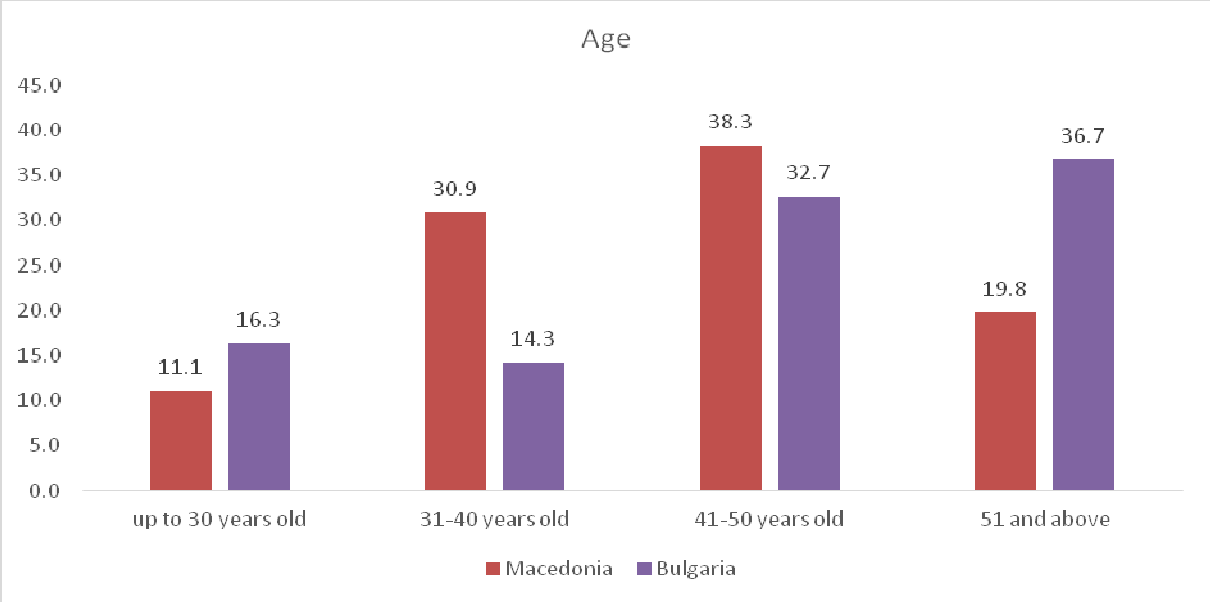


Figure 2

To assume – the age group of 41-years-old or older is occupied by 60% of the respondents in Macedonia and 70% in Bulgaria. (Figure 2).

Educational level of respondents is dominated by people with bachelor or equivalent level diploma, or with short-cycle tertiary education. The representatives from Bulgaria are more often with higher education comparatively to those from Macedonia (Figure 3).

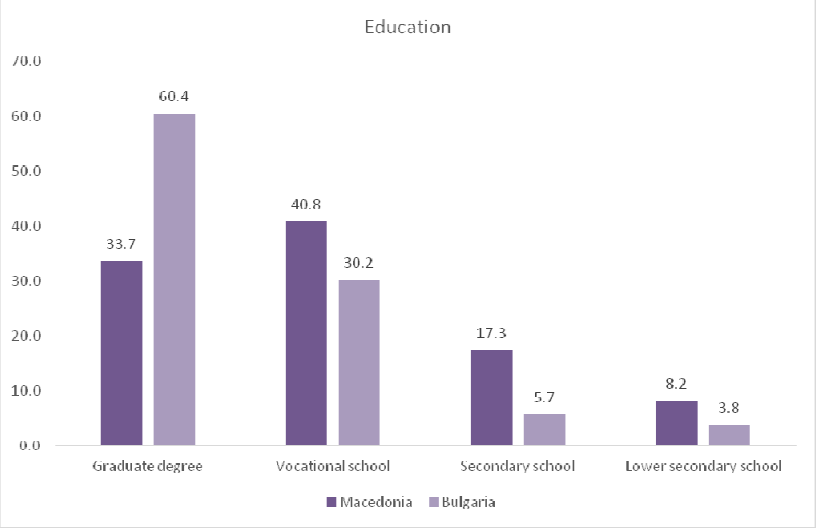


Figure 3

1.2. Position of respondents in the firm represented

The respondents used to be managers of the firms represented are dominating - about 90% in Macedonia and 70% - in Bulgaria. This is a result of a preliminary requirements in the survey to ask predominantly managers, and on the other hand – because of the dominated number of firms were solo liability enterprises. In very few cases the people who answered the questionnaires were applied specialists, administrative staff or skilled workers (Fig.4).

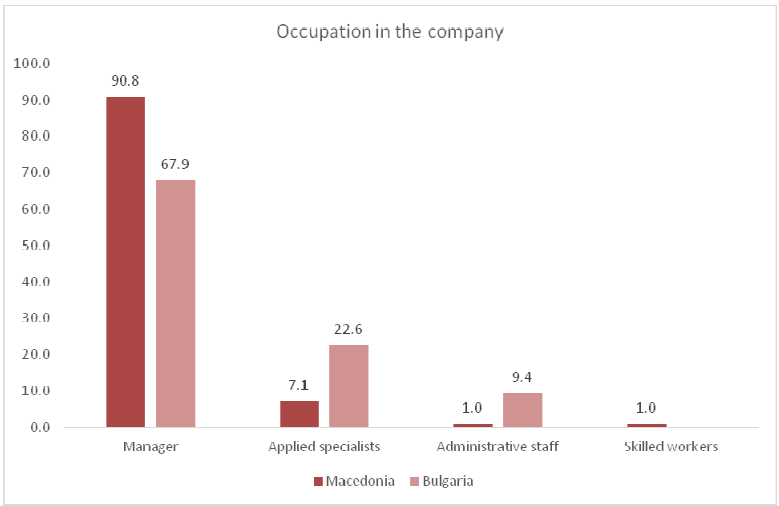


Figure 4

It could be concluded the majority of respondents were managers, male, in the age group above 40 years, with bachelor or short-cycle tertiary education level of education.

2. Companies profile

The companies observed during the survey in Bulgaria were dominated by activities like sawmilling and plating of wood and manufacture of other furniture, while in Macedonia – logging and support services to forestry (Figure 5).

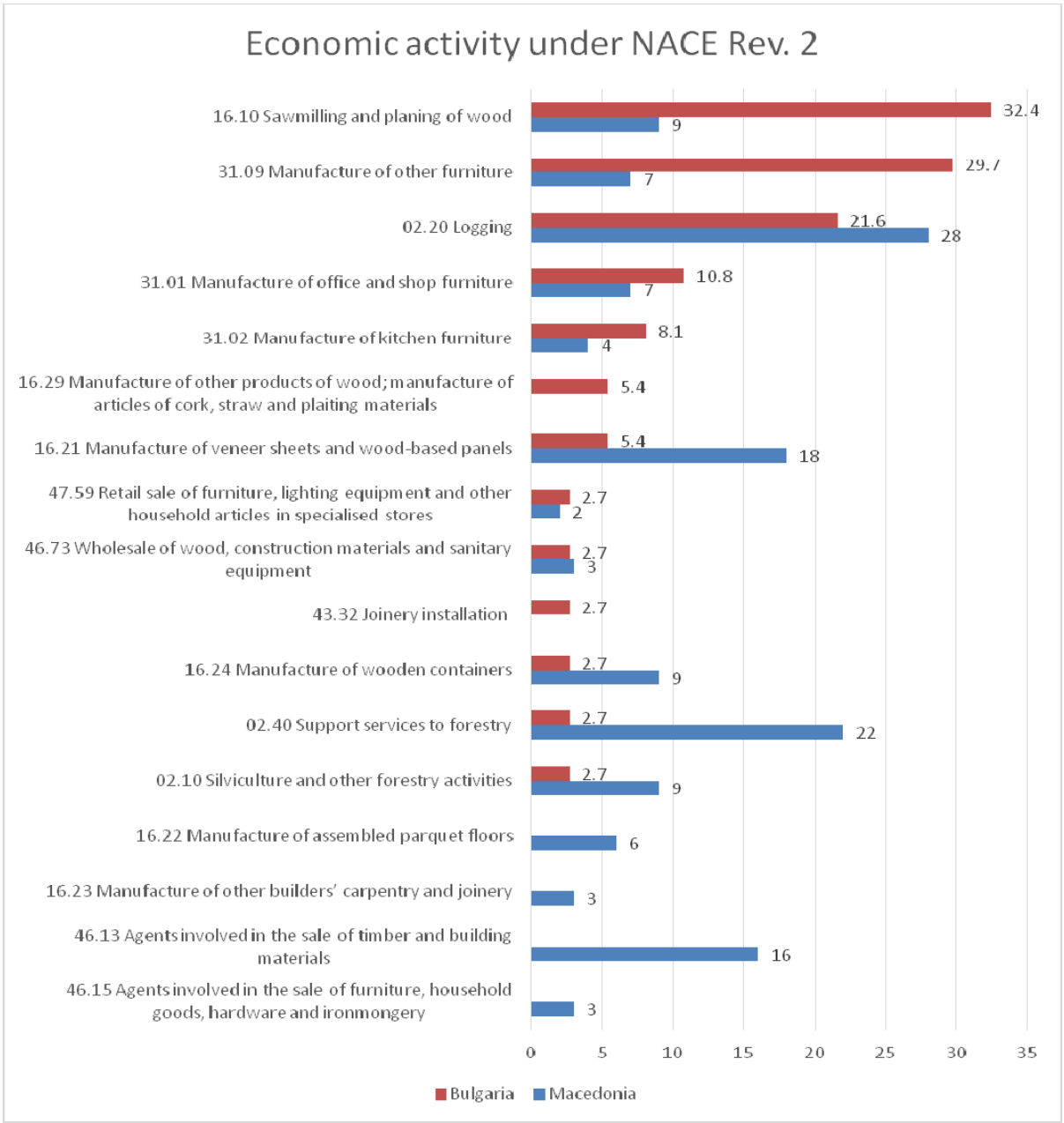


Figure 5

The age structure of the enterprises operation was dominated by those, established in the period 2001-2010. 38,4% of the Bulgarian ones have been operating for less than 16 years. The biggest share of companies participating in the study in Bulgaria were started in 2011 or later (43, 4% against 28,8% in Macedonia) (Figure 6).

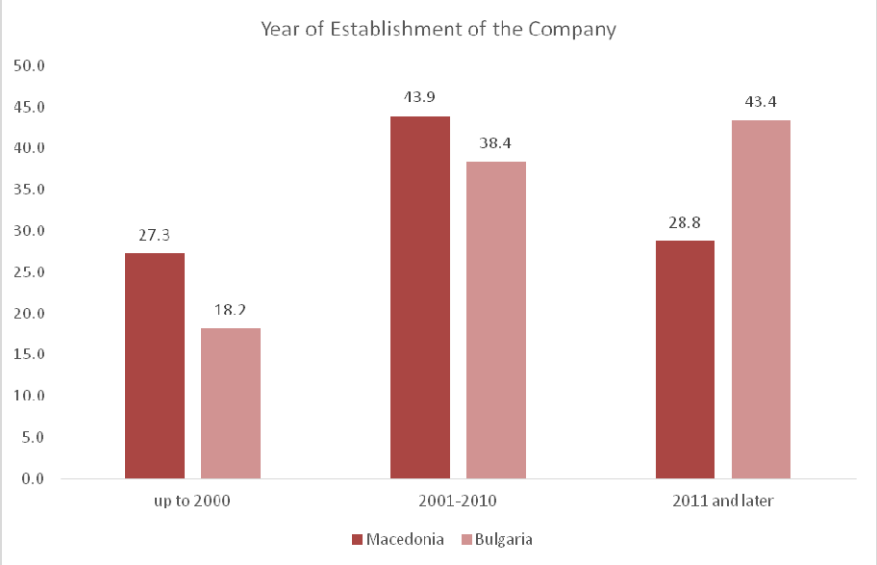


Figure 6

All of the surveyed enterprises in Bulgaria were private ones, while in Macedonia 14,3% of them were public (Figure 7).

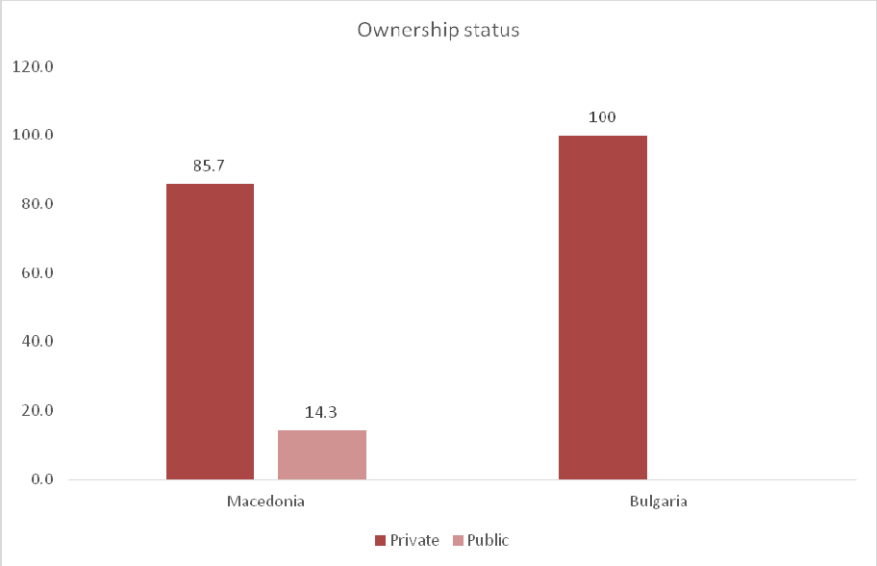


Figure 7

The observed companies were predominantly local (with either Bulgarians or Macedonians being the owners). In Macedonia, there were some cases of foreign or mixed ownership (Figure 8).

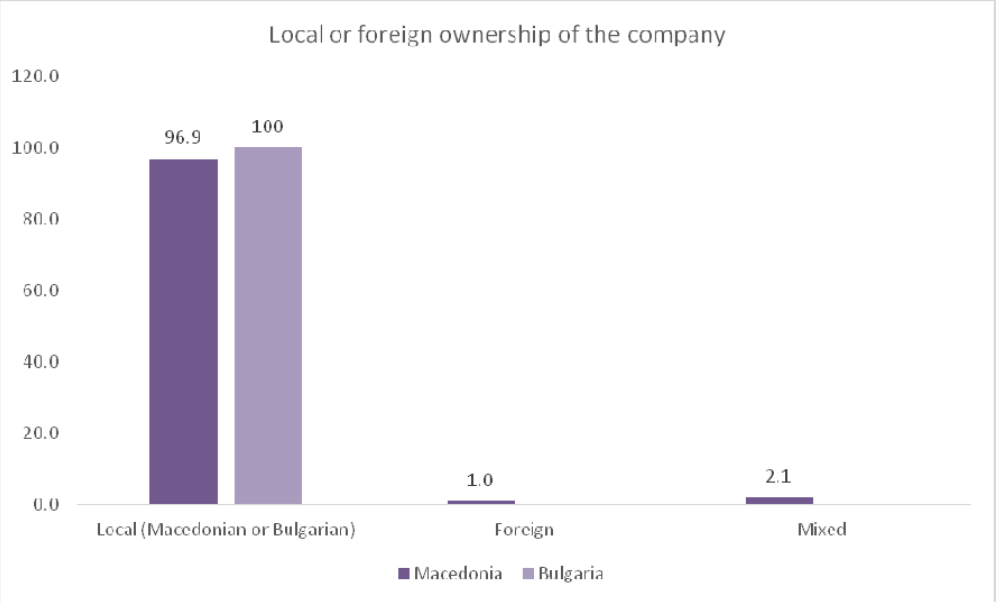
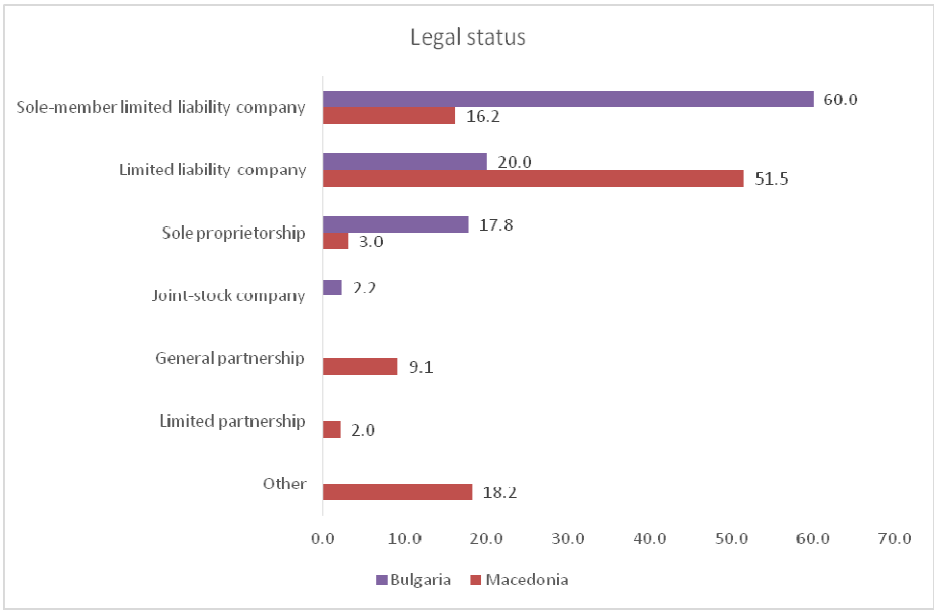


Figure 8

The legal status of firms observed the organization's in Bulgaria are predominantly sole-member limited liability companies (60%).and In Macedonia, where 51,5% of the surveyed enterprises were limited liability companies. Since in Macedonia there were public companies, they answered "other" when asked this question (Figure 9).



(Figure 9)

The connectivity of firms in the observed regions is not well performed as the majority of the organizations in the survey in both countries are independent. In Macedonia, very few companies are part of another enterprise (Figure 10).

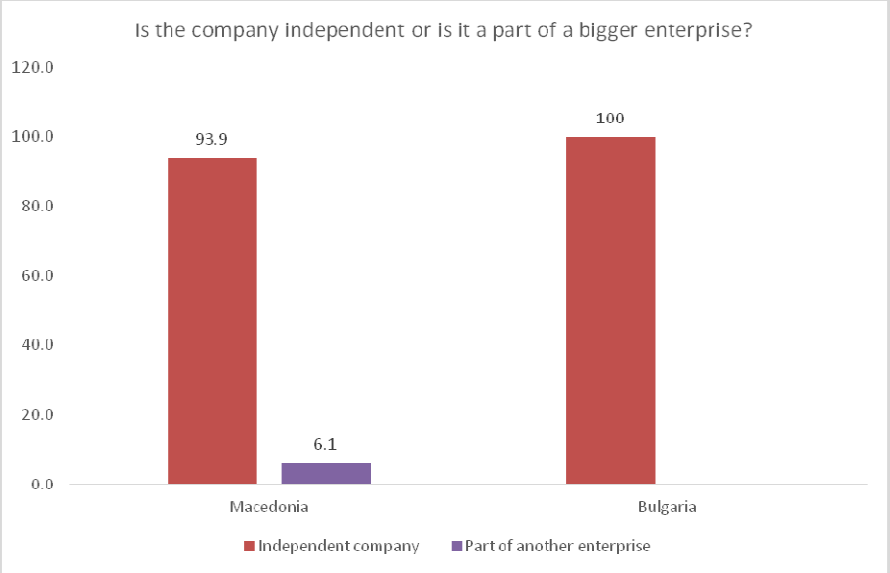


Figure 10

The majority of the businesses in the observed sectors were operating in the years 2014, 2015 and 2016. In Macedonia, those that were not operating were between 2 and 4% of the responding companies and in Bulgaria that percentage varies between 5,3% and 12,2% (Figure 11).

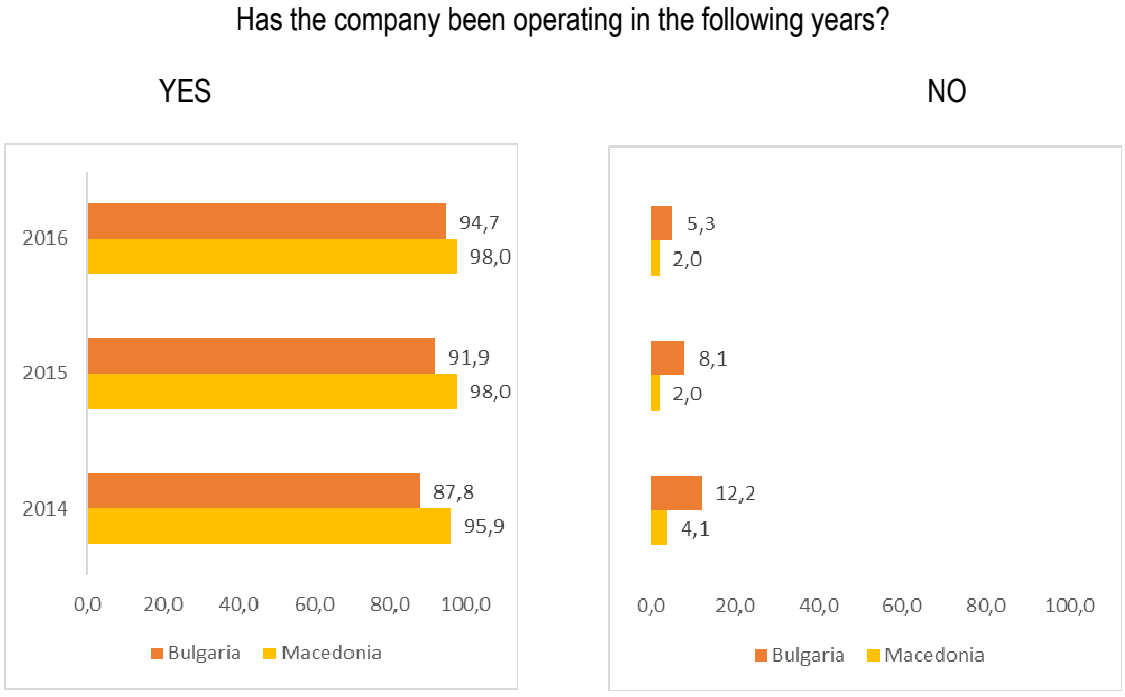


Figure 11

Predominantly the survey enterprises were micro, small and medium. The following data provides arguments for such conclusion: a) Companies that took part in the study in both of the regions typically have assets whose book value is no more than EUR 350 000 (72, 3% and 94, 7% in Macedonia and Bulgaria respectively). In Macedonia, 18, 1% of the interviewed enterprises have a book value of the assets that is between EUR 350 000 to EUR 4 mln (Figure 12).

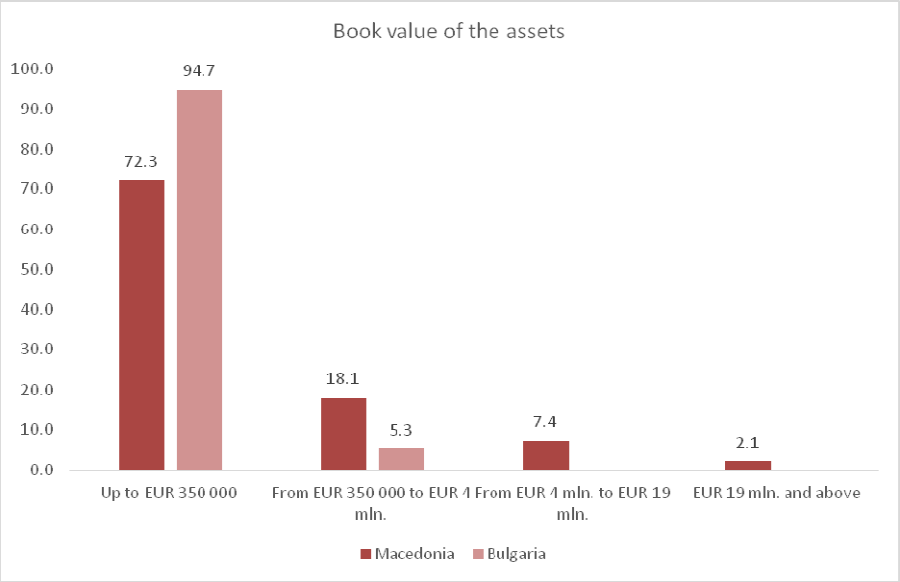


Figure 12

According to the next indicator of the size of the firms the survey says the net sales revenue of the majority (84,3% in Macedonia and 94,6% in Bulgaria) of the companies are small and have revenue which does not exceed EUR 700 000. 6,7% and 5,4% of the interviewed companies in Macedonia and Bulgaria respectively have net sales revenue between EUR 700 000 and EUR 8 mln (Figure 13).

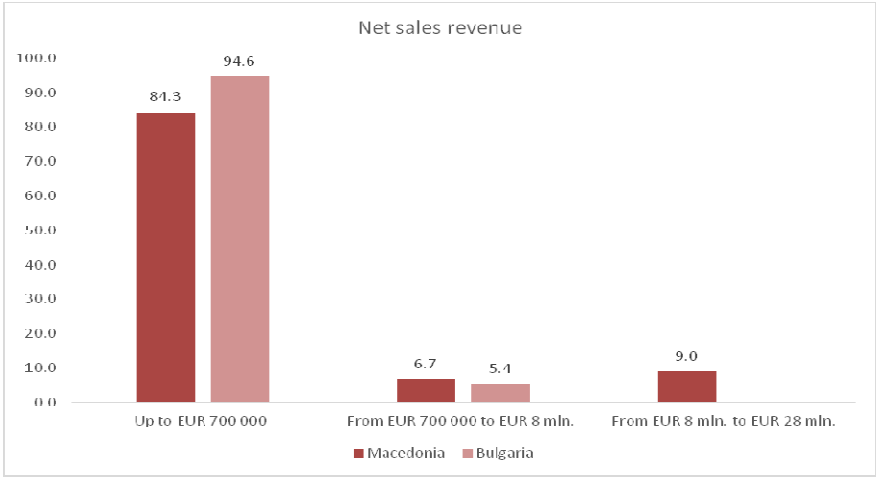


Figure 13

The majority of organizations which participated in the study were micro – about 61 and 65 % of all firms, and small with between 50 and 249 employees were 12,5% in Macedonia and 2,6% in Bulgaria (Fig.14).

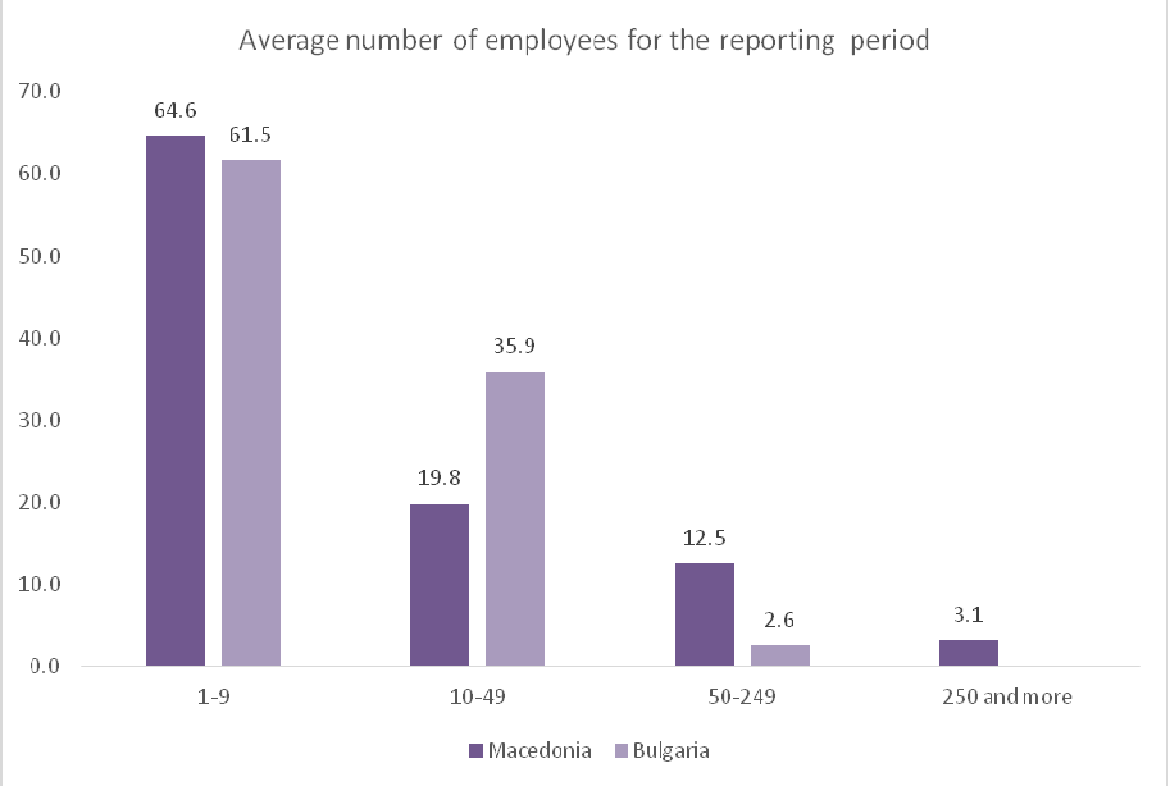


Figure 14

In conclusions, the observed enterprises were predominantly micro, and private, operating for less than 16 years. There are few small and medium size enterprises which operate in last 3 years in wood related sectors according to NACE Rev.2. The majority of the companies that took part in the survey in both Bulgaria and Macedonia have been micro – with between 1 and 9 employees (61,5% and 64,6% respectively). 19,8% of the respondents in Macedonia work in middle sized companies with 10 to 49 workers (against 35,9% in Bulgaria). Dominated observed firms' activity in Bulgaria were sawmilling and plating of wood and manufacture of other furniture, while in Macedonia – logging and support services to forestry, predominantly sole-member limited liability companies.

3.Innovation and cooperation potential of enterprises in the sector

The R&D intensity (share of research and development expenditures expenses of turnover) is commonly accepted indicator of the innovation activity in the businesses. The companies dominated in the observed sectors in the regions of Kyustendil and Blagoevgrad in Bulgaria and Northeastern,

Eastern and South-eastern planning regions of Macedonia spend 0% of their turnover on R&D (55,7% of the businesses in Macedonia and 84,6% in Bulgaria). 30,9% of the Macedonian companies spend up to 0,3% of their turnover on R&D (against 12,8% of Bulgarian organizations, affected by the EU funds. (Figure 15).

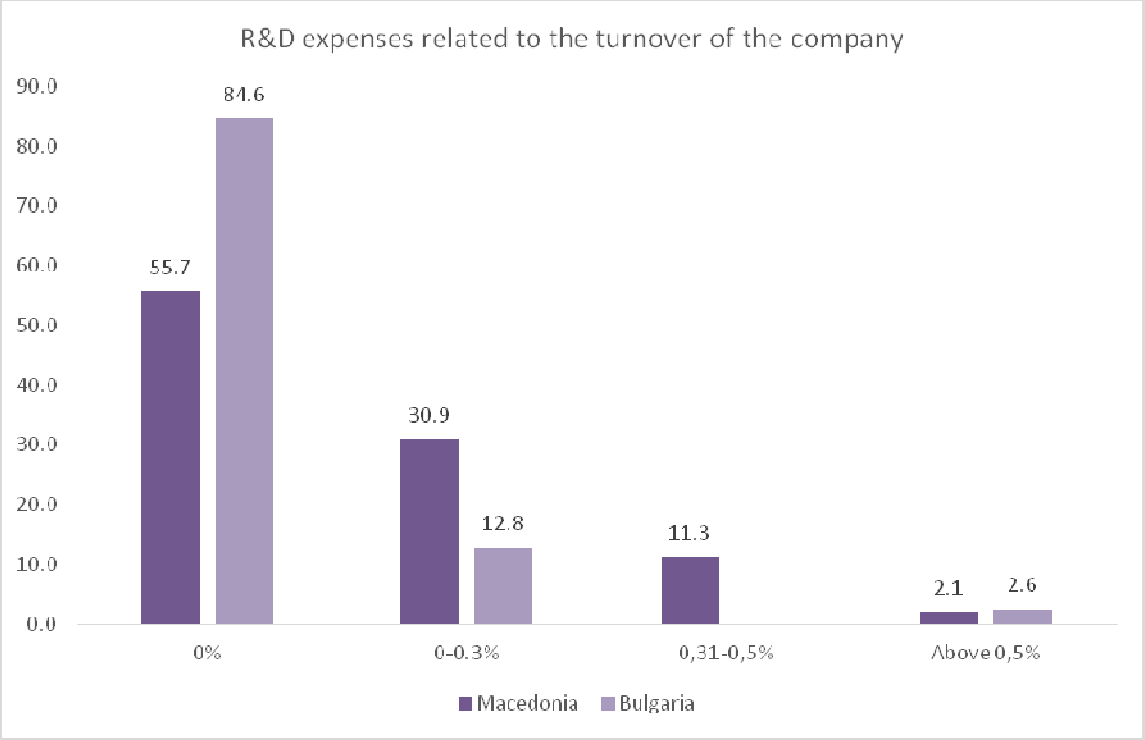


Figure 15

The innovation policy of the firms is dominated by objectives for introducing novelties in the observed enterprises n Bulgaria in Macedonia like the improvement of the quality of the products, the expansion or maintenance of the existing markets and the reduction of environmental pollution. The surveyed firms realise reducing unit labour costs and energy expenses as well as increasing the flexibility of the production are of high importance in both countries. (Figure 16).

Among priorities in policy making are expansion of the product portfolio, reducing the expenditures on materials, entering new markets or increasing market share, implementing new standards and the removal of products at the end of the life cycle (Figure 17).

Investments inn both countrties correspods to their innovation In the period 2014-2016, about 76% of the enterprises in Macedonia that were interviewed invested mainly in acquiring new machines and equipment, around 48% in staff trainings, 41% in advertisement and 39% in buying computed hardware. In Bulgaria, the companies as well were spending the most on new machines and equipment, staff training, market research advertisement and computer software (Figure 18).

What are the main aims of your enterprise when introducing technological novelties? What priority are they given?

Figure 16

What are the main aims of your enterprise when introducing technological novelties? What priority are they given?

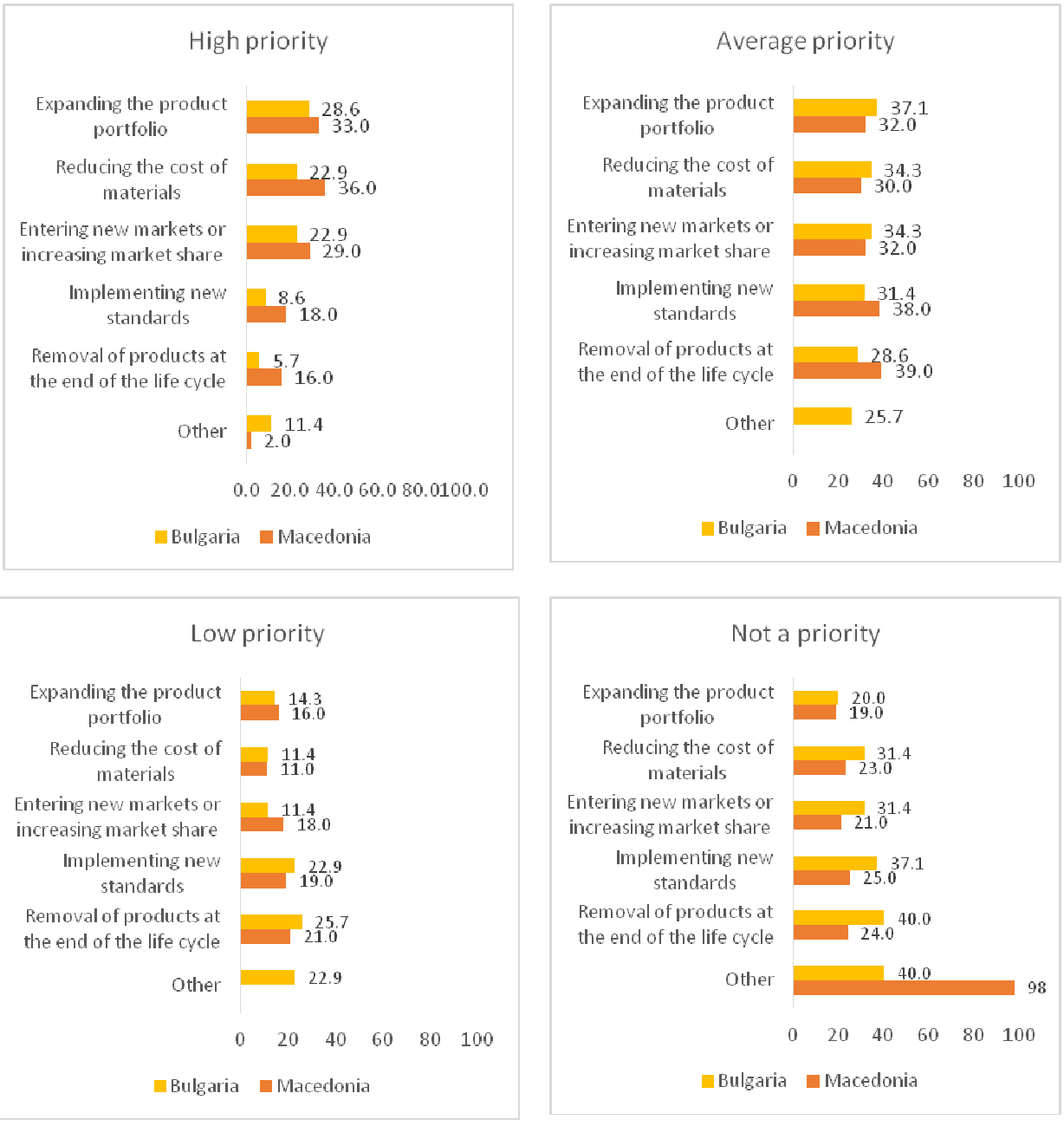


Figure 17

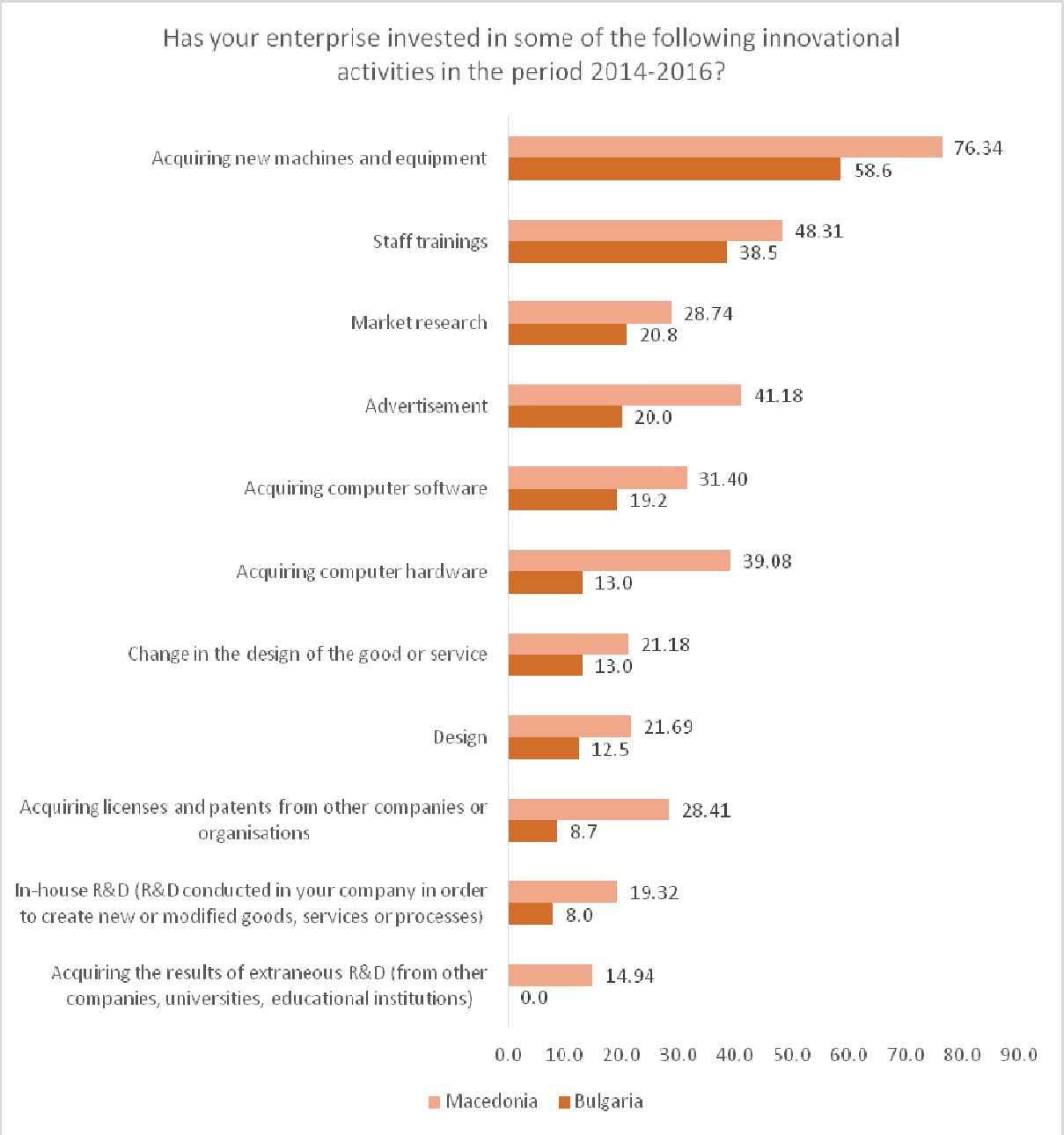

Has your enterprise invested in some of the following innovational activities in the period 2014-2016?
Acquiring new machines and equipment
76.34
58.6
Staff trainings
48.31
38.5
Market research
28.74
20.8
Advertisement
41.18
20.0
Acquiring computer software
31.40
19.2
Acquiring computer hardware
39.08
13.0
Change in the design of the good or service
21.18
13.0
Design
21.69
12.5
Acquiring licenses and patents from other companies or organisations
28.41
8.7
In-house R&D (R&D conducted in your company in order to create new or modified goods, services or processes)
19.32
8.0
Acquiring the results of extraneous R&D (from other companies, universities, educational institutions)
14.94
0.0
0.0 10.0 20.0 30.0 40.0 50.0 60.0 70.0 80.0 90.0
Macedonia
Bulgaria

Figure 18

A vast majority of firms interviewed provided information they have been innovative during 2017 In Macedonia, more than half of the organizations that took part in the survey answered that they have introduced technologically new or modified products in the last three years. In Bulgaria, 76,5% of the firms said that they have not introduced technologically new or modified products to the market. That could be related to the low R&D activities that the companies undertake, traditionally low level of innovation intensity of the sector and low level of novelty in innovations taking place in the firms (Figure 19).

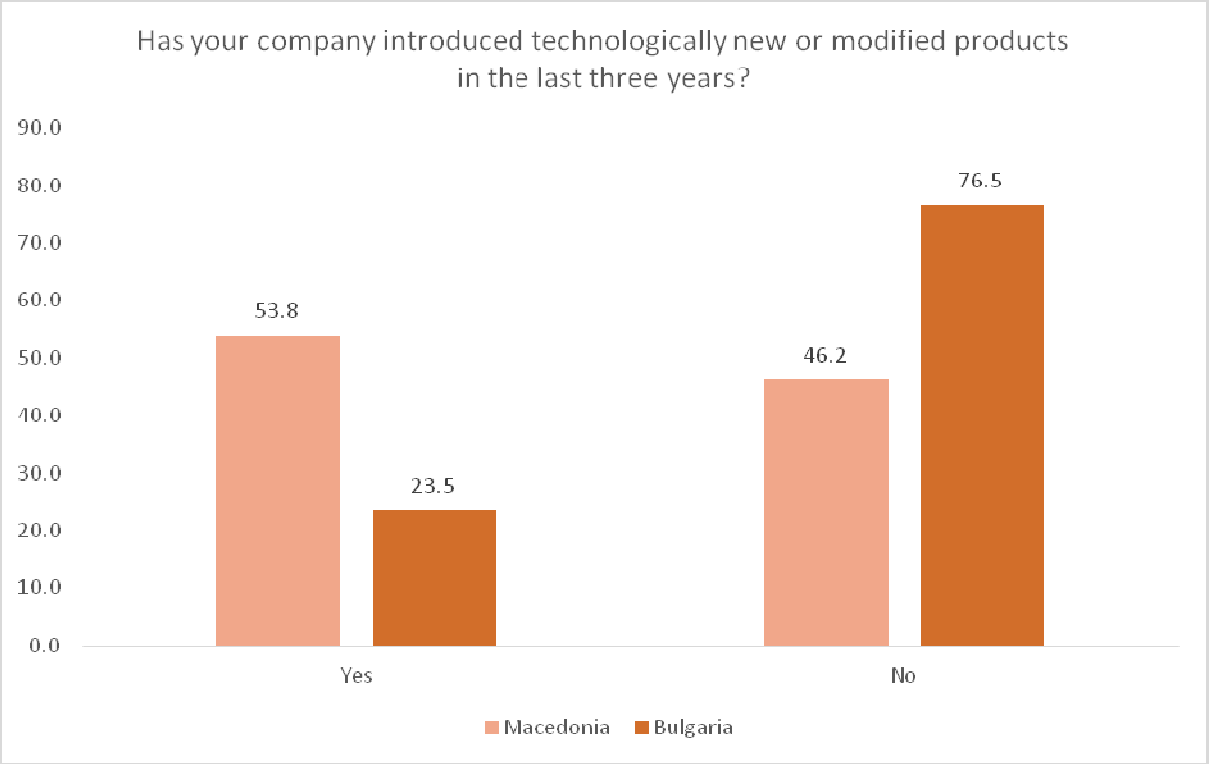


Figure 19

When Bulgarian companies launch a technologically new or modified product, they have acquired the know-how related to it inside their organization. In Macedonia, enterprises acquire that either in house, when cooperating with other firms or institutes or directly from other enterprises or institutes (Figure 20). The low level of connectivity results in low level of their innovations of micro and small enterprises.

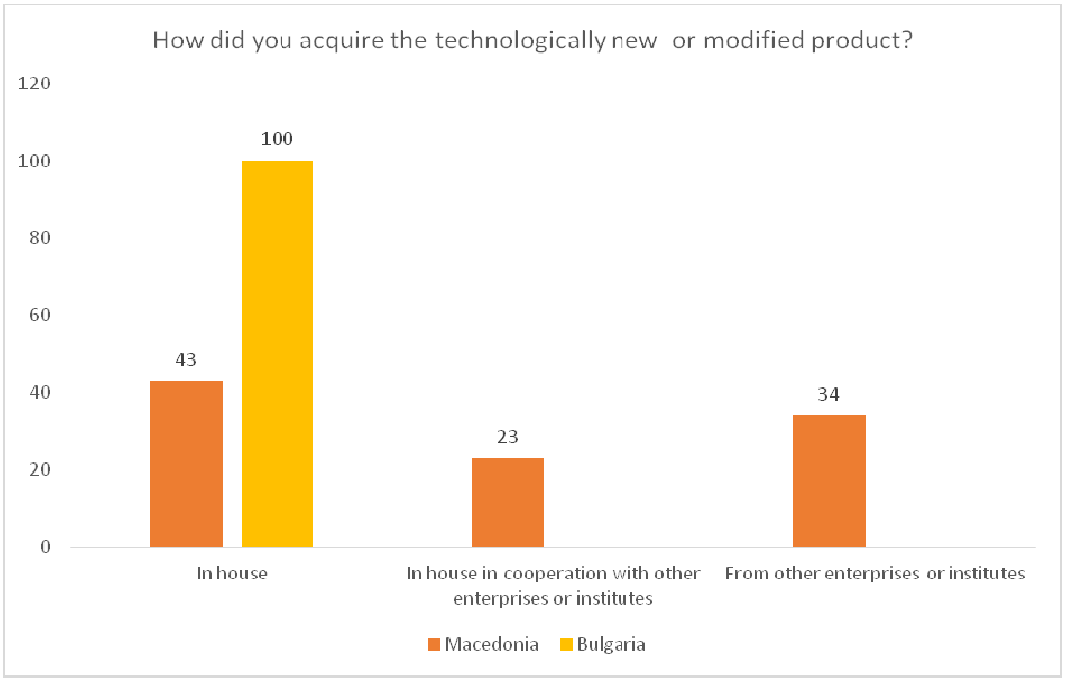


Figure 20

There is one more argument the novelty of innovations is low - launching products that are technologically new or modified and are also new to the market is not a common practice in both of the observed regions: the majority of companies have not introduced such in the last three years (Figure21).

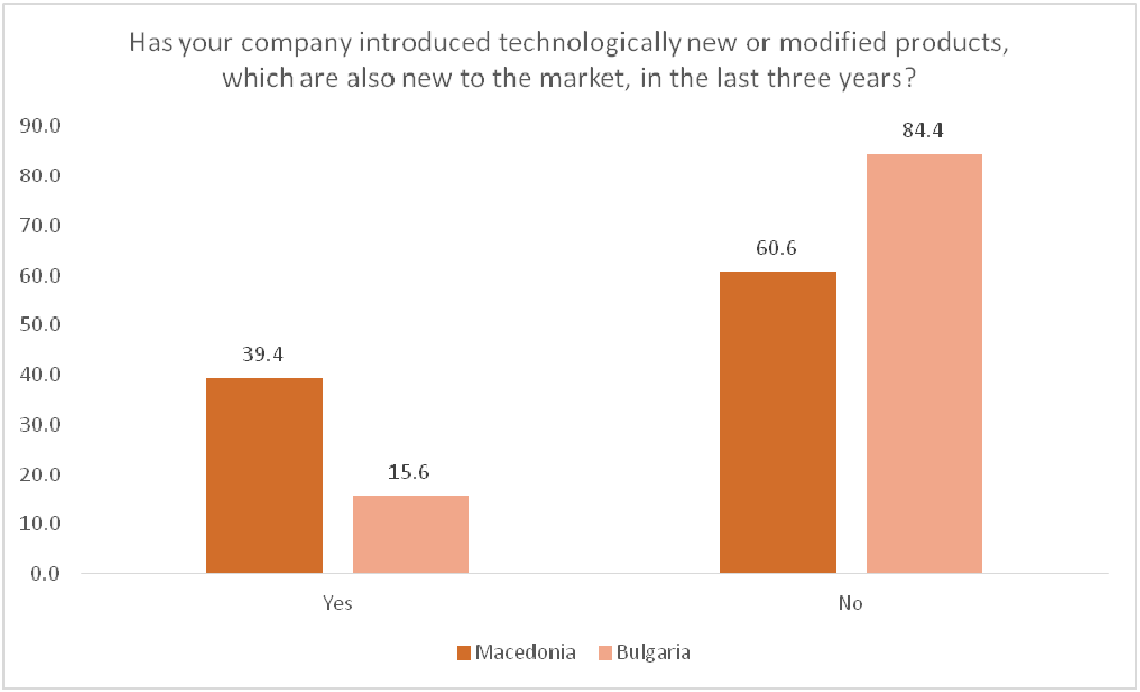


Figure 21

The organizational changes were no radical. The introduced new management techniques that happen in the most in the surveyed companies in Bulgaria are using the Internet and e-mails, electronic data exchange and investing in the development of the staff. Macedonian companies gave analogical answers and there JIT planning systems or similar were also popular (Figure 22).

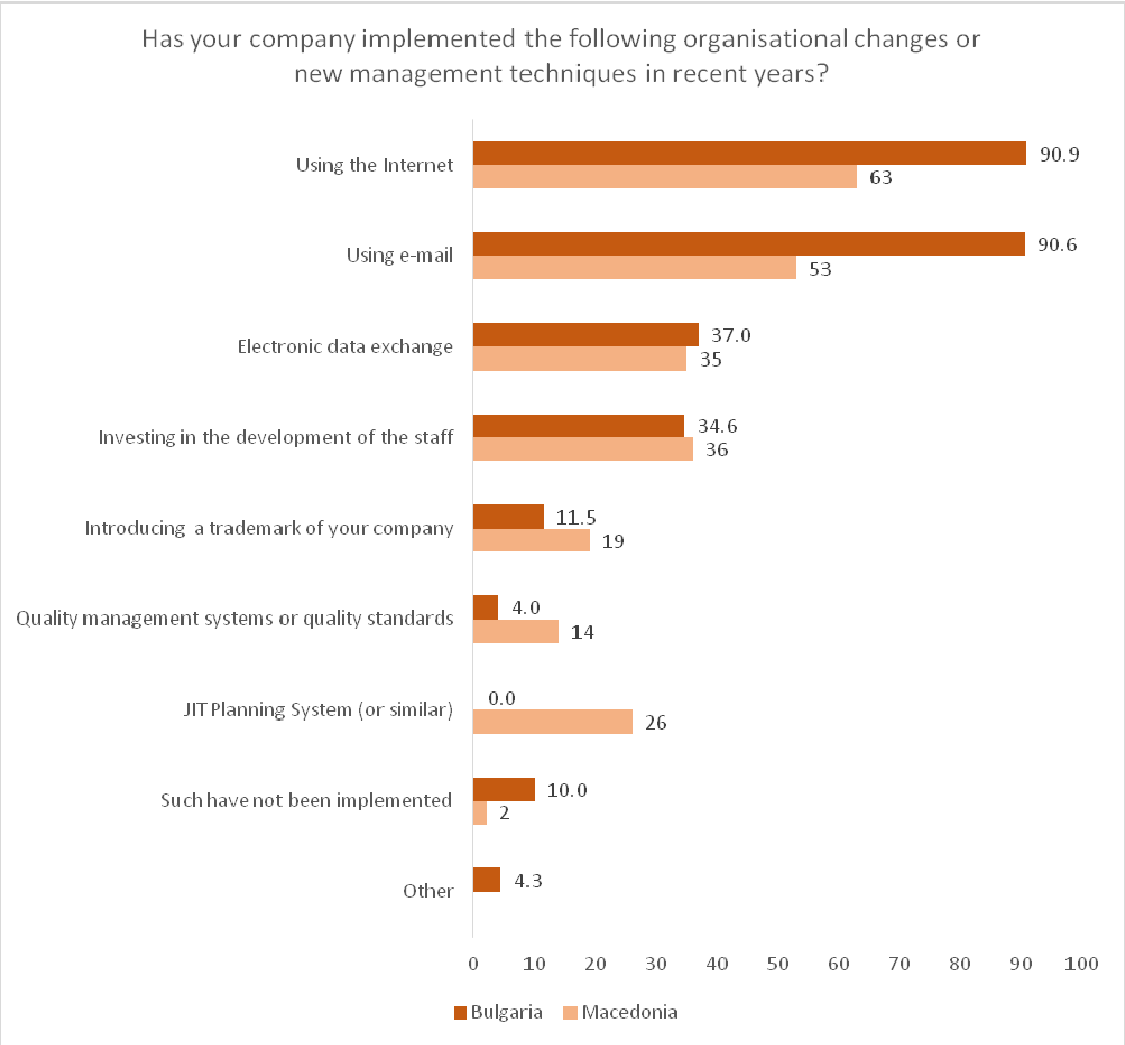


Figure 22

The above question reveals the reasons behind the low innovational activities of the firms in the region. The companies in both countries faced setbacks such as financing, extremely high costs which are in direct relation to innovations, lack of qualified workforce. In Macedonia the enterprises also indicated the great economic risks (Figure 23).

Another area of organizational changes concerns activities that are related to products or services design, engineering, advertising as well as multimedia, graphic and web design in Bulgarian companies most often include the work of internal specialists. Software development and database management are left to external specialists. In Macedonia, the division of the work is the following: engineering and products or services design is also done by specialists from the firm itself. The majority of the other activities, such as graphic and web design and software development are performed by external specialists (Figure 24).

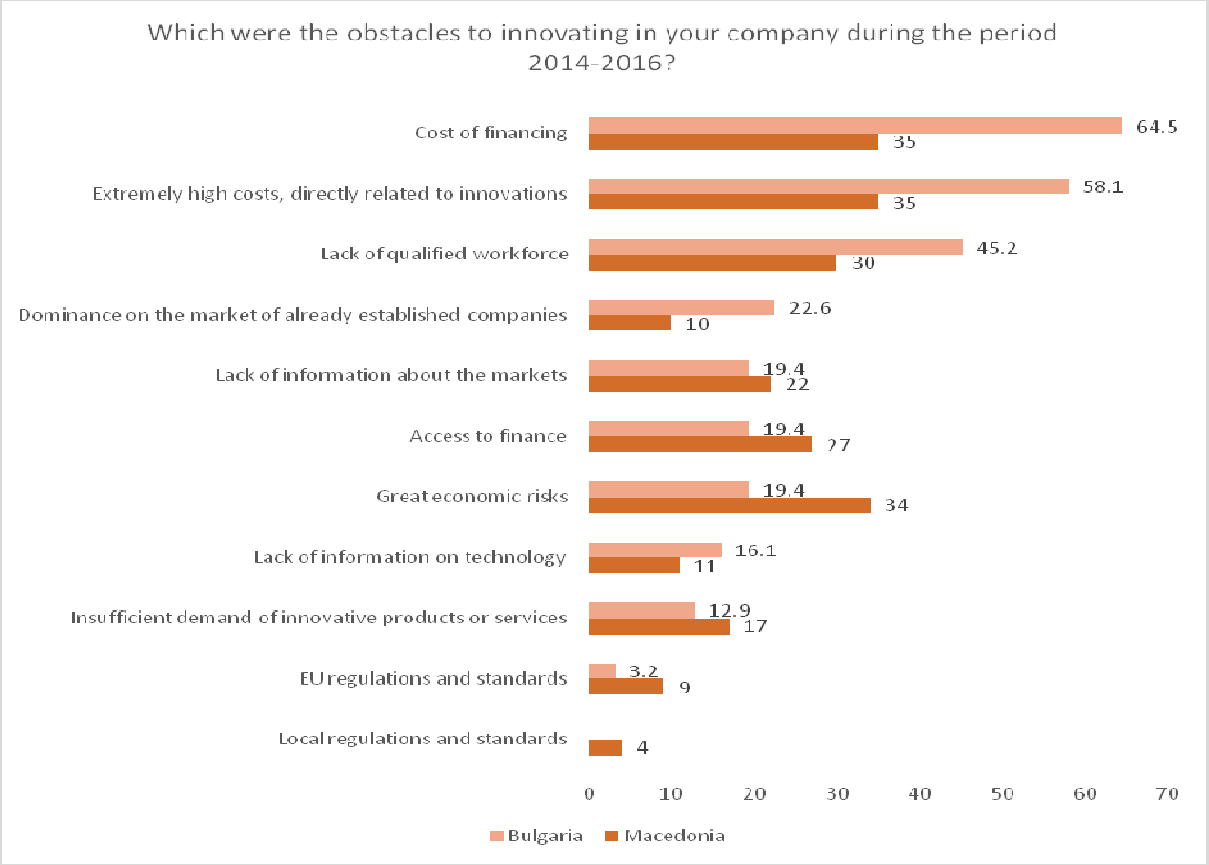


Figure 23

During the last three years what kind of specialists have been engaged with the following activities?

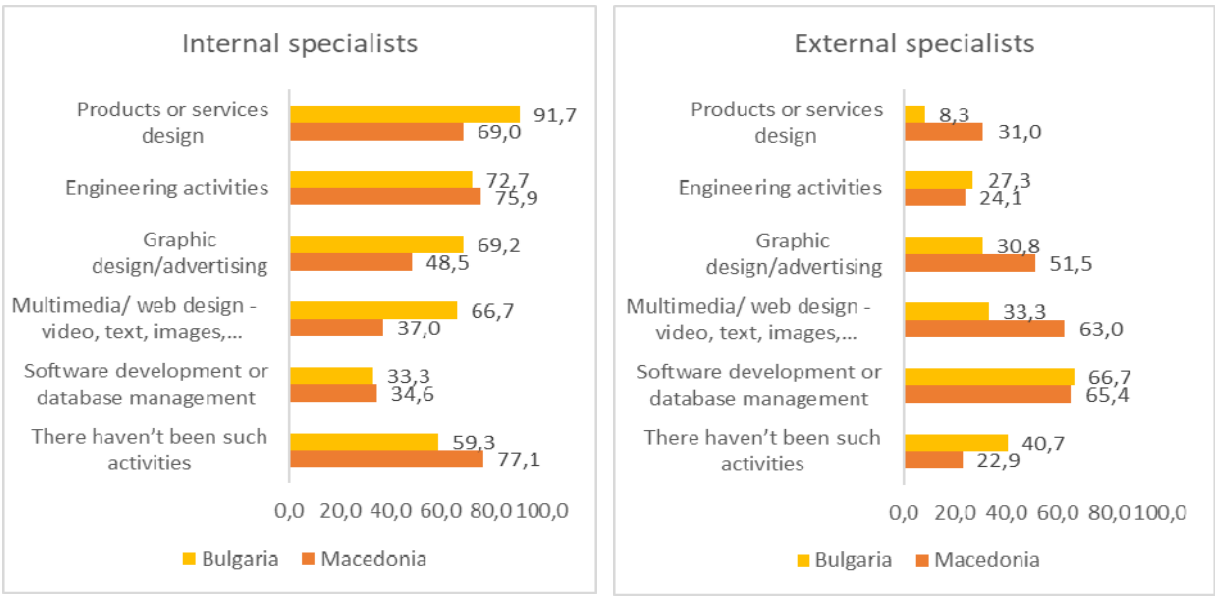


Figure 24

The internal for the firms' sources for innovative ideas are prevailing for both countries. The production process itself is regarded as a very important source of innovative ideas both in Bulgaria and in Macedonia. Bulgarians see the control over the technological process and management bodies and individuals to be of high importance to innovations as well. In Macedonia, the own research and development, the control over the technological process and the market research have a key role in new projects and innovation (Figure 24).

To what extent are the following sources of innovative ideas important to the new projects and technological innovations of your enterprise?

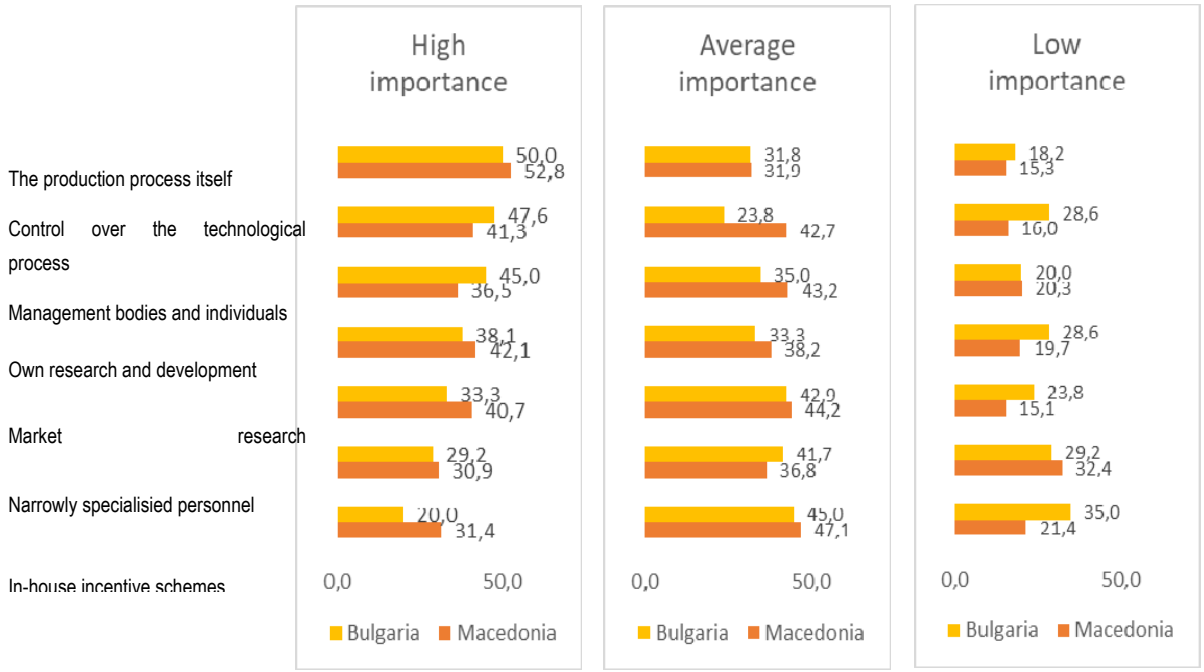


Figure 25

Among external to the firm sources for innovative ideas local innovation programs are regarded of high importance by some of the companies in Bulgaria. Foreign competitors have a minor role when it comes to innovative ideas, both in Bulgaria and in Macedonia. Less important to new projects and technological innovations are fairs and exhibitions, state and foreign innovation programs. This fact indicates that cooperation levels are low and thus companies do not consider them to be important in relation to innovation (Figure 25).

To what extent are the following sources of innovative ideas important to the new projects and technological innovations of your enterprise?

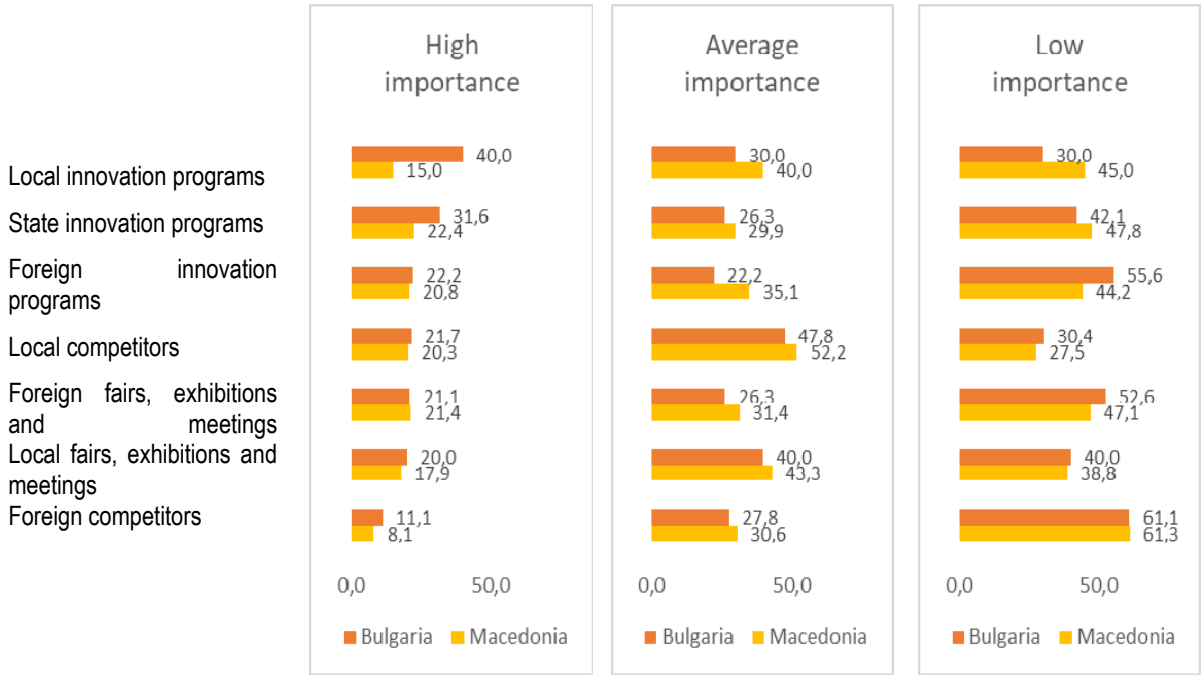


Figure 25

Among the external sources of innovative ideas that are neglected by the firms are many others. The surveyed companies regard the software that they purchase to be of low importance to innovative ideas. Newly purchased equipment from local or foreign manufacturers is of average importance (Figure 26).

To what extent are the following sources of innovative ideas important to the new projects and technological innovations of your enterprise?

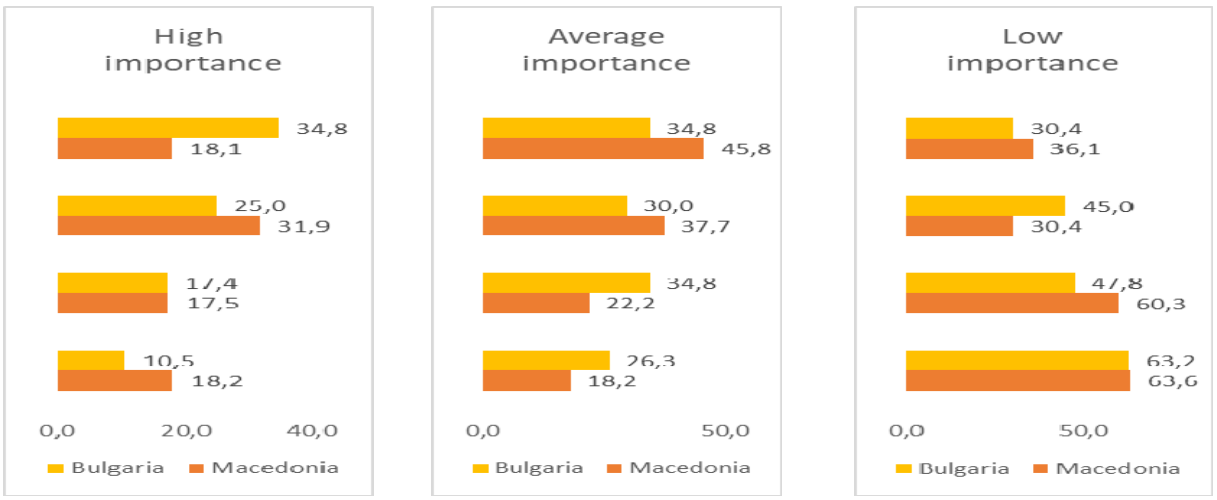


Figure 26

The fact the foreign and local customers and suppliers are considered to be either of average or low importance to innovative idea and so are local consulting companies, and the foreign consulting companies are not perceived as an important source of ideas for innovation shows the innovation system of the region is weak (Figure 27).

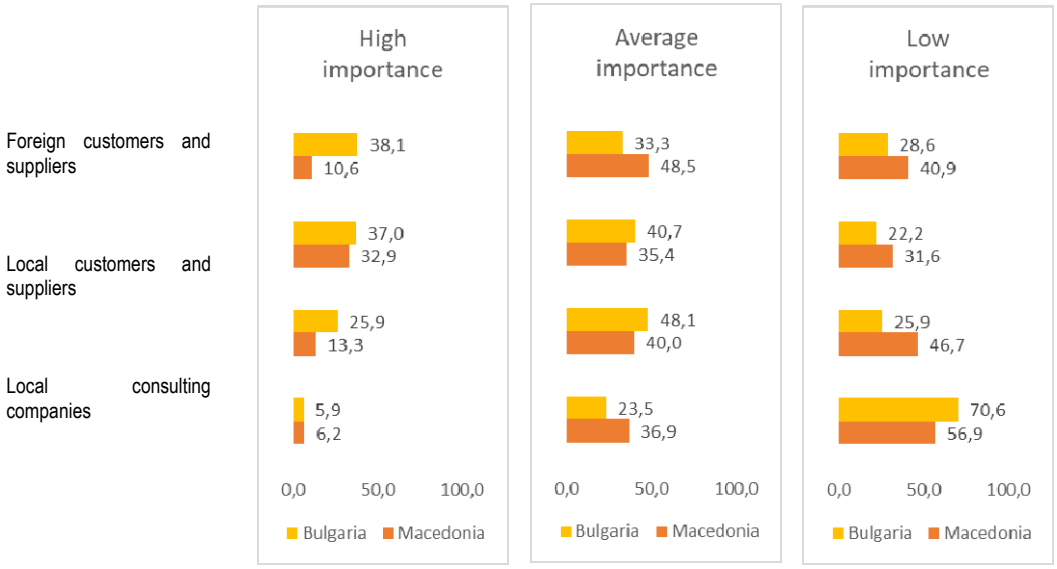


Figure 27

The next argument to the above statement is that research institutions are predominantly rated as a source of low importance to the new projects and technological innovations and innovative ideas related to them. This could be attributed to the registered low R&D activities as well as to the low levels of cooperation between the business and the institutions in the observed sectors (Figure 28).

To what extent are the following sources of innovative ideas important to the new projects and technological innovations of your enterprise?

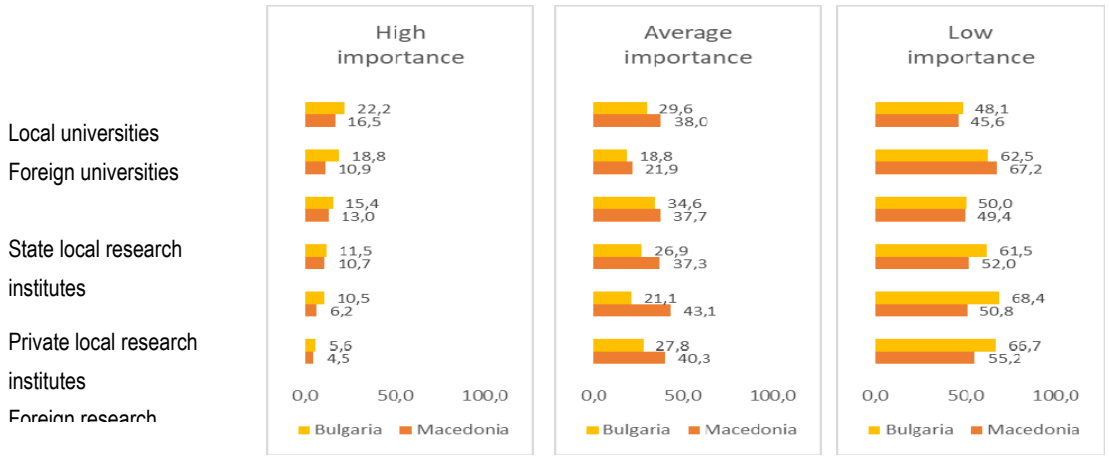


Figure 28

Companies in Bulgaria and Macedonia neglect another important for innovating factors - computer-based networks and patents from other countries are of low importance to innovative ideas. The importance of occupational safety and health regulations, environmental regulations and product standards is split into equal parts for the different firms: some regard those factors as vital, others as having average importance, others as insignificant (Figure 29).

To what extent are the following sources of innovative ideas important to the new projects and technological innovations of your enterprise?

Figure 29

Enterprises that participated in the survey generally believe that innovative ideas might come from their business connections, from advice to the company, from meetings and conferences as well as from trade associations. All those factors were rated as having average importance by approximately half of the firms both in Macedonia and in Bulgaria. (Figure 30).

To what extent are the following sources of innovative ideas important to the new projects and technological innovations of your enterprise?

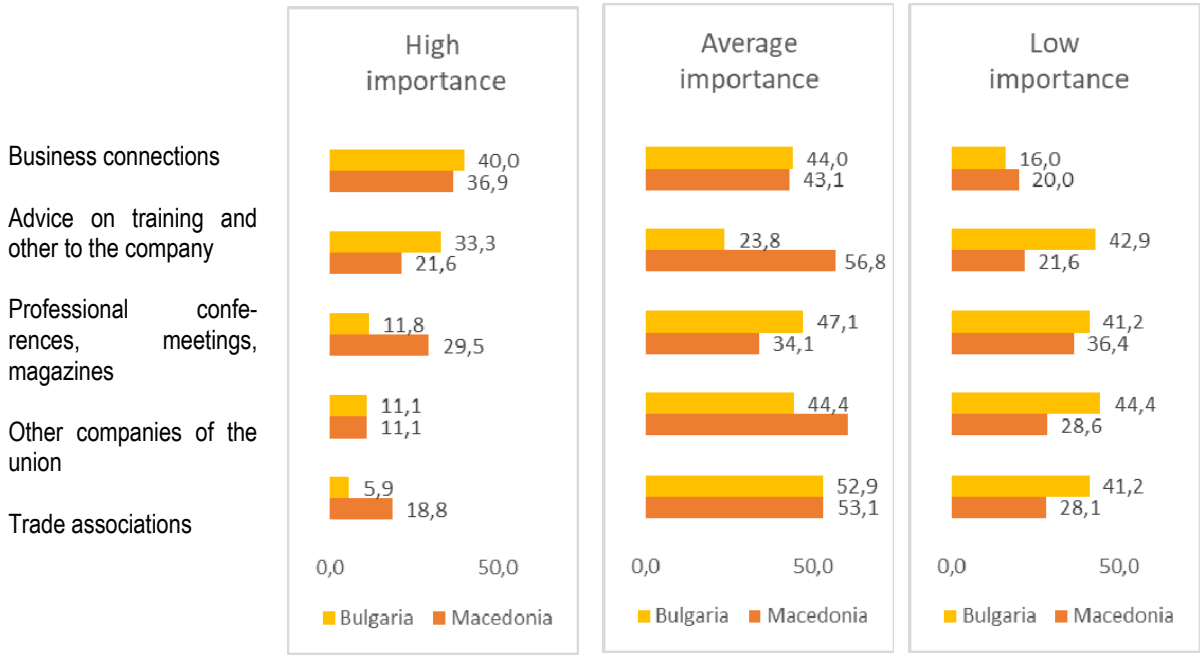


Figure 30

Concluding the above results it could be assumed level of innovativeness and respective policies has to be on focus in the process of fostering economic cooperation in the region. It has to be taken into account the R&D intensity in the observed firms is very low. The novelties introduced are incremental, produced in-house, no any radical innovations. The sources of ideas for innovation are internal.

Innovation policy is very general. these characteristics correspond to the size structure of the observed enterprises, defined in previous section.

3. Digitalization

ICT usage is a precondition for contemporary activity of any firm. The basic indicators concerning digitalization include availability of computers, Internet usage, type of connections, purposes for Internet usage, availability of website.

The most companies in the observed sectors use computers. In Macedonia 17,3% of the enterprises answered that they do not use a computer and in Bulgaria that percent was 7,9% (Figure 31).

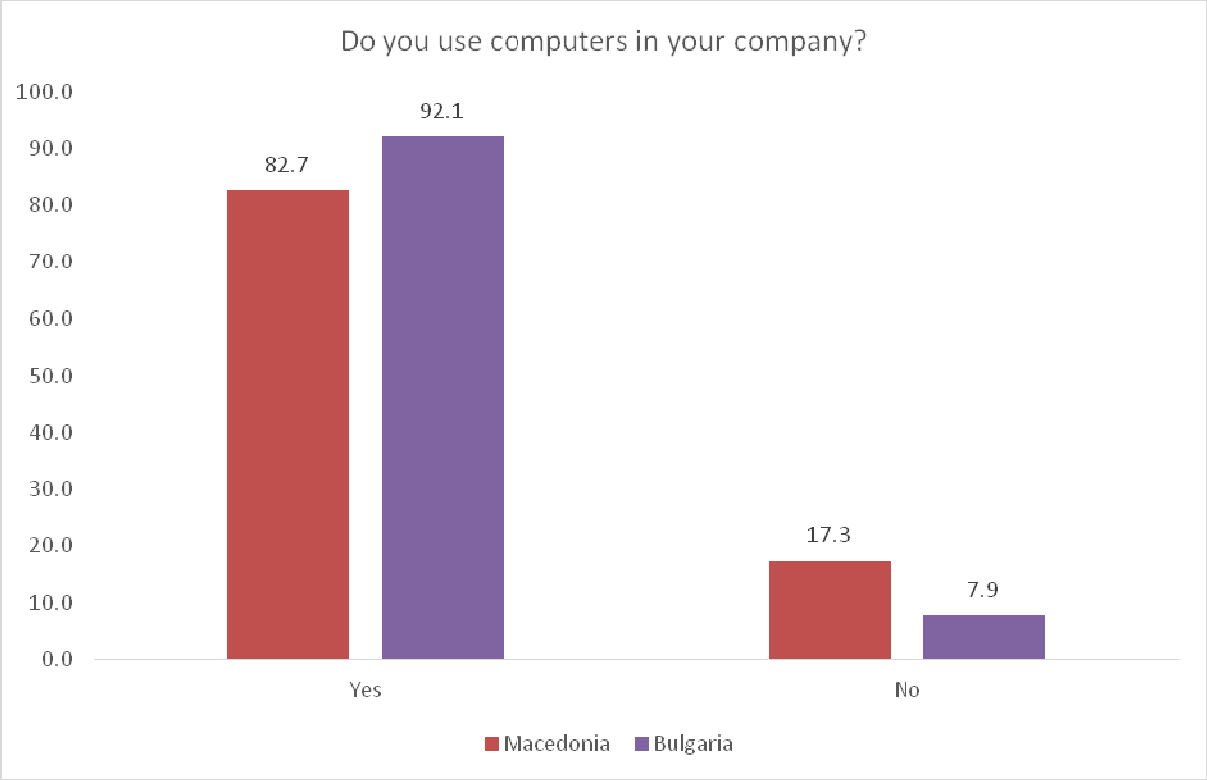


Figure 31

Internet penetration is approximately well presented in the surveyed businesses, but there is a room for better performance. In Bulgaria, 7,9% of the interviewed companies do not use it, while in Macedonia that percentage is 22,4. (Figure 32).

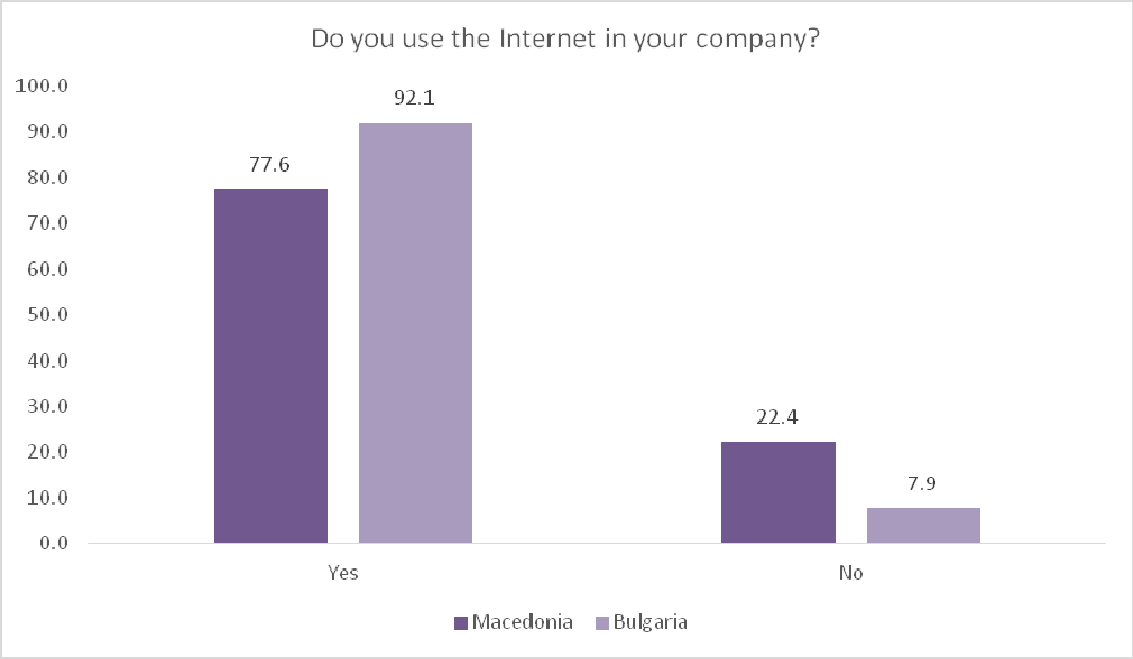


Figure 32

The companies which use the Internet mostly have a fixed or broadband connection (observed firms in Macedonia and Bulgaria - 66,2% and 61,8% respectively) (Figure 33).

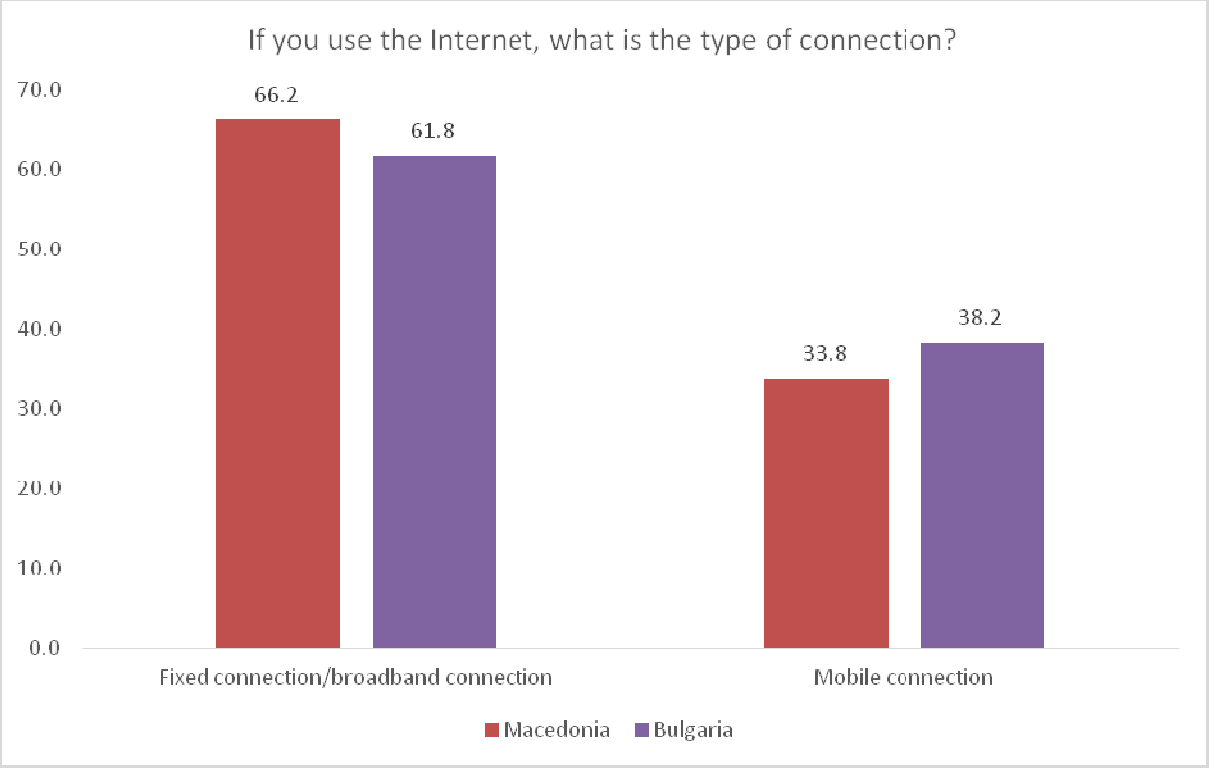


Figure 33

The most widespread use of the Internet amongst the surveyed companies is for interaction with public institutions. This is valid for 91,4% of the enterprises in Bulgaria and 48% of those in Macedonia. Another purposes of Internet usage is electronic invoice, followed by social media and automated relations to the customers or suppliers of the firms. Some of the companies have online shops or use cloud services. ERP or CRM systems and information security policies are less popular (Figure 34).

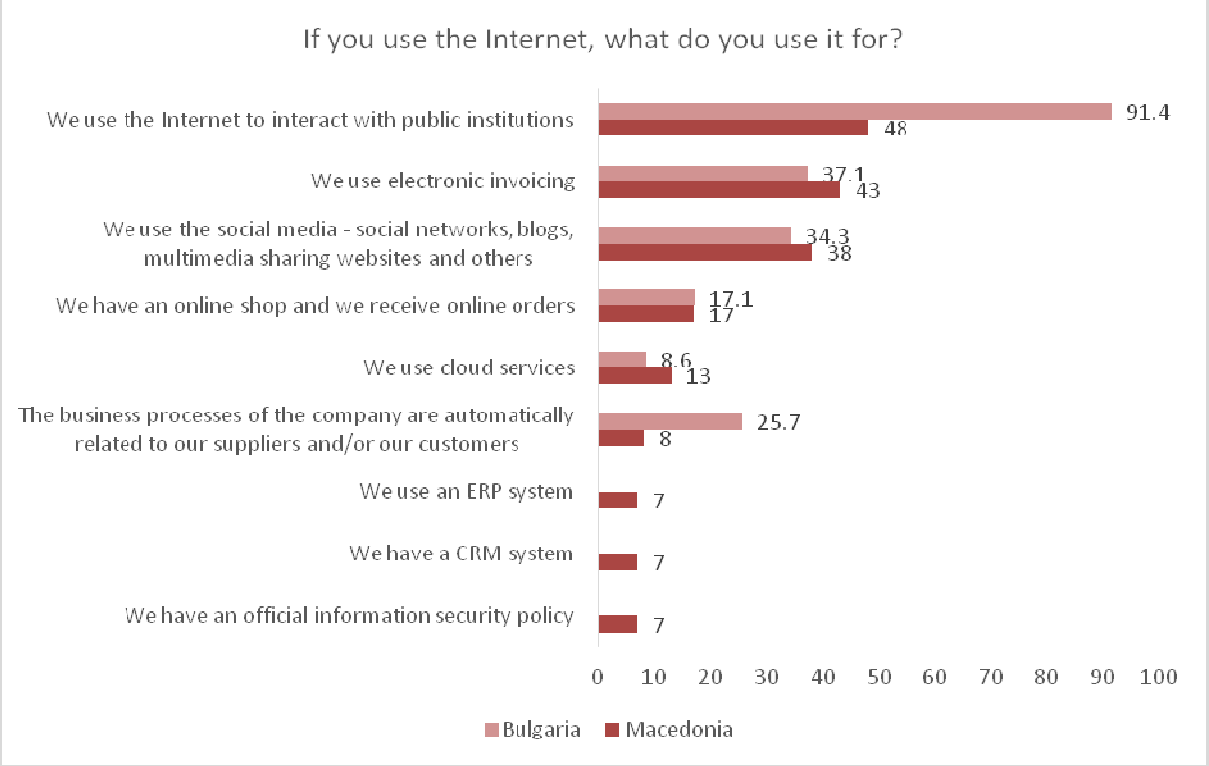


Figure 34

A common barrier to connectivity of the firms is that more than half of the interviewed companies, both in Bulgaria and Macedonia, do not have websites. (Figure 35).

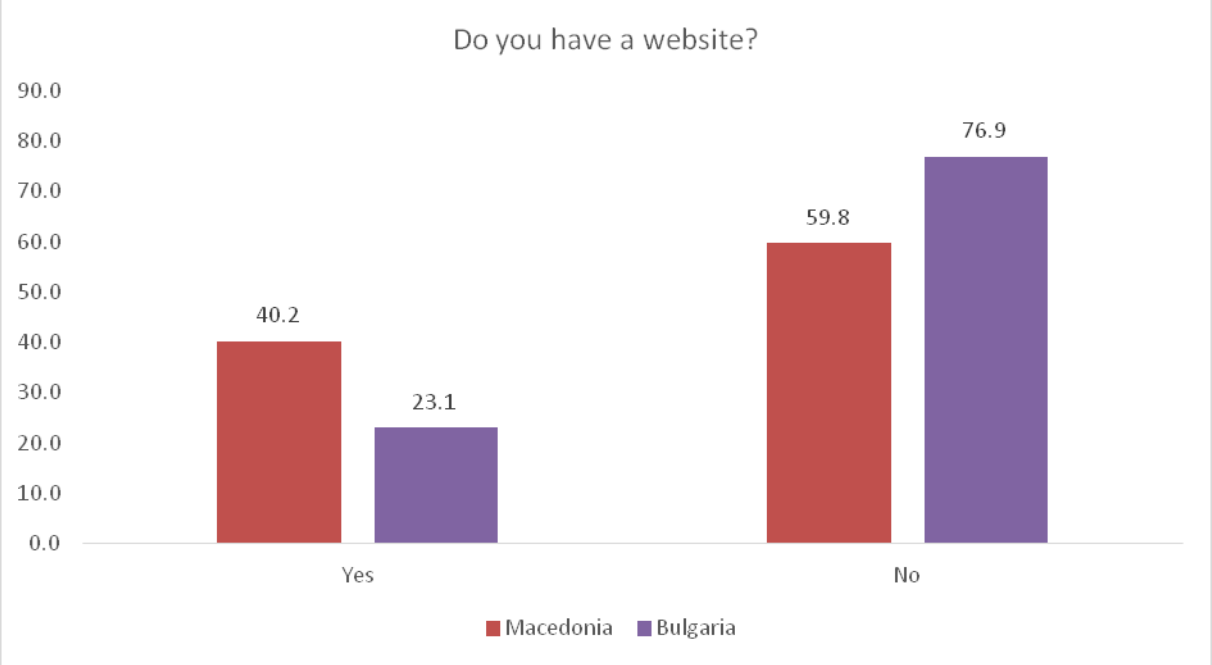


Figure 35

In conclusion it could be summarized that in spite firms from the sector in Bulgarian side are better performed in ICT usage there is a lot of room for improvement for all firms surveyed. The typical firm in the observed population has computers, and use Internet for connecting with public institutions, but has not any website.

5. Export intensity

Intensity of foreign trade of the firms in the sector is an indicator for economic integration in any region.

The survey says export intensity of the majority of the interviewed enterprises is low. 87,7% in Macedonia and 84,6% in Bulgaria export goods or services with a value which equals up to 20% of their turnover. The export of only 12,8% of the Bulgarian companies which participated in the survey equals a value which is between 21 and 49% of their turnover. The export of only 8,6% of the companies from Macedonia that took part in the study equals more than 50% of their turnover (Figure 36).

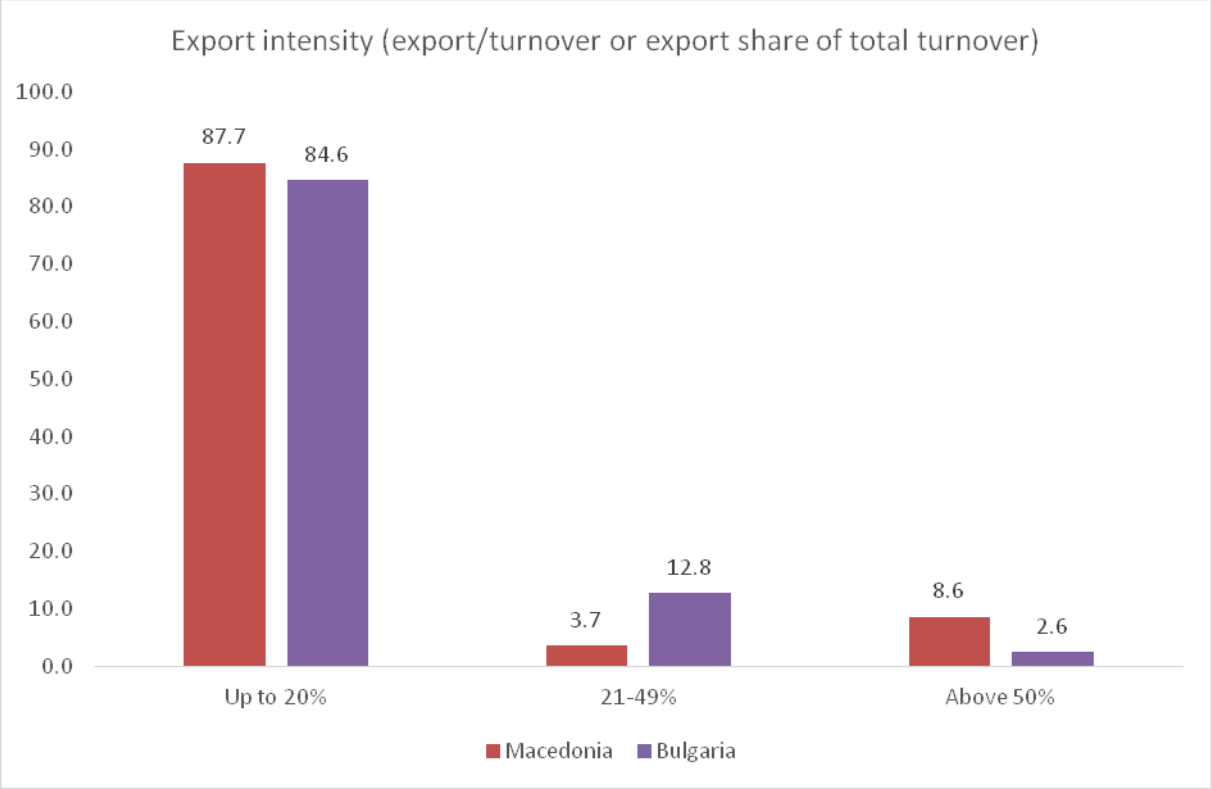


Figure 36

Another indicator about level of cooperation between firms in crossborder region is availability of suppliers and costumers in the nabour country.

The data obtained from the survey says the most of the firms do not have suppliers from the neighboring country: 97,1% of Bulgarian companies do not have suppliers from Macedonia and 84% of Macedonian businesses are not supplied by Bulgarian partners (Figure 37).

Similar is the state of the art with customers. Approximately 90% of the interviewed companies do not have customers from the neighboring country. (Figure 38). On the other hand, the local authorities and all the stakeholders in the forestry, logging, wood, paper and furniture production and trade might enhance cooperation between the regions through appropriate policies and initiatives.

These figures inform about low level of cooperation, which could be a result of the influence of many factors. On the first place it is the dominating micro size of the firm and very limited average number of suppliers and customers for each of them.

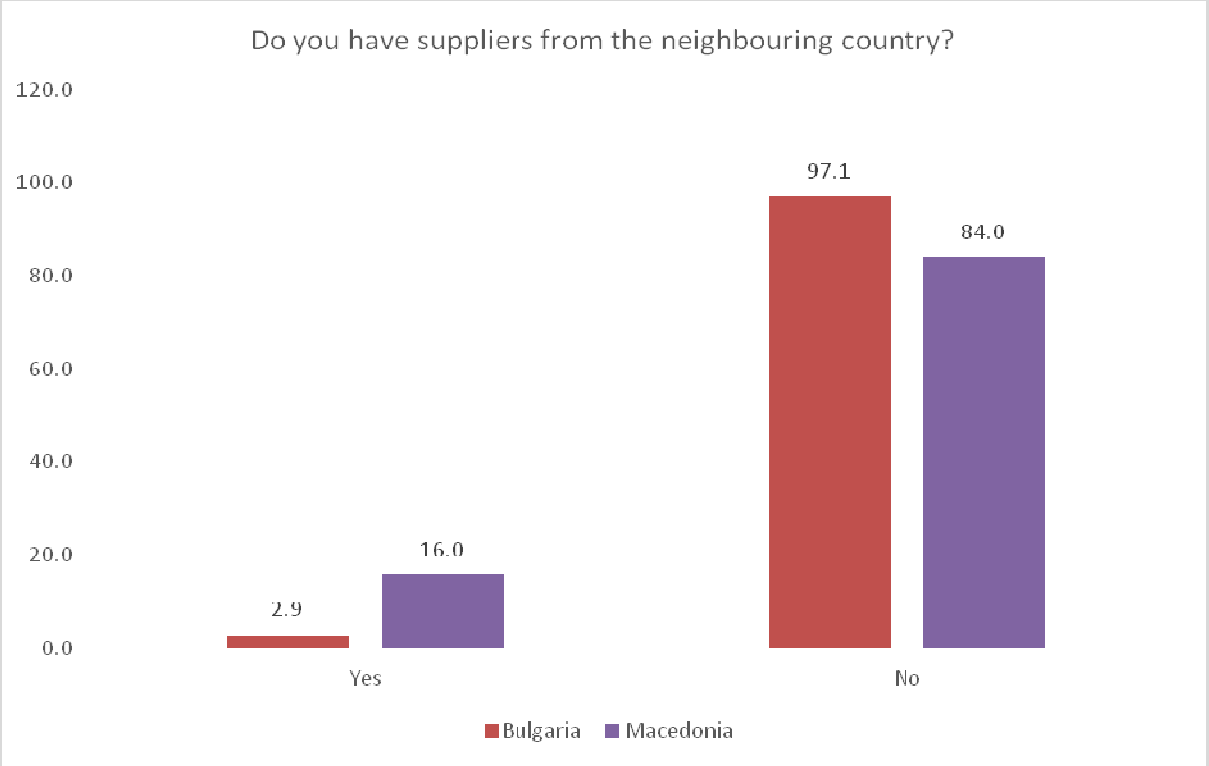


Figure 37

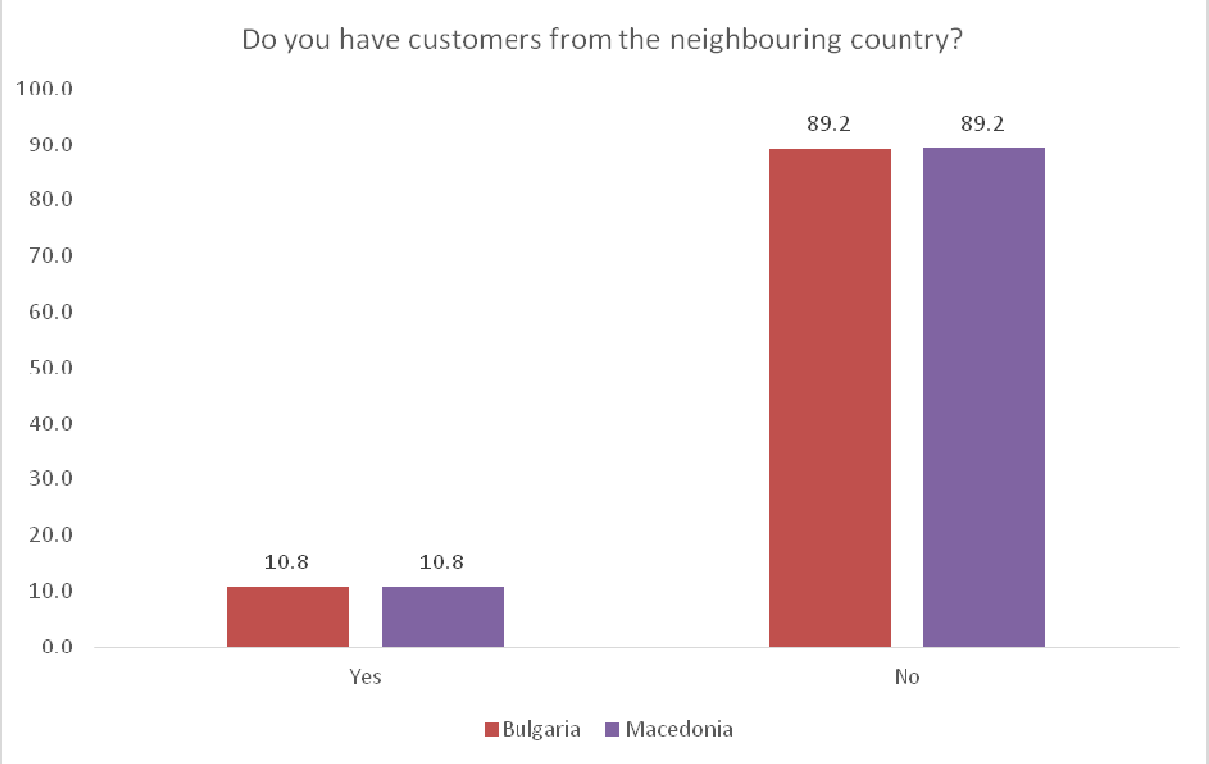


Figure 38

The above results may be influenced by the fact that in Bulgaria most of the customers of the interviewed companies are end consumers - 42,4% (versus 23% in Macedonia) and that In Macedonia the majority of enterprises (48%) sell to the logging division (versus 24,2% in Bulgaria). A quarter of all firms sell out to the manufacturers of furniture.

International cooperation is influenced strongly by the expenditures on transportation. In Bulgaria, 34,6% of the companies have delivery costs that are equal to 5 to 10% of the total production value. In Macedonia, the delivery costs of more than half of the com

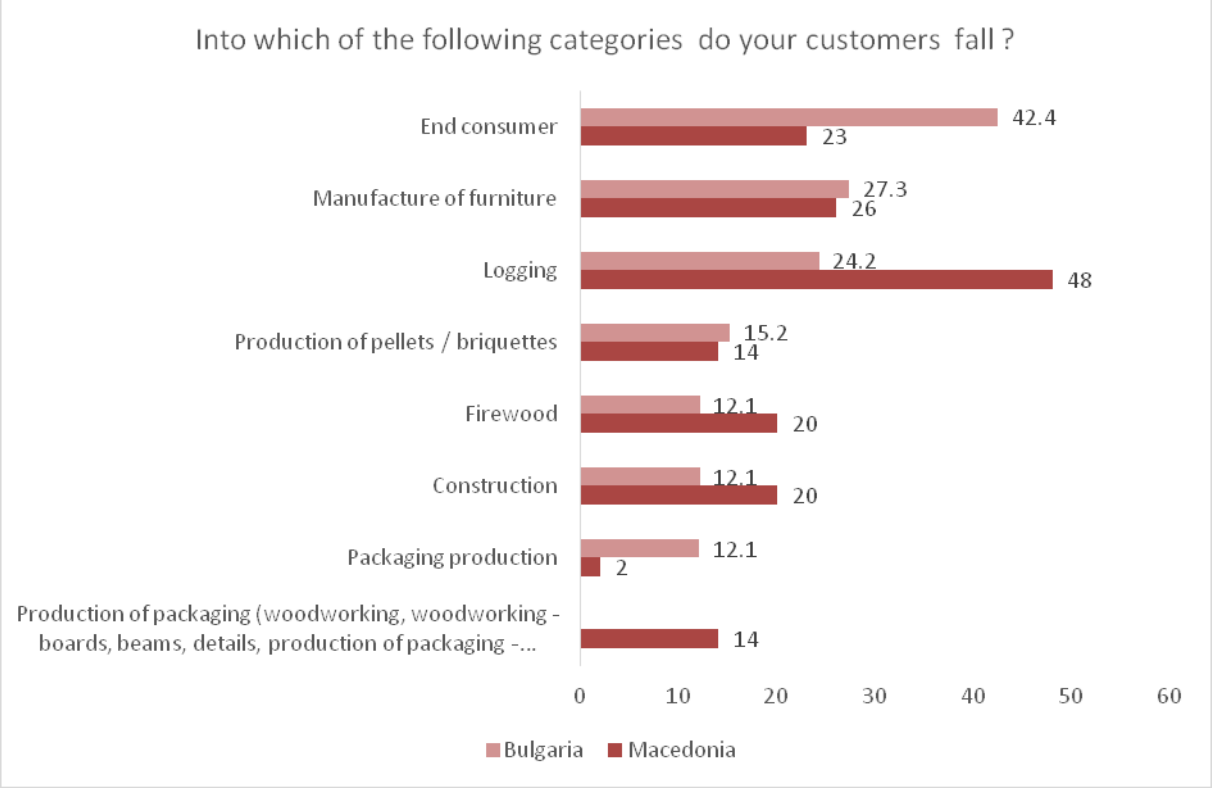


Figure 39

In conclusion it could be summarised the export intensity of the majority of the firms observed is on low level. There is a lot of room for activities to use the potential for economic integration in the region, starting from optimization of the transpotration expenditures..

6. Key findings

The key findings from the survey could be summarized as follow:

The majority of the companies in the sectors observed in the regions of Kyustendil and Blagoevgrad in Bulgaria and Northeastern, Eastern and South-eastern planning regions of Macedonia are micro, small and medium sized companies. Their turnover of that companies is usually less than 700 000 euro and the majority has employees between 1 and 9 people (62-65%). In majority of the cases the value of the assets is up to 350 000 euro. The legal form of the companies is solo-member limited liability company or limited liability company. Their managers are predominantly male, and ageing.

The prevailing share of enterprises is not innovating, or is innovating with no or low level of novelty. The digitalisation provides opportunities for increasing competitiveness if companies develop their website. By now the key reason for using Internet is interaction with public administration and electronic invoices. Rarer the companies use internet for social media and blogs (around one third). Some of the companies have online shops or use cloud services. ERP or CRM systems and information security policies are less popular. Connecting as much of the firms as possible to the Internet might prove to be efficient (when it comes to maintaining the relationships with customers and suppliers) and eventually profitable for the organisations in the observed sectors.

The innovation policy provided shows the most important aims of the enterprises in Bulgaria and in Macedonia when they introduce technological novelties are as follow: the improvement of the quality of the products; the expansion or maintenance of the existing markets and the reduction of environmental pollution. Reducing unit labour costs and energy expenses as well as increasing the flexibility of the production are of high importance in both countries, too. The innovations realised are with a low level of novelty, using predominantly in-house sources for innovative ideas. In general, the cooperation levels between enterprises from the forestry sector in the both countries across boarder region are low. Their representatives would like to increase the cooperation that will contribute in increasing the innovativeness and competitiveness in the region.

Conclusion

The level of innovation of enterprises in the Balkan region, characterised on the case of a survey of 1941 enterprises from the forestry sector on cross border region between Bulgaria and Macedonia in 2017, is low. Approximately good level of internet penetration is accompanied with a low level of ICT usage for business activities (digitalization). The level of trade between both countries is low, showing

low level of cooperation, nevertheless the potential and willingness for cooperation and innovative initiatives is high which is a good precondition for cooperation and integration in the region. On other hand it has to be considered necessity of future research for developing such cooperation in order to achieve better economic performance in the Balkan region.

Acknowledgments

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Bibliography

Proposed Standard Practice for Surveys of Research and Experimental Development – Frascati Manual, fifth edition (OECD, 1993).

OECD Proposed Guidelines for Collecting and Interpreting Technological Innovation Data – Oslo Manual (OECD/EC/Eurostat, 2005).

The Measurement of Scientific and Technological Activities: Using Patent Data as Science and Technology Indicators – Patent Manual [OCDE/GD(94)114].

The Measurement of Human Resources Devoted to S&T – Canberra Manual, [OECD/EC/Eurostat, OCDE/GD(95)77].

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Major Fields of Scientific Research*: innovativeness of national economy, innovation policy and management, knowledge driven economy*

SMART MANAGEMENT OF THE BUSINESS ORGANIZATIONS – TRANSITION FROM A PROCESS-ORIENTED TOWARDS AN ANALYTICAL TOOLSET

Iliyan Bakalov

Abstract*: The growing need of smart management of the business organizations results from the fundamentally changed principles of the present-day economy, which ever more persistently is defined as digital rather than market economy, and is ever more often expressed as economy based on asset sharing rather than based on asset ownership. Therefore, in the emerging digital environment, the business organizations should address the new challenges, which they are facing – the need of quick data exchange, instant reaction, flexible production, including under individual orders, prompt execution, and efficiency of management. That would be possible only and solely if the economic entities have their management provided by cyber-physical systems, which, on the basis of artificial intelligence, form a new organizational ecosystem and upgrade the management concept. The development of management on the basis of artificial intelligence lays down on its fundament not the process, but the analysis, which requires outlining the conceptual differences between the traditional process-oriented management tools and the analytical toolset, necessary for the functioning of the smart management systems.*

Keywords*: smart management, business organizations, process-oriented toolset, analytical toolset.*

ITHEA Keywords*: K.6.1 Project and People Management: Management Techniques.*

Introduction

The typical for the 20th century automated management of the business organizations, and wide-scale advance in their governance of the computer systems and products, have determined the ever more evident need nowadays of introducing smart management in the economic entities. The already started Fourth Industrial Revolution has led to radical reinterpretation of the economic realities, blurring the borderlines between the digital and the material, as well as to the identification of new opportunities in respect to the usefulness of the goods and the human resources.

The smart management of the business organizations is a direct result from the changed economic mechanisms, restructuring the economic system from an “economy of ownership” to an “economy of sharing”, where of primary importance is not the asset ownership, but the access to assets [Temelkova, 2016, Temelkova, 2018]. The intensified digitalization in all the areas of public life in this dynamic economic reality requires the introduction into the business organizations of management based on artificial intelligence.

Why the Fourth Industrial Revolution imposes upon the business organizations a transition from a process-oriented towards an analytical toolset?

The increasing application of smart management in the business organizations leads to their fundamental restructuring related to the swift replacement of the computerized factory with the so-called “smart factory”, in which products and machines communicate with each other and products control their own manufacturing. Production at the smart factory is more flexible, faster and more efficient, since the machines in it are self-organized to a large extent, while the supply chains are automatically co-coordinated, and the orders are transformed directly into manufacturing information, feeding the actual production process. In spite of the unfavorable forecasts that human labour in the factories of the future will become redundant, people remain indispensable in the world of Industry 4.0. They are creative leaders and thinkers, who through their intelligence think all the processes and procedures over and generate software for the functioning of the smart factories. [Webel, 2016, Ematinger, 2017]

Under the conditions of global digitalization, instantaneous analysis is a primary factor, ensuring the realization of the strategy. In order to meet the new challenges of the global macro-framework, the toolset of Industry 4.0 is focused on responding to the specific and dynamically changing needs of the business units, operating in a highly changeable environment. [Köhler-Schute, 2016, Bauernhansl, 2013] Thus, the design of smart manufacturing solutions, which ensure entirely predictable processes and optimal results, is no longer possible without a transition in the corporate organization from a process-oriented toolset towards an analytical one.

The management toolset, being imposed by Industry 4.0 upon the business organizations, is not only a means for optimizing the existing IT-based processes, but also a stimulator for detailed analytical tracing of all organizational processes and their impact. That leads to an ever more evident advance of analytical activities in the economic entities, which are carried out by ultra-fast smart devices working in a network, and concentrating in themselves large bulks of data. The information sustainability of the business organizations is already guaranteed not only by the optimal running of the processes therein,

but also by the adequate operation of smart tools, which collect, process and analyze in real time data from the external and internal corporate environment, while, at the same time, they maintain the two-way oriented communication channels [Temelkova, 2017].

A conceptual framework of the transition from a process-oriented towards an analytical toolset in the smart management of the business organizations

The conceptual framework of the transition from a process-oriented toolset towards an analytical one in the smart management of the business organizations upgrades the basic foundations of traditional management. It is focused on generating a permanent feedback in the cyber-physical systems of a business unit. On this basis, the concept of transition towards a process-oriented toolset in the smart systems acts as a contemporary starting point for business development, and should be based on the conceptual principles of the PDCA cycle, which is used to outline the needs for improvements in the business units, and the PDSA cycle, which maintains the improvements and shows the ways for achieving them.

The analytical toolset applied in the smart management of the business organizations leads to a more adaptable, faster and more efficient development, while it puts an emphasis on the deviations in results as a major prerequisite for the permanent improvement of an economic entity's activities. It is focused on:

- ✓ planning a system of actions for achieving efficient results;
- ✓ carrying out the planned actions;
- ✓ verifying the obtained results for their compliance with the preliminary set requirements;
- ✓ adjusting the system of actions in view of maintaining acceptable quality of the results.

The analytical toolset in smart management generates a new model of management in a business organization by setting out five main tasks:

- ✓ planning, which comprises the definition of the goals and tasks of management, justifying the need of the defined tasks, determining the responsibilities, defining the method for realizing what has been planned, restricting the scope of action, elaborating a plan;
- ✓ realization – implementing the planned activities into the operations of the business unit;
- ✓ verification expressed in analyzing the execution of the implemented planned activities and evaluation of the achievements;

- ✓ exploring – this task is for studying and analyzing the achieved results in view of specifying the further actions;
- ✓ action – there are two types of action possible with the solving of this task: introducing the achieved higher level as a new standard in the business organization, or performing corrective and/or preventive actions to improve what has been achieved.

The conceptual differences between the traditional process-oriented toolset and the analytical one, providing smart management in a business organization, are expressed by priority in:

- ✓ examining the possibilities for achieving the strategic benchmarks by a business organization on the basis of the improvements in it;
- ✓ identifying the non-functioning elements in the management system;
- ✓ studying the principles of management, which prevent the achievement of dynamic and efficient growth.

Table 1. Differences between the traditional process-oriented toolset and the analytical smart toolset

	PROCESS-ORIENTED TOOLSET	**ANALYTICAL TOOLSET IN SMART MANAGEMENT**
nature	verification of the provision of the desired quality of the process	creating opportunities for achieving the desired quality by the organization
goal	achieving acceptable efficiency of the process	obtaining the best efficiency for the organization
emphasis	compliance	pursuing excellence
development	retaining the permanent improvement due to shortage of information for analysis	requires permanent improvement through analysis
feedback	only partial or indirect information is available about the exceptions in the process	available quantitative or other direct information about the exceptions in the process

The conceptual differences between the management tools, which are process-oriented and used in the organizations, which do not apply smart management, and the analytical smart toolset, applied in the business organization of the future, can be found in the fundamental differences in the nature, goal, emphasis, development and possibilities for a feedback, which they provide.

Conclusion

As a result of the conducted theoretical and practical-applied research, it can be summarized that in the present-day business organizations there is a growing inevitable need of transition from the traditional management, based on computer programs, towards entirely digitalized smart management, based on the development of cyber-physical systems, bringing higher added value to the economic entities. This requires reconsidering and changing the management doctrine, since the increasingly digitalizing economy puts essentially new requirements to the management concepts, approaches and tools, which, nowadays, should ensure fast, flexible and efficient management and production. Therefore, the analytical toolset in the organizations from the business sector is ever more seen as a basis of smart management, since it promotes organizations' development on the grounds of the continuous improvement of their activities and enables the upgrading of the cyber systems with artificial intelligence.

Bibliography

[Bauernhansl, 2013] Bauernhansl, Thomas. Die vierte industrielle Revolution verändert die Prozesse in der Produktion. Maw, 7.05.2013.

[Ematinger, 2017] Ematinger, Reinhard. Von der Industrie 4.0 zum Geschäftsmodell 4.0: Chancen der digitalen Transformation (essentials). Springer Gabler. 2017.

[Köhler-Schute, 2016] Köhler-Schute, Christiana. Digitalisierung und Transformation in Unternehmen: Strategien und Konzepte, Methoden und Technologien, Praxisbeispiele. KS-Energy-Verlag. 2016.

[Temelkova, 2017] Temelkova, Miglena. Development of Controlling in the Organizations from the Service Sector under the Conditions of the Fourth Industrial Revolution. International Journal of Advanced Research in Management and Social Sciences, Volume 6, Issue 3, March 2017. ISSN 2278-6236.

[Temelkova, 2018] Temelkova, Miglena. From hierarchical structures to networked business models based on team collaboration. GE-International Journal of Management Research, Volume 6, Issue 2, February 2018. ISSN (O): 2321-1709, ISSN (P): 2394-4226.

[Webel, 2016] Webel, Sebastian. Industrie 4.0: Was Sie über die Produktion der Zukunft wissen müssen? Pictures of the Future - Das Magazin für Forschung und Innovation. 21.01.2016.

[Temelkova, 2016] Temelkova, Miglena. Introduction to controlling. Color print. Varna, 2016. ISBN 978-954-760-425-4. http://www.serkem.de/industrie-4-0-produktion-vorteile-mehrwert/

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PROTECTION OF INFORMATION IN SMALL AND MEDIUM SIZE ENTERPRISES

Hristo Ivanov

Abstract*: Protection of information could help to create theoretical and practical mechanism for defining security level and to formulate specific measures to be taken to counteract the existing threats.*

Keywords: *Information, protection of information, middle and small sized enterprises.*

ITHEA Keywords: *K.6 Management of Computing And Information Systems; K.6.5 Security and Protection.*

Introduction

The protection of information is secured by means for protection of information. They shall foresee control for their own efficiency and shall provide evaluation of this efficiency. The protection means shall not limit the functional characteristics of the information system.

Protection of information

Protection of information is the safety of the information as well as the means and facilities where it is accumulated and stored. The protection of information is responsibility of the information owners or managers authorized by them who:

- Secure their rights of owning, managing and exerting other rights;
- Preventing the disclosure of information;
- Store and secure the integrity, availability of the information, its data base and the program application;
- Protect confidentiality or secrecy of the protected information in compliance with the legislation.

Therefore it is of extreme importance to analyze the legal base for protection of information. The legal base is following the business activities and the relationships between the parties. Measures for state and administrative control sometimes suitable, sometimes not are introduced, as well as sanctions for natural persons and legal entities which affect the rights of the business entities. The purpose is to permanently improve the legal aspect for protection of information. The legal base as a whole is defined

by security regime and is in compliance with means which define and support this regime. It creates the legal fundament for the impact of protection of information.

Means for protection of information

2.1. The most important mean for protection of information is the legislation.

During the latest years in Republic of Bulgaria a complex of means for protection of information was introduced. Good base was formed, which can be seen by the following acts:

- ✓ Data Protection Act (State Gazette, issue 1/ 2002)
- ✓ Classified Data Protection Act (State Gazette, issue 45/ 2002)
- ✓ Access to Public Information Act (State Gazette, issue 55/ 2000)
- ✓ Local Self-Governance and Local Administration Act (State Gazette, issue 77/ 1991)
- ✓ Administrative Infringements and Penalties Act (State Gazette, issue 92/ 1969)
- ✓ Ratification Act for Convention 108 for the Protection of Individuals with regard to Automatic Processing of Personal Data (State Gazette, issue 56/ 2002)

In addition, ordinances were enforced:

- ❖ Council of Ministers Decree 73 for creation of Coordination council for information society (State Gazette, issue 38/ 2000)
- ❖ Council of Minsters Decision 213 for approval of Updated National Program for Development of Information Society in Republic of Bulgaria (State Gazette, issue 36/ 2001)
- ❖ Decision XXXIX of the National Assembly for assigning a Data Protection Commission (State Gazette, issue 54/ 2002)
- ❖ When drafting the legal base there was an attempt to list the means for protection of information and as an addition the term systematization was used, which is not implemented in another important ordinance: Ordinance for the obligatory conditions for security of the automated information systems and nets, in which classified information is processed, stored and transferred
- ❖ Another ordinance of importance is the Ordinance for system of measures, ways and measures for physical security of the classified information and the conditions and procedure for their use.

The list of legislation document is not exhaustive but rather selective due to the purpose for which this article is drafted.

2.2. Standards

The European and international standards which are implemented and applied in Republic of Bulgaria have the status of Bulgarian standards. In the National Standardization Act the process of national standardization and the process of creation, structure and activities of the Bulgarian Standardization Institute are regulated [Ivanov, 2011, Temelkova, 2017].

The standard is a bunch of norms, rules, requirements towards goods and services or in other words this is a sample, model of a product or process agreed as a reference. Standards are developed and exist not only for the production processes and the products, but also for all other areas of social and economic life. It is important for us to define what standard is, its purposes, system, types, requirements, their application and the business security.

The standard is a document which is drafted based on a mutual consent and defined for general and repeated application of the rules, basic guidance or characteristics for activities or their results, in order to reach an optimum process under the specific circumstances. It could be accepted as a statement that the standard is a combination of strictly defined parameters and requirements towards them in order to reach uniformity and high quality for specific structures, products, processes, services and activities. This is a template, sameness, uniformity [Temelkova, 2018].

Historically, the first evaluation standard which had been widely used and had a great impact over the standardization base in the protection of information area in a lot of countries is the MO standard in US “Trusted Computer Systems Evaluation Criteria”. The document which accepted the title the Orange Book is published in August 1983 for the first time. In the title it is defined that the standard is not about safety system, but a systems that can be trusted to some extent.

The technical specification X800 is published little after the Orange Book. This specification defines in detail the protection of information issues in defines systems. This is rather extensive document.

Standard ISO/IEC 15408 “The Common Criteria for Information Technology Security Evaluation” is issued on 1 December 1999. Due to historical reasons this standard is often referred as “Common Criteria”. Actually the Common criteria are used as a meta-standard which defines the instruments for security evaluation of information systems and how they are used [Ivanov, 2011].

Net Configurations

In 1987 in the National Computer Security Center in US the Orange Book interpretation for net configurations is published. This document is in two parts: first contains its own interpretation, in the second security services, specific or pretty important for net configurations [Ivanov, 2011].

Standard ISO/ IES 17799-2000

The standard (emerged from the British Standard BS 7799-1) is a reply to the requirement for creation of common legal framework which allows the organizational structures to develop, apply and evaluate the effective procedures for management and protection of information. The goal is to build trust in the created relations between the organizations and without conflict in business processes by the limitation and minimization of the incident impact in relation to information protection. UK government had stated that each governmental structure, which functions as part of e-government shall have developed and effective management structure of information security in compliance with BS 7799-2 Standard [Ivanov, 2011].

Standard COBIT

Having in mind the great impact on information protection a special regard is given to the control over the risks for information emerging from the use of information technology. In this area the important aspects are COBIT standard, which manages the information technology from one side and the information technologies which develop dynamically and meet the rising need for functionality from the other.

Standard ISO 27001

Security of Information Management Systems

This international standard is valid for all types of organizations. It defines the requirements for creation, implementation, functioning, monitoring, review and support and improvement of documented system for security information management in regard to the common risk, connected to the organization's activities [Ivanov, 2011].

ISO 27002

Code of a good practice for security information management

This international standard gives guidance and general principles for implementation, support and improvement of security information management in an organization. The purpose of this international standard is to provide direction for the general guidance of security information management.

The international standard ISO 27001 states the requirements for information security management systems (ISMS) in all organizations, no matter of the size, scope, type of products and processes or other specifics [Ivanov, 2011].

When an organization creates and supports ISMS, it does not only follow the aspects of its own business, but also the requirements of the law and its security obligations. So, a ISMS system of ISO/IEC 27001 model generates relative security and calmness not only in favor of the business, but also in favor of its clients, suppliers, partners and the society as a whole.

2.3. Activities

The information activities are classified in the following four types:

- *Collection of information*

The collection of information is used mainly to form the state policy in the information environment for improving its legal, methodological, technical and organizational guarantees for development of programs in this area. It is the base of the strategic management.

- *Information storage*

The information storage is enlarging and developing fast during the last years and it is difficult to make classifications of its categories.

- *Data processing*

Data processing is an informatics term meaning “collection and manipulation of records aiming at producing of readable information”.

Data processing involves a number of different operations with the data:

- Validation – assuring that the data is correct and of quality
- Sorting – organization of records of data
- Classification – dividing of data in different categories depending on different criteria
- Resuming of data – reduction of details of data to the most essential part of them
- Aggregation – combination of data from several different sources
- Analysis – collection, organization, statistical analysis, interpretation and providing of data
- Reporting – providing in detailed and resumed form the data or the information extracted from the data as well as its visualization

A lot of products offer protection in several of the above categories, as especially famous lately are UTM type (United Threat Management).

- *Dissemination of information*

Dissemination of information is a process in which the information available in one moment, in the following moment another information (or the same one) is received. Every information process is reviewed as combination of the basic information activities.

In general, none of the four types of activities is performed on its own.

Conclusion

Computer systems and nets are one of the highest technological products nowadays. Despite all advantages they can offer, they have a number of disadvantages. Problems with security such as disinformation, infringement of information rights, sending of undesired online advertising or spam affect almost every user of technology.

Bibliography

[Ivanov, 2011] Hristo Ivanov. Processes of standardization of extracurricular education in the European Higher Education Area. Sociosphere of 2011. Rusia

[Temelkova, 2017] Miglena Temelkova, Development of Controlling in the Organizations from the Service Sector under the Conditions of the Forth Industrial Revolution. International Journal of Advanced Research in Management and Social Sciences, Volume 6, Issue 3, ISSN 2278-6236, March 2017.

[Temelkova, 2018] Miglena Temelkova, Studying the leadership style of business organizations' management under the conditions of the Fourth Industrial Revolution. Asia Pacific Journal of Research in Business Management, Volume 9,Issue 2, ISSN: 2229-4104, February-2018.

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OPPORTUNITIES AND INDICATORS FOR STRATEGIC DEVELOPMENT OF LEADERSHIP IN MOBILE OPERATORS

Ivaylo Stoyanov

***Abstract**: This publication is about the issue of mobile operators, the social climate and effective interaction between human resources by identifying opportunities and indicators for the strategic development of leadership. The goal is to achieve optimal results from people work together by designing an appropriate strategy to influence leaders on the talent and work of followers.*

***Keywords**: Strategy, Leadership, Opportunities, Indicators, Mobile operators.*

***ITHEA Keywords:** J.1 Administrative Data Processing: Business*

Introduction

The modern business is dynamic, and the accelerated technology development is an objective process that requires flexible adaptation to environmental factors - external and internal. This is typical for mobile operators that operate and develop in a turbulent business environment. This process requires two fundamental strategies. On the one hand, to respond to competition in the industry, mobile operators need to develop a portfolio of strategic initiatives. They are aimed at attracting and satisfying customer needs, developing a system of diverse services, introducing new concepts, refining and reengineering business processes. On the other hand, mobile operators should optimize work and achieve optimal performance in services that require highly skilled human resources. But this is not a sufficient condition for competitiveness, people's work also depends on other factors and indicators that determine the outcome of work, motivation and making adequate and timely solutions in different situations. In order to optimize the work and social climate of human resources in mobile operators, strategic leadership development is needed to synchronize internal business processes and determine their direction of sustainable development [Темелкова, 2017]. In this sense, the publication aims to offer some opportunities and indicators for the strategic development of leadership through a methodological framework defining the correlation between the vision, the strategy and the organizational values of the mobile operators and the activities of the human resources.

Methodological framework for strategic development of leadership in mobile operators

In order to create the necessary conditions for the strategic development of the leadership in the mobile operators it is necessary to design a methodological framework for this purpose, taking into account the opportunities and the indicators. This requires consideration of interrelated components that determine the success of the methodology that covers the following areas for strategic leadership development:

1. Vision suitable for mobile operators

The mobile operators operate in a specific sector that requires them to design a market-friendly vision. It will depend on their priorities, intentions and resources, which must ensure their sustainable development over a long period of time. In order to design an effective system of strategic leadership, the leadership of mobile operators must take into account its specifics in terms of work - objectives and tasks of implementation, as well as its engagement with all stakeholders (clients, partners, investors, human resources etc.) [Kriger, Zhovtobryukh, 2016, Dimcheva, 2016]. Since the vision is a part of people's activity for a specific period of time, mobile operators should determine whether it is in line with the competencies, perceptions and attitudes of human resources. The strategic development of leadership necessarily imposes on the leadership of mobile operators to synchronize what needs to be achieved with what human resources perceive for granted. In other words, people need to be convinced of the benefits and priorities that the leadership of mobile operators will develop and, most importantly, understand how to follow them [Adair, 2010]. This is an important part of the strategic development of leadership that can be realized through effective communication between stakeholders, accurate and clear formulation of the priority areas and their reduction to all stakeholders is the business process of the mobile operators. *Some indicators that are taken into account when designing the vision are as follows:*

- Identifying resources and opportunities for strategic development;
- Identifying and stimulating people's leadership potential;
- Synchronize objectives, tasks and methods for their implementation;
- Personal planning of leaders and teams;
- Timely and reliable information on upcoming initiatives;
- Creating the right conditions for future leadership development;
- Linking priorities to documents, guidelines, manuals, etc.

2. Appropriate for the mobile operators strategy

The mobile operators must implement a strategy that will provide them with a competitive edge on the market and increase the efficiency of service businesses. This is a difficult process that requires mobile operators to focus on all aspects that add business value and optimize business processes over the long run. The strategic development of leadership requires that a strategy be developed that develops it, but at the same time it is related to the business strategy of the mobile operators so that it builds a service business. Major initiatives in this regard are ignoring the weaknesses in mobile operators' business, seeking opportunities to mitigate threats, optimizing the benefits and chances of entering new markets, attracting customers, and optimizing internal business processes [Hughes, Beatty, Dinwoodie, 2014, Dimcheva, 2014, Otsetova, 2017(a)]. *Some indicators that are taken into account when designing the strategy are as follows:*

- Determination on the key performance indicators of the service business;
- Identification of Critical Indicators of Business Services;
- Opportunities to optimize inefficient business processes and practices;
- Attract new customers and satisfy the requirements of existing ones;
- Developing strategies for opposing competitors;
- Linking the objectives, competences and results of human resources activities;
- Improving the quality of services, etc.

3. Appropriate organizational values for mobile operators

The strategic development of leadership in mobile operators cannot be achieved without appropriate organizational values. They define the direction, the style of management and the decisions taken by leaders and their teams in the operation of mobile operators. Organizational values are an extremely important element of strategic leadership development because they show human resources what is right or wrong in defining management policy and decision-making in mobile operators [Glanz, 2005, Otsetova, 2017(b)]. Strong organizational values are a prerequisite for ethical practices and good social relationships between people. In order to have an optimal level of strategic development of leadership in mobile operators, it is necessary to reconcile personal with organizational values, ignore banality and corrupt practices, build a climate of trust and support in favor of common goals and shared values [Singh, Useem, 2016]. *Some indicators that are taken into account when designing organizational values are as follows:*

- Determination the level of organizational culture;
- Determination of the factors related to the influence of the organizational culture;
- Defining the appropriate typology of organizational culture;
- Defining the limits in the use of organizational culture;
- Defining subcultures;
- Determination of ethical norms and practices of behavior;
- Positive perception of the elements of the organizational culture;
- Opportunities to change organizational culture, etc.

4. Integration of the human resources into work and provision of resources

The mobile operators cannot achieve strategic development in leadership if they do not integrate human resources at all levels in the service business. A flexible strategy is needed to optimize human potential, stimulate people's activity and competence, motivate them to achieve personal and team results. For this purpose, various initiatives by the mobile operators' leadership, which are oriented towards the career development of the human factor, the social relations and the responsibility towards the assigned tasks, are required [Темелкова, Колев, 2017, Kolev, 2017]. However, this is not a requirement for an optimal performance because people need resources to use to achieve the goals. The information and other resources (financial, technological, etc.) are important to mobile operators because they provide them with a competitive advantage, but in order to be effectively utilized, skilled and experienced human resources are needed. It is a kind of symbiosis between intellect and workflow capabilities that are connected in modern business and difficult to co-ordinate [Cannella, Finkelstain, Hambrick, 2010]. That is why the strategic development of leadership in mobile operators aims to ensure and synchronize the work of people with optimal use of the resources. *Some indicators that are taken into account when integrating human resources into work and resource provision are as follows:*

- Identifying and conducting the training needed for people;
- Personal and team training;
- Stimulating career development, knowledge and talent of people;
- Implementing adequate motivation mechanisms;
- Work-related individual and team rewards;
- Organizing regular meetings for debating problems;

- Overcoming resistance to organizational changes;
- Identification of the resources supporting implementation of the objectives and tasks;
- Implementation of good organizational practices;
- Support from top management and others.

Conclusions

The mobile operators must respond adequately to the impact of the business environment which is dynamic, unpredictable and requires a rapid response to adaptation. In order to achieve competitive advantage, work efficiency and decision-making, the mobile operators implement strategic leadership. It is a set of strategic initiatives and business practices that enable successful reconciliation of vision, strategy, organizational values and human resources. Their optimal design and interaction will also depend on their positive application in mobile operators.

Bibliography

[Темелкова, 2017] Темелкова, М., Лидерство в бизнес организациите от сектора на услугите. "Колор принт", 2017.

[Темелкова, Колев, 2017] Темелкова, М., Колев, Д. Релацията личен имидж на лидера-организационен имидж в българската бизнес практика. // 2nd International Conference "Telecommunication, Informatics, Energy and Management", 2017.

[Adair, 2010] Adair, J. Strategic Leadership: How to think and Plan Strategically and Provide Direction. Kogan Page, 2010.

[Cannella, Finkelstain, Hambrick, 2010] Cannella, B., Finkelstain, S., Hambrick, D. Strategic Leadership: Theory and Research on Executives, Top management Teams and Boards, 2008.

[Dimcheva, 2014] Dimcheva, G., "The Role of key customers for telecommunication service providers". // Zbornik prispevkov za VII medzinarodnej vedeckej conference "Diagnostika podniku, controlling a logistika", Zilina, 16 – 17 april, 2014.

[Dimcheva, 2016] Dimcheva, G., Factors for increase of business clients' consumer satisfaction of telecommunication services, // 8th International Scientific Conference "Company Diagnostics, Controlling and Logistics", p. 29-34, Zilina, 2016.

[Glanz, 2005] Glanz, G. Strategic Leadership. Corwin, 2005.

[Hughes, Beatty, Dinwoodie, 2014] Hughes, R., Beatty, K., Dinwoodie, D. Becoming a Strategic Leader. Jossey-Bass, 2014.

[Kolev, 2017] Kolev, D. International branding as a part of the system of human resource management. // International Scientific Conference "management and Engineering", Sozopol Bulgaria, 2017.

[Kriger, Zhovtobryukh, 2016] Kriger, M., Zhovtobryukh, Y. Strategic Leadership for Turbulent Times. Palgrave Macmillan, 2016.

[Otsetova, 2017(a)] Otsetova, A. Relationship between logistics service quality, customer satisfaction and loyalty in courier services industry. // Management and Education, Vol. II, (2) 2017, pp. 51-57, ISSN: 13126121.

[Otsetova, 2017(b)] Otsetova, A. An examination of relationship between service quality, customer satisfaction and loyalty in courier services industry in bulgaria. // Management and Education, Vol. II, (2) 2017, pp. 58-63, ISSN: 13126121.

[Singh, Useem, 2016] Singh, H., Useem, M. The Strategic Leader's Roadmap. Wharton Digital Press, 2016.

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STATISTICAL MODELS FOR PREDICTING OF TELETRAPHIC PARAMETERS OF MARKOV CHAINS

Stanimir Sadinov, Ivelina Balabanova, Georgi Georgiev

Abstract: *The presented work is in the subject area "Teletraffic systems with Markov chains". The object of the study is the Markov chain of type M / M / c / k, where c = 25. A complete factorial experiment is accepted with managed object factors - Avg. Arrival Rate; Avg. Service Time and Max Station Capacity, and three levels of their variation. Modeling of the specified system was performed. The simulation was conducted under accepted numerical values of the factors aligned with parametric coding levels. Experimental data for the parameters of the object - Arrival Time and Exit System was obtained. An intellectual information analysis has been performed. Based on the experimental data, the content of the experiment plans is formed. Regression procedures have been applied to analyze and select the most appropriate plan to find statistical models for predicting the change in teletraffic parameters. Detailed results from the analysis of the predicted models are presented. The results include a set of coefficients of determination, surfaces of the response, lines of the same response, analysis of residues and others.*

Keywords: *Teletraffic System; Markov Chain; Plan of Experiment; Regression Analysis; Statistical Model; Teletraffic Parameters.*

ITHEA Keywords: *H. Information Systems, F. Theory of Computation.*

Introduction

There are a number of studies on the application of Markov chains as tools to build models and analyze data in various fields such as genetics, economics and others. As well as those exploring the significance of the order and the characteristics of higher order chains.

An example is research to find mathematical models of Markov chains with a big order retrieving knowledge of the human genome, studying at different depths of memory. In another study, a statistical analysis of high-order chains and a small number of parameters was considered, where statistical evaluations of parameters and tests for defined parametric hypotheses [2] were developed and analyzed. A similar study again explores the limited models with integer time series. These results

contain probabilistic characteristics and statistic conclusions of two models - a chain of "s" order partial "r" connections and circuit with conditional order.

It is interesting to use Markov's chains as models for prediction of the parameters of the wind when generating energy by wind turbines. The models are analyzed on the basis of a comparison between the theoretical derivative characteristics and their empirically determined analogues. Here speed, direction and wind force are used to define the states of the circuit. The matrix of transitions is determined by estimating the maximum probability based on transient data. There are also studies performing statistical analysis at Markov's Discrete Chains, consisting of evaluation of a transition matrix, standard error, confidence intervals and others.

It is known to adapt the chains of Markov as a method Markov-Chain Monte Carlo. Its applications are related to the determination of the real distributions of the probabilities of parameters in a different volume of data analysis related to the estimation of the quantity and direction of distribution of environmentally harmful chemical agents, etc. The volume of studies focused on statistical study of telegraphic parametric status in Markov chains is limited. This article shows the possibility of estimating the approximate moments of entering and leaving packet data in information passage through different system states. The target object of the study is a Markov chain with a number of servers and a limited tail size M / M / 25 / k.

Simulation modeling of telegraphic system M / M / 25 / k

Markov chain M / M / c / k modeling was performed using a graphical user interface in the Java Modeling Tool (JMT) simulator environment. Number of server serving devices and system users, respectively, "c = 25" and "cust. = 1000" were selected. The study was carried out based on the attached types of experimental plans, respectively: Composite plan Hartley for3; B3 symmetric composition plan; D-optimal plan at m = 3; Symmetric quasi-D-optimal plan (Pesochinian plan) at m = 3 and unsymmetrical quasi-D-optimal plan at m = 3.

The system input parameters are defined as controllable object factors labeled as follows: x1 - Avg. Arrival Rate (lambda) [cust./s] - average arrival rate in the system; x2 - Avg. Service Time S [s] - average system attendance time and x3 - Max. Station Capacity k [cust.] - maximum queue capacity (waiting places in the system). Their numerical values have been adopted, aligned to the coding parameter levels shown in Table 1.

As a result of the simulation performed under specify groups of code combinations for each of the specified planes of the experiment, experimental data were obtained for the defined object output

parameters: y1 - Arrival Time [s] - arrival time in the system and y2 - Exit System [s] - time for system exit.

Table 1. Levels of control factors of object

Variable levels	x_1, cust./s	x_2, s	x_3, cust.
-1	0.25	0.50	31
0	0.50	1.00	41
+1	0.75	1.50	51

Regression analysis procedures are applied to verify the adequacy of mathematical equations from zero (1), first (2) and second (3) degrees.

$$y = b_o + b_1x_1 + b_2x_2 + b_3x_3 \quad (1)$$

$$y = b_o + b_1x_1 + b_2x_2 + b_3x_3 + b_{12}x_1x_2 + b_{13}x_1x_3 + b_{23}x_2x_3 + b_{123}x_1x_2x_3 \quad (2)$$

$$y = b_o + b_1x_1 + b_2x_2 + b_3x_3 + b_{12}x_1x_2 + b_{13}x_1x_3 + b_{23}x_2x_3 + b_{123}x_1x_2x_3 + b_{11}x_1^2 + b_{22}x_2^2 + b_{33}x_3^2 \quad (3)$$

The procedures are performed on the advanced matrix experiments. Analyzing the values of the Ri2 coefficients in the regression results, the best plan of the experiment - B3 Symmetric Composition Plan was selected. A detailed study of the selected plan was carried out in the Statistica product.

Results of the regression analysis on the B_3 Symmetric Composition PlanB_3

In Fig. 1 is an expanded matrix of experiments analyzed type plan an experiment based on the highest-level regression model. Variable indices reflect the impact of one or the interaction between two or more controllable factors.

Data: SimetrichenB3 (12v by 14c)

	1 x1	2 x2	3 x3	4 x12	5 x13	6 x23	7 x123	8 x11	9 x22	10 x33	11 y1	12 y2
1	1	1	1	1	1	1	1	1	1	1	241,53	244,73
2	-1	1	1	-1	-1	1	-1	1	1	1	693,66	697,48
3	1	-1	1	-1	1	-1	-1	1	1	1	289,95	291,02
4	-1	-1	1	1	-1	-1	1	1	1	1	855,6	855,91
5	1	1	-1	1	-1	-1	-1	1	1	1	283,84	285,66
6	-1	1	-1	-1	1	-1	1	1	1	1	818,96	820,51
7	1	-1	-1	-1	-1	1	1	1	1	1	275,76	275,82
8	-1	-1	-1	1	1	1	-1	1	1	1	738,2	738,69
9	1	0	0	0	0	0	0	1	0	0	270,5	270,53
10	-1	0	0	0	0	0	0	1	0	0	782,95	785,21
11	0	1	0	0	0	0	0	0	1	0	417,25	418,15
12	0	-1	0	0	0	0	0	0	1	0	459,67	459,77
13	0	0	1	0	0	0	0	0	0	1	407,96	407,98
14	0	0	-1	0	0	0	0	0	0	1	440,95	442,09

Fig.1. Expanded Experiment Matrix

The results of the nalysis are shown in Figures 2 through 4. In terms of the Arrival Time parameter for the zero, first and second degree models, the coefficients of determination are R^2 = 0.93949388, R^2 = 0.96258631 and R^2 = 0.99953506 (Fig.2.a); Fig.3.a) и Fig4.a). With the Exit System parameter, the criteria are equal to R^2 = 0.93921893, R^2 = 0.96181636 and R^2 = 0.99942524 (Fig.2.b); Fig.3.b) and Fig.4.b).

Regression Summary for Dependent Variable: y1 (SimetrichenB3)
R= ,96927492 R?= ,93949388 Adjusted R?= ,92134204
F(3,10)=51,758 p<,00000 Std.Error of estimate: 64,308

N=14	b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
Intercept			498,341	17,18708	28,9951	0,000000
x1	-0,966884	0,077786	-252,779	20,33603	-12,4301	0,000000
x2	-0,062707	0,077786	-16,394	20,33603	-0,8062	0,438904
x3	-0,026396	0,077786	-6,901	20,33603	-0,3393	0,741366

a)

Regression Summary for Dependent Variable: y2 (SimetrichenB3)
R= ,96913308 R?= ,93921893 Adjusted R?= ,92098461
F(3,10)=51,508 p<,00000 Std.Error of estimate: 64,504

N=14	b*	Std.Err. of b*	b	Std.Err. of b	t(10)	p-value
Intercept			499,539	17,23931	28,9768	0,000000
x1	-0,967003	0,077962	-253,004	20,39783	-12,4035	0,000000
x2	-0,059120	0,077962	-15,468	20,39783	-0,7583	0,465758
x3	-0,025092	0,077962	-6,565	20,39783	-0,3218	0,754195

b)

Fig.2. Results using model (1) for a) parameter y_1 and b) parameter y_2

N=14	Regression Summary for Dependent Variable: y1 (SimetrichenB3) R= ,98111483 R?= ,96258631 Adjusted R?= ,91893700 F(7,6)=22,053 p<,00070 Std.Error of estimate: 65,284					
	b*	Std.Err. of b*	b	Std.Err. of b	t(6)	p-value
Intercept			498,341	17,44786	28,5617	0,000000
x1	-0,966884	0,078966	-252,779	20,64459	-12,2443	0,000018
x2	-0,062707	0,078966	-16,394	20,64459	-0,7941	0,457382
x3	-0,026396	0,078966	-6,901	20,64459	-0,3343	0,749546
x12	0,017465	0,078966	5,105	23,08135	0,2212	0,832292
x13	-0,008647	0,078966	-2,527	23,08135	-0,1095	0,916373
x23	-0,127953	0,078966	-37,400	23,08135	-1,6204	0,156283
x123	0,079628	0,078966	23,275	23,08135	1,0084	0,352189

a)

N=14	Regression Summary for Dependent Variable: y2 (SimetrichenB3) R= ,98072237 R?= ,96181636 Adjusted R?= ,91726878 F(7,6)=21,591 p<,00075 Std.Error of estimate: 66,003					
	b*	Std.Err. of b*	b	Std.Err. of b	t(6)	p-value
Intercept			499,539	17,64001	28,3185	0,000000
x1	-0,967003	0,079774	-253,004	20,87194	-12,1217	0,000019
x2	-0,059120	0,079774	-15,468	20,87194	-0,7411	0,486619
x3	-0,025092	0,079774	-6,565	20,87194	-0,3145	0,763763
x12	0,017161	0,079774	5,020	23,33554	0,2151	0,836798
x13	-0,008512	0,079774	-2,490	23,33554	-0,1067	0,918502
x23	-0,126650	0,079774	-37,047	23,33554	-1,5876	0,163475
x123	0,078679	0,079774	23,015	23,33554	0,9863	0,362090

b)

Fig.3 Results using model (2) for a) parameter y_1 and b) parameter y_2

N=14	Regression Summary for Dependent Variable: y1 (SimetrichenB3) R= ,99976750 R?= ,99953506 Adjusted R?= ,99798525 F(10,3)=644,94 p<,00009 Std.Error of estimate: 10,292					
	b*	Std.Err. of b*	b	Std.Err. of b	t(3)	p-value
Intercept			432,476	6,559974	65,9265	0,000008
x1	-0,966884	0,012449	-252,779	3,254658	-77,6668	0,000005
x2	-0,062707	0,012449	-16,394	3,254658	-5,0371	0,015084
x3	-0,026396	0,012449	-6,901	3,254658	-2,1203	0,124142
x12	0,017465	0,012449	5,105	3,638819	1,4029	0,255221
x13	-0,008647	0,012449	-2,527	3,638819	-0,6946	0,537270
x23	-0,127953	0,012449	-37,400	3,638819	-10,2781	0,001964
x123	0,079628	0,012449	23,275	3,638819	6,3963	0,007740
x11	0,192697	0,013412	94,249	6,559974	14,3672	0,000731
x22	0,012234	0,013412	5,984	6,559974	0,9122	0,428940
x33	-0,016400	0,013412	-8,021	6,559974	-1,2228	0,308718

a)

N=14	Regression Summary for Dependent Variable: y2 (SimetrichenB3) R= ,99971258 R?= ,99942524 Adjusted R?= ,99750939 F(10,3)=521,66 p<,00012 Std.Error of estimate: 11,452					
	b*	Std.Err. of b*	b	Std.Err. of b	t(3)	p-value
Intercept			432,819	7,299246	59,2964	0,000011
x1	-0,967003	0,013841	-253,004	3,621440	-69,8628	0,000006
x2	-0,059120	0,013841	-15,468	3,621440	-4,2712	0,023557
x3	-0,025092	0,013841	-6,565	3,621440	-1,8128	0,167519
x12	0,017161	0,013841	5,020	4,048893	1,2398	0,303175
x13	-0,008512	0,013841	-2,490	4,048893	-0,6150	0,582068
x23	-0,126650	0,013841	-37,047	4,048893	-9,1500	0,002760
x123	0,078679	0,013841	23,015	4,048893	5,6843	0,010791
x11	0,194189	0,014912	95,051	7,299246	13,0221	0,000978
x22	0,012547	0,014912	6,141	7,299246	0,8414	0,461924
x33	-0,015902	0,014912	-7,784	7,299246	-1,0664	0,364456

b)

Fig.4. Results using model (3) for a) parameter y_1 and b) parameter y_2

In the first two models the significant coefficients of regression b_i alphabetically coincide for both output parameters, respectively b_0 and b_1. Whereas in the regression model (3) the coefficients of significance are $b_0 = 432.476$, $b_1 = -252.779$, $b_2 = -16.394$, $b_{23} = -37.400$, $b_{123} = 23.275$ and $b_{11} = 94.249$ for y_1; $b_0 = 432.819$, $b_1 = -253.004$, $b_2 = -15.468$, $b_{23} = -37.047$, $b_{123} = 23.015$ и $b_{11} = 95.051$ with y_2. Very good indicators of Fisher's criteria have been achieved $F(10;3) = 644.94$ and $F(10;3) = 521.66$ and their respective probabilities $p < 0.00009 << 0.05$ and $p < 0.00012 << 0.05$. Where 0.05 is the assumed level of coefficient α for the parameters y_1 and y_2.

The numerical values of the coefficients of determination in equation (3) for both output parameters approximate to the maximum theoretically the ideal best value of this coefficient "1". That is why (3) is chosen as the basis for defining the final statistical models describing the most appropriate behavior of the object of study. System predictive models based on applied regression analyzes can be recorded as follows:

$$y_1 = 432.476 – 252.779x_1 – 16.394x_2 - 37.400x_2x_3 + 23.275x_1x_2x_3 + 94.249x_1^2 \quad (4)$$

$$y_2 = 432.819 – 253.004x_1 – 15.468x_2 - 37.047x_2x_3 + 23.015x_1x_2x_3 + 95.051x_1^2 \quad (5)$$

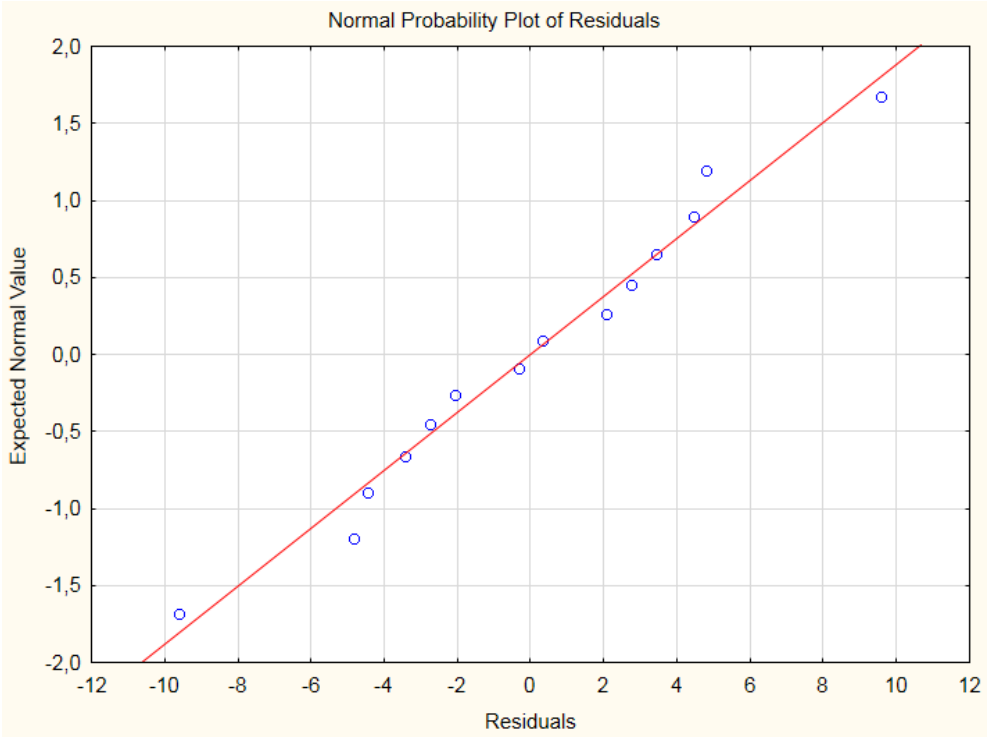
Analysis of the residues for the selected for systematic forecasting models

The "normal probability charts of residues" presented in Figure 5 were generated. There is a very good residual approximation to the right angle of 45□ for both output parameters. Residues have characteristics of normally distributed data supporting the correctness of the application of regression analysis when investigating the object telegraph system.

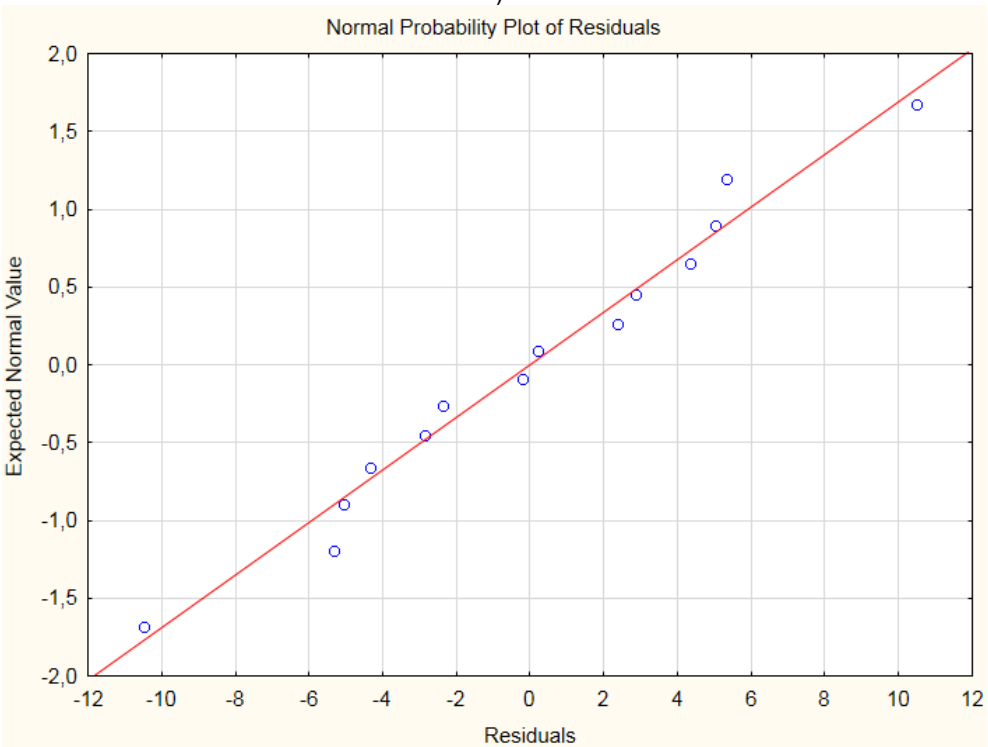
Surface response and lane response study in Equation (3) on B_3 Symmetric Composition Plan

A three-dimensional graphical space is defined and "response surfaces" are constructed and their "equal response" surface sections are aligned with planes parallel to the x1Ox2, x1Ox3 and x2Ox3 planes. Graphical dependencies illustrate the areas of change in the controllable factors in which its output parameters are at the highest levels. Below are the "response replies" (fig.6) and "equal response lines" (fig. 7) regarding the x2Ox3 plane for the Arrival Time and Exit System parameters.

By analyzing the "equal response lines" in term of x1Ox2 and x1Ox3 planes for the parameters y1 and y2, they can be said to have the highest values at all the variation levels of the factors x2 and x3 and the low change levels of factor x1. In x2Ox3 plane, things look quite differently, there is a trend of large parameter changes only at extreme high for x2 and high variance levels for factor x3.

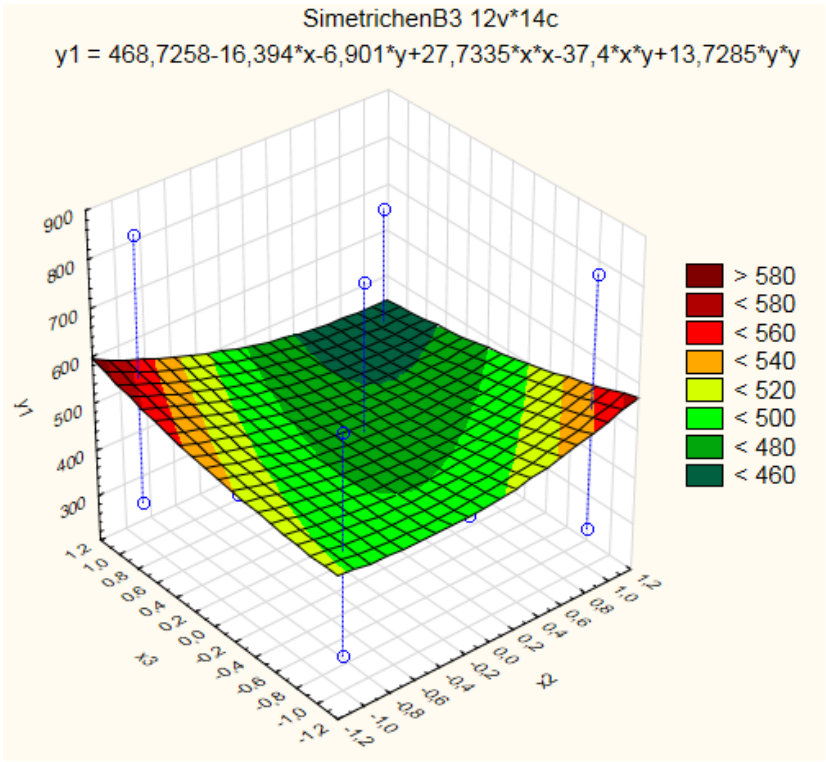


a)

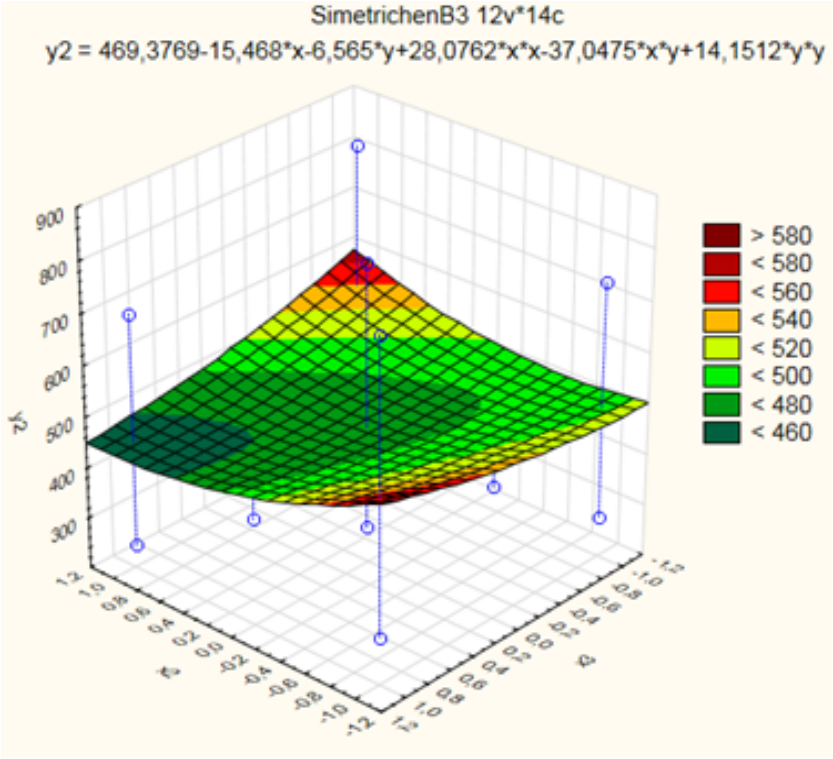


b)

Fig.5. Normal probability graphs when applying a) model (4) for parameter y_1 and (b) a model (5) for parameter y_2, concerning a B_3 Symmetric Composition Plan B_3

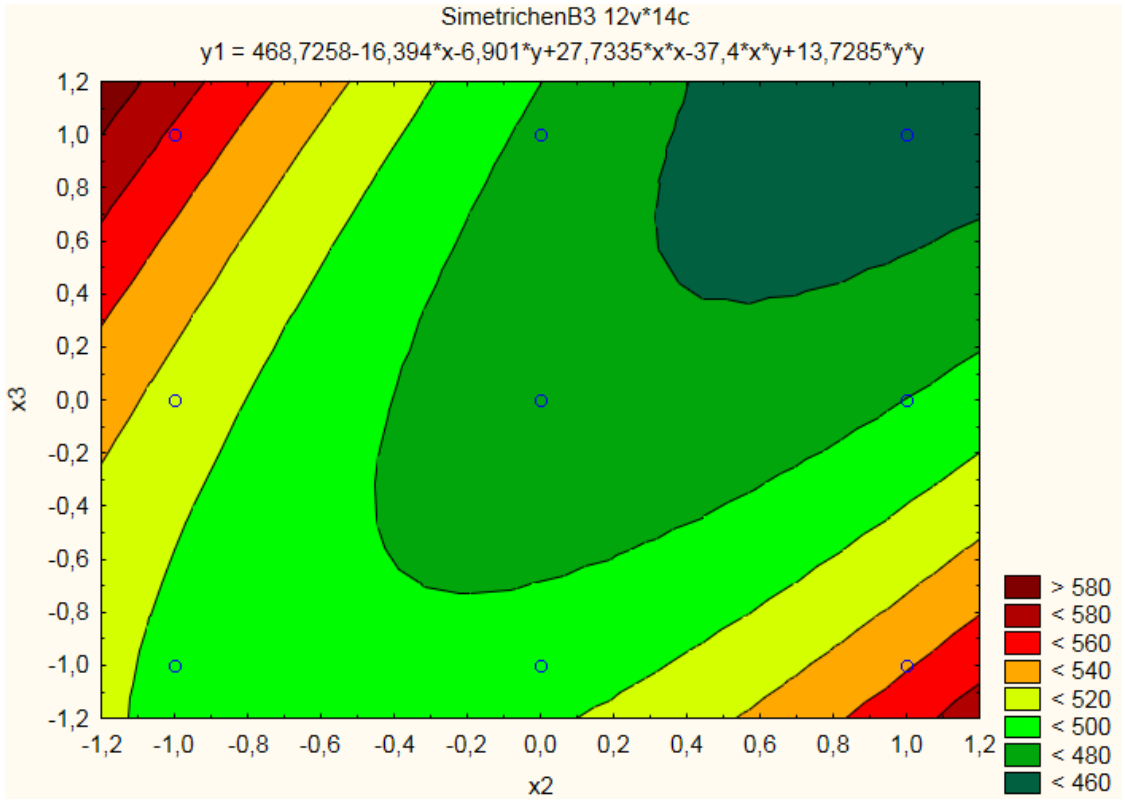


a)

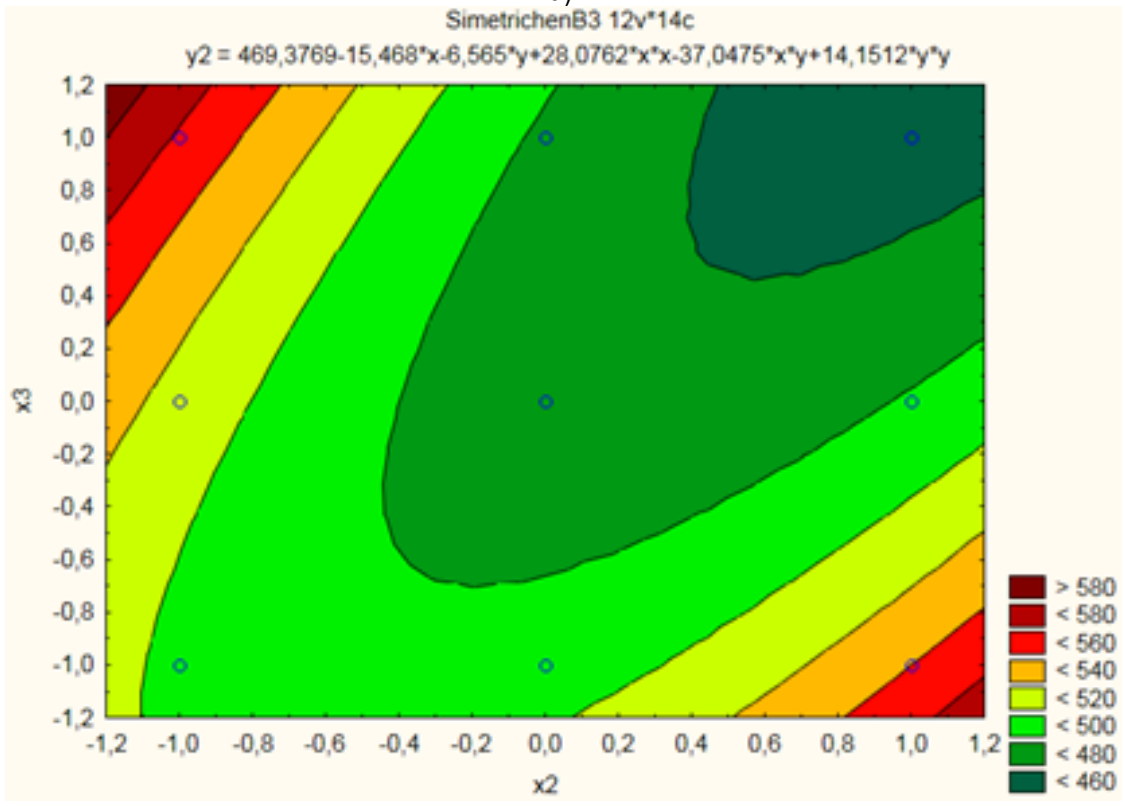


b)

Fig.6. Parameter Response Surfaces a) $y_1 = f(x_2,x_3)$ and b) $y_2 = f(x_2,x_3)$



a)



b)

Fig.7. Lines of the same response for parameters - a) $y_1 = f(x_2,x_3)$ and b) $y_2 = f(x_2,x_3)$

Conclusion

The tools of regression analysis have been successfully used in finding statistical models for mathematical prediction of the state of targeted teletraffic parameters. This gives prerequisites for future perspectives of the development of the presented paper in the field of communications and information systems. It is envisaged to study the specifics of the other types of Markov chains, and also studying the feasibility of regression equations of third or higher degree in the formation of Teletraffic predictive modeling.

Bibliography

[Kharin and Maltsew, 2010]] Kharin Yu., Maltsew M., On statistical analysis of Markov Chains with conditional memory depth. Electronic library of BSU, EBU BSU: NATURAL AND EXACT SCIENCES: Mathematics, EBU BSU: INTER-BRANCH PROBLEMS: Statistics, Vol.2. Publishing center of BSU, 2010, pp.22-25, ISSN: 978-985-476-848-9 (on-line), http://elib.bsu.by/handle/123456789/23927

[Kharin and Maltsau, 2014] Kharin Yu., Maltsau M., Markov chain of conditional order: Properties and Statistical Analysis. Austrian Journal of Statistics, Vol. 43/3-4, 2014. pp. 205-216. http://www.ajs.or.at/

[Kharin and Maltsew, 2017] Kharin Yu., Maltsew M., Statistical analysis of high-order Markov dependemcies. ACTA ET COMMENTATIONES UNIVERSITATIS TARTUENSIS DE MATHEMATICA, Vol.1, Number 1, 2017. pp. 79-91. http://acutm.math.ut.ee

[Lopes et al, 2012] Lopes V., Scholz T., Estanqueiro A., Novais A., On the use of Markov chain models for the analysis of wind power time-series, *11th International Conference on Environment and Electrical Engineering*. Environment and Electrical Engineering (EEEIC), Venice, Austria, 2012, pp. 770-775. IEEE, DOI 10.1109/EEEIC.2012.6221479 http://ieeexplore.ieee.org/document/6221479/

[Spedicato, 2017] Spedicato G., Discrete time Markov chains with R. The R Journal, Vol.9/2. CONTRIBUTED RESEARCH ARTICLE, 2017. pp. 84-104. ISSN: 2073-4859, https://journal.r-project.org/archive/2017/RJ-2017-036/

[Görlitz et al, 2011] Görlitz L., Gao Zh., Schmitt W., Statistical analysis of chemical Transformation kinetics using Markov-chain Monte Carlo methods. *Environ. Sci. Technol.*,, Vol. 45(10). Environmental Science and Technology, American Chemical Society, 2011. pp. 4429-4437. ISSN: 0123-0123 (print version), doi: 10.1021/es104218h https://pubs.acs.org/doi/abs/10.1021/es104218h

[Raja et al, 2017] , Raja A. , Mikael B., Jorge M., Sayyed M., Joel S., Syed Z., Raja A., Lars A., VMCMC: A graphical and statistical analysis tool for Markov chain Monte Carlo traces. BMC Bioinformatics, 2017. pp. 2-8. Open Access, DOI: 10.1186/s12859-017-1505-3 https://bmcbioinformatics.biomedcentral.com/articles/10.1186/s12859-017-1505-3

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ISOPERIMETRIC PROBLEMS IN DISCRETE SPACES

Levon Aslanyan

Abstract: *A substantial survey of results, obtained around the discrete isoperimetry problems, is presented in Harper's book of 2004. But a number of important results remain not reflected. These basic results, obtained in period 1980-90, and a number of new results obtained recently are included in this text. Results are presented in terms of geometry of multidimensional unit cube. And of course the considered in this paper issue concerns the vertex-isoperimetry paradigm vs. to the edge-isoperimetry version that is also a research topic in this area. The edge-isoperimetry counterpart of these topics will be surveyed in a separate publication.*

Keywords: *Data structures, discrete optimization, isoperimetry.*

ITHEA Keywords: *G.2 Discrete mathematics, G.2.3 Applications*

Introduction

The classical mathematical problem about isoperimetry is very old. The problem itself is linked to the name of queen Dido of Cartagena, ~800 BC [2]. Mathematical investigation in the area started in ancient time by Archimedes, Zenodot and others.

In modern terms the main isoperimetry result (on a plane) can be formulated as:

Theorem. Let C be a simple closed curve in the plane with length L and bounding a region of area A. Then$L^2 \geq 4\pi A$, with equality if and only if C is a circle.

$L^2 \geq 4\pi A$ is the so called the basic isoperimetry inequality for the plane. A similar relation holds for the 3 dimensional space. The basic isoperimetry theorem, historically, was proved in 2 stages. Firstly it was proven that if a curve satisfies the isoperimetry requirement, then it must be a circle. The proof is more or less simple and it can be found in Blyashke's book "Circle and ball". The part about the existence of a solution is harder and it was elaborated firstly by Karl Weierstrass, as part of the variation analysis that was appearing that time.

Applications of isoperimetry property could be found in different areas. Our goal in this paper is not the classical/continuous but the so called discrete isoperimetry problem.

Consider a text document and its word count histogram (the so called word vector model). The Armenian language, for example, involves approximately 10000 word roots (H. Adjarian, G. Jahukyan). Thus, such a document may be codded by a 10000-dimensional numerical vector and a collection of n documents corresponds to an n-subset of points of this integer vector space. These n vectors may be arranged as columns of a $10000 \times n$ matrix. Given a subset of vertices, to analyze its structural properties geometrical and algebraic approaches may be applied. The aim is to understand compactness, diversity of types, and other properties. This means, that we are interested to know the isoperimetry like properties, and our example is just to show that multidimensionality is a natural phenomenon of the discrete isoperimetry studies. Classical isoperimetry is two or three dimensional basically.

Consider one more example. When a new web page is created a natural question is to know the closest pages to it, that is the pages that contain a similar set of links, information or keywords. This question translates to the geometric question of finding nearest neighbors in a multidimensional multivalued space. This best match type query needs to be answered quickly. One of the ways to address this issue is to use the so called Random Projection Technique. If each web page is a d-dimensional vector, and d is very large, then instead of spending time d to read the vector in its entirety, once the random projection to a k-dimensional space is done, one needs only read k entries per vector. The use of isoperimetry in problem of best match search is demonstrated in [18,19].

Consider the n-dimensional unite cube $\mathrm{E^n}$. A vertex $\alpha \in \mathrm{A} \subseteq \mathrm{E^n}$ is called interior for subset A if $\mathrm{S_1^n(\alpha)} \subseteq \mathrm{A}$, where $\mathrm{S_r^n(\alpha)}$ is the sphere of radius r centered at α. Denote by $\mathrm{I(A)}$ and $\mathrm{B(A)} = \mathrm{A} - \mathrm{I(A)}$ the sets of all interior and boundary vertices of the set A.

Basic Discrete Isoperimetry

Consider the revers lexicographical order and the standard order over the $\mathrm{E^n}$. In reverse lexicographic order $1 < 0$. In standard order vertices are arranged layer by layer starting from layer 0. Inside the layers vertices are in reverse lexicographic order. L_m^n denotes the initial segment of length m in standard order over the $\mathrm{E^n}$.

Theorem (Harper L.) L_m^n is the maximum internal vertex set for size m and dimension n, $1 \leq m \leq 2^n$.

The simplest proof of this theorem is based on the so called compression technique. We say that set A is i-compressed if partitions of A, $A^0(i)$ and $A^1(i)$ in direction i are in standard order of the $n-1$

dimension space. Arbitrary subset A, step by step can be partitioned and compressed by directions and after finite number of such steps we arrive to a uncompressible set A^c.

Theorem (Aslanyan L., Karakhanyan V., Torosyan B.) Compression does not enlarge the boundary set of vertices, and A^c either equals to L_m^n, or $m = 2^{n-1}$ and $A^c = L^n_{2^{n-1}-1} \cup \alpha_{2^{n-1}+1}$.

I. Leader, [3] "Discrete Isoperimetric Inequalities" (1991) refers to D. J. Kleitman [4] concerning the short proof of Isoperimetry that is factually based on compression. In fact, D. Kleitman presents just a survey in [4]. At that time simple proof was already published in Russian as well as in English [7].

Isoperimetry Inequalities

Isoperimetric inequalities are the key element of proofs in classical isoperimetric analysis.

To consider the discrete isoperimetry inequalities represent $a = |A|$ in the following canonical form

$$\mathrm{a} = \sum_{\mathrm{i}=0}^{\mathrm{k}} \binom{\mathrm{n}}{\mathrm{i}} + \delta,\ 0 \le \delta < \binom{\mathrm{n}}{\mathrm{k}+1}.$$

The following isoperimetric inequalities are derived by Nigmatullin R. [5,6]:

I. $\mathrm{B(A)} \supseteq \mathrm{B(A^0(i))} \cup \mathrm{B\,(A^1(i))}$ for any $\mathrm{A} \subseteq \mathrm{E^n}$, and direction i,

II. $|\mathrm{B(A)}| \ge |\mathrm{B(A^0(i))}| + |\mathrm{A^1(i)}| - |\mathrm{A^0(i)}|$ for any $\mathrm{A} \subseteq \mathrm{E^n}$ of reduced form and direction i (A has reduced form, if $|\mathrm{A^1(i)}| \ge |\mathrm{A}|/2,\ \mathrm{i} = 1, \cdots, \mathrm{n}$),

III. If $\mathrm{A} \subseteq \mathrm{E^n}$, $|\mathrm{A}| = \mathrm{m} = \sum_{\mathrm{t}=0}^{\mathrm{k}} \binom{\mathrm{n}}{\mathrm{t}} + \delta,\ 0 \le \mathrm{k} \le \mathrm{n}$ and $0 \le \delta < \binom{\mathrm{n}}{\mathrm{k}+1}$ then $\exists \mathrm{i} \in \overline{1,\mathrm{n}}$ such that $|\mathrm{A^1(i)}| \ge \sum_{\mathrm{t}=0}^{\mathrm{k}-1} \binom{\mathrm{n}-1}{\mathrm{t}} + \delta\frac{\mathrm{k}+1}{\mathrm{n}}$.

Characterization of Solutions

Theorem (Aslanyan L., Karakhanyan V.) For each isoperimetric subset $A \subseteq E^n$ there exists a vertex $\alpha \in A$ such that $\mathrm{S_k^n(\alpha)} \subseteq \mathrm{A}$.

Subset A is called critical if $\forall\ \alpha \in A\ S_1^n(\alpha) \cap I(A) = \emptyset$. A number m is critical if L_1^n is a critical set. In this case it is easy to check that all m-element optimal subsets are critical.

Theorem (Aslanyan L., Karakhanyan V.) For each isoperimetric subset $A \subseteq E^n$ of critical cardinality there exists a vertex $\alpha \in A$ such that $\mathrm{S_k^n(\alpha)} \subseteq \mathrm{A} \subseteq \mathrm{S_{k+2}^n(\alpha)}$.

m is a critical cardinality in dimension n iff the n-th entry of $\alpha_{L_m^n}$ equals 1. So the number of critical cardinalities equals 2^{n-1}.

Asymptotic Estimations

This point surveys the asymptotic behavior of discrete compactness when n→ ∞. For this we form sequences a_n of sizes of considered subsets in form $a_n = 2^{n-1}(1+\alpha_n)$. We require $-1 \le \alpha_n \le 1$ to satisfy the plain conditions $0 \le a_n \le 2^n$. Finally we denote $\mathfrak{M}_{a_n} = \{$ the set of sequences $A_n \subseteq E^n, |A_n| = a_n$, by $n = 1,2, \dots\}$ and let $\mathfrak{M} = \cup\, \mathfrak{M}_{a_n}$.

We call set $A \subseteq E^n$ γ-dense if $\gamma(A) = \frac{|I(A)|}{|A|} = \gamma$, $0 \le \gamma \le 1$. Further denote by $m(\gamma)$ $(m_{a_n}(\gamma_n))$ the fraction of those subsets $A \subseteq \mathfrak{M}$ $(A_n \subseteq \mathfrak{M}_{a_n})$ which are γ_n dense. In a similar way $\tilde{m}(\gamma)$ $(\tilde{m}_{a_n}(\gamma_n))$ denotes the fraction of those subsets $A \subseteq \mathfrak{M}$ $(A_n \subseteq \mathfrak{M}_{a_n})$ with $\gamma(A) \ge \gamma$.

Theorem (Aslanyan L., Arsenyan I., Sahakyan H.)

A) $\lim_{n\to\infty} \gamma(A) = 0$ for almost all subsets $A \subseteq E^n$.For arbitrary integer k $\lim_{n\to\infty} m\left(\frac{k}{2^{n-1}}\right) = \frac{1}{2^k k!\sqrt{e}}$ and $\lim_{n\to\infty} \tilde{m}(\frac{\eta(n)}{2^n}) = 0$ with $\eta(n) \to \infty$.

B) If $\lim_{n\to\infty} n\alpha(n) \to -\infty$ with $n \to \infty$, then for almost all subsets$A_n \subseteq \mathfrak{M}_{a_n}$ $\gamma(A_{n)} = 0$.

C) If $\lim_{n\to\infty} n\alpha(n) \to \infty$ with $n \to \infty$, then $m_a\left(\frac{1+\alpha(n)}{2}\right)^n \to 1$. If 1- $\alpha(n) \sim \frac{c}{n}$, $c > 0$, then for almost all $A_n \subseteq \mathfrak{M}_{a_n}$ $\gamma(A_{n)} \sim e^{-c/2}$. Moreover, $m_a(1) \to 1$ if 1- $\alpha(n) = o(1/n)$.

D) If $\lim_{n\to\infty} n\alpha(n) \to \infty$ then for almost all $B_n \subseteq \mathfrak{M}_{b_n}$, $|b_n - a_n| = o(\frac{2^n}{n})$ $\gamma(B) \sim \left(\frac{1+\alpha(n)}{2}\right)^n \sim \gamma(A)$.

E) If $n\alpha(n) \to \lambda$ with $n \to \infty$, then $m_a\left(\frac{k}{2^{n-1}}\right) \to \frac{1}{k!}\left(\frac{e^\lambda}{2}\right) e^{-\frac{e^\lambda}{2}}$, and $\tilde{m}(\frac{\eta(n)}{2^{n-1}}) \to 0$ when $\eta(n) \to \infty$.

Theorem (Aslanyan L., Danoyan H.)

A) For arbitrary subset A the function $f_A(k) = \left|A^{(k)}\right|$ has one or two points of maximum over the domain {1,2,…,n} and in case when the maximum appears in two points, then they are neighbor points

B) Let we have an isoperimetric set S and any $A \subseteq E^n$, such that $|A| \ge |S|$. Then there exists an integer $\gamma \in \{0,1, \dots, n-1\}$ such that $\left|S^{(i)}\right| \le \left|A^{(i)}\right|$ when $i \le \gamma$ and $\left|S^{(i)}\right| \ge \left|A^{(i)}\right|$ when $i > \gamma$.

Conclusion

Studies in the discrete isoperimetry area appeared as issues of chip design and optimization, started in 70's, by a paper of L. Harper. Isoperimetry may vary concerning the real data structure considered and the set of constraint applied. The basic problem is in boundary minimization for the subsets of binary cubes. This paper considered the basic postulation and the aim was to conclude the results about the

characterization of the set of all solutions of the problem. These results include postulations such as the existence of a maximal sphere in an arbitrary solution of the problem, the asymptotic description of the subset distribution by the volume of internal vertices, et. Participants of these researches are V. Karakhanyan, B. Torosyan, I. Arsenyan, H. Sahakyan, H. Danoyan. The extended narration of the topic is under preparation for further publication. This text will include theoretical as well as applied area descriptions such as chip design, cross connectivity networking and optimization, bioinformatical applications and others.

References

Harper L. H., Global Methods for Combinatorial Isoperimetric Problems, Volume 90 of Cambridge Studies in Advanced Mathematics, Cambridge University Press, 2004.

Popular Lectures and Addresses by Sir William Thomson (Baron Kelvin) in Three Volumes, Vol. II, Geology and General Physics, Nature Series, London, MacMillan and Co., 1894.

B. Bollobás, Probabilistic Combinatorics and its Applications, Proceedings of Symposia in Applied Mathematics, Volume 44, 1991.

B. Bollobás, Surveys in Combinatorics, Cambridge University Press, 1979, Chapter 3 “Extremal hypergraph problems” by D. J. Kleitman.

Nigmatullin R. G., Some metric relations in the unite cube (in Russian), in Diskretny Analiz 9, Novosibirsk, 1967, pp. 47-58.

Nigmatullin R. G., Some metric relations in the unite cube (in Russian), in Diskretny Analiz 10, Novosibirsk, 1967, pp. 69-89.

Aslanyan L. H., Karakhanyan V. M. Torosyan B. E. On the compactness of Subsets of Vertices of the n-dimensional unit cube, in Soviet. Math. Dokl., American Mathematical Society, Vol. 19(1978), No. 4, pp. 781-785.

Асланян Л. А., Караханян В. М., Описание множества всех решений дискретной изопериметрической задачи, Доклады Академии Наук, Арм. ССР, 65(4), Ереван, 1977, стр. 211-215.

Асланян Л. А., Караханян В. М., Торосян Б. Е., Решение дискретной изопериметрической задачи, Доклады Академии Наук, Арм. ССР, 65(5), Ереван, 1977, стр. 257-262.

Асланян Л. А., Караханян В. М., Торосян Б. Е., О компактности подмножеств вершин n-мерного единичного куба, Доклады Академии Наук, СССР, 241(1), Москва, 1978 (English translation in Soviet. Math. Dokl., American Mathematical Society, Vol. 19(1978), No. 4, pp. 781-785), стр. 11-14.

Асланян Л. А., Изопериметрическая задача и смежные экстремальные задачи для дискретных пространств, Проблемы Кибернетики, 36, Москва, 1979, стр. 85-127.

Kleitman D. J., Extremal Hypergraph Problems, in London Math. Soc. Lect. Note Ser., Cambridge Univ. Press, No. 38(1979), pp. 44-65.

Bezrukov S. L., Isoperimetric Problems in Discrete Spaces, in: Extremal Problems for Finite Sets., Bolyai Soc. Math. Stud. 3, Budapest 1994, pp. 59–91.

Aslanyan L. A., Akopova I. A., On the distribution of the number of interior points in subsets of the n-dimensional unit cube, Colloquia Mathematika Societatis Yanos Bolyai, 37, Finite and Infinite Sets, (Eger) Hungary, 1981, pp. 47-58.

Асланян Л. А., Дискретная изопериметрическая проблема - асимптотический случай, Доклады Академии наук, Арм. ССР, 74 (3), Ереван, 1982, стр. 99-103.

Асланян Л. А., О единственности компактных булевых функций с точностью до изоморфизма, Working Paper, MTA SzTAKI, E/17 Budapest, 1983, pp. 1-11.

Aslanyan L., Metric decompositions and the Discrete Isoperimetry, IFAC Symposium on Manufacturing, Modelling, Management and Control, July 12-14 2000, Patra, Greece, pp. 433-438.

Aslanyan L. H., Danoyan H. E., On the Optimality of the Hash-Coding Type Nearest Neighbor Search Algorithm, Selected Revised Papers of 9th CSIT conference, submitted to IEEE Xplore, 2013.

Aslanyan L., Danoyan H., Complexity of Hash-Coding Type Search Algorithms with Perfect Codes, Journal of Next Generation Information Technology (JNIT), Volume 5, Number 4, November 30, 2014, ISSN : 2092-8637(Print), 2233-9388(Online), pp. 26-35.

Arsenyan I., Aslanyan L., Sahakyan H., Randomized Set Systems Constrained by Discrete Tomography, Information Theories and Applications, Vol. 23, Number 3, 2016, pp.203-231.

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DISTRIBUTED LEADERSHIP

Anastassia Dyulgerova

Abstract*: This paper main goal is to reveal the nature of the distributed leadership, its distinctive features and its impact on the complexity of the leader's role. Brief comparison between the command and control leadership and the distributed leadership is made. Distributed leadership step-by-step application is uggested applicable for big corporations and small firms.*

Keywords*: leadership, collective form of leadership, distributed leadership*

ITHEA Keywords: *J.1 Administrative Data Processing: Business*

1. Introduction

Nowadays the work and corporate environment have become too complex and broad scope demanding. As a result, the leadership and the criteria for effective leadership have changed over the years. The *charismatic hero-type leader* has become *more hero of old times* and place is made for new approaches in leadership. According to Temelkova (2017) “Those changes require such a fundamental restructuring in the internal structures, which would ensure harmony with that environment. This may be achieved through the application of innovative approaches and toolset in management, which would provide a reliable mechanism for:

- timely detection of the changes;
- risk evaluation;
- elaborating and taking efficient management decisions in the conditions of a growing uncertainty. (p. 30)[1]

1 Temelkova, M (2017) *Development of Controlling in the Organizations from the Service Sector under the Conditions of the Fourth Industrial Revolution*, International Journal of Advanced Research in Management and Social Sciences, Vol 6, No 3, 28-43, ISSN: 2278-6236, p 30

2. Task and challenges

This paper main goals are first to reveal the nature of the distributed leadership, its distinctive features and its impact on the complexity of the leader's role, and second to suggest a simple step-by-step application applicable for both big corporations and small firms.

3. The complexity of the leader's role

The complexity of the leader's role can be revealed by reviewing some of the *various functions* the leader is dealing with. (i) *An administrator* - this is his most obvious function. (ii) *Planner* - this feature includes both identifying immediate steps, methods and tools, and long-term business plans. (iii) *Politician* - one of the leader's most important functions is to set goals and dictate the line of group behavior. (iv) *Expert* - the leader in the group is the person most often referred to as a reliable source of information or as a classified expert. (v) *Representative of the group to the outside environment* - the leader is an official representative of the group and a spokesperson on its behalf. (vi) *Regulator of the internal relations within the group* - the regulation of the business relations in the group is done through a communication network. (vii) *Source of encouragement and punishment*, etc. [1]

On the other hand, the complexity of the leader's role is determined by the wide expertise in various fields, which leader must possess - law, economics, psychology, marketing, etc. This broad knowledge is required along with the specific expertise in the field of work in which the leader operates.

Is it then possible for a one person to acquire all these skills and knowledge to become a successful leader? Often the answer to this question is that the good leader is the one who can form a good team. Such a team, however, will always need control and ongoing coordination. That is why he clarification of the problem of leadership in its various aspects is extremely important.

The last decade the leadership theories has evolve in a less linear manner. Rather than seeking 'one true theory' of leadership, contemporary thinking has explored the idea of leadership from different perspectives.

1 Detailed on Leadership Features see Марков К., *Лидерство и формиране на екипи*, Издателски комплекс при НВУ „Васил Левски", Велико Търново, 2014, ISBN *978-954-753-205-2, p 58-59*

4. The nature of the distributed leadership

The command and control leadership is exercised individually by appointed leaders in formal positions of authority in a clearly defined hierarchy and by using top-down decision-making. Vice versa the *distributed leadership* is exercised by multiple leaders - some in formal positions of authority and some not who work collaboratively across hierarchy levels.

The distinctive features of distributed leadership are:

(i) Distributed leadership concentrates on the leadership practice rather than the particular person. As Spillane (2005) formulates "Distributed leadership is first and foremost about leadership practice rather than leaders or their roles, functions, routines, and structures" (p 144)[1].

(ii) The individuals involved are not necessarily appointed formal leaders. The distributed perspective focuses on the interactions of individuals through leadership practice. It is often noted that leadership needs to be shared and distributed leadership is collective contribution of all leaders to the organization.

(iii) This is achieved through cooperation, reliance on others and a willingness to engage, working together with people who are different from us, sometimes leading and sometimes following[2]. That is the reason why distributed leadership involves leadership practices that are more collaborative, open and decentralized.

(iv) The borders in distributed leadership are not definitive and strict.

(v) Distributed leadership is solving problems oriented

(vi) Distributed leadership is a collective form of leadership. Collective leadership is an umbrella term for shared responsibility in an organization and the distributed leadership is one of the possibilities.

Distributed leadership has been mostly criticised for failing to conform to traditional views of 'the leader', and that not all leadership occurs in the context of a problem.

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1 James P. Spillane (2005) Distributed Leadership, The Educational Forum, 69:2

2 On distributed leadership nature see also Deborah Ancona and Elaine Backman (2017) *Distributed Leadership from Pyramids to Networks: The Changing Leadership Landscape*, Management Sloan School, Leadership Center

5. Distributed leadership first steps in a step-by-step application

The steps for using the distributed leadership advantages in a big corporate structure or a small firm are the same.

Step one - *people have to be engaged to become leaders*. The easiest way is to separate their talent from the day job routine and to give them a chance to prove themselves. This will improve their confidence. The importance of this step is connected mostly with the fact that the biggest resistance will come from the people themselves.

Step two - *encouraging risk taking*. Communication is a key factor in making sure people understand what the risks are and what risks they can take. The size of a company is also an influential factor in determining how quickly a decision can be made. Employees in large corporate organizations tend to take far fewer risks than the ones in a company with ten to twenty employees.

Step tree - *building a no-blame culture*. Mistakes have to be talked about and learned from.

6. Conclusion

Distributed leadership is not about just taking collective decisions is about finding the ad hock leader. The one who will react best depending on pending issues and problems to be solve. There are few small steps to be taken first in engaging people to become leaders.

7. Further researches

A more complex research on step-by-step approach of distributed leadership should be made. More practical suggestions for the big corporate structure or a small firm must be made.

Bibliography

1 David Barry, (1991) *Managing the Bossless Team: Lessons in Distributed Leadership*, Organizational Dynamics (V21, #1: 31-47)

2 Deborah Ancona, Elaine Backman (2017) *Distributed Leadership from Pyramids to Networks: The Changing Leadership Landscape*, Management Sloan School, Leadership Center

3 Frederick P. Morgeson, D. Scott DeRue, Elizabeth P. Karam (2010) *Leadership in Teams: A Functional Approach to Understanding Leadership Structures and Processes*, Journal of Management, Vol. 36 No. 1, January 2010 5-39

4 James P. Spillane (2005) *Distributed Leadership*, The Educational Forum, 69:2, 143-150, DOI: 10.1080/00131720508984678

5 Lisa L. Wright (2008) *Merits and Limitations of Distributed Leadership: Experiences and Understandings of School Principals*, Canadian Journal of Educational Administration and Policy, Issue #69, February 7

6 Süleyman Göksoy (2015) *Distributed Leadership in Educational Institutions*, Journal of Education and Training Studies Vol. 3, No. 4; July, ISSN 2324-805X, URL: http://jets.redfame.com

7 Temelkova, M (2017) *Development of Controlling in the Organizations from the Service Sector under the Conditions of the Fourth Industrial Revolution*, International Journal of Advanced Research in Management and Social Sciences, Vol 6, No 3, 28-43, ISSN: 2278-6236

8 Temelkova, M. (2018) *Studying the leadership style of business organizations' management under the conditions of the Fourth Industrial Revolution*. Asia Pacific Journal of Research in Business Management, Volume 9,Issue 2, ISSN : 2229-4104

9 Temelkova, M. (2017) *A Model determining Leadership in the Business Organizations under the Conditions of the Forth Industrial Revolution*. Current Scientific Resarch - Collection of scientific articles. Monreal, Canada, ISBN 978-617-7214-49-5.

10 Temelkova, M. , Bakalov, I. (2017) *Study of the Need for Smart Management in the Business Organizations from the "Telecommunication" and "Courier Service" Sectors.* Topical questions of contemporary science - Collection of scientific articles. Aspekt Publishing, Taunton, MA, United States of America. ISBN 978-0-9988732-1-3

11 Lakomski, G (1999) *Against leadership: A concept without a cause*. In: Begley, PT, Leonard, PE (eds) The Values of Educational Administration: A Book of Readings, 37–51. Available at: http://www.goodeconsulting.com.au/Publication%20Copies/the-values-of-educational-administration.pdf (accessed 3 August 2016). Google Scholar

12 Марков К., *Лидерство и формиране на екипи*, Издателски комплекс при НВУ „Васил Левски", Велико Търново, 2014, ISBN *978-954-753-205-2*

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