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Zinātnisko rakstu krājumā iekļauti IX starptautiskās zinātniski praktiskās konferences "Vide. Tehnoloģija. Resursi" raksti.
Rakstu tematika saistīta ar vides kvalitāti un monitoringu, piesārņojuma novēršanas tehnoloģijām, tīrāku ražošanu, ilgtspējīgo lauksaimniecību, vides izglītību un ekonomiku. Rakstu krājumā pārstāvēti referāti, kas ir saistīti ar datorzinātnes, matemātikas, mehānikas, elektrotehnikas, elektronikas un mehatronikas pielietošanu vides zinātnē, metālapstrādē un citu nozaru problēmu risināšanā.
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VII ENVIRONMENTAL EDUCATION, ECONOMICS AND CASE STUDY

VII

ENVIRONMENTAL EDUCATION, ECONOMICS AND CASE

Environmental Niche Modelling with Desktop GARP for Wild *Origanum vulgare* L. (*Lamiaceae*) in Armenia

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***Abstract*. Predicting species' distributions has became one of the significant components of conservation biology in recent years. During the study, GARP (genetic algorithm) has been identified the key modelling technique for determining *Origanum vulgare* L. (Oregano, *Lamiaceae*) environmental niche in the Republic of Armenia. For over three consecutive years, from 2010-2013 it has been created relevant environmental layers through ESRI ArcGIS programs to be used with the plant actual distribution (occurrence records) as input data of GARP. In the result of the study, it has been produced the fundamental and realized niche and predictive habitat distribution of *O. vulgare* L. with Bitmap under the global climate change. Produced Bitmap illustrates that Oregano distributions would decrease mostly in the central regions due to environmental deterioration and climate change. This research could provide significant data for future conservation planning of wild Oregano in the Republic of Armenia.**

***Keywords*: artificial intelligence framework, Bitmap, predictive distribution, realized niche.**

I Introduction

Predicting species' distributions has become an important component of conservation planning in recent years, e.g. searching for rare or endangered species, planning new conservation areas, assessing the impact of human activities on biodiversity, predicting the impacts of climate change on species' distribution, preventing the spread of invasive species etc.. In fact, wide variety of modelling techniques have been developed for this purpose [2;5].

Environmental niche modelling refers to the process of using computer algorithms to predict the distribution of species in geographic space on the basis of a mathematical representation of their known distribution in environmental space.

This research work has been carried out for over three consecutive years, from 2010-2013. During the study, Desktop GARP has been identified the key modelling technique for determining *Origanum vulgare* L. (Oregano, *Lamiaceae*) environmental niche or predictive habitat distribution in the Republic of Armenia.

During the study, the model is applied for funding associations between environmental variables and known wild Oregano' occurrence records to identify environmental conditions, within which populations can be maintained. The spatial distribution of environments that are suitable for this wild valuable plant can then be estimated across a study region.

This approach has proven valuable for generating biogeographically information that can be applied across a broad range of fields, including conservation biology, ecology and evolutionary biology.

II Materials and Methods

Potential distribution modelling is the process of combining occurrence data (locations where the species has been identified as being present or absent) with ecological and environmental variables (such as temperature, precipitation, and vegetation) to create a model of the species' requirements [1]. The correlative approach and presence data (actual distribution of populations) has been identified the key elements of Desktop GARP during the study. *Correlative* models of Desktop GARP aim to estimate the environmental conditions that are suitable for a species/populations by associating known species' occurrence records or actual distribution with suites of environmental variables that can reasonably be expected to affect the species' physiology and probability of persistence. In fact, this approach is applied to determine the plant fundamental niche, and realized niche. The following diagram shows a hypothetical situation where a species distribution is controlled by just two environmental variables: temperature and moisture.

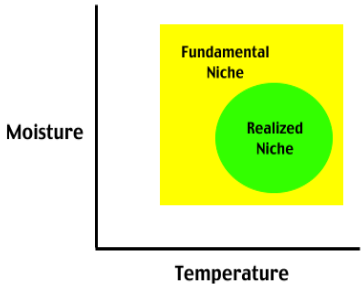

Figure 1: The green and yellow areas describe the combinations of temperature and moisture that the species requires for survival and reproduction in its habitat.

This resource space is known as the fundamental niche. The green area describes the actual combinations of these two variables that the species utilizes in its habitat. This subset of the fundamental niche is known as the realized niche. While suitable environmental conditions determine a species' fundamental niche, biological factors such as competition tend to reduce the fundamental niche into the realized niche [6]. The potential distribution of a species can be seen as the geographical expression of its realized niche at a particular time (i.e., where there is a fulfillment of both abiotic and biotic requirements) [5].

The principal steps required to build and validate a correlative species' distribution model are outlined in **Figure 2.** Two types of model input data has been applied: 1) known species' occurrence records (actual distribution); and 2) a suite of environmental variables. 'Raw' environmental variables, such as daily precipitation records collected from weather stations, are often processed to generate model inputs that are thought to have a direct physiological role in limiting the ability of the species to survive. Correlative species' distribution models rely on observed occurrence records for providing information on the niche and distribution of a species.

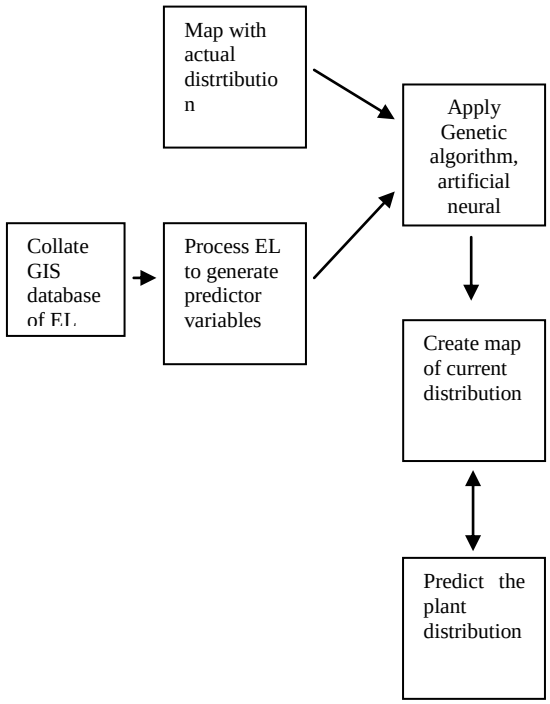

Fig.2: Flow diagram detailing the main steps required for building and validating a correlative approach of distribution model, where EL refers to Environmental Layers.

So, DesktopGarp as a software package for biodiversity and ecologic research allows us to predict and analyze wild Oregano distributions in the RA. Based on artificial intelligence framework, GARP is capable of creating ecological niche models of wild Oregano with the environmental conditions under which the plant should be able to maintain populations. For input, GARP uses a set of point localities where the plant is known to occur and a set of geographic layers representing the environmental parameters that might limit the species' capabilities to survive [3]. For instances, GARP contains a window where we have specified all the parameters and data to be used in the experiment. Below is a sample of the interface.

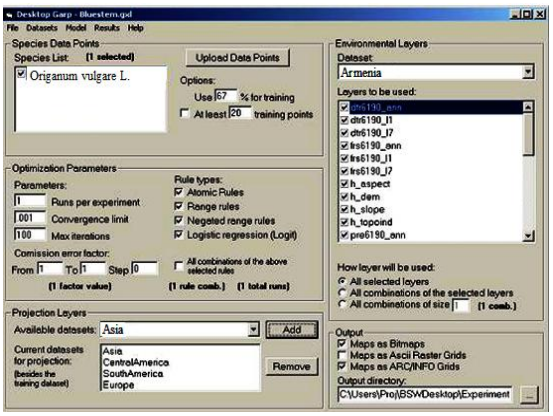

Fig.3: Desktop Garp parameter

In fact, environmental layers typically represent abiotic conditions by representing temperature, precipitation, radiation, wind, evaporation, topography, soil moisture, and vegetation coverage. Environmental rasters have been produced from satellite data, weather station data (by interpolation of raw data) and some other set of measurements.

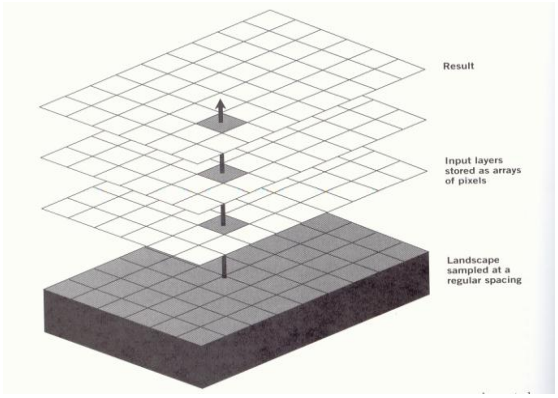

Fig4: Environmental layers

During the study, ESRI ArcGIS program is applied to produce relevant environmental layers. For example, the precipitation or temperature layers and also, to recorded the locations of the populations.

III RESULTS AND DISCUSSION

A crucial consideration that is overlooked in the study time is exactly what component of a plant' niche is being modelled distinguish three broad categories of factors that determine of Oregano distributions over the country: abiotic environmental factors, biotic factors concerning interactions among species, and factors that affect the ability of species to disperse to different areas.

In the result of the study, it has been determined the ratio between fundamental, realized niche and the

actual distribution of wild *O. Vulgare* L. in the Republic of Armenia (**Figure 5**). Environmental niche components of used variables in the distribution models are approved to be the direct drivers of Oregano distributions, which means that Desktop Garp is more closely resemble the realized distribution than the fundamental distribution. In the following diagram has been shown it.

Fundamental and Realized Niche of Oregano vulgare L. in Armenia, 2012

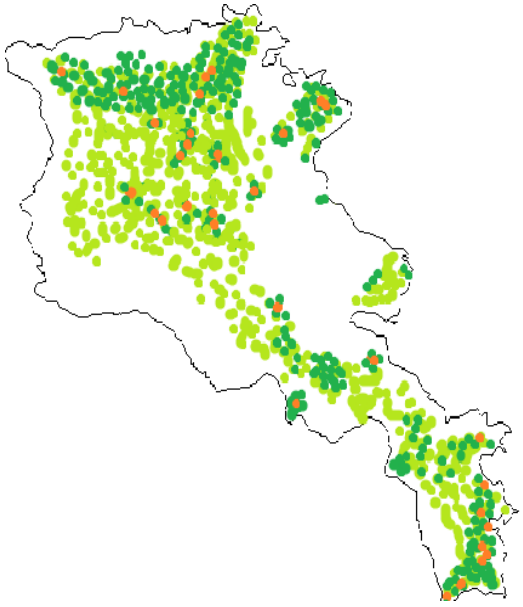

Figure 5: Fundamental niche encompasses yellow points, realized/potential niche green and the actual distribution comprises brown points.

Also, it has been predicted future distributional pattern of wild Oregano in Armenia under global climate change, environmental deteriorations and other threats in accordance with relevant input data e.g. environmental layers appertain to global climate change.

In the following figure it is illustrated Bitmap or predicted map of wild *Origanum vulgare* L. distributions.

Wild Oregano vulgare L. Predicted Distributions

Figure 6: Bitmap of Oregano in Armenia up to 2100 under global climate impact.

According to the produced Bitmap, the vulnerability *O. Vulgare* L. would particularly increase in the central regions of the country. These territories were identified to be comparatively stressful environments under global climate changes and anthropogenic threats. Likewise, it has been anticipated much more negative impact of the climate change into populations distributions in the central regions of the country by comparison with northern and south regions.

Generally, in the south and north regions wild oregano future distribution might increase, which is also obvious from figure 5, where realized/ potential niche is widely distributed in these regions. In addition, realized niche is comprising that portion of fundamental niche from which the plant is not excluded due to biotic competition encapsulated with set of favorable environmental conditions.

So, the populations from south and north regions would not suffer so much from the global warming. Also, in these regions populations are more sustainable and mostly exposed increase of their sizes and abundance during the study period. There could be many different factors affecting on the increase of populations 'sizes, such as biological characteristics of the plant, favorable environmental and habitat conditions, biotic interactions among the *O. Vulgare* L. and other plants, antropogenetic threats, environmental deteriorations, habitat loss etc.

In fact, one of the key elements that might affect on future distributions of wild *O. Vulgare* L. populations over the country is the mentioned factors interactions along with global climate change impact. For instances, populations would increase in their sizes and would cover new territories in the south and north regions not only because of favorable habitat environment (e.g. with slight mechanical structure and relatively high humus concentration bearing soils) but also because of the fact that the global climate change would not arise here habitat distortions as much as in the central regions.

In fact, precipitations decrease will occur in higher level here then the other regions, the increase of temperature with 4-5^{o}C again is recorded the highest one, droughts also will occur more often here then the other regions according to B_2 scenario (2030-2100 of global climate change,) etc.

I. Conclusion

In conclusion, it has been determined wild *Oreganum vulgare* L. fundamental and realized niche. During the environmental niche modeling, variables components has been identified the key directives for Desktop Garp. That is why, it is more closely resemble the realized distribution than the fundamental distribution.

Also, the produced Bitmap with the predictable habitats illustrates that Oregano distributions would decrease mostly in the central regions under global climate change.

In fact, these territories were identified to be comparatively stressful environments. On the other hand, the plant distribution in the North and South regions would not suffer that much from the climate change and environmental deterioration.

This research provides significant data that can be used for future conservation planning of this unique culinary and medicinal plant in the Republic of Armenia.

V. Acknowledgments

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VI. References

[1] Anderson RP, Lew D, Peterson AT, Evaluating predictive models of species' distributions: criteria for selecting optimal models. Ecol Model, 2003, 162:211–232

[2] Guisan, A., and W. Thuiller. 2005. Predicting species distribution: Offering more than simple habitat models. Ecology Letters 8, 993-1009http://www.treehugger.com/cars/e-cars-and-buses-charge-magically-with-underground-induction.html

[3] Huntley, B., P.M. Berry, W. Cramer, and A.P. Mcdonald. Modelling present and potential future ranges of some European higher plants using climate response surfaces. Journal of Biogeography 22, 967-1001, 1995

[4] IUCN, WHO, WWF (1993). Guidelines on the Conservation of Medicinal Plants, IUCN, Gland, Switzerland, 50 p.

[5] Peterson AT, Uses and requirements of ecological niche models and related distributional models.Biodiversity Informatics, 2006, 3:59–72.

[6] Peterson A.T. & Cohoon K.P. (1999). Sensitivity of distributional prediction algorithms to geographic data completeness. Ecological Modelling, 117, 159-164.

[7] Austin, M. P. et al. 1990. Measurement of the realized qualitative niche: environmental niches of five Eucalyptus species. _ Ecol. Monogr. 60: 161_177.

[8] Taghtajyan A. L., Flora of Armenia, VIII sector, National Academy of Sciences of Armenia, Botanical Institute, Yerevan, 1987, Pages 418

[9] www.gbif.org

[10] http://www.ncdc.noaa.gov/paleo/paleo.html

[11] http://www.worldclim.org/

[12] http://www.ipcc-data.org/

Modernization of Public Administration and e-Government in Bulgaria

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Abstract. **The present paper discusses current issues related to administration and government that affect e-Governance and e-Government. It considers the strategic document addressing the modernization of the Bulgarian state administration and the improvement of the judicial system functioning, as well as the implementation of e-Government in Bulgaria – the Operational Programme "Administrative Capacity". It is part of the National Strategic Reference Framework 2007 – 2013 and contributes to achieving the following strategic objectives:**

1. Enhancing economic competitiveness in terms of high and stable economic growth;

2. Stimulation of human potential by ensuring intensive employment, higher incomes and social integration.

The Operational Programme has a horizontal nature and its purpose is to improve the operation of public administration directed to implementation of effective policies and quality services to citizens and businesses and creating conditions for sustained economic growth and employment, increasing professionalism and transparency, improving the functioning of the judiciary.

On this basis, the priorities of the Operational Programme for achieving the strategic goals of modern administration – quality services and e-Governance – are considered.

I INTRODUCTION

This document pays attention to the architecture of the portal infrastructure of the e-Government in Bulgaria. The interoperability in it is analyzed, as well as the need of existence of common standards when dealing with electronic documents. The preconditions for this are given by the National Framework for interoperability of the information systems.

Based on the analyses done, it is concluded that Bulgaria has a consistent policy of modernizing its administration. The basis for this is the existing legislative framework. However, it is said that in comparison with other EU countries the implementation of the e-Government in Bulgaria is lagging behind. The reasons for the weaknesses in the implementation of the e-Government in Bulgaria are discussed and measures for overcoming the backlog are proposed.

1. OP "Administrative

Capacity" - a key tool for realizing e-government in Bulgaria

OP "Administrative Capacity" is the strategic document of the Government of Bulgaria, which is the basis of modernization of the Bulgarian state administration and aims to improve the operation of the legal system and structures of civil society for the period 2007 - 2013. It is funded by European Social Fund (ESF) and the national budget. The program line with the recommendations of the Strategic Guidelines for Community cohesion to undertake special action for strengthening of the administrative capacity under the "Convergence".

OP "Administrative Capacity" has a horizontal scope, and its strategic goal is:

Improving the functioning of state administration to implement effective policies, quality services for citizens and businesses, and creating conditions for sustainable economic growth and employment. Enhancing the professionalism, transparency and accountability in the judiciary.

The Programme has the following specific objectives:

- Effective functioning of the administration and judiciary;
- Improving human resources management and qualification improvement of public officials, judiciary and structures of civil society;
- Modern service provided by the administration and the judiciary.

By fulfilling of the OP "Administrative Capacity" will be accomplished common standards and rules for public administration reform at all levels - central, regional and local. It shall be developed professional administration aimed at the needs of society and reduce the cost and bureaucratic procedures in its operations. The Programme will also implement effective mechanisms for internal and external controls for greater accountability and transparency. The capacity of civil society cooperation and dialogue with the administration and the judiciary will also be supported within The Programme. This will ensure efficient formulation and implementation of policies in implementing the principle of partnership.

Besides its horizontal scope The Programme has and sectoral scope, as it addresses the reform of the judiciary with focusing in transparency in its work and development of human resources. Strengthening of the judiciary is essential for the implementation of

Community law. Effective and transparent judicial system is an important precondition for creating a good environment for business and higher economic growth. In addition the opportunities of transnational and interregional cooperation will be used for the exchange of best practices with other Member States in areas of importance to the administrative and judicial reform.

To achieve its objectives, The Programme is concentrated in the following priority areas:
Axis I: Good Governance
Axis II: Human Resource Management

***Axis III*: Quality administrative service and development of e-Government**
Axis IV: Technical Assistance

In the developing The Programme are considered the main strategic documents of the European Union (EU), the national policy priorities and the National Reform Programme.

Indicative Financial Framework 2007 - 2013 г.

- Total budget of the OPAC 2007 - 2013 years: **181 million**
- **3.5%** of total aid is from the Structural Funds and **13%** is from the European Social Fund
- Ratio of EU funds / national co-financing: **154/27 million (85/15%)**
  Programme priority axes
- Priority AxisI "Good Governance" - 24% of the total budget for The Programme
- Priority Axis II "Human Resources" - 41% of the total budget for The Programme
- **Priority Axis III "Quality administrative service delivery and development of e-government" - 31% of the total budget for The Programme**
- Priority Axis IV "Technical assistance" - 4% of the total budget for The Programme

2. E-Government

The e-Government is a modern way of working the state administration through the use of informational and communicational technologies (ICTs). It's a tool for improving the administrative services, the increase of efficiency of public administration and optimization of costs.

The development of e-governance improves transparency in the administration and accessibility of services. It reduces the time and effort of citizens and businesses in their communication with the administration. The e-Government covers four major groups of relations (communication and services): administration - citizens, administration – business, administration – administration, administration - employees.

There is already an overall concept for developing an e-Government in Bulgaria.

It's been noticed in Bulgaria a lagging behind the EU Member States in the field of building an e-government. Analysis of the reasons for it allows the identification of measures for its development to a level meeting the European requirements. Until now there could be four major reasons for the inadequate development of e-Government in Bulgaria: lack of appropriate legal basis, lack of interoperability of the information systems administration, lack of adequate electronic exchange, as well as unsolved problem of data unification.

Improvement of the basic legal and strategic basis for developing of e-governance

An important element of the development of the e-government is the adoption of legal documents related to implementation, application and exploitation of ICTs (strategies, plans, architectures, description of work processes, procedures, rules and regulations). They also provide determination and coherence of the administration in the field of e-Government.

In 2006 was completed successfully the implementation of e-Government Strategy, 2002-2006, which determines the purposes and principles of development of information systems related to the services provided by public administration and the general environment for information technology in the administration of Bulgaria. We are currently preparing a new strategy for e-government and a roadmap to it. These documents will be adopted at the end of 2007. To ensure sustainable implementation of projects in the field of e-government it should also be established a comprehensive framework for their long-term financing.

A Law for the e-Government was accepted by the National Assembly on 30.05.2007. It regulates the administrative service delivery for citizens and businesses by electronic means: actions when working with electronic documents in one administration and exchange of electronic documents between public authorities. With this law the delivery of public services electronically will become mandatory for all administrative structures and for persons performing public functions (notaries, state and municipal schools, etc.), and for organizations providing public services (education, health , district heating and telecommunications, postal, etc.).

3. E-Government in Bulgaria

Since the end of 2007 the country is implementing the "Integrated administrative services at central and local level and providing public services", which contractor is the Ministry of State Administration and Administrative Reform (Ministry of State Administration). The project objective is providing Internet access to quality services for the organizations and citizens, including citizens with disabilities, and integrating information systems administration.

The project, called "Electronic Government" or "Electronic Governance", is using modern information and communication technologies. They are used for building an integration environment to which it will

gradually be connected information systems of all government administrations at central and local level, as well as providers of public services (education, health, electricity, district heating, etc.). This will enable the exchange of operational information and services electronically among all providers of administrative and public services.

Thanks to this project, citizens and businesses will receive both new electronic services and simplified electronic versions of existing public services, with a significantly reduced number of documents required for declaring them and with greater transparency and improved control over their implementation. And most importantly - will not be necessary for applicants to visit the private service provider. E-services will may be made 24 hours a day, 7 days a week, 365 days a year.

For users of electronic services - citizens, businesses and other organizations - the face of "e-Government" will be a single portal for access to the electronic services. The portal is part of the integrated e-Government environment and it will be publicly available on the Internet. Through it users of administrative services shall communicate with service providers - will declare their service, will send and receive electronic documents and messages. When the nature of the service allows, its results will be received as an electronic document signed with digital signature of the provider. If the supplier requires it, users will need to use digital signature in order to identify in applying for electronic administrative services. There will be a range of services that will require identification by digital signature in its declaring.

The pilot start of the program became a fact on 1 February 2010, starting with 14 electronic services via the government portal. Integrated platform for Internet services started in test mode, which will continue for at least 4 months. The aim is to launch 15 more electronic services by March and by the end of the year to reach 100.

The prototype of the portal is the so called "One stop shop". This service model allows citizens and organizations to:

- have quick and easy access to institutions;
- to reduce the time for service;
- to reduce contact between applicants and employees, which will help to reduce bad practices.

The places that need to be "visited" in this service model are reduced to one, and required documents, which must be presented by the applicant are minimized (Figure 1).

The single portal for access to the electronic services is a result of mixing model for one-stop shop with information and communication technology and electronic processing of documents.

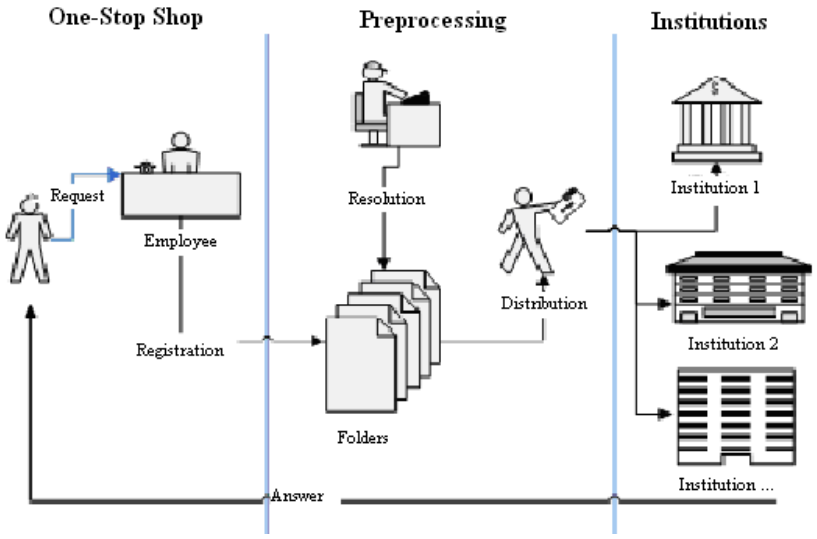

Figure 1: One- stop shop

The portal inherits the advantages of the model of one-stop shops and the opportunities of the technologies, used in information processing. The result is an environment that has great potential for development and interaction with other systems (Figure 2).

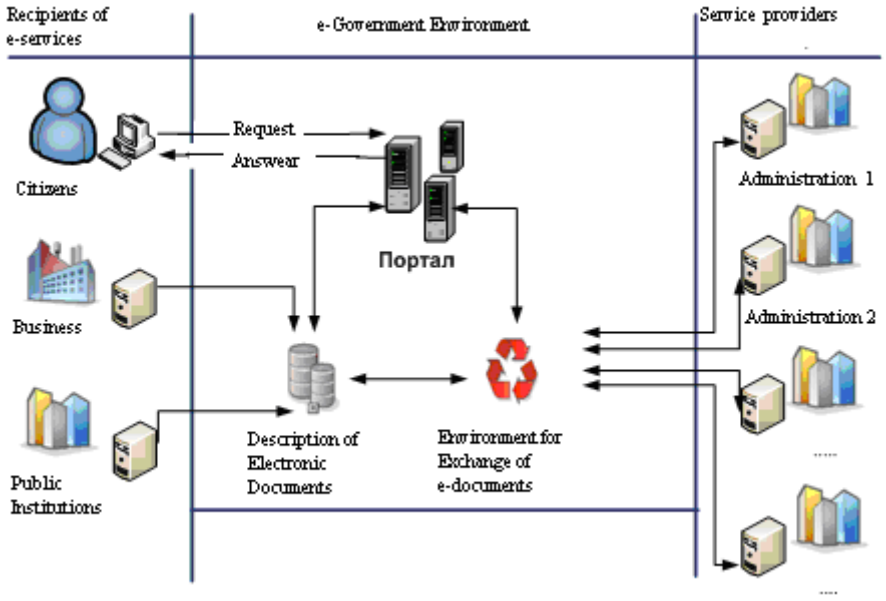

Figure 2

Access to e-services via the portal will be free, unlimited and unconditioned by any requirements for user authentication. In other words, users can use the portal without introducing name and password, i.e. as anonymous users.

3.1. Interoperability

A major problem in the implementation of e-governance is the need for interoperability, common standards and rules for handling electronic documents.

In 2006 the government adopted a National Framework for interoperability of the information systems executive. It includes the establishment of a Register of standards to ensure interoperability, Register of information objects and Register of electronic services. An Instruction on the procedures for certification of systems according to European standards was approved. This provides interoperability to information systems to the departments in providing e-services. National Interoperability Framework is a document that allows Bulgaria to meet the integration of national systems of Member States of the European Union to organize cross-border electronic services. Bulgaria will comply with the European Interoperability Framework.

The implementation of centralized integrated system of the e-Government is yet to be done. It aims to serve as integrated environment for existing independent information systems in public administration and will be the basis of the integrated environment for document exchange. It is developed and a pilot integrated system for e-field, which will integrate the information systems of local and regional level.

With the implementation of the two projects will be constructed a unified information environment for providing electronic services from the central, regional and municipal administrations. They provide electronic exchange of documents for performing the requested services between all departments of central and local administrations. With their implementation will be created a technological environment that will provide:

- Single point of access to all electronic services at any time and from anywhere;
- Online description of all administrative services;
- Simplified user-friendly interface for ordering services, including for disadvantaged people;
- Unified design of the portals of all regional and municipal administrations by creating uniform standards;
- Opportunity for citizens and businesses to electronically track the progress of implementation of the services they have ordered.

II Conclusion

With regard to its commitments to modernize the public administration in Bulgaria is pursue a consistent policy. The basis for this legal framework is already established. However, it should be noted that in comparison with other Member States of the European Union Bulgaria has a delay in the use of electronic governance and e-Government. Analysis of the reasons for this allows measures to be taken to ensure that European requirements will be met.

Until now there have been established four main reasons for weaknesses in the implementation of e-government in Bulgaria:

- Lack of efficiently functioning legal base;
- Lack of interoperability of information systems in the administration;
- Lack of adequate electronic document workflow between administrative departments;
- Unresolved problems with unification of the information for administrations.

III REFERENCES

[1] Bulgaria: ICT Infrastructure and E-Readiness Assessment, ARC Fund, 2002

[2] E-Europe 2005: An information society for all, An Action Plan to be presented in view of the Sevilla European Council, 2002

[3] E-Government: Presentation of the Status and development of e-Government in Bulgaria, Coordination center for information, communication and administration technologies, Sofia

[4] Operative Programme "Administrative capacity" 2007 – 2013, Ministry for State Administration and Adminisrative reform, Sofia

[5] Government Strategy for E-Government in Bulgaria

[6] Government Strategy for modernizing the state administration, 2002

[7] Obama 2009: Obama, Barack: Memorandum for the Heads of Executive Departments and Agencies SUBJECT: Transparency and Open Government, in: General Services Administration: Transparency and Open Government, Intergovernmental Solutions Division, GSA Office of Citizens Services and Communications, Washington DC 2009, S. 4

[8] Programm für Transparenz in der Staatsverwaltung und in der Tätigkeit der Personen im höheren Dienst http://www.mdaar.government.bg/programs.php

[9] Bericht über den Zustand der Verwaltung, 2006, S. 156 http://www.mdaar.government.bg/docs/Annual%20Report%20%202006_26.07.2007.pdf

[10] Bericht über das Programm für Transparenz in der Tätigkeit der staatlichen Verwalung und der Personen im höheren Dienst, zum Dezember 2006, S. 14, www.mdaar.government.bg/lucidity.php

Enhancing the General and Special Skills of Students

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***Abstract*. The paper discusses some specific features related to the practical training of students of the Technical University of Gabrovo (Bulgaria) in some specific companies.**

***Keywords:* practice, firm, training, modernization, students, new machines and technologies, economization**

I INTRODUCTION

In recent years, the need to deepen the relationship between theory and practice is increasingly felt. On one hand, requirements of the manufacturers are getting higher, which is related to the firms' natural growth and competitiveness, on the other hand, the introduction of science and technology in almost all spheres of public life requires the involvement of a growing number of highly qualified professionals not only with specialized secondary education, but also with higher technical education.

In Bulgaria, the real need for professionals is becoming more and more tangible over time. Because of the deplorable economic condition of the country most of the best university graduates seek job opportunities in countries offering a reward several times better. This in turn leads to an even greater crisis in the economy, as the state has in one way or another invested in education without actually being able to recover this huge investment.

These issues have been discussed more than once. Moreover, in order to make things happen in the right direction, the so called political will is necessary, which is not always in the public interest. Current events in the country in recent months and the fall of the government are other shining examples of this.

II THEORETICAL GROUNDING OF THE RESEARCH

At the Technical University of Gabrovo, (Gabrovo is a town which had the greatest number of industrial enterprises in Bulgaria until the year 2000) we are continuing to look for a formula meeting in the most complete way the growing need of society for generating more and more not only knowledgeable, but also capable young people. In this regard, the relationship between universities and business is of particular importance. In Gabrovo, there are currently only a few industrial enterprises, but some of them, such as the Bulgarian-Swiss company "Mechatronica" (Fig.1), the German-Bulgarian company "AMK", the Austrian-Bulgarian company "Instrument" and some others, perform at a modern European level.

Fig.1. Company "Mechatronica" building

This makes it possible for some of the town's graduates and university students to find professional realization in an area where they can prove their knowledge and skills. The skills, however, are those which the graduating engineers and technicians mostly lack. In this regard, the very innovative company "Mechatronica", feeling the lack of well prepared and trained young people for its high-tech developments and production (Fig. 2, Fig. 3), established a specialized Training and Production Center (Fig. 4).

Fig.2: Assembly sector of the "Mechatronica" company

Fig. 3: A module of high-tech manufacturing

Fig. 4: Part of the newly opened Training Centre

The main objective of this Center is the development of the relationship between theory and practice in order to ensure production with promising personnel among both high school graduates (Figure 4) and university graduates (Figure 5).

Fig. 5: Soldering of electronic components on a printed circuit boar

In creation of a training center, the students who were on training at “Erasmus” program in the same company helped a lot. (Fig.6).

Students who are passing training, are trained on the newest elements in the development of the firm "Mechatronics". (Fig.7)

Fig.6: Making one of the stands for teaching the basics of electrical engineering

Fig.7: Students whom show a linear motor control

Besides the "Mechatronics" company Gabrovo city offers a training possibilities to students in other specialties. For example, the company "Impuls" AD is open to an internship and practice of both our and foreign students. (Fig.8), (Fig.9).

Fig.8: Company „Impuls” AD building

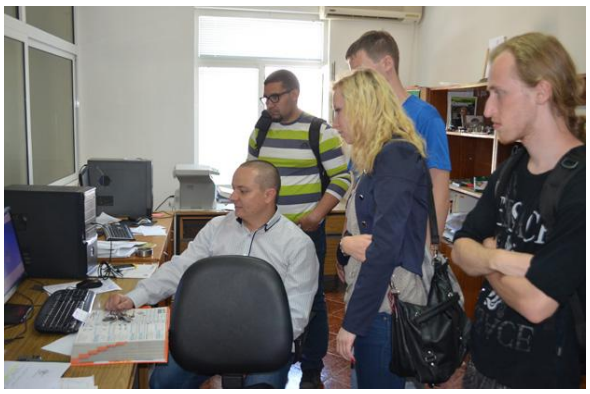

Fig.9: Showing the capabilities of modern software design of complex parts in 3D format

In year 2013 in the territory of the plant a student from the Republic of Latvia Laura Cipruse held a practice. (Fig.12) Which is learning in programme "Environment Engineering". Attracted particular interest to her was the segment electroplating (Fig.10), where it was an opportunity to be familiar in details with work of modern sewage treatment plant (Fig.11).

Fig.10: Section for electroplating

Fig.11: General view of one of the workshops where precisely are processed parts for medical equipment using modern machines with digital program control

Fig.12: Part of an advanced system for wastewater treatment (after the process of electroplating)

The aim is to create an opportunity for practical training of knowledge and skills at the Training Centre, which will gradually grow into a utility production area.

For the first time this year, additional time for work placement in a volume of 240 hours is envisaged. During this time students will be divided into groups of 10 to 15 people (Figure 5), each group will have an academic mentor (lecturer from the University) and a mentor from the company. Each student will have the right to choose his academic mentor and a company in which to conduct this work placement. Reports on the results will be performed in specially approved by the Ministry of Education diaries.

Outstanding students will be offered permanent employment depending on the needs of the company.

III Results

On the territory of the companies "Mechatronica", "Micron" and "Elna", under the direction of Assoc. Prof. N. Nenov, five-month work placements of students from the Higher Technical School in Rezekne (Republic of Latvia) have been carried out for three years within the "Erasmus" Program.

The results of the placements are as follows: 1/students have the opportunity to get familiar in practice with almost all items related to their training as future professionals in the field of mechatronics and the training is conducted at the highest international level; 2/during the period of practical training prerequisites are created for solving some production problems enabling real and independent assessment of the students' knowledge and skills. 3/from the psychological and social point of view, communication with workers from other countries is very important both for students and for employees. This makes the working team more flexible and sociable and creates additional prerequisites enhancing its performance.

IV Conclusions

Each country seeks to increase the welfare of its citizens. In the context of the 21-st century it can be done in a peaceful and democratic way only through proper economic development of the country, using its characteristic natural resources. The development of the economy, in turn, can be guaranteed only by boosting productivity and quality in both the private and public sector. The real economic growth can be achieved based on the knowledge and experience of a growing number of well-trained specialists. This would lead to the development of the market economy not only in the developed European countries, but also in Bulgaria.

Ultimately, this will give a new look to the European Union, will make it stronger and more diverse, and perhaps with a better and real future.

V References

[1] Petrova D., Higher productivity of labor and competitive power on firm used motivation of staff through involvement in concept oriented change processes, 38th IGIP Symposium – Q^2 of E^2, Quality and Quantity of Engineering Education, September 6-9, 2009, Graz, Austria, Fachhochschule der Wirtschaft CAMPUS 02 – Graz, ISBN: 978-3-85295-035-8, pp. 291-299

[2] Higher Education Act

[3] School Education Act

Lichens as Indicators of the Urban Environment Quality

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Abstract. **The ranging of lichens among classes of poleotolerance were made. The most widely spread species from each class are mentioned. The estimation of the ecological state of air environment of the city of Pskov with lichens was held.**

Keywords **– lichenoindication, lichens, sensitive and tolerant species.**

I Introduction

In the system of the urban environmental quality assessment lichens are widely used as indicators of air pollution. The most common methods are air quality mapping, determination of the projective cover of epiphytic lichens, investigation of the biology of lichen species tolerant and sensitive to the air pollution. There are data of ecological state of a number of Russian cities such as Moscow [2], Saint-Petersburg [3], Yoshkar-Ola [7], Yekaterinburg [5], Kazan' [1], Krasnodar [6], etc.

II Materials and methods

During the lichenological research in the city of Pskov 121 lichen species were identified there [4; 9]. Ranging of lichen species according to the scale of poleotolerance proposed by H. Trass [8] was made. Most lichen species react to different pollutants of urban environment [2]. The proposed 10-point scale helps to determine the level of air pollution of study area on the analysis of the lichen species composition.

III Results and discussion

As a result, the species belonging to 7 classes of poleotolerance (from 10) were found in the city. There are no representatives from the first two classes, which include highly sensitive to pollution lichens confined to anthropogenically undisturbed habitats.

Species of the third, fourth and fifth classes, spreading in the natural or slightly to moderately disturbed habitats, are confined to forest ecosystems (forest parks), located on the outskirts of the city, and to the parks in the central part of it. Among them are *Hypogymnia tubulosa* (Schaer.) Hav., *Tuckermanopsis chlorophylla* (Willd.) Hale, *Usnea subfloridana* Stirt. (Class 3), *Graphis scripta* (L.) Ach., *Lecanora leptyrodes* (Nyl.) Degel, *Melanelixia subaurifera* (Nyl.) Essl., *Pseudevernia furfuracea* (L.) Zopf, *Vulpicida pinastri* (Scop.) J.-E. Mattsson et M. J. Lai (Class 4), *Lecanora argentata* (Ach.) Malme, *Lecidella euphoria* (Flörke) Hertel, *Physcia aipolia* (Ehrh. ex Humb.) Furnr., *Lecania cyrtella* (Ach.) Th. Fr., *Ramalina farinacea* (L.) Ach. (Class 5), etc.

The most common species for the green areas of the city (parks, squares, plantings along the streets, neighborhood territories, etc.) are tolerant taxa related to the 7-9th classes. The presence and high frequency of these groups of lichens shows a strong anthropogenic change in the habitats. There are such species as, *Candelariella vitellina* (Hoffm.) Müll. Arg., *C. xanthostigma* (Ach.) Lettau, *Phaeophyscia nigricans* (Flörke) Moberg, *Physcia adscendens* H. Oliver (Class 7), *Physconia enteroxantha* (Nyl.) Poelt, *Caloplaca cerina* (Ehrh. ex Hedw.) Th. Fr., *Xanthoria candelaria* (L.) Th. Fr. (Class 8), *Phaeophyscia orbicularis* (Neck.) Moberg, *Xanthoria parietina* (L.) Th. Fr. (Class 9), etc. These lichens are most often found in urban areas.

Species relative to the 10^{th} class of poleotolerance, such as *Scoliciosporum chlorococcum* (Graewe ex Stenh.) Vězda, *Lecanora hagenii* (Ach.) Ach., *Lepraria incana* (L.) Ach., are confined in their distribution to habitats along the highways with active transport movement. The high frequency of these species indicates a very strong anthropogenic disturbances.

IV Conclusions

Thus, the territory of the city of Pskov can be described as moderately polluted. As the distance from the center to the periphery, where the recreational, forest park areas are located, extends the number of species confined to the natural and slightly disturbed habitats and sensitive to air pollution increases. But in the central part of the city such green areas as parks and gardens appear to be a kind of refugium for a number of lichens relative to natural and undisturbed habitats.

V References

[1] Baibakov E.I. Assessment of the environmental condition of urban areas using methods of lichen indication (by the example of Kazan'). Synopsis of a thesis. Izhevsk, 2003, 19 pp. [In Russian]

[2] Byazrov L.G. Lichens in the environmental monitoring. Moscow, 2002, 336 pp. [In Russian]

[3] Malysheva N.V. Lichens of Saint-Petersburg. Saint-Petersburg, 2003, 100 pp. [In Russian]

[4] Malysheva N.V. Lichens of the city of Pskov. 1. Brief analysis of lichen flora. Botanical journal. 2004. Vol. 89. №7, pp. 1070-1077. [In Russian]
[5] Paukov A.G. Lichen flora of urban ecosystems. Synopsis of the thesis. Yekaterinburg, 2001, 18 pp. [In Russian]
[6] Sionova N.A. Assessment of the ecological state of the atmospheric environment in the city of Krasnodar by the methods of lichenoindication. Synopsis of the thesis. Krasnodar, 2006, 20 pp. [In Russian]
[7] Suetina Y.G. Changes in epiphytic lichen flora and *Xanthoria parietina* (L.) Th. Fr. population structure in an urban environment. Synopsis of the thesis. Yoshkar-Ola, 1999, 26 pp. [In Russian]
[8] Trass H.H. Classes of poleotolerance of lichens and environmental monitoring. Problems of ecological monitoring and modeling of ecosystems. Leningrad, 1985. Vol. 7. pp. 122-137. [In Russian]
[9] Environmental monitoring of the urban area with the bioindication methods (by the example of the city of Pskov. Part 1. Pskov, 2009, 188 pp. [In Russian]

Software Provisioning of the Protech Integrated Engineering Automation System

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***Abstract*. This is a presentation of the basic principle, operational functions and modules of the software for planning, programming and control of the serial production in the engineering automation system environment. We specified the software provisioning of the particular application and the benefits from its use in the manufacture process. There is a description of the available data bases for the input of the basic technological information about the work-pieces and details and for setting-up of the metal-processing tools. This product traces the technological sequence and the specifics of the production process of machines with computer and numerical control (CNC), the direct connection and dependency of the individual modules within the processing and exchange of the running current information.**

***Keywords*: integrated automation system, operational modules, software provisioning**

I INTRODUCTION

The reports hitherto presented the main items and positions of this dissertation thesis on automation of engineering design using system for programming, planning and prototyping of the serial machining production. The main functions of these systems are particularly useful in terms of management of the total time and quantity of production; they are based on the material and capacitive economy and perform activities ranging from order processing through accounting control. The system automates the common logistics chain – from distribution and procurement through production and delivery .[3]

Special attention is paid to the present state of the machine-building industry in Bulgaria and the immediate necessity of a system for automation and programming of production, aiming at higher quality of production and shorter periods for order implementation, and a more detailed discussion of the issue is provided in the report "Analysis of the modern machine-building industry in Bulgaria, in terms of utilizing systems for automation and programming in the production"[5]. It contains a detailed analysis of the systems for computer and numerical control (CNC) – Mazak Integrex IV and Siemens – Sinumerik 840D, which will mainly provide support for provisioning of the production cycle, and the topic of the report is "Working with modules for coding programs for control of machines with CNC Mazak – Integrex IV and Siemens – Sinumerik 840D in the Protech system environment.[6] A specifically modified technological sequence of work was defined taking into account both systems for CNC control and programming – part of the topic "Method for technological planning and management of the automated production in the Protech system environment.[7] Defining of the main algorithm of operation for "Protech", and block diagrams for interaction, updating and application of the current information between individual modules of the system in the report "Programming, planning and prototyping of serial production in the Protech integrated engineering automation system environment".[8] The present report continues the direct operation and connection between all of the factors listed hitherto, emphasizing on the software provision of the Protech system.

The main goal of automation of production processes is to reduce the manufacturing periods and to increase the quality of manufactured articles. The mere introduction of machines with computer and numerical control permits quick setup and flexibility. In the same time, extensive work is done concerning the automation of the engineering designers' work, in accordance with the increasing requirements of the market, which cause the necessity of development of more and more complex structures and the corresponding technological processes, within increasingly shorter deadlines. [1]

II DESCRIPTION

The software product is currently in its development process and only part of the hitherto designed software is considered in the present report. These are the modules for provision of the tool equipment, method for input and processing of the parameters of the tools, which will take direct part in the production cycle of the details and work-pieces. The other modules, which are still to be defined, are: - module for warehouse management and availability, module for machine provision and the respective equipment, and the module for planning and management of the manufacturing process. The names and definition of the tools are fully compliant with the requirements of the systems for management and programming of CNC machines. When a metal-processing tool is added to the program, its operational modes are also to be defined, taking into

account the specified and recommended cutting modes, according to the type of the processed material, used by some of the most reputable cutting tools manufacturing companies in the world (Walter, Kennametal, Ceratizit). Within the tool addition process there is an integrated image of the specific tool, so that the programmer setting-up the CNC machine is able to see and evaluate whether the respective tool configuration will be efficient for the particular work process. The software product integrates basic information about machines and systems with CNC control, and this option enables the operator to quickly find more accurate technological decision concerning the sequence and basing of new articles and details in the production process.

The machines with software control are some of the most efficient facilities for automation of the production processes. Their main use is mechanical processing of blanks and details in the conditions of serial, small-number and single item fabrication processes. In its broadest sense, the term software control denotes the expedient definition and the sequential bringing to action of the required operation cycles of the production machine and the simultaneous control of their actual performance and implementation of the processing modes, which provide achieving the quality indicators and productivity designed for the implemented technological operation. [4]

In brief, the goal of the design automation is to increase the quality of the very process, to reduce the cost, to shorten the deadlines for designing and hence, the deadlines for implementation of the article, as a whole. At the present stage, this is implemented by different in complexity, scope and field of application systems for automated design, called generally CAD/CAM systems. [2]

For the development of Protech integrated engineering automation system – automated programming and planning of the production, we used the module for input, operation and analysis of two of the most widely spread systems for control of metal-cutting machines with computer and numerical control (CNC) made by the companies Mazak and Siemens - Mazatrol – Integrex IV and Sinumerik 840D, respectively. They are extensively applied in the modern machine-building industry and provide a serious pre-requisite for technological development and progress in the sphere of automated design engineering and production. The high technological and technical capacities and the favourable financial factor of these systems for control make them some of the most preferred areas for programming and control in the modern machine-building industry. [6]

When planning and implementing of all main stages of operation with the Protech automation system the input-output data within the system is updated and processed aiming at full efficiency and continuous interdependence between the component modules and the staff operating the system. One of the main advantages of this program is the opportunity to be further developed and upgraded in any software aspect. Each module containing the fundamental data base can be ”updated” with new information concerning new articles or details, by adding to them the respective module and data about the necessary new tools and devices, which were not used hitherto in “Protech”, or in the machined production. Furthermore, inputting of new technological-programming and structural parameters is also possible using this function. One of the main advantages of this program is the exchange of data between the individual modules of the Protech system, and in this case the accent was put on the sectors for planning, programming and production. The specifics and complexity of articles and details manufactured are evaluated using the data base, which the technologist-programmers operate. The technological sequence of processing is built on basis of this evaluation, designed mainly for machines with a system for control Mazak - Mazatrol or Siemens – Sinumerik 840D.[8] Operational programs for the respective systems and machines are compiled, and from an organizational point of view, the necessary appliances, tool equipment and quality control devices must be prepared. The material of the blanks is defined, and in this case there must be a permanent control and information exchange with the warehouse base. The optimum period for implementation of the order is defined upon evaluation of the complexity of the article. During the entire planning, technological and production process of the manufacture, processing and exchange of information between these three sectors is continuous. Detailed block diagram and main operational algorithm for interaction of the above-specified information processes and data transfers can be seen in the article ”Programming, planning and prototyping of serial production in the Protech integrated system for automation of engineering design environment” presented at the 9th International conference ”Standardization, prototyping and quality: Balkan conference” 5-6 October, 2012, Tirana [8].

III OVERVIEW OF THE PROGRAM MENU

Options of programs menu:

1 – Overview of the main menu;
2 – Description of the tool module;
3 – Management of the tool interchangeability;
4 – Overview of the machine module.

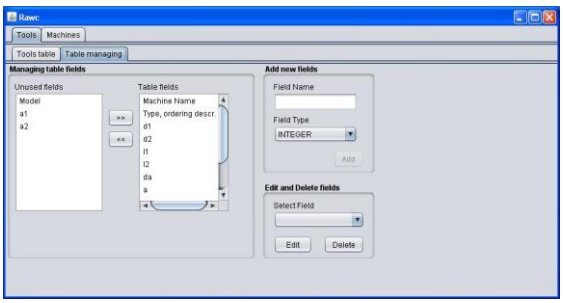

Fig.1 Overview of the main menu of the program

General advantages of the software product: 1 – Flexibility of the software product – easy to use, configured and adapted to the specific needs; 2 – Planning - allowing planning and optimizing of the processing technology from start to finish; 3 – Control and management – better quality and quick production results.

IV DESCRIPTION OF THE TOOL MODULE

Management of the main menu of the program. The internal sub-menu **Tools managing** provides you with the possibility to create a separate sub-window of the **Tools managing** table. This enables creating new fields, which are suitable for the particular requirements of the user. There are two combined windows of the menu - **Unused fields** and **Table fields**. They enable and disable the visibility of the fields in **Table fields**, by moving within the individual menus using the buttons << and >>. The user can add, edit or delete fields with the tool data, depending on the complexity of the tool configuration.

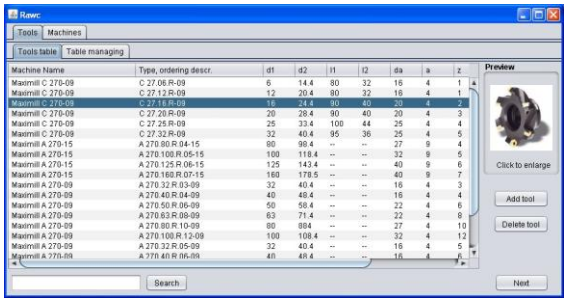

Fig.2 Tools table

When the application is started, it allows you to use the default tool library (Tools table). The table provides detailed information about every tool. From within the preview window, one can see more about the shape of the tool by clicking on the image, obtaining thus full information about the particular metal-processing tool. There is also an option for adding or removing tools from the given menu. This is possible using the buttons **Add tool** and **Delete tool**. Even greater convenience is the button **Search**, through which every match and tool search criteria can be verified.

In the first section of the tool equipment menu are described the types of metal-processing cutters, drills, sink-tools, reamers, and the leftmost column contains the name of the tool, in this case – where the blue marker Maximill C 270-09 is – that is the name (model) of the given tool according to the technical and catalogue documentation of the manufacturing company, and every company has its own name coding. The next column describes in abbreviated manner the geometric parameters of the tool – C 27.16.R-09, in this case the letter **"C"** means that the cutter is of shank type (the letter **"A"** denoting shell-end cutters), designed for clamping in collet holder or holder of Weldon chuck type (based on autonomous fastening to a specially made site on the oblong part (shank) from the cutter body), the number 27 is the model of the milling tool, the number d1=16 mm is the diameter of the cutting inserts relative to their frontal direction, d2=24.4 mm - the diameter of the inserts in radial direction, l1=90 mm is the length of the entire milling tool including the brazed carbide cutting inserts mounted onto it, l2=40 mm is the length of the working part of the cutter, da=20mm diameter of the cutter shank, a=4 mm is the height of the bevel of the cutting edge (below 45 grad relative to the front-end and diameter of the cutting edge), z=2 the number of the replaceable carbide cutting inserts fixed onto the cutter. When the application operator selects the desired tool and image of it is shown in the right half of the **Tools table window**. Upon completion of the development of the tool module, the codes of the tools names will be described in detail according to their manufacturing company, along with all the parameters required for programming and setting-up of machines with CNC control. Using this menu one will also be able to monitor the availability of a given model of tools and when their quantity runs low or is depleted new tools will be ordered.

V INPUT OF NEW TOOL

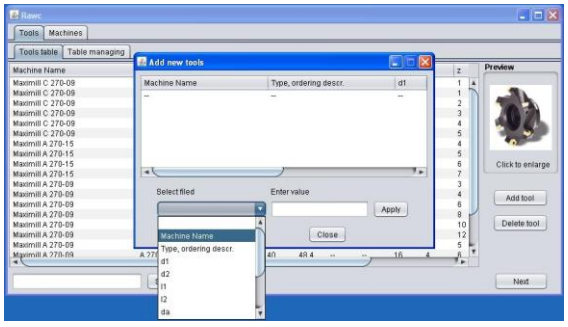

Fig.3 Adding new tool

Fig.3 clarifies the steps for inputting new tool, where by clicking on the menu **Add tool** a sub-window with the respective name opens, where one can define and store the parameters of the new tool. The operator can first define the name of the metal-processing tool in the option **Machine name**, and the next stage is **Type ordering descry.**, which option allows him to select which geometric parameters shall be entered – d1, d2, l1, l2 etc. in compliance with the configuration of the tool. Once these positions are

defined, the operator can click on the button **Apply** from the program menu so that the data about the new tool will be entered into the data base of the tool module. At the final stage of this manipulation the operator can close the sub-window of the menu using the button **Close**.

VI CONCLUSION

This article reports the beginning of the development of a software product for automation of engineering design in the serial production environment of the machine-building industry. There is a module for inputting of tool equipment, and the steps for setting-up of the necessary information are described in detail. The development of the remaining part of the software product is pending, part of which will be the module for warehouse and availability management, module for machine and the respective equipment provisioning and the module for planning and management of the manufacturing process. The innovations in the software product will be added and described in the presentation attached to the report during the 9th International scientific and practical conference, Rezekne – Latvia 20-22 June.

VII REFERENCES

[1] Donkov D., CAD/CAM systems in the machine-building industry – part 1, Gabrovo, Vasil Aprilov University Publishing house, 199

[2] Kartunov S., Rachev P., Automated planning and management of the production. Computer integrated production (CIM), Gabrovo, Printing base of the Technical University – Gabrovo, 1997

[3] Kartunov S., Engineering logistics, Gabrovo, Vasil Aprilov University Publishing house, 2008

[4] Kartunov S., Manual on programming and application of metal-cutting machines with computer and numerical control, Gabrovo, Publishing house of the Technical University – Gabrovo, 1996

[5] Ivanov R., Analysis of the modern machine-building industry in Bulgaria, concerning using systems for automation and programming in the manufacture, Scientific session on the occasion of the 50th anniversary from the founding of the Technical University – Varna, 2012

[6] Ivanov R., Kartunov S., Working with modules for programming of control applications for CNC machines Mazak – Integrex IV and Siemens – Sinumerik 840D in the Protech system environment, XXI international scientific-technical conference Automation of discrete manufacturing" ADM – 2012" – Sosopol, 2012)

[7] Ivanov R., Rachev P., Method for technological planning and management of the automated production in the Protech system environment, National conference in machine-building industry and machine science, International house of scientists „F.J. Curie" Varna– 2012)

[8] Ivanov R., Kartunov S., Programming, planning and prototyping of serial production in the Protech integrated system for automation of engineering design environment, 9th International conference "Standardization, prototyping and quality: Balkan conference", Tirana – 2012

Application of the Multicomponent Method of Assessment of Student's Progress in Physics

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Abstract **The multicomponent method of assessing the progress in physics of students from the Technical University of Gabrovo is discussed in the paper. It is shown that tests papers as a modern form of examining students can successfully be combined with other traditional forms of examination. In that way the teacher can get important feedback on how students understand lectures and laboratory teaching material during the semester and to adjust their work so that they can in time adapt to the necessary level. Thus, students are actively involved in the learning process, which improves the results they show at the final exam. These conclusions are based on the results of the last decade, ever since the method was introduced.**

Keywords**: examination, test, physics, students.**

I INTRODUCTION

In recent years education in the technical universities of Bulgaria has faced new challenges. The possibility for more flexibility of students and teachers and the new means of communication and information has lead to students being more demanding and has also made them more critical towards traditional methods of education and assessment of their knowledge. Moreover, the motivation of the students to do well and to receive good marks has suffered because of the difficult economic situation in the country. Students presume that the education they receive will not help them to get well paid and prestigious jobs; therefore they feel that they waste their time, do not attend classes regularly and are surprised when they do not do well in exams.

II EXPOSITION

What is more, 20 years ago several people applied for one place in the technical university, which led to better selection and competition and desire for better results. Now the situation is totally different.

On the one hand, some of the best high school students go to study abroad, on the other, because of the demographic problems in the country, the total number of students, graduating high schools decreases every year. As a result the number of people applying to study at universities in the country decreases, which leads to fewer requirements towards them, tolerant attitude towards less successful students during the course of their study, as well as allowing students with less serious and organized approach to work to get into university. Such students cannot easily adapt to the academic style of studying. The fact that they can choose whether to attend lectures or not they interpret as a permission not to attend at all; the time they are given to study on their own they use as leisure time.

In the new curricula has been reduced auditorium employment of students at the expense of extracurricular. This is because of the new requirements of ECTS which aims the introduction of the credits in the training of students. For course Physics I credits are 5, including 60 hours auditorium employment (30 hours of lectures and 30 hours laboratory exercises) and 76,4 hours through extracurricular employment. This study was prompted by the growing importance of extracurricular activity in the education of students.

Therefore as a result of all this we, as teachers of the University, introduced the multicomponent method of assessment of our students in physics.

III PRINCIPLE OF THE MULTICOMPONENT METHOD OF ASSESSMENT OF STUDENT'S LEARNING

During the first semester of their study in the university our students study Physics I (which includes Mechanics, Thermodynamics and Statistical Physics, Electricity and Magnetism, Vibrations and Waves).

The method of assessment of students in physics is based on the following three components:

- The knowledge obtained during laboratory seminars;
- Test examination during the semester;
- Written examination at the end of the semester.

Assessment of the students during laboratory exercises.

The laboratory exercises in Physics are relatively self-dependent in the common course of education in Physics. The reasons for this are the specific method of approach and the disrupted sequence of the learning process. The latter appears to be the main difficulty during the laboratory seminar. It would be easier if the theory is taught during lectures first and then followed by laboratory exercises. In the current method of approach, which is to perform the laboratory seminars in different cycles of physical experiments by small groups of students (two or three a group) this requirement cannot be fulfilled for the larger part of the

students. They have to prepare for the particular laboratory experiment by referring to a textbook in Physics or a practical handbook, which makes it more difficult for them. The work during the laboratory exercises requires that the students know the experimental set-ups and connections in the electrical circuits and the constants of various devices as well as their different ranges. They should know how to measure different physical quantities and analyze the experimental results (analytically, in tables and graphically); how to register the measured and indirectly received results together with the errors and to form and improve new habits and abilities. Besides this, they have to be careful and continuously abide by the safety rules, be concentrated and organized and be able to cope with the laboratory problems within the set deadlines.

What makes the assessment during laboratory seminars easy is the comparatively long period of direct contact between teacher and students and the comparatively small number of students in a group (10-15 students). There is constant feedback which the teacher receives every week and helps him/her form a clearer idea of the students' abilities. The teacher routinely tests the students and this routine has been long established (the Department of Physics at the Technical University - Gabrovo was founded in 1963). For example:

-The students are tested before they are given permission to work in the laboratory. They are asked suitable questions, many of which are written on the laboratory tables. They are also tested on how well they know the theory of a given physical problem, connected with the laboratory exercise. They also have to write in advance the first part of their logs for the laboratory exercise where some aspects of the problem have to be defined more precisely;

- The student's involvement during the practical work connected with the particular physical problem is taken into account;

- The students' logbooks at the end of the laboratory exercise are checked, e.g. authenticity of the received results, the data for every problem, presence of gross errors in the measurements, preliminary checks of the calculation and analysis of the measured results received by the students during the current exercise;

- The logbooks of the finished laboratory exercises (this is done during the next lesson after analysis of the laboratory problem) are handed over to the teacher. The teacher checks the calculations, the results together with their errors (absolute and percentage errors) and the correctness of the graphs. The students must present all necessary steps in the calculation of every physical value or error as well as interpret and analyze the received results.

All this gives the teacher the possibility to give an objective mark to every student for his or her work during the laboratory seminar. Besides this, when the students know in advance that their work during the laboratory seminars will be taken into account in the final exam, they get additional motivation to work better during the laboratory lessons.

Test examination during the semester

Teaching Physics requires feedback during the semester – during lectures as well as in the laboratory exercises. This can be done with the contemporary form of written examination – the tests.

In the beginning of the semester it is appropriate to give students an introductory test. From this information the teacher can get an idea about the level of the student awareness in Physics depending on what they have learned in the high school. Usually the students come from different schools (ordinary high schools, mathematics, language or technical schools) where Physics syllabi differ. Besides this the capabilities of the students applying for technical universities are different. Depending on the received results, the teacher can work individually with the students, who have serious problems. Consultation hours are very appropriate for this individual work (4 hours weekly at the Technical university of Gabrovo). The teacher can discuss problem areas with the students and give them assignments.

Thematic tests during the semester, done on completion of each part of Physics are appropriate as well. For example, for the students from the Faculty of Electrical Engineering and Electronics, these are Mechanics, Thermodynamics and Molecule Physics, Electricity and Magnetism. They are also given a test based on the laboratory seminar at the end of the semester. When at the beginning of the semester the timetable for the tests is drawn and the students know that their performance at the tests will be taken into account in the final examination, they are additionally motivated to take Physics more seriously and work harder. One needs to take into account the system for assessing the results of the tests, developed by the teachers from the department [1] and that the subjective factor in the assessment of the tests is reduced to a minimum.

These examinations are very useful for the students, because in that way students participate more actively in the educational process. They prepare for the tests and have the opportunity to use their lecture notes and textbooks, some of which are written by the teachers at the Department of Physics [2-5]. They also use handbooks with tests in Physics [6-10]. Using these handbooks students get an idea about how well they will do at the test since they can combine questions and their answers, included in the handbooks.

The examination consists of sets of tests with 15 questions each and each question has 5 answers. Every student has a different set of questions. These sets of tests include the lecture material from the Physics curriculum. The students are given 2 minutes for every question, which is 30 minutes for the whole test. During the last laboratory seminar students are given another test, which includes all the material studied during laboratory seminars.

So, the students are given 4 tests in total and the 4 marks from these tests are used for the average grade in Physics at the final examination.

Written examination at the end of the semester

The preparation of the students for the final examination is made easier since the great part of the taught material is learned during the semester thanks to the practical laboratory examinations and tests on lecture and laboratory material.

The most important in the written examination is memorizing and reproduction of the studied material. Students have to interpret and explain the physical phenomena and processes, to understand the Physics laws and their consequences and to explain the connections between the physical values. As a whole, students should have a comparatively full picture of the world.

At the final examination the students draw a piece of paper with two topics from the conspectus, which they receive during the first lecture in Physics. The topics have to be answered in writing and when necessary the students are asked additional questions afterwards. The student's written work is marked.

The final mark for the subject is calculated in the following way:

$$c = k_1 x + k_2 y + k_3 z, \qquad (1)$$

where k_1, k_2 and k_3 are coefficients, c is the final mark on the subject, x – the mark from the laboratory practicum, y – the average mark from the 4 tests, z – the mark from the written examination.

IV RESULTS

The marks the students from the Faculty of Electrical Engineering and Electronics received during the academic years 2009/10, 2010/11, 2011/12 and 2012/2013 at the Physics I examinations are given in Table 1. The values of the coefficients are: $k_1 = 0{,}3$; $k_2 = 0{,}3$ and $k_3 = 0{,}4$. The comparatively big values of k_1, and k_2 correspond to the important role of the experiment and tests during the semester in the teaching of Physics at a technical university. The formula for the final mark in the subject is explained to the students during the first lecture when the conspectus is given, as already mentioned above. In that way every student can their own strategy for achieving of better results.

We have to mention that the results, shown in column II (for the 2009/10 academic year) are received when the old system was practiced. Then the students were examined only at the final exam. The results shown in columns III, IV and V were received when the application of the multicomponent method of assessment of the students was practiced.

As an example, the distribution of the scores of the students from the group № 7 from the exam on Physics I for the academic years 2009/10 and 2011/12 are shown on the figures 1 and 2, respectively. In the academic year 2009/10 the evaluations are 21 % "poor" and 16 % "Very Good "and" Excellent". During the academic year 2011/12 all students have successfully passed the exam such as 39 % of them have evaluations "Very Good "and" Excellent". There is increase of the success with more than half unit (4,17 for 2011/12 and 3,54 for 2009/10).

Year Group №	2009/10	2010/11	2011/12	2012/13
1	2,92	3,44	3,57	3,61
2	2,75	3,25	3,35	3,48
3	3,20	3,50	3,46	3,73
4	3,12	3,50	3,43	3,67
5	3,60	4,00	4,10	4,14
6	3,25	3,78	3,83	3,91
7	3,54	4,25	4,17	4,19
8	3,16	3,71	3,90	4,05
9	3,68	4,14	4,05	4,00
10	3,32	3,42	3,75	3,81

Table 1. The average scores of the students in Physics I. Degree courses: (1,2) – Automation, information and control systems, group (a,b); (3,4) - Electronics, group (ab,);(5,6) – Power engineering and electrical equipment, group (a,b); (7,8) – Computer systems and technologies, group (a,b); (9,10) – Communication equipment and technologies, group (a,b)

In this way we are able to compare the results for the same group of students (taught during the same academic year in different subjects), as well as for different groups of students (taught during two subsequent academic years in the same subject).

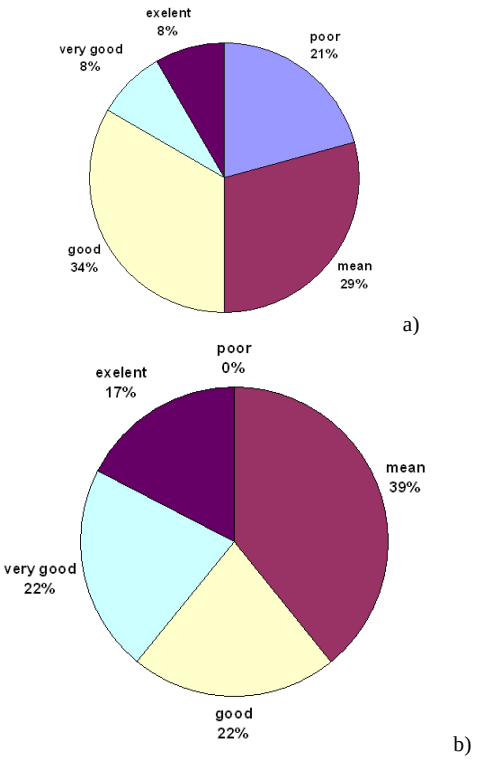

Figure1. Distribution of the scores of the students from the group № 7 from the exam on Physics I: a) for the academic year 2009/10: b) for the academic year 2011/12

Table 1 shows that the average scores of the students is significantly improved with the use of the multicomponent method - for 2009/10, 2010/11, 2011/12 and 2012/13 academic years. Our opinion is that this is due mainly to the better work of the students during the semester which helps them to build up better habits for work with the textbooks as well as to form their own strategy for better learning.

According to our study, the proposed multicomponent method for assessing the progress of students showed the following positive effects on the learning process in the discipline physics:

- Obtained a direct connection of the learning process with the credit system ECTS.
- Strengthened the role of feedback lector-students such as it acquires dimension, both in the auditorium employment and extracurricular one.
- Globally is evaluated as knowledge of students in terms of content and level of the individual modules (elements), which build the discipline physics (laboratory practicum, tests, homework, assignments, etc.).
- Allows fast response and take concrete decisions from methodological point of view.
- Expanded opportunities for individual assessment and consultation with lagging.
- Provides information to the administrative authorities of management such as group leaders to assess the state of progress of each student more during the semester, thus helps make the right management decisions.
- Is an important step towards creating the students' habits and skills for independent work and self-estimation.
- Provides opportunity to integrate specific methodological emphases and visions in university educational platform MOODLE.

V CONCLUSIONS

The implementation of the multicomponent method for assessment of the students' performance enables them to achieve more as a result of their work during the semester. This leads to improved learning of the studied material, as well as to a better quality of the educational process.

This method of assessment of the students at TU Gabrovo leads to a greater among of work for teachers and students during the semester. But there is the moral satisfaction of both sides because of the improved opportunities for achieving better results. Remains the moral satisfaction from both sides, due possibility of achieving good exam results, to refine and optimize academic work in physics discipline, which leads to enhancing the quality of education in technical universities.

VI REFERENCES

[1] Angelov N., D. Demireva, L. Lazov (2003), *Thematic test for checking the learning on physics of the students in high technical schools during the semester*, Karlsruhe, Referate des 32 Symposiums der Internationalen Gesellschaft fur Ingenieurpadagogik (pp.454 – 457),.

[2] Lazov L., N. Petrov, B. Laemmel (2002), *Physics 1: Mechanics, Special theory of relativity (second edition)*, Gabrovo, Publisher „Alma Mater International".

[3] Mihailova V. (2011), Basics of *physics, Part I and II 2*; Sofia, Publisher „Siela".

[4] Maksimov M. (2003), Basics of *physics, Part I*; Sofia, Publisher „Bulvest 2000".

[5] Lazov L., (2006), *Physics 3: Electricity and magnetism*, Gabrovo, Publisher „Alma Mater International".

[6] Angelov N., L.Lazov, P.Stoyanova (2002), *Test questions on Physics: Vibrations and waves, Optics, Quantum Mechanics*; Gabrovo, Publisher „Alma Mater International".

[7] Angelov N., L.Lazov, P.Stoyanova (2003), *Test questions on Physics: Mechanics. Special theory of relativity, Thermodynamics and Molecular Physics, Electricity and Magnetism*; Gabrovo, Publisher „Alma Mater International".

[8] Angelov N. (2004), *Test questions on Physics: Laboratory practicum. Entry level*, Gabrovo, Publisher „Vasil Aprilov".

[9] Angelov N. (2007), *Test tasks on Physics, Part I*, Gabrovo, Publisher „EX-PRESS".

[10] Angelov N. (2008), *Test tasks on Physics, Part II*, Gabrovo, Publisher „EX-PRESS".

Control of Heavy Metal Pollution in Degraded Rural Areas

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***Abstract*. The paper presents the issue of heavy metals in the different types of degraded territory in rural areas. For the test was chosen three different degraded territory: the former petrol station, the former farm mechanical workshop, the former farm cattle storage. All of three objects during operation were subjected to intensive polluting impact. They are included in the contaminated and potentially contaminated sites register. High concentrations of heavy metals in the soil of degraded territory is a factor that affects the planning for regeneration. Revitalization of contaminated sites and further use of them is possible only after the remediation works.**

***Keywords*: degraded territory; heavy metals; concentrations.**

I INTRODUCTION

Degraded territories are previously used and abandoned sites, the return of the efficient exploitation of them require intervention. Types of degraded territory in rural areas are old agriculture, infrastructure and production facilities whose physical condition over time becoming increasingly worse. They are included in the contaminated and potentially contaminated sites register. In such areas often start to develop spontaneous dumps, and they also become an environmental problem [1; 6]. Waste dumping may lead to localized, but in the event the spread of pollution, a regional soil, ground and groundwater contamination [4]. Most significant of these pollutants are heavy metals. Heavy metals in soil and in the ground are non-biodegradable. It is possible their migration with downward flows of water. Engaging in chemical and biochemical reactions heavy metals may to form new compounds, which may increase toxicity [2].

Heavy metal naturally concentration in soil is dependent of the bedrock, of soil type and chemical properties of them. Anthropogenic effects may contribute the increase of concentration of heavy metals in comparison with natural background [3]. Soil contamination with heavy metals resulting from fuel combustion and under the influence of motor vehicle. Heavy metals accumulate in the soil, especially in the upper soil layers [7].

To determine soil and ground quality have been developed limits for purpose and values of the more toxic heavy metals concentration. According to the legislative requirements of soil, ground and groundwater conditions there are 3 limit groups:

- "A" value, or purpose value. If pollutant concentrations are above this level, it is impossible to ensure sustainable soil or groundwater quality;
- "B" value, or the prudential limit. It indicates the maximum contamination level above which is possible potential negative effects on human health or the environment, as well as the level to be attained by the contaminated site remediation, if is not indicate stricter requirements for remediation;
- "C" value, or a critical limit. If it reaches or exceeds the soil and ground functional characteristics are seriously impaired by pollution, or pollution directly threatened to human health or the environment [5].

In Rezekne Higher Education Institution is made a complex study "Exploration of regional peculiarities of areas degradation processes and scientific- technical justification of regeneration principles ". This study took place in framework of complex study. The ground contamination is one of the influencing factors of degraded territories revitalization planning; the continued use of contaminated sites is possible only after the remediation works.

Research methods and equipment

For the study were chosen three objects, which are typical examples of Soviet agricultural infrastructure in rural areas, they was the former gas station, a former farm mechanical workshop (hereafter referred to as - Workshop), and the former cattle farm Storage (hereafter referred to as - Storage). In the gas station in 2002nd and 2003th was carried out environmental monitoring. By the data of monitoring object was found to be contaminated. The second object - the Workshop and the third object - Storage are typical examples of rural degraded territories. All of three objects during operation were subjected to intensive polluting impact. They are included in the Latvian contaminated and potentially contaminated sites register. In such a way have been investigated several types of degraded territories. Samples were taken in two depths, 0.25 m deep and 0.5 m deep.

Used equipment and work methodology

Experimentally was set at 8 heavy metals (Cr, Cu, Mn, Sr, Zn, Ca, Fe, Mg) concentration in soil samples by inductively coupled plasma optical emission spectrometer Optima 2100 DV ICP / OES.

The method is based on the measurement of optical emission intensity of metal atoms, which formed by awake of metal atoms with inductively coupled argon plasma energy. Equipment is able to determine metals substance up to 10^{-10} %.

Experiments were performed according to standard LVS EN ISO4934: 2004th. Samples were dried and crushed to a particle size <150μm, the sample mass for measurement was 1.5 g.

Results were obtained in (mg / l). To convert the units (mg / l) per unit (mg / kg) in calculations using the formula:

$$C = \frac{C_{el} \cdot Vpar \cdot 1000}{m_k} \text{ (mg / kg)}$$

Where: C_{el} - element concentrations (mg / l);
Vpar - volume of sample after mineralization, (l);
m_k - ground mass (g).

II Results and Discussion

Gas station description. Gas station is located on a small hill with a skid top. It is 1.5 to 5.0 m above the surrounding territory. The area is 0.5 ha. Gas stations in the east and the north is limited by deep valleys, which about 150 m from the object connects to the stream that connects several lakes.

Fuel tanks placement area, which was located 4 overground fuel tanks of 10 m^3 each, is limited to the bottom rampart 0.3 to 1.0 m in height.

Economic activities are not carried out since 2004. Since the discontinuation of gas station facilities have been removed, but the buildings are collapsed. Object is included in the contaminated and potentially contaminated sites database of Latvian Environment, Geology and Meteorology Centre, and complying with degraded territories properties.

Soil samples were taken in gas station territory in two locations:

- the fuel tank area, 1st place (Table 1.);
- the petrol pumps area, 2nd place (Table 2.).

TABLE 1.
HEAVY METAL CONCENTRATIONS IN 1ST PLACE SAMPLES OF GAS STATION (MG / KG)

The metal	0.25 m depth	0.5 m depth
Cr	0,39	0,17
Mn	47,32	47,15
Sr	0,13	0,13
Zn	4,38	4,33
Ca	1142,87	995,15
Fe	343,81	302,25
Mg	652,90	694,07

TABLE 2.
HEAVY METAL CONCENTRATIONS IN 2ND PLACE SAMPLES OF GAS STATION (MG / KG)

The metal	0.25 m depth	0.5 m depth
Cr	0,74	0,61
Mn	46,89	46,80
Sr	0,22	0,17
Zn	4,68	4,46
Ca	1248,13	1199,64
Fe	357,72	364,10
Mg	523,25	565,80

In ground granulometric composition inspection found that the gas station samples consist of sandy loam with gravel and organic particulate impurity from the plant roots. Analysis of soil samples from the gas station site, concentrations of heavy metals in excess of the target value of A, was not detected.

Workshop description. The area is 2.8 ha. Workshop in the east and north is restricted to the deep ravine which connects to the west creek that runs about 100 m from the object, which connects several lakes. Soil samples were collected in Workshop territory in two locations:

- repairable technical area 1st place (table 3.);
- equipment storage area 2nd place (table 4.).

TABLE 3.
HEAVY METAL CONCENTRATIONS IN 1ST PLACE SAMPLES OF WORKSHOP (MG/KG)

The metal	0.25 m depth	0.5 m depth
Cr	4,16	3,51
Cu	1,65	1,43
Mn	130,35	127,23
Sr	0,95	0,82
Zn	5,07	4,85
Ca	2406,43	2353,61
Fe	2852,81	2611,87
Mg	1665,99	1747,07

TABLE 4.
HEAVY METAL CONCENTRATIONS IN 2ND PLACE SAMPLES OF WORKSHOP (MG/KG)

The metal	0.25 m depth	0.5 m depth
Cr	3,47	2,77
Cu	1,26	1,04
Mn	121,94	117,56
Sr	0,61	0,39
Zn	4,81	4,72
Ca	2260,87	2152,97
Fe	2484,78	2392,61
Mg	1629,85	1595,19

In ground granulometric composition inspection found that the workshop samples consist of sandy loam, gravel, dolomite shivers mixture and organic contaminants from the plant roots. Analysis of soil samples from the site workshop, heavy metal concentrations in excess of the target value of A, was not detected.

Storage description. The area is 8.7 ha. Storage is located on the hill with poor natural drainage to the east and south, which is restricted to the deep valley where there is excavated drainage ditch which about 250 m from the object flows into a stream that flows into the river and then flows into the lake.

The object is partially destroyed, in the area begins to form spontaneous construction waste and municipal solid waste landfill site.

Soil samples were taken into a storage area in three places:

near the entrance to the feed warehouse, 1st place (table 5.);

next to the object's internal road, 2nd place (table 6.);

near the entrance to the housing of livestock, 3rd place (table 7.).

TABLE 5.

HEAVY METAL CONCENTRATIONS IN 1ST PLACE SAMPLES OF STORAGE (MG/KG)

The metal	0.25 m depth	0.5 m depth
Cr	3,03	2,64
Cu	0,87	0,52
Mn	49,40	48,14
Sr	0,43	0,39
Zn	6,07	5,94
Ca	1040,00	1045,55
Fe	2457,43	2330,64
Mg	948,13	825,80

TABLE 6.

HEAVY METAL CONCENTRATIONS IN 2ND PLACE SAMPLES OF STORAGE (MG/KG)

The metal	0.25 m depth	0.5 m depth
Cr	1,82	1,73
Cu	0,39	0,30
Mn	48,58	48,27
Sr	0,30	0,26
Zn	4,94	5,98
Ca	1026,05	994,15
Fe	1886,78	1745,16
Mg	926,08	924,43

TABLE 7.

HEAVY METAL CONCENTRATIONS IN 3RD PLACE SAMPLES OF STORAGE (MG/KG)

The metal	0.25 m depth	0.5 m depth
Cr	1,60	1,43
Cu	0,26	0,22
Mn	48,01	48,06
Sr	0,30	0,17
Zn	6,24	5,81
Ca	1138,71	1123,24
Fe	1660,19	1532,44
Mg	800,45	839,54

In ground granulometric composition inspection found that the storage samples consist of clay with gravel and dolomite shivers impurities. In the level upper 0.25 m a lot of the roots. Analysis of soil samples from the storage the heavy metal concentrations in excess of the target value of A, was not detected.

Comparing the the heavy metal concentrations in studied soil samples shows that 85.7% of the measurements of heavy metal concentrations increased depth decreases. This is explained by soil filtration ability, which is different for different soil types. Exception is mainly composed of Mg concentration ratio that in 4 cases in 0.25 m depth is less than in 0.5 m depth. This can be explained to the high consumption of Mg in plants. This can lead to increased Mg migration from the soil and the top soil layers. Assessing the soil sample results can be concluded that the concentration of heavy metals in tested soil samples are not exceeding the maximum natural concentration.

Storage soil analysis results in comparison with results of GAS and Workshop soil analysis results show that the concentrations of heavy metals there are more than in the samples of gas station and lower than in the samples of workshop, although there is no economic activity within the storage area for twenty years. This can be explained to the fact that:

The slope of storage terrain is insignificant, which complicates rainwater draining and flushing of the upper layers of soil;

The upper soil layers make up clay - soil with low filtration coefficient, which prevents surface water leaching into deeper soil layers, providing filtering pollutants from the upper soil layers to deeper.

Assessing the results of soil sample analysis in facilities GAS and workshop can be concluded that over time the upper soil layers are cleansed naturally. Factors that contribute to cleansing are:

Topography of area;

Geological structure of the territory.

GAS and workshop areas has a natural inclination towards the southeast, south, it provides a natural rainwater runoff from the area by promoting the

potential leaching of pollutants from the upper soil layers.

Workshop area observed a higher concentration of heavy metals than the GAS area, but it does not exceed the maximum allowed natural concentrations.

Ca, Fe, Mg, is one of the constituent elements of rocks, it sets it relatively high concentration in soil samples. Another reason for the high concentration of this element is the presence of dolomite shiver in workshop and storage soils. Dolomite is composed of magnesium and calcium carbonate. In comparison with gas station where the ground is composed of natural elements - sand with contamination, in sampling sites of workshop completely but in storage partially the upper layer of ground in sampling depth is composed of an artificial gravel and dolomite shiver mixture. Mn in Earth's crust is in second place after Fe in heavy metals prevalence. In tissues of plant and animal, it is present as a trace element. In the soil it comes from plants, as well as the fuel and combustion products. Sr is one of the constituent elements of the micro-organisms, plants and animals, its concentration in ground samples may be associated with plant metabolism. Cr, Cu and Zn concentrations were determined in all soil samples. Limit values were not exceeded in none of samples.

III CONCLUSIONS

By conducting a study led to the following conclusions:

1. Concentrations of heavy metals in the soil of studied objects do not exceed the target values.
2. Natural concentration of heavy metals in the soil is dependent on the bedrock, where samples were taken, from type and chemical properties of the soil.
3. Ground which is contaminated through the economic use over the years can clean itself of heavy metal contamination.
4. Objects GAS and workshop areas are ground geological structure, which is composed of different fractions of sand and loamy sand provides high filtration coefficient for the upper layers of ground that allow pollutants to flow through the upper ground layers and come into the deeper ground layers.

IV REFERENCES AND SOURCES

[1] Degradētās teritorijas. Rokasgrāmata. Redaktors B. Voijvodikova, Rēzekne: SIA Latgales Druka, 2010. 140 lpp.

[2] Kļaviņš M. Vides piesārņojums un tā iedarbība. Rīga: LU Akadēmiskais apgāds, 2009. 198 lpp.

[3] Mirsal I. A. Soil pollution. Origin, monitoring & remediation. Berlin: Springer – Verlag Berlin Heidelberg, 2004. 252 p.

[4] Vide un ilgtspējīga attīstība. Redaktori Kļaviņš M., Zaļoksnis J. Rīga: LU Akadēmiskais apgāds, 2010. 334 lpp.

[5] Noteikumi par augsnes un grunts kvalitātes normatīviem. LR Ministru kabineta noteikumi Nr.804, 25.10.2005.

[6] Noviks G., Teirumnieks E., Lemešonoka N., Matisovs I., Teirumnieka Ē., Miklaševičs Z. Evaluation of brownfields in Latvia. Rēzekne: Proceedings of the 7th international scientific and practical conference, 2009

[7] Мотузова Г. В., Безуглова О. С. Экологический мониторинг почв. М: Академический проект Гаудеамус, 2007. 237 с

Modelling by Finite Element Analysis Method of Stress State Establishing for an Steel Alloy

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***Abstract*. The paper presents some results about thetension state in samples subject to pure bending fatigue process. Numerical simulation based on finit elementmethod was used. The tension field induced by a verticaldeformation imposed at the sample ends was generatedon an original patented machine. The studies werecarried out on two steels currently used in pressurevessels industry. Experimental data are in good agreementwith the simulated ones.**

I INTRODUCTION

Developing mechanical constructions for the pressure vessels industry, aircrafts, construction equipment or shipbuilding calls for the investigation of the characteristics of the materials subject to a small number of tension loads cycles close to the material elasticity limit[1].

To get a deeper insight into some aspects related to damage process of the materials used in the machine manufacturing variably subject to pure bending, a universal testing machine was designed and patented[2].

The steels considered for the investigations were: OL50,10TiNiCr180 basically used for the construction of pressure boiler and vessels.

To analyze the pressure states at the given moment, under forced deformations subject to pure bending on the above universal machine, the FEM method was applied.

II REAL STRUCTURE DISCRETIZATION. DESCRIPTION OF FEM AND THE MODEL USED

The real structure discretization process consists in replacing the given structure, which is continuous, by a discrete one which discontinuous and idealized. The study of to the given structure is substituted by an approach to the entire assembly of the finite elements as obtained from discretization. [3], Thus, the elastic element in Fig. 1, which represents the type of sample to be used for fatigue tests at high tensions and small number of cycles, has the shape of a plate.

The finite element used is an iso parametric rectangular thick shell of six degrees of freedom across each node, and 24 degrees of freedom across an element which simulates the membrane and bending plate effects. The sides of the quad element are straight, a disadvantage eliminated by a fine discretization in the curvature radius area. Across the thickness five surface layers(Fig. 2) were considered by a suitable modeling of the tension field and the surface layer in the Z direction.

The finite element model considers the displacement field as the main unknown parameter and assembling the structure finite elements results in a lineal algebraic problem of generalized nodal displacement unknown parameters.

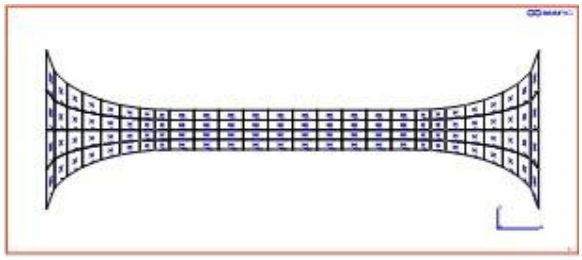

Fig 1. The elastic element

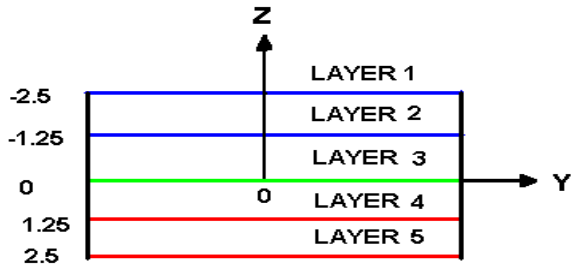

Fig 2.

The model used is considered is the one illustrated in Fig. 3 of the following boundary conditions; free displacement and rotations blocked $d_y=0$, $r_x=0$, $r_z=0$ and forced/imposed displacement d_z (implicity angle α) at the fixing ends.

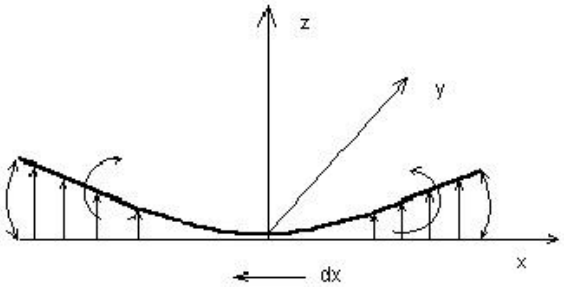

Fig 3. Illuatration of the model used

The materials used for the samples have the features given in Table 1. [4] [5]

To make the appropriate calculations by the FEM method the program MARC version 6.2 was used.

TABLE 1.

Steel	σ_c [MPa]	ν	E [MPa]
OL 50	210	0,30	$2{,}10 \cdot 10^5$
10TiNiCr180	205	0,26	$1{,}93 \cdot 10^5$

Data pre – and post processing was carried out by MENTAT II 1995 program. The operating system is HP UNIX 10.10 installed on a work station HP 712 of processor PA RISC 9000. The program is provided by the company MARC Analysis Research Corporation, California, USA, tested and recommed by Germanischer Lloyd and Technical University from Germany and Holland [6].

After running the program for the two types materials, for the imposed deformations the max sample tensions were obtained under the yieding limit at pure bending static load. The results are given in Table 2.

TABLE 2.

No	Steel A [OL50] $E=2{,}1 \cdot 10^5$ [MPa]			Steel B [10TiNiCr 180] $E=1{,}93 \cdot 10^5$ [MPa]		
	σ_{max} $[MPa]$	z [mm]	α [grad]	σ_{max} $[MPa]$	z [mm]	α [grad]
1	230	0,84	1,84	150	0,6	1,31
2	250	0,91	2	170	0,68	1,48
3	**270**	**0,99**	**2,16**	**190**	**0,76**	**1,66**

The paper presents the tension states at pure bending load for one sample only, at an imposed deformation, of alloyed steel currently used for the pressure vessels manufacture. Figures 4-6 illustrate the results of the FEM analysis for the alloyed steel OL50 (for 3 layers) as follows: fig. 4 shows the displacements over direction z, fig. 4.1 shows the axial tensions at the surfaces compression(layer 1), fig. 4.2 – detail from 4.1 for the area concerned, fig. 4.3 – the values of the network nodes for tensions $\sigma_X=\sigma_{11}$, fig.5.1 and 5.2 present elongation values $\sigma_X=\sigma_{11}$ at z=2,16 mm(layer2) and finally fig. 6.1 and 6.2 the elongation tension on the inner face(layer 3).
For all the other cases of imposed deformations of the two types of steels given in Table 2 the same variations laws of the normal tensions $\sigma_X=\sigma_{11}$ in the element layers.

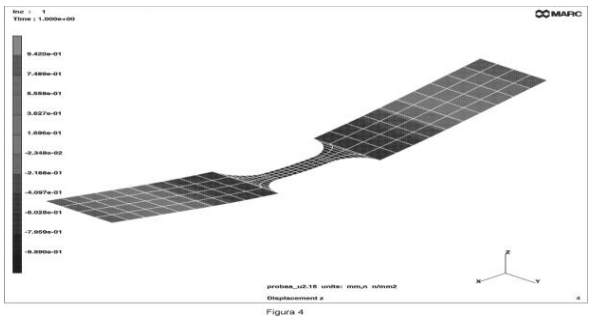

Fig 4. Displacement over directions

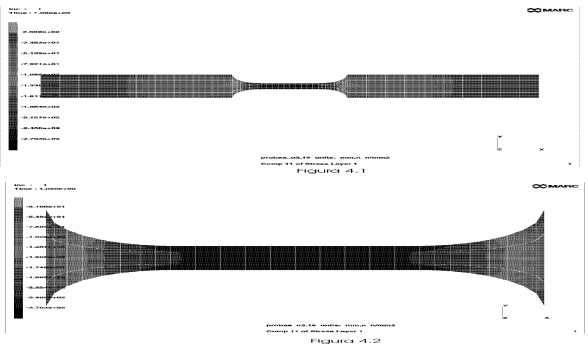

Fig 4.1 and 4.2 Axial tensions at the surfaces compression

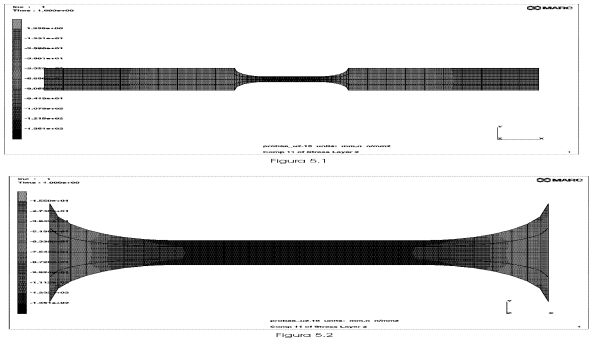

Fig. 5.1 and 5.2 Elongation values

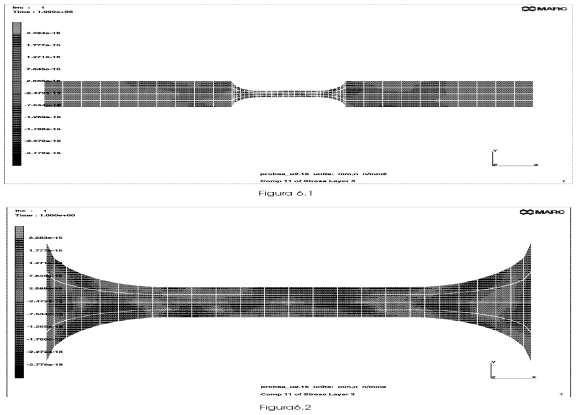

Fig. 6.1 and 6.2 The elongation tension on the inner face

III CONCLUSION

From the analysis of figs 4-6 it can be seen in the area concerned tensions are uniform over a stress layer while linearly varying across the layer thickness(the Navier model of tension distribution is complied with).

IV REFERENCES

[1] Karpenko, G.W, *Maloţiklovaia ustalost' stali v rabocih sredah*, Izd. Naukova Dumka, Kiev, 1977, p. 5-105.

[2] Crudu, I., Măcuţă, S., *Maşina universală de încercat materiale*, Patent Machine 102714 / 1991.

[3] Macuta, S., *Thesis Ph.d*., Univesity"Dunarea de jos"of Galati, Galati, 1999.

[4] Chesa, I., *Alegerea şi utilizarea oţelurilor*, Ed. Tehnică, Bucureşti, 1977, p. 25-35.

[5] Ştefănescu, I., Măcuţă, S., *Materiale utilizate în construcţia instalaţiilor şi utilajelor specifice industriei alimentare şi frigorifice*. Tome I, University "Dunarea de jos"of Galaţi, Galati, 1996, p. 40-65

[6] *** User Manual for Marc-Mentat Analysis Research Corporation, California, USA1999

The Role of Clusters in the Economic Development of the North-West Regions of Russia

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***Abstract*. The purpose of this paper is to identify problems in innovation and show the role of clusters in the innovative development of the North-West regions of Russia. A characteristic feature of the present stage of economic development of the regions of the Russian Federation is the transition to an innovative socially oriented model of economic development based mainly on the generation, dissemination and use of knowledge. Analysis of policy documents on the federal, as well as macro-regional level regarding issues of strategy of innovative development has shown that the transition to an innovative model of development at the regional level is largely related to formation of clusters:**

High-tech clusters in urban areas;

Clusters focused on the deep processing of raw materials and energy with the use of modern technologies in underdeveloped areas;

Tourist and recreational clusters in areas with unique natural and climatic conditions;

Transport and logistics clusters in areas with favorable geographical position.

Great attention to the practical issues of creating clusters is also paid to the regional level. In the strategic development documents of the most of the subjects in the North-West of Russia specific clusters are identified, which could become locomotives of innovation development of the regional economy. The most common in the regions of North-West are the following clusters: forest, tourism, manufacturing, transport and logistics. Analysis of regional practices on creating clusters showed that they are mainly based on the existing specialization of regional economies. Insufficient attention is paid to identify and support of new innovative clusters, and formation of inter-regional clusters.

***Keywords* – cluster, innovative model, regional economic development, region.**

I INTRODUCTION

A characteristic feature of the present stage of economic development is the transition to an innovative, socially oriented economic development model, based mainly on the generation, dissemination and use of knowledge.

The strategy of innovative development of Russia up to 2020 resulted in the following thesis: «Russia has ambitious but achievable goals ensuring a high level of well-being, strengthening the country's geopolitical role as one of the global leaders. The only way to achieve these goals is the transition of the economy to an innovative development model» [1].

Great attention is paid to innovative development documents in the regions. Thus, one of the main goals of innovation policy in the North-West should be noted increase the level of innovation of the regional economy and the transition to the principles of the innovation cluster policy.

In the present time there is a contradiction between the high innovation potential of the Russian economy and the extremely low rates of innovation, which causes importance of decision complex of issues to improve its innovation system, designed to ensure the implementation of existing significant innovation potential.

Studies indicate that an unfavorable situation in the sphere of innovation is largely due to an insufficient level of scientific support for management of regional economies through the cluster approach. Therefore actual problem is to identify the problems of innovation at the regional level and systematization of practical experience in the innovation cluster policy in the Russian regions. In this paper mainly the regions of North-West of Russia were studied: Arkhangelsk, Vologda, Kaliningrad, Leningrad, Murmansk, Novgorod, Pskov Region, Republic of Karelia, Republic of Komi, St. Petersburg.

II MATERIALS AND METHODS

Problems in innovation

Problems of innovation activity in the Russian Federation will be evaluated on the analysis of three groups of indicators: innovative opportunities, indicators of results of innovation activity, as well as indicators of demand for innovation. The indicators of innovative opportunities give an estimate of the current level of economic development of the region, the level of investment opportunities, consumer demand, etc. and include:

- the gross regional product per capita;
- investment in fixed capital per capita;
- average monthly per capita income of the population;
- share of personnel engaged in research and development, in total employment in the economy.

Indicators of results of innovation activity include:

- share of innovative products in the total volume of production;
- number of advanced production technology;
- number of patents;
- number of patents for utility models.

Indicators of demand for innovation include:

- expenditure on technological innovation, in% of gross regional product;
- number of used advanced technologies;
- share of organizations implementing technological innovations.

The choice of these parameters, on the one hand, is quite clear, as there are some studies on innovations, which have been used this method [2], and on the other hand, this choice is determined by the availability of information from existing statistical sources [3].

This paper presents a comparative analysis of innovation activity in the North-West Federal District in 2005 and 2010.

For integrated assessment of innovation activity in the regions of North-West for each selected group of indicators we calculated integral index (IP) as follows:

$$IP = \sum_{i=1}^{n} \alpha_i \times B_i , \qquad (1)$$

Where IP – an integral index as the sum of points for the region;

α_i – share of the i-index;

B_i – evaluating point of the i-index, belonging to the group.

The share of each indicator received the same, i.e. for the integral indicator of innovation potential and integral indicator of innovation activity, it was 0.25 (used 4 indicators), and for the integral indicator of the demand for innovation - 0.33 (used 3 indicators). Evaluating points are based on the normalization of the absolute values of the indicators included in the integral index.

Systematization of practical experience in cluster policy in the regions of Russia

In this direction of research such methods are widely used as systematization, synthesis and grouping. The purpose of the analysis was to identify aspects of the creation of regional innovation clusters.

At the first stage the analysis of the legal and program documents was performed at the federal level. It concerned the issues surrounding the use of clusters as a tool for implementing the strategy of innovative development at the regional level.

From the point of view of development methodology for strategy of innovative development at the regional level special interest are positions of federal documents concerning the creation system of strategic planning, covering three levels of management. The strategy of innovative development of Russia belongs to the first, the federal, level. The second level includes strategies of federal districts, which are developed in accordance with the strategic documents and state programs. These strategies are designed to ensure the coordination of the support and promotion of regional innovation activities. It also provides large projects of interregional importance. The third level includes strategy of socioeconomic development of subjects of the Russian Federation and the regional strategy of innovative development. Further analysis of methodology for strategic planning at the level of federal districts was performed.

Methodology of strategic planning is actively developed at the regional level. The analysis shows that all of the documents regulating the sphere of strategic planning in the regions can be divided into two groups:

- documents regulating the procedure of development and implementation of forecasting, analytical and program documents of strategic development;
- documents of strategic development of territories.

Under the analysis of the documents of the second group we have examined the development strategy of subjects of the North-West Federal District.

The results of the analysis of all these groups of documents are presented in the section "Systematization of clusters as a tool for regional development".

III RESULTS AND DISCUSSION

Problems in innovation

The results of calculations of integral indexes of innovative opportunities, results of innovation activity, and demand for innovation for 2005 and 2010 are shown in Fig. 1, 2, 3.

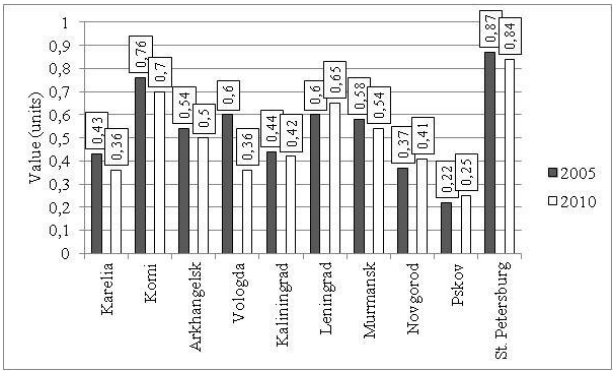

Fig. 1. Integral index of innovation opportunities of subjects of the North-West Federal District in 2005 and 2010

The highest index value of innovation opportunities in 2010, is typical for the St. Petersburg (0.84), slightly lower for the Republic of Komi (0.70). The smallest value of the integral index calculated is typical for the Pskov region (0.25). It is worth noting that in the leading regions innovation potential decreased slightly compared to 2005, and in the Pskov region, on the contrary, increased, although this did not change the place of the region among other subjects of the North-West.

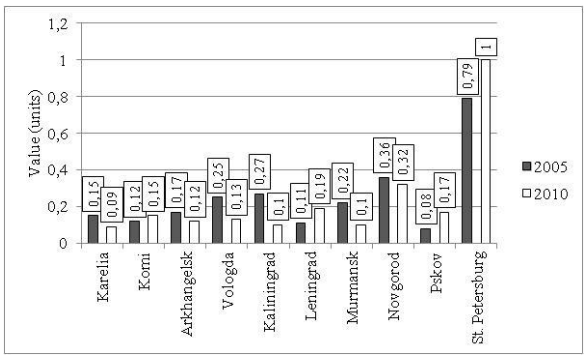

Fig. 2. Integral index of results of innovation activity of subjects of the North-West Federal District in 2005 and 2010

In 2010, innovative activity was the most effective in the St. Petersburg (IP = 1), the least efficient - in the Republic of Karelia (0.09). If compared to 2005, St. Petersburg as the region-leader has considerably strengthened its position in this rating (+0.21), and the subjects of the Russian Federation, located at the end of the list, even more reduced the integral result of innovative activity.

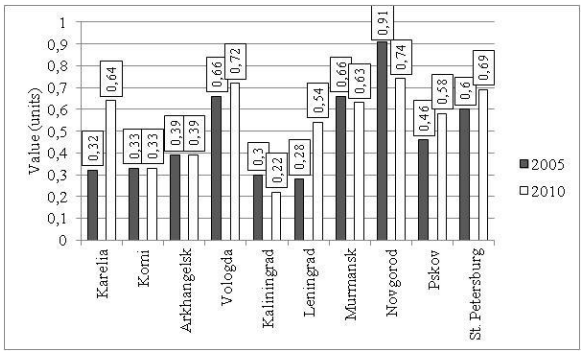

Fig. 3. Integral index of demand for innovation of subjects of the North-West Federal District in 2005 and 2010

The analysis showed that the greatest demand for innovation in 2010 is typical for the Novgorod (0.74), Vologda (0.72) Region and Saint Petersburg (0.69). The smallest value of demand for innovation is typical for the Republic of Komi (0.33) and the Kaliningrad region (0.22). It should also be noted that the growth of demand for innovation in comparison with 2005 is typical for half of the subjects of North-West, except for the Novgorod (down 0.17 of IP), Kaliningrad (down 0.08) and Murmansk (down 0.02) region. At the same time in the Arkhangelsk region and the Republic of Komi integral index of demand for innovation has not changed.

Thus, the analysis showed that the following problems are characteristic of most of the subjects of the North-West:

- high degree of differentiation of regions on the index of innovation opportunities, as well as low level of implementation of the innovative potential of the regions, which is manifested in the low indicators of results of innovation activity;

- low value of the demand for innovation in the regions with high potential for innovation;

- mismatch of demand for innovation his suggestion in the relevant regions of Russia.

These problems are mainly due to insufficient use of the cluster approach in the formation of innovation development strategy at the regional level. Use of this tool, in our opinion, will help to resolve these problems, and will open wide perspectives of development of innovative activity in the regions of Russia, which are the following positive changes:

- maximum use of the subjects of the Russian Federation of its innovation potential;

- satisfaction of internal demand for innovation through the implementation of innovation opportunities of the regions;

- qualitative improvement of the indicators of results of innovative activity of the subjects of the Russian Federation.

Systematization of clusters as a tool for regional development

Analysis of policy documents of the federal, as well as macro-regional level regarding issues of strategy of innovative development showed that the transition to an innovative model of development at the regional level is largely related with the formation of clusters:

- High-tech clusters in urban areas;

- Clusters focused on the deep processing of raw materials and energy with the use of modern technologies in underdeveloped areas;

- Tourist and recreational clusters in areas with unique natural and climatic conditions;

- Transport and logistics clusters in areas with favorable geographical position.

Great attention to the practical issues of creating clusters is also paid to the regional level. The analysis showed that certain aspects of the creation of innovation clusters is more refined in the following documents of the North-West Federal District Kaliningrad, Murmansk, Novgorod Region, St. Petersburg. These aspects include not only the selection of priority clusters (as in most of the North-West), but also the availability of certain provisions in the documents to encourage the construction of clusters. The issues of creating innovative clusters is elaborated only in the documents of St. Petersburg.

In Arkhangelsk and Vologda major innovative universities become a basis for formation of innovation clusters: in the Arkhangelsk region - North Federal University, in the Vologda region - Vologda State Technical University.

In the documents of the Republic of Karelia factors contributing to formation of clusters at the regional level are presented: increased knowledge sharing and experience intensification of cross-border co-operation and cross-border flows of investment, availability of advanced educational and research organizations and large firms, attractive living conditions and business environment.

Activities aimed at creation and development of innovation clusters are best reflected in the legal and regulatory framework of St. Petersburg, and include:

- competition on the organization of the Prize of the Government of St. Petersburg for the best innovative project in the framework of clusters;
- procurement of innovative products of cluster of health, environmental, instrumentation and biotechnology for health needs of St. Petersburg;
- provision of subsidies to legal entities registered in the territory of St. Petersburg, on compensation of expenses for the purchase of production and processing equipment in connection with the activities of the cluster;
- a project of creating a centre of prototyping.

As already mentioned, in the most regions of North-West aspects of the creation of innovation clusters include only a selection of cluster-specific priorities. We systematized cluster priorities of subjects of the North-West (Table 1).

TABLE 1.

CLUSTER PRIORITIES OF SUBJECTS OF THE NORTH-WEST

Subject of the North-West	Cluster priorities of subjects of the North-West
Arkhangelsk Region	Shipbuilding, mechanical engineering, forestry, transport, tourism.
Vologda Region	Construction, forestry, agriculture, flax, tourism.
Kaliningrad	Food processing, furniture production, building materials, shipbuilding and repair, amber production and design, retail chains.
Leningrad Region	Transportation and logistics, automotive and auto components, timber processing, building materials, chemical and petrochemical cluster, food industry.
Murmansk region	Maritime activity, mining and metallurgical, mining and chemical, transportation and logistics, fishing industry and aquaculture, tourism.
Novgorod region	Automotive components, logistics, peat, timber and flax.
Pskov region	Agro-industrial, transport and logistics, flax, timber, electrical and mechanical engineering, tourism, a cluster of local fuels [4].
Republic of Karelia	Forestry, tourism, mining.
Republic of Komi	Fuel, timber, individual cluster of low-rise housing.
St. Petersburg	High-tech industry, transport, tourism, science, education, finance and credit, insurance, trade, information and communication.

Table 1 shows that in strategic documents of development of the most of subjects of the North-West specific clusters were identified, which could become a driving force of innovation development of the regional economy.

The following industry clusters are the most common ones in the regions of North-West: forest (except for St. Petersburg and the Murmansk region), tourism (with the exception of the Republic of Komi and the Leningrad region). Engineering cluster is also frequently mentioned in Arkhangelsk, Kaliningrad, Leningrad, Novgorod, Pskov regions and the Republic of Karelia. Transport (transport and logistics) cluster is mentioned in documents of St. Petersburg, Pskov, Murmansk, Arkhangelsk, Kaliningrad, Leningrad regions.

Territorial clusters are associations of companies, suppliers of equipment and component parts, specialized production and support services, research and educational organizations, linked by relations of territorial proximity and functional dependence in the production and sale of goods and services. At the same time clusters can be placed in either one or several regions of the Russian Federation.

In addition to regional and interregional clusters represented in the strategic documents of subjects of the Russian Federation a number of interregional cluster is mentioned in the Strategy of Development of the North-West Federal District (Table 2).

Table 2 shows that the relationship between the enterprises and organizations of the cluster can be organized in different ways, depending on the location of the regions in which to place enterprises of the industry is profitable; the economic and geographical situation of the territory, in particular the transport accessibility; the availability of a large and powerful development centre, around which enterprises of cluster are grouped (for example, for the North-West Federal District such a centre is St. Petersburg), and other factors [5].

Currently, the use of the cluster approach has taken one of the key places in strategy of socioeconomic development of a number of Russian regions and municipalities. A number of territorial clusters development projects is implemented proactively [1].

At the same time, only a relatively small part of the projects of cluster development has reached the stage of practical implementation. Work has not started for a number of priority directions of the cluster policy:

- mechanisms of methodological, information, consultation and educational support of cluster development are not created;
- there is no necessary coordination of federal executive authorities, executive bodies of subjects of

the Russian Federation and local self-government, business associations to implement cluster policy;

tools of financial support of cluster projects from budget sources is limited.

TABLE 2.

INTEGRATION OF SCIENCE AND INNOVATION CLUSTERS IN THE NORTH WEST FEDERAL DISTRICT

Type of complexing connections	Science and innovation profile of cluster relations	Subjects of North-West Federal District
Radially oriented interregional complexing connections	Shipbuilding cluster	St. Petersburg, Arkhangelsk and Murmansk regions
	Mechanical engineering cluster	St. Petersburg
	Cluster of information and communication technologies	St. Petersburg, Republic of Karelia, Novgorod region
	Nanotechnology cluster	St. Petersburg, the Republic of Komi
	Cluster of nuclear technology	Saint-Petersburg, Leningrad region
	Automotive cluster (forming)	Saint-Petersburg, Leningrad region
	Cluster of scientific support of agriculture	Saint-Petersburg, Leningrad region
Peripherally oriented interregional complexing connections	Timber cluster	The Republic of Karelia, the Republic of Komi, Vologda and Arkhangelsk regions
	Cluster of technology development of fisheries and aquaculture	Arkhangelsk and Murmansk regions
Regionally localized complexing connections	Geological basis of sustainable development	Kaliningrad region

-

IV CONCLUSION

The study showed that the regions of the North-West of Russia is characterized by high degree of differentiation on the index of innovation opportunities, low level of implementation of the innovative potential, low value of the demand for innovation, mismatch of demand for innovation his suggestion, because of the insufficient use of the cluster policy instruments.

The main objective of the cluster policy is to ensure high rates of economic growth and diversification of the economy by improving the competitiveness of enterprises, suppliers of equipment, parts, specialized production and support services, research and educational organizations, forming the territorial-production clusters.

The analysis showed that the following industry clusters are the most common ones in the regions of North-West: forest, tourism, engineering and transport.

But in order to effectively develop these clusters in the subjects of the North-West the main tasks of the cluster policy of the regions should be as follows.

1. Creating conditions for effective organizational development of clusters, including the identification of members of the cluster, the cluster development strategy.

2. Providing effective support for projects aimed at improving the competitiveness of the cluster members, at the expense of focusing and coordination, according to the priorities of development of clusters and economic policy measures.

3. Providing an effective methodology, information and consulting and educational support to the implementation of cluster policy at regional and branch level.

Results of the implementation of cluster policy is the growth of productivity and innovation activities of enterprises in the cluster and increasing the intensity of development of small and medium enterprises, the activation of direct investments, ensuring accelerated socioeconomic development of clusters based regions.

Implementation of cluster policy requires effective interaction of federal executive authorities, executive bodies of subjects of the Russian Federation and local self-government bodies and business associations.

V ACKNOWLEDGMENTS

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VI REFERENCES

[1] Order of the Government of RF «About the Approval of the Strategy of Innovative Development of the Russian Federation up to 2020» from 8.12.2011 № 2227-r.

[2] Kazantsev S. Assessment of the potential and scale of innovation activities in the subjects of Russian Federation. Innovations, 8, 2012, pp. 36-45.

[3] Regions of Russia. Socio-economic indicators [electronic resource]. The website of the Federal State Statistics Service. Mode of access: http://www.gks.ru/wps/wcm/connect/rosstat/rosstatsite/main/publishing/catalog/statisticCollections/doc_1138623506156.

[4] Nikolaev M., Malyshev D. The mechanism of management of regional project of high-tech cluster formation. Bulletin of the Novgorod State University. Ser.: Economic Science, 69, 2012, pp. 27-32.

[5] Makhotaeva M., Nikolaev M., Malyshev D. Methodological aspects of formation of innovation development strategy at the regional level: monograph. Pskov. PskovGU Publishing, 2013, 296 p.

Factors of Economic Growth in the Regions of the North-West Federal District of Russia

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***Abstract*. The purpose of this paper is to identify the factors determining the growth of the regional economy. The research of the influence of the main determinants of economic growth has been executed in the paper: labor force, investments into fixed capital, R & D expenditure on the index of regions' economy growth. The analysis shows that all these factors made an essential impact on the rates of increase of economy of regions in 2000-2008. Estimating the prospects of the growth of economy of regions in strategic prospect (till 2020) it is necessary to notice that possibilities of the growth at the expense of extensive factors are almost set. In these conditions a steady growth of regional economy is possible only at the expense of an intensification of investment process and strengthening of its innovative component.**

***Keywords*: economy of regions, economic growth, investment, innovations, labor force.**

I INTRODUCTION

It is known that the territorial factor plays an important and multidimensional role in development of human society and economy. This factor is of particular importance to the Russian Federation. The vast territory of the state, a variety of resources and the business environment on the one hand create certain problems in the development of branches of engineering and social infrastructure, on the other hand they provide manifold opportunities of socio-economic development, increasing the pace and quality of economic growth. These possibilities are realized, in particular, due to the synergistic effect of interaction of areas with different specialization, integrated into a single value-added chain.

In accordance with this, the territorial factor is given high priority in the scientific literature, as well as in the policy documents of the Russian Federation. In this case a significant asymmetry in the levels of social development and investment activities between the regions of the Russian Federation is considered as limitation of opportunities for economic growth. Thus, the problems of economic growth and regional development are of top priority for all levels of management. These issues are closely related. Without fast economic growth, territorial problems cannot be solved. At the same time, the steady growth of the national economy is possible only in conditions of effective use of competitive advantages of the territories.

Economic growth is a long-term trend in real GDP growth, an integral index indicating the size of economy. In 2008, Russia's GDP was 158% compared to 2001. In accordance with the main macroeconomic growth indicators, Russia was significantly ahead of most of the developed countries of Europe. So the GDP of Germany in 2008 was only 109%, France - 112%, Finland - 122% and Poland -136% compared with 2001. The economy growth rate in Russia was about the same as in Ukraine, Moldova, Latvia, Lithuania and Estonia. Among the former Soviet Union republics, Azerbaijan and Armenia were the leaders in terms of economic growth. In a relatively short period of time Azerbaijan's GDP grew more than three times, and Armenia's - more than twice. Kazakhstan, having close economic ties with our country and a similar economic structure, had higher indicators of economic growth than that of Russia. Sustained high rates of growth of the Chinese economy provided doubling GDP over the period under review [1].

Thus, the growth of the Russian economy, which looked quite good against the developed countries, was significantly behind the indicators of dynamically developing countries with transition economy. This situation is largely due to the underestimation of the role of the territorial factor in social and economic policy of the state. As noted above, a significant asymmetry in the levels of development and investment between the regions currently serves as the main constraint factor to growth of national economy.

The priority of the territorial problems makes actual the search of effective strategies for their solving. In this study, as the first phase of strategy forming, we propose to identify the factors determining the dynamics of the processes of territorial development. At that, the Gross Regional Product (GRP) and the GRP per capita act as the main indicators of level of socio-economic development of the region.

Let us consider the dynamics of the GRP in the North-West Federal District for the period 2001-2008. (See Table 1.).

For the analyzed period, the volume index of GRP of ten regions of the North-West was 173.3%. This growth rate roughly corresponds to the situation in the Russian Federation as a whole. However the growth rates of the economy of regions differed considerably. So, the GRP of Leningrad region grew more than twofold, while the economya of the Murmansk region

showed a growth of only 12.1%. Thus, within one federal district there is a high differentiation in economic growth. Indicators of a leader (Leningrad region) and an outsider (Murmansk region) differ by nearly an order of magnitude. The high degree of differentiation of the indicators brings into focus the analysis of the factors of regional economies growth.

TABLE 1.

VOLUME INDEX OF GRP IN THE NORTH-WEST FEDERAL DISTRICT (%)

Regions	2008/2000
North-West Federal District	173,3
Republic of Karelia	134,5
Republic of Komi	132,3
Arkhangelsk Region	185,1
Vologda Region	133,3
Kaliningrad region	208,5
Leningrad region	213,5
Murmansk region	112,1
Novgorod region	149,7
Pskov region	131,8
St. Petersburg	207,1

Source: Regions of Russia. Socio-economic indicators.

II MATERIALS AND METHODS

To identify the major factors, conditioning economic development of the North-West in the period 2001-2008, it is necessary to refer to the well-known models of economic growth. Most of the models are based on the fact that an increase in real output is influenced by an increase in the number of basic economic resources and, above all, - labor force and capital. Economic growth, deriving from quantitative expansion of the resource potential of the economy, is called the extensive economic growth. On the other hand, the economic potential of the economy is affected by scientific and technical progress, which leads to improvements in technology and appearance of more advanced types of capital goods. In addition, human capital development contributes to increasing the economic potential of the nation [2]. Economic growth, deriving from of quality improvement of resource potential of the economy, is called the intensive economic growth.

In this article we study the effect of factors such as the number of employed in the economy, investment in fixed assets and R & D expenditure on the growth of the economy of regions. To assess the degree of influence factors on the growth of the economy, we use the correlation analysis. As a source of information, we use the data of the official statistics.

III RESULTS AND DISCUSSION

At the first stage we consider the impact on economic growth of the extensive factors - the number of the economically active population and investment in physical capital. The dynamics of the economically active population in the North-West for the period 2000-2008 is presented in the Table 2. The period under consideration is characterized by the growth of the economically active population. In the North-West Federal District as a whole, this index increased 4.0%. At the same time, this index has a significant differentiation in the regions. Maximum growth of the economically active population took place in St. Petersburg - by 10.3%. In the Arkhangelsk region the index decreased by 5.7%.

TABLE 2

DYNAMICS OF THE ECONOMICALLY ACTIVE POPULATION

Region	Economically active population - total, thousands		Changes, %	GRP index, %
	2000	2008	2000-2008	2008/2000
North-West Federal District	7394,6	7688,0	4,0	173,3
Republic of Karelia	381,0	384,0	0,8	134,5
Republic of Komi	547,8	570,0	4,1	132,3
Arkhangelsk region	724,2	683,0	-5,7	185,1
Vologda region	667,3	659,0	-1,2	133,3
Kaliningrad region	495,2	537,0	8,4	208,5
Leningrad region	855,2	918,0	7,3	213,5
Murmansk region	542,3	520,0	-4,1	112,1
Novgorod region	360,3	342,0	-5,1	149,7
Pskov region	369,4	371,0	0,4	131,8
St. Petersburg	2451,8	2704,0	10,3	207,1

Source: Regions of Russia. Socio-economic indicators.

The analysis shows that in all regions with high growth rates of the GRP a significant increase in the economically active population has taken place. The exception is the region with harsh climatic conditions - the Arkhangelsk region. In the regions with low growth rates of the GRP, economically active population decreased or remained about the same. In this group, Republic of Komi, which takes the second place in the district in terms of the GRP per capita, is an exception.

Analysis of the relationship of the growth rates of GRP and changes in the number of economically active population reveals the presence of strong enough correlation between them, where the correlation coefficient is 0.63. Thus, we can conclude

that the growth of population involved in the economy was a significant factor in the economic growth of the North-West for the period 2001-2008. This conclusion is entirely consistent with the known models of economic growth.

Next, let us consider the impact of capital on economic growth. Capital is created in the course of investment and, on this basis, we will evaluate its growth in terms of fixed investment. Based on the Table 3 data, we consider the relationship between the level of investment activity in the region and the growth of their economies.

TABLE 3

THE RELATIONSHIP OF INVESTMENT AND ECONOMIC GROWTH

Region	GRP index, %	Index of fixed investment, %
	2008/2000	
Republic of Karelia	134,5	202,0
Republic of Komi	132,3	188,4
Arkhangelsk region	185,1	494,5
Vologda region	133,3	421,0
Kaliningrad region	208,5	478,4
Leningrad region	213,5	284,5
Murmansk region	112,1	276,0
Novgorod region	149,7	299,2
Pskov region	131,8	257,0
St. Petersburg	207,1	400,7

Source: Regions of Russia. Socio-economic indicators.

The analysis shows that the regions differ significantly in terms of investment activity. Thus, in the Republic of Komi investment grew less than twice, while in the Arkhangelsk and Kaliningrad regions - more than 4 times. Quantitative analysis of the relationship between investment and economic growth shows that the correlation coefficient between the GRP index and fixed investment index is 0.58.

Thus, the level of investment activity is key factor of economic growth and regional development. To assess the prospects for intensification of the investment processes, we should consider the dynamics of processes of gross saving and accumulation. The analysis shows that, in the period 2000-2006, despite the favorable macroeconomic situation - quite stable and high growth rates of the GDP, gross capital formation amounted 20%, and investment in fixed assets - 17% of the GDP. At the same time, gross saving in all years exceeded 31% of the GDP. In subsequent years, the situation has improved. In 2000, the correlation of gross capital formation and savings was 0.52, i.e. only 52% of the savings were used for accumulation of fixed and working capital; by 2006, the value of the index rose to 0.68 and in 2008 – to 0.81 [3].

The analysis shows that in the 2000s there was a tendency to improve the efficiency of the mechanism of transformation of savings into investments. It was due to the following factors: a disinflation, reduction of risk and interest rates in the economy. In 2000 the inflation rate was 20.2%, and it decreased by 2008 to 13%. An important guide mark in formation of interest rates in the economy is a refinancing rate. In early 2000, it was 55% and decreased by the end of the year to 28%. Then there was a gradual reduction in the rate to 11% in 2008.

In recent years the rise phase of the business cycle, situation in investment in Russia has improved significantly. Gross capital formation in 2008 was 25.5% of the GDP. This rate of accumulation exists in developed countries. This rate of accumulation is sufficient in order to develop an average of 2.5-3% per year, regularly update well-maintained the basic production assets, maintain and develop the already created a highly developed infrastructure. In Russia, adjusted for high level of wear of fixed assets, a significant lag in housing and infrastructure development, investment rate should be much higher.

In the paper of S. Naryshkin, a problem of gross capital formation is considered from the point of view of national security [4]. By the investment security the author means an ability of the national economic system to generate the investment process, to support sustainable growth and strategic competitiveness of the economy. Investment security policy can be implemented in three areas: ensuring the overall adequacy of investment for sustainable economic development; optimization of branch and territorial structure of the investment; filling the investment process, all investment projects with innovative content. In terms of the overall adequacy of investment, the indicator of the share of savings in the GDP is the most important. For countries with economies in transition, the minimum threshold of gross investment is 25%. Otherwise the normal process of reproduction of basic capital as a foundation for continuous modernization and competitiveness of the national economy is violated. In Russia, a minimum investment threshold of sufficiency economy was reached only in 2008. But in the crisis year of 2009, the share of savings in the GDP has decreased noticeably. The inadequate level of investment activity in the Russian economy is proved by the negative trend of depreciation of fixed assets in the economy. The index grew from 39.3% in 2000 to 45.3% in 2008.

Thus, the level of investment activity in the 2000s failed to ensure the sustainable development of the economy in terms of the reproduction of capital. In this case, stability is the most important characteristic of the process of territorial development and it implies the long-term preservation of conditions for reproduction of the region's potential. Thus, we can conclude that the level of investment activity in the 2000s was not able to ensure the reproduction of the economic potential of the territories. In this case, there are significant resources for increasing economic growth by further improving the mechanism of transformation of savings into investments and using

them to upgrade obsolete production facilities, as well as for infrastructure upgrading.

Next, we consider the impact on economic growth of the technology development, which is the result of innovation. Despite the efforts of the state, indicators of innovation activity of Russian companies remain low. Thus, in 2009, only 9.4% of the total number of enterprises of the domestic industry carried out the development and introduction of technological innovations, which is significantly less than in most European countries (Germany (69.7%), Ireland (56.7%), Belgium (59 , 6%), Estonia (55.1%), Czech Republic (36.6%)) [1]. Also, the cost structure of technological innovation of Russian enterprises is very different from that of the foreign companies. In Russia, the share of spending on research and development is about a quarter of all the cost. In this case, more than 50% of the cost of innovation is assigned for the purchase of machinery and equipment. Such a strategy of the apportionment of innovation expenditures is typical for the counties with low scientific potential. In developed countries, the main costs are related to innovative R & D (70-80%).

We can consider the proportion of domestic spending on research and development in the GDP as an integral indicator of innovation activity in the economy. In the 2000s, in Russia this figure was in the range of 1,1-1,25%. This roughly corresponds to the level of European countries, which do not claim to the role of the technological leaders: Spain, Hungary, Portugal, and Estonia. In a number of European countries - Bulgaria, Greece, Latvia - the share of these costs is approximately two times lower. European technology leaders (Germany, Austria, Sweden, Finland, France, and Denmark) have a twice higher index of R & D expenditures than in Russia [1].

Let's consider the level of innovation activity in the regional context. As an indicator we use the share of R & D expenditures in the GRP.

The analysis shows that in all regions of the North-West Federal District except St. Petersburg, the index value is significantly lower than the average in Russia. In this case, in the regions there is a high level of differentiation in the proportion of expenditures on research and development. The group with a low level of innovation activity includes the Vologda region, the Pskov region and the Arkhangelsk region. In these regions the value of the index does not exceed 0.2. The group with medium level consists of the Republic of Karelia and Republic of Komi, the Kaliningrad region, the Novgorod region, the Leningrad region and the Murmansk region. Their index values do not exceed 0.5%. Only St. Petersburg has a high index of the R & D expenditures in the GRP. Its index is at about the same level as in such countries as Finland and Sweden. In these countries the domestic expenditure on R & D amounts to 3.73 and 3.75%, respectively, and they are the leaders in Europe for this indicator. Here, however, we should note the negative trend of innovation indicator of St. Petersburg - for the period 2000-2008 it declined from 4.7 to 3.4% [3].

The analysis shows that the correlation coefficient between the GRP indexes and proportion of R & D costs in the GRP is 0.42, i.e. the relationship between the indexes is average. Low value of the index apparently is due to the low level of innovative activity in most regions of the North-West Federal District. To assess the prospects of increasing the rate and quality of economic growth due to the intensive factors it is necessary to take into account that Russia is among the world leaders in many indicators characterizing the level of science and technology. In Russia, there is a contradiction between the high scientific and technical potential of the economy and the extremely low level of innovations. Effective use of this potential must provide a significant increase in the rate and quality of growth of regional economies.

IV Conclusions

Thus, we have investigated the effect of employment in the economy, the index of investment in fixed assets and share of the costs of research and development in the gross regional product for the growth rate of GRP. The analysis showed that the most significant factors include the following: an increase in the number of economically active population (correlation coefficient is 0.63), the index of investment in fixed capital (the correlation coefficient is 0.58). This level of innovation activity showed a slightly lower degree of impact on economic growth (correlation coefficient 0.42).

Assessing the prospects for the development of the regional economy in the long term (up to 2020), it should be noted that the growth opportunities due to the factor of increasing the number of the economically active population are almost exhausted. So, according to the average variant of the Rosstat's forecast, the population of working age will decline from 87,524 million people in 2011 to 79,033.2 million people in 2020, i.e. 9.7% [5]. In these conditions, ensuring sustainable growth of the regional economy is only possible due to the intensification of the investment process, which includes increasing public investment in infrastructure, and strengthening its innovation component.

V References

[1] Russia and the countries of the world. Goskomstat, 2012.

[2] Nikiforov A.A. Macroeconomic: scientific schools, concepts, economic policy: the textbook. – M: Publishing house «Business and Service», 2010. – 624 p.

[3] Regions of Russia. Socio-economic indicators [electronic resource]. The website of the Federal State Statistics Service. Mode of access: http://www.gks.ru/wps/wcm/connect/rosstat/rosstatsite/main/publishing/catalog/statisticCollections/doc_1138623506156.

[4] Naryshkin S. Investment safety as the factor of steady economic development// Voprosy Economiki. - 2010. - №5.

[5] The website of Federal Agency of the state statistics http://www.gks.ru/wps/wcm/connect/rosstat/rosstatsite/main/population/demography/#

Analysis of SMEs in Bulgaria – Assessment of Their Innovation Activities

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Abstract. **The main thesis of the report is that the vast choice of planned innovation is given by combining traditional financial and economic assessment approaches innovation, namely through the net present value (NPV).**

The aim is to analyze the situation of SMEs in Bulgaria, to identify the problems facing their development and to formulate recommendations to address them.

Keywords **– innovation, small and medium enterprises (SMEs).**

I INTRODUCTION

Nowadays innovation is key to improving the competitiveness of the company. The survival of a business organization depends on the ability to create and develop new products and implement new technologies, new organization of production, new ways of managing and entering new markets.

Fast growing industry is characterized by the following five types of models [1] (Fig. 1):

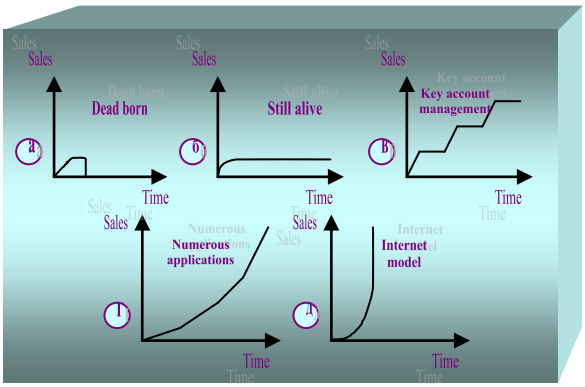

Fig. 1. Fundamental models of companies

„А" (Dead born) - start business ideas; **„Б" (Still alive)** - after starting the business idea, it is not perfect, and there are constant sales and satisfy only a certain range of users; **„В" (Key account management)** - is constantly improving product, maintenance, service, nomenclature, to implement innovations and new technologies, expanding markets; **„Г" (Numerous applications)** - whose clients (users) require specific product development, we have established and producing products that are crafted with new knowledge; **„Д" (Internet model)** - Business development which is characterized by the product-offer, address, price, quantity and number of applications of the product, is implemented on-line in INTERNET space in real time, the delivery is door to door.

As typical examples of models for companies engaged in manufacturing based on a model **„В" (Key account management)** in Microtechnology and **„Г" (Numerous applications)**. They start their business if necessary by market demand. The launch was successful when starting with a series of products and then mass production, because the equipment (machinery, equipment, etc.) necessary large investment, but also need highly qualified staff. Both strategies (Key account management, Numerous applications) for business development of crucial importance:

- Create and update competence, service and communications;
- Work and evolution, probably in larger scale production;
- Guaranteed service and maintenance.

If successful, the companies will develop sustainable, but then there is always risk that they will develop a model **"А" (Dead born)** and model **"Б" (Still alive)**.

Most young companies dealing with micro and manufacture of micromechanical elements (MME) and microcomponents (MC) for a microtechnology (MT) are innovative, not only in technology but also in the management and organizational structure.

Innovative solutions include: staff, motivation with a new concept, marketing to water demand (market) use the findings, achievements and research laboratories and university groups, exclusive contracts with business partners.

In general we can say that the situation is rapidly changing. Innovations are common, and if you want to be good and to prosper, it must be reckoned with them and implement them, even if you have strength and ability to beat them with a team of researchers.

"Small and medium enterprises in the industrial world". Based on studies of various theoretical clarifying the nature, substance and criteria for defining SMEs, we can formulate:

"Small and medium-sized industrial enterprises (SMIEs) are physical and/or legal entities that carry out production activities, independent and autonomous in its legal form, and have a number of employees, annual turnover and/or balance sheet total assets under statutory law in particular country**. "**

On the basis of a systematic approach, we can say that industrial is a multifaceted business entity having

social, technical, technological, legal, economic, product, market and organizational and managerial aspects, building and implementing specific policies of different production activities.

II SMALL AND MEDIUM ENTERPRISES IN BULGARIA AND INNOVATION ACTIVITY

According to statistics SMEs do not pay enough money for development (including innovation), which makes the market uncompetitive behavior, both in Bulgaria and abroad. They are inadequately protected by the state and support the development of their productive activity is minimal. Outlined in their strategic documents specific measures for their development remain unfinished or undone. SMEs continue to face difficulties in accessing finance as an imbalance between the three size groups - micro, small and medium enterprises.

Research on the effectiveness of small and medium-sized industrial enterprises in various aspects due to specific indicators that identify it, it is hard to generalize the macro. Companies themselves are rarely calculated efficiency when planning their activities, leading to frequent losses and even bankruptcies. The presence of various criteria and evaluation indicators are not meeting their full use in practice, confirming the need to create mechanisms for their implementation in small and medium-sized industrial enterprises. Evaluation of the effectiveness of the activities of small and medium enterprises (SMEs) do not contribute to improving the quality of decisions and the criteria used to evaluate the performance of small and medium enterprises need systematization and their inclusion in the generalized approach to evaluate their activity [3].

Due to its size and market presence SMEs in Bulgaria's economic stabilization and progress. Together, they are under pressure from various institutions, which hampers their development. This is a prerequisite for subsequent analysis and development of tools with which to tackle the problems identified. Small and medium-sized industrial enterprises can form a competitive advantage in a different way and take advantage of this in order to grow and survive. One approach to determining the competitive advantage is the evaluation of the effectiveness of the activities. Thus justifying the need for development of an application tools with which to carry out this assessment.

"Innovation is based on knowledge. Is associated with a new product, process or technology that is measured by degree of novelty of the company and / or market. Following the introduction of innovation enhancing the competitiveness of the enterprise (firm), industry, the economy and increase consumer satisfaction. Innovation is a creative process. It is also a result of the process, which is based on innovation."

- Innovation is seen as a continuous process of creation and innovation.
- Innovation by linking integrative process which includes creation, design, implementation, adaptation and use.

Innovation is such a behavior in which there is something that has not been created. For the entity it is always unknown until the time of its introduction. This does not mean that it is necessarily some absolutely new, unknown to anyone until now.

When it comes to innovation, the term is associated with something positive and progressive. Through her achieve intellectualization of labor, improve working conditions, raising the level of education and culture, better satisfy the needs.

Own R & D and technology transfer are two ways used in the implementation of innovation policy. Technology transfer can be effected in the following manner [2]:

- Transfer from local and foreign companies to others;
- Transfer from research organizations (universities) to companies;
- Transfer from firm to research organizations (universities).

Innovation is bringing success and the result of innovation and is associated with growth and development. Satisfaction, quality, performance, price, time and competitiveness are the goals and results of the implementation of the innovation.

Innovation, whatever their field of application is associated with novelty, which must be especially valuable for the company as it implements it. The essence of innovation because of the specificity of its expression, allows for multidimensional interpretation, leading to the formulation of new questions that should be addressed.

The innovation process is creative, cyclical, complex and expensive process, the result of many interrelated activities by type and specificity depend on the size of the innovation project and not always innovation. Implement them in their entirety and complexity requires specific knowledge and skills. Innovation can be called any activity carried out for the development and implementation of innovative project or plan.

There is increasing innovation activity of SMEs in Bulgaria, but it is well below the average for the EU countries.

The largest share of innovation in Bulgaria organizational and marketing. In small and medium-sized industrial enterprises innovation is associated with improvement of products, processes, technologies, and less radical innovations.

Innovation policy is declared priority of countries - members of European Union. For Bulgaria, this is reflected in the strategic documents for the development of the country, but practical steps for their implementation are not enough.

Based on the analytical study has found that small and medium enterprises do not allocate enough resources for innovation.

"Investment and financing of innovation and innovation in small and medium-sized industrial enterprises"

The most commonly used financial indicators for optimization activities, including innovation are: *net present value (**NPV**), internal rate of return (**IRR**), Profitability Index (**PI**), payback period on investment (**PBPi**).* That they are included in the traditional approach to assessment and analysis of inputs into innovation and innovation. Net present value (NPV) is the difference between the amount of the discount required rate of return and net annual flows and investment costs. Calculated by the following formula [1]:

$$NPV = \sum_{i=1}^{n} \frac{C_i}{(1-r)^i} - C_0$$

Where:

C_0 - Initial investment;

n - Number of years in the discount period;

r - Discount rate, characterizing the rate of return on alternative investments of the same risk class.

If **NPV> 0**, the project should be implemented.

If **NPV <0**, it must be invested in this project.

If **NPV = 0**, the project is neutral (indifferent) to the company.

The internal rate of return (IRR) can be calculated again by trial and error.

$$IRR = r_1 + (r_2 - r_1) \times \frac{NPV_1}{NPV_1 - NPV_2}$$

Where:

r_1 - internal rate of return (IRR), which net present value is positive;

r_2 - internal rate of return (IRR), which net present value is negative.

$$NPV_1 = r_1$$

$$NPV_2 = r_2$$

Profitability index is very good and preferred method. It is the **ratio between the sum of the present values of annual net flows and the amount of the investment cost** (IR), i.e.:

$$IP = \frac{\sum_{i=1}^{n} \frac{CF_i}{(1+r)^i}}{ИР}$$

The higher is the IP, the better is the investment project.

If $IP > 1 \rightarrow NPV > 0$.

If $IP < 1 \rightarrow NPV < 0$.

If $IP = 1 \rightarrow NPV = 0 \rightarrow IRR \equiv PZ$.

The discount period of return (PPd) is the inverse of the index of profitability (IP). Formula is:

$$PP_d = \frac{ИР}{\frac{\sum_{i=1}^{n} \frac{CF_i}{(1+r)^i}}{n}}$$

and therefore

$$PP_d = T_0 + \frac{CF_i^d - CF_{i-x}^d}{CF_i^d}$$

In determining the appropriateness of the proposed innovation and related activities can be used in static and dynamic methods. Because of the failure to take account of the change in the value of money prefer the dynamic methods. Typically applying multiple indicators for planned innovation activities. The most commonly used indicators are net present value, internal rate of return, payback period and profitability index. The different methods used to implement one or the other approach can lead to contradictory and mutually exclusive outcomes that hinder decision for the future of innovation.

In the application of real options when evaluating innovation and innovation is examined and analyzed on the real options approach as a means of evaluating investments in real assets, in particular - to the innovation and related activities. Identified key parameters, limitations, advantages and disadvantages in using real options to evaluate the innovation.

In Bulgaria through real options analysis (**ROA**) is not popular. In support of this assertion were formulated following reasons:

- A relatively small number of publications in Bulgarian, in which to present the advantages of this approach compared to other known approaches;
- The absence of a methodology for the application of **ROA**, developed an accessible language for managers;
- Knowledge of mathematics and statistics needed by managers to implement **ROA**.

The main advantages of the approach are optional: an opportunity for expanded research unit in assessing the appropriateness of investing in innovation can be evaluated on innovation stages of planning and implementation; the possibility of measuring the flexibility offered by incoming information or the separation of what is happening on different stages of implementation; ability to reduce uncertainty in the light of incoming information.

III Conclusion

In a constantly changing environment assessment of flexibility in developing innovative projects and in corporate behavior is in correlation with the survival and development of small and medium-sized industrial enterprises.

In considering innovation and activities associated with it, an opportunity to be realized, not as an obligation, a prerequisite for a more precise estimate of the potential outcome. The determination of the expected financial benefits requires the application of appropriate methods and approaches by which to account the uncertainty of the environment.

Successful development of small and medium-sized industrial enterprises is only possible if the company management is convinced of the need for detailed planning and exploring possible alternatives for the implementation of innovation and related activities.

On this basis, an analysis of real options as an opportunity to supplement and enrich the evaluation of innovation and related activities.

One of the key aspects to assess innovation in small and medium-sized industrial enterprises is determining their economic viability. It was found that the implementation of innovation can be represented as a complex system of actions, tools and technologies that are reaching the strategic goals. Often the economic viability of innovation is presented as part of the entity's performance, including small and medium industrial enterprise. There are various instruments that are used to determine the feasibility and cost effectiveness financial decisions related to innovation.

Innovation activity of Bulgarian small and medium-sized industrial enterprises rarely developed as a long term company policy and mostly confined to reorganization processes and improvement of product creation.

The analysis of innovation policy in Bulgaria tends to confirm the alleged leadership of innovation in the formation of a competitive business, although the measures for their encouragement and development are inadequate.

IV REFERENCES

[1] Petrova D., Management on firm – theory and practices, monograph, Education „EKC – PRES" – Gabrovo, Bulgaria, 2010, ISBN 978-954-490-112-7

[2] Petrova, D., Europe 2020 and Transfer on Innovation in Bulgaria, „Research and Development in Mechanical Industry" RaDMI 2012, 14-17 September 2012, Vrnjačka Banja, Serbia, SaTCIP Ltd., Technical-Mechanical School in Trstenik, ISBN 978-86-6075-036-7, Volume I, pp. 261-265.

[3] Petrova D., EFFICIENCY OF INVESTMENTS, 39th IGIP Symposium, Joint International IGIP-SEFI Annual Conference 2010,19th - 22ndSeptember 2010,Trnava, Slovakia,ISBN 978-2-87352-003-8, pp. 543-551

Innovation, Business, Education – Regional, National and European Policies 2020

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Abstract. **This report examines the choice of innovation strategy, which is based on an analysis of the innovation capacity of the region in: innovation, business and education. Set is a set of features that facilitate and support innovation. The purpose of the analysis is to identify the main features and to what extent they have.**

Keywords **– business, education, innovation, politics.**

I INTRODUCTION

EU Innovation Union – new programme under Europe 2020 strategy

Innovation in its widest sense represents fresh thinking which provides value. It is our capacity to achieve the future we desire. As such, innovation provides new sources of growth.

The gradual emergence of the EU from the financial crisis, coupled with the need to tackle global challenges, has rendered innovation more crucial than ever. Challenges such as climate change, energy, food security, health and an ageing population can only be solved through innovative, new solutions.

Looking back, we can see almost 20 years of EU-level innovation policy, remarkable achievements and a continuous improvement of Europe's innovation performance. However the world is changing rapidly, as this is the nature of innovation, and it is against this background that the Commission has prepared, as part of the Europe 2020 strategy [4], its proposal for an "Innovation Union".

The Innovation Union focuses on innovation which addresses the major social challenges identified in Europe 2020, pursues a broad concept of innovation and aims to involve all stakeholders and regions in the innovation cycle.

Its underlying objectives are the following:

- **Strengthening Europe's knowledge base** and reducing fragmentation - by promoting excellence in education and skills development, delivering the European Research Area and promoting the European Institute of Innovation and Technology. As a recent study has demonstrated, meeting our target of investing 3 percent of GDP in R&D could create 3.7 million jobs and increase annual GDP by up to €795 bn by 2025.

- **Getting good ideas to the market** - by enhancing access to finance for innovative companies, creating a single innovation market, promoting openness and capitalising on Europe's creative potential.

- **Removing social and geographic disparities** - by spreading the benefits of innovation across the EU with smart specialisation and higher social benefits (with public sector and social innovation).

- **Pooling forces to achieve breakthroughs** - by launching specific initiatives, called "European Innovation Partnerships", aimed at simultaneously tackling all bottlenecks, on both the supply and demand side, and bringing the benefits of innovation to ordinary Europeans as quickly as possible.

Examples of key policies include:

- **Access to finance** - surveys continuously show that companies consider poor access to finance the biggest barrier to innovation, right next to red tape.

Public investment should help leverage private investment. To date, the €400m contribution from the EU's Competitiveness and Innovation Programme to loan guarantees and Venture capital has leveraged investments of €9bn, benefiting some 70 000 small businesses. This, however, is not enough. Europe invests some €15bn less a year in venture capital than the US. The Innovation Union therefore proposes a cross-border venture capital regime, work with the European Investment Bank to scale up current EU financial schemes and the appointment of a leading figure to strengthen cross-border matching of innovative firms with investors [3].

- **Procurement of innovation** - public bodies spend over €2 trillion on supplies, labour and services every year. Little of this money goes to innovative products and services – a huge wasted opportunity. The reasons are wrong incentives, lack of knowledge and capabilities and fragmentation in demand. We will therefore provide financial support for public authorities across the EU to develop tools like innovative specifications.

- **Design thinking** -although often associated with aesthetics and the 'look' of products, the application of design is much broader. It is increasingly recognised as a key discipline and activity in bringing ideas to market, transforming them into user-friendly, appealing and high quality products. When applied to services, systems and organisations, user-centred design thinking drives business model innovation, organisational innovation and other forms of non-technological innovation. We will therefore launch a European Design Innovation Initiative, an open and flexible platform for working out concrete proposals on how to better integrate design, user aspects and

other non-technological aspects into innovation policy and support.

- **Public sector innovation** - building on the success of the European Innovation Scoreboard, which measures innovation performance in EU countries and provides incentives and evidence for national policy measures, we will pilot a *European Public Sector Innovation Scoreboard*, to share information on the characteristics of public sector innovation and, over time, evidence for effective policy making and benchmarking.

Social innovation - in 2011, the Commission will launch a *European social innovation pilot*, which will provide expertise and a "virtual hub" for social entrepreneurs and the public and non-profit sectors.

II "SMALL BUSINESS ACT"

Through measures provided in the "Small Business Act", the European Commission make Europe more attractive for businesses and encourage people to become entrepreneurs. Europe's economy relies heavily on small businesses and realizing their potential. In the EU, 67% of private sector employees working in nearly 23 million small and medium-sized businesses that create 80% of new jobs

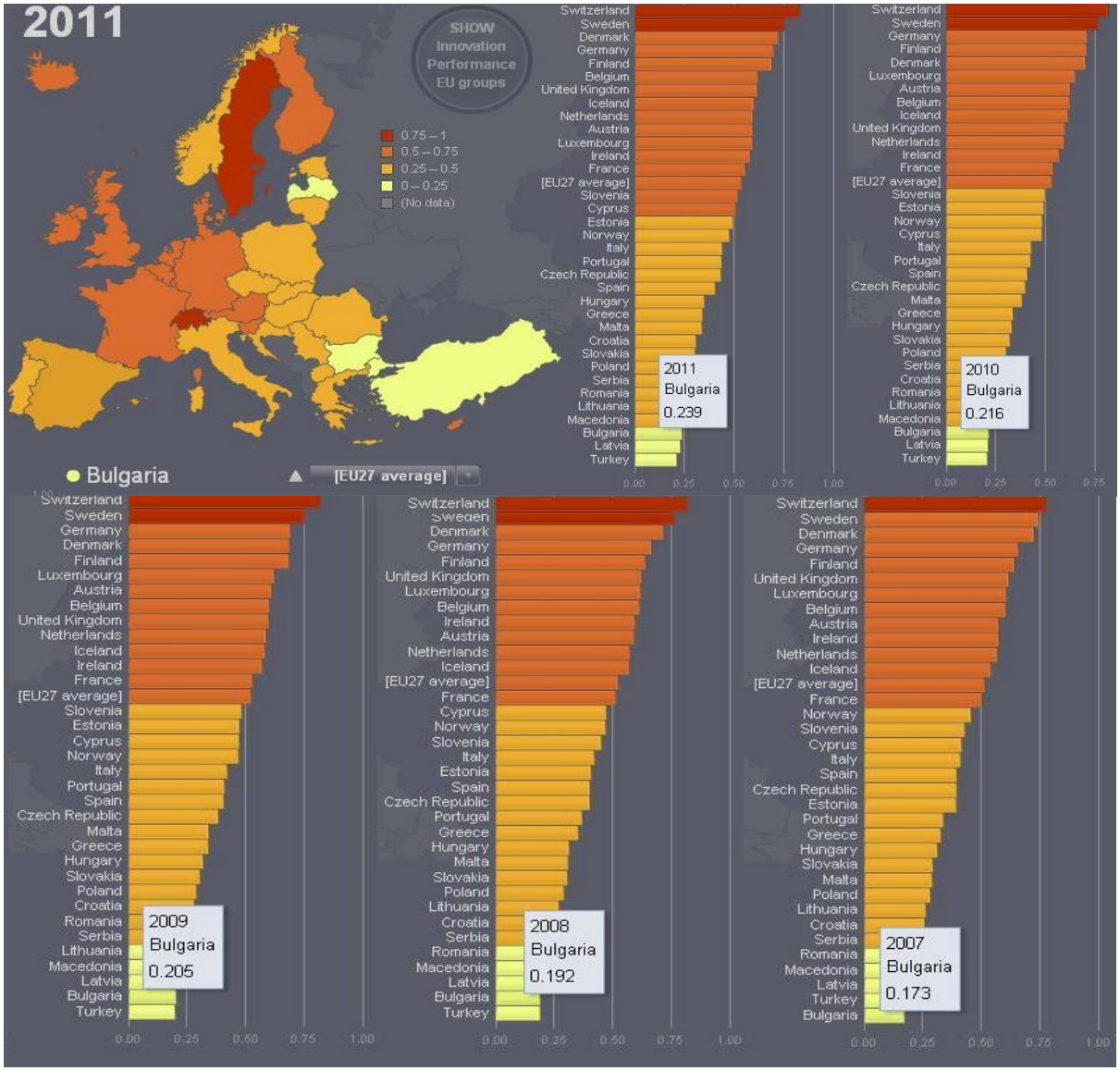
The Act has already:

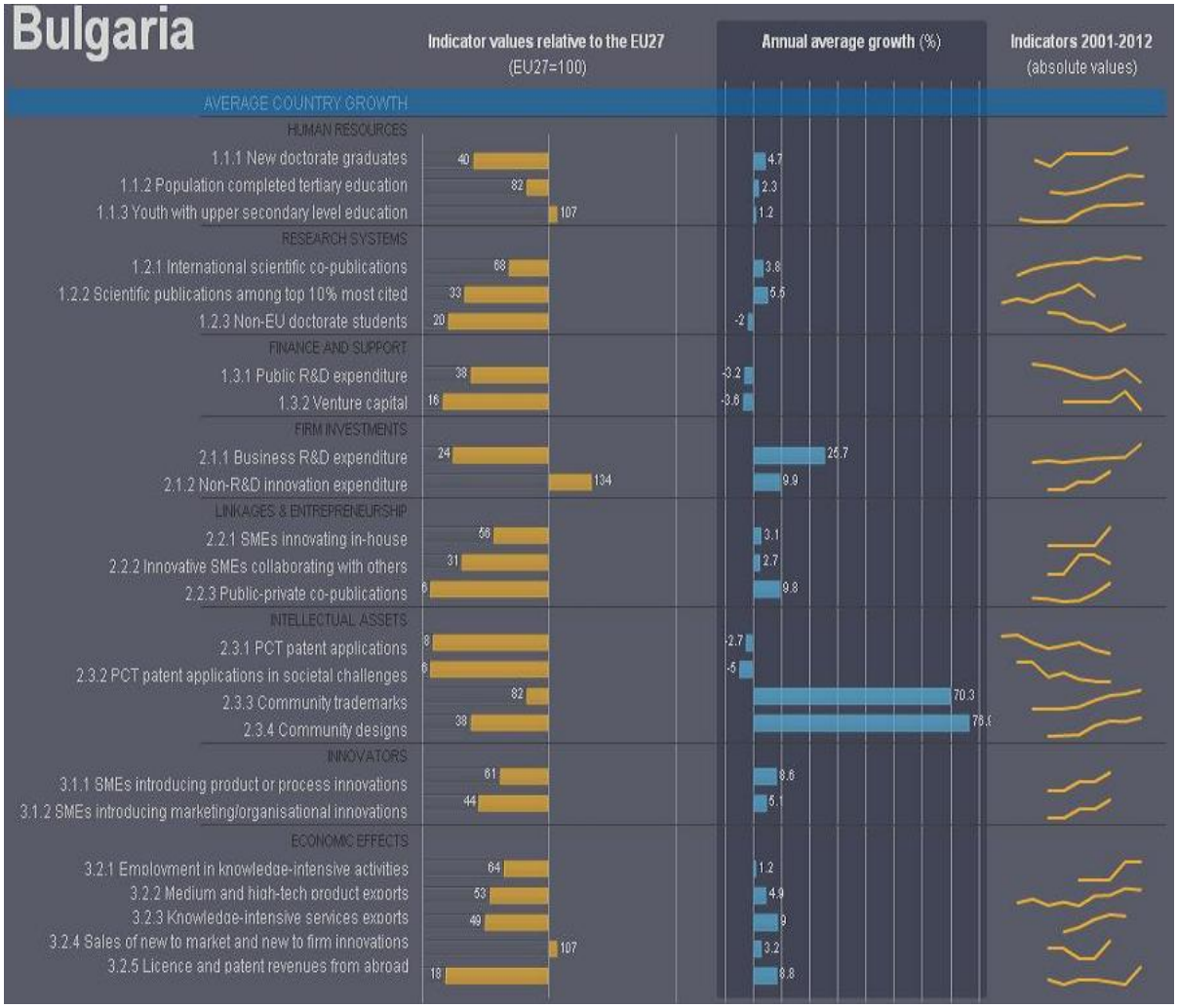
- helped streamline and simplify regulations and
- provided funding to more than 110 000 firms, with 200 000 expected to benefit by 2012.

In addition, national governments have:

- cut the cost and time involved in setting up a company
- eased small businesses' access to credit and
- launched schemes to help firms do business in other countries

After research, data collection and summary, the following charts for Bulgaria:




Bulgaria
Indicator values relative to the EU27
(EU27=100)
Annual average growth (%)
Indicators 2001-2012
(absolute values)
AVERAGE COUNTRY GROWTH
HUMAN RESOURCES
1.1.1 New doctorate graduates
1.1.2 Population completed tertiary education
1.1.3 Youth with upper secondary level education
RESEARCH SYSTEMS
1.2.1 International scientific co-publications
1.2.2 Scientific publications among top 10% most cited
1.2.3 Non-EU doctorate students
FINANCE AND SUPPORT
1.3.1 Public R&D expenditure
1.3.2 Venture capital
FIRM INVESTMENTS
2.1.1 Business R&D expenditure
2.1.2 Non-R&D innovation expenditure
LINKAGES & ENTREPRENEURSHIP
2.2.1 SMEs innovating in-house
2.2.2 Innovative SMEs collaborating with others
2.2.3 Public-private co-publications
INTELLECTUAL ASSETS
2.3.1 PCT patent applications
2.3.2 PCT patent applications in societal challenges
2.3.3 Community trademarks
2.3.4 Community designs
INNOVATORS
3.1.1 SMEs introducing product or process innovations
3.1.2 SMEs introducing marketing/organisational innovations
ECONOMIC EFFECTS
3.2.1 Employment in knowledge-intensive activities
3.2.2 Medium and high-tech product exports
3.2.3 Knowledge-intensive services exports
3.2.4 Sales of new to market and new to firm innovations
3.2.5 Licence and patent revenues from abroad
40
82
107
68
33
20
38
16
24
134
56
31
6
8
6
82
38
61
44
64
53
49
107
18
4.7
2.3
1.2
3.8
5.5
-2
-3.2
-3.6
25.7
9.9
3.1
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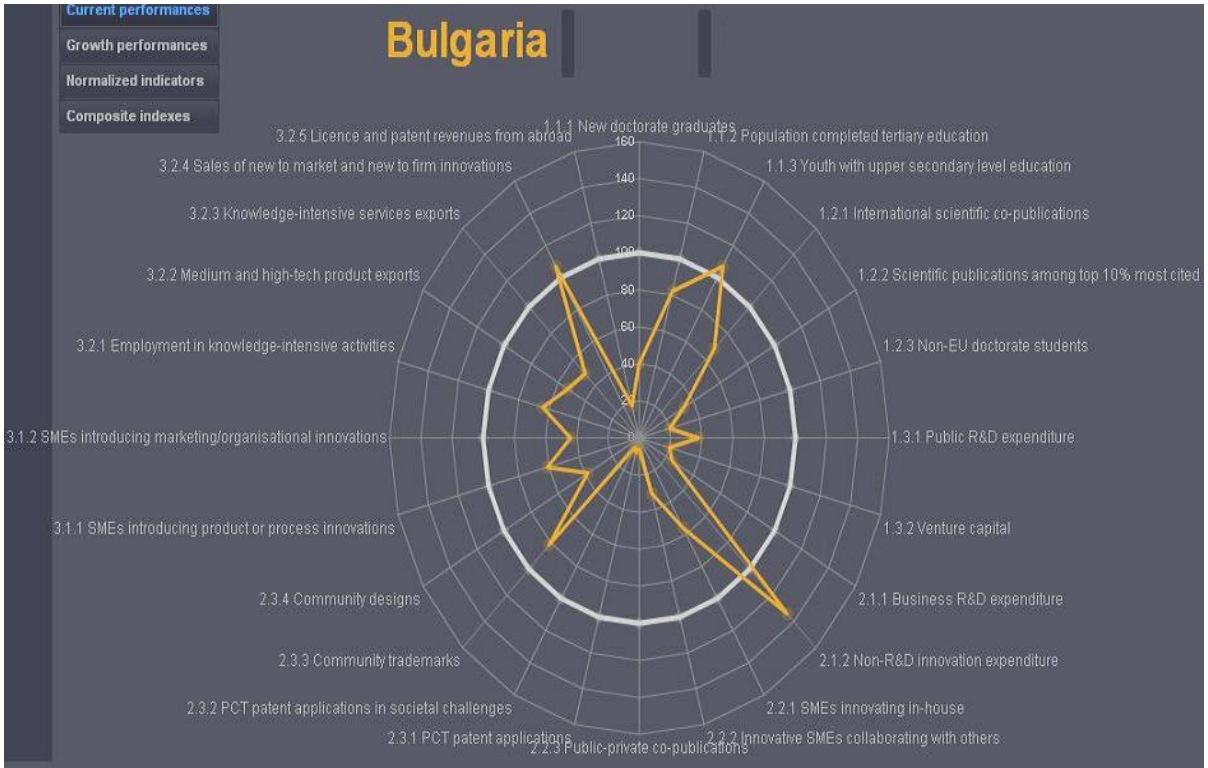
Current performances
Growth performances
Normalized indicators
Composite indexes
Bulgaria
1.1.1 New doctorate graduates
1.1.2 Population completed tertiary education
1.1.3 Youth with upper secondary level education
1.2.1 International scientific co-publications
1.2.2 Scientific publications among top 10% most cited
1.2.3 Non-EU doctorate students
1.3.1 Public R&D expenditure
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3.2.2 Medium and high-tech product exports
3.2.3 Knowledge-intensive services exports
3.2.4 Sales of new to market and new to firm innovations
3.2.5 Licence and patent revenues from abroad
160
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120
100
80
60
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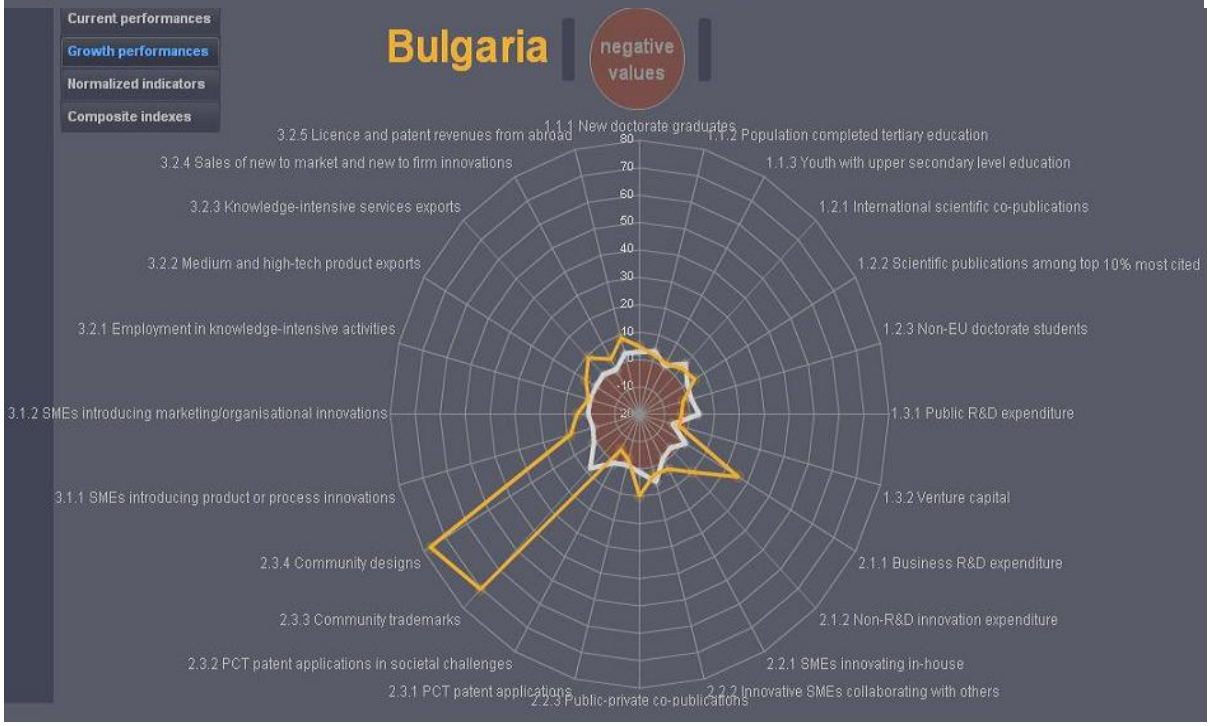
Current performances
Growth performances
Normalized indicators
Composite indexes
Bulgaria
negative values
1.1.1 New doctorate graduates
1.1.2 Population completed tertiary education
1.1.3 Youth with upper secondary level education
1.2.1 International scientific co-publications
1.2.2 Scientific publications among top 10% most cited
1.2.3 Non-EU doctorate students
1.3.1 Public R&D expenditure
1.3.2 Venture capital
2.1.1 Business R&D expenditure
2.1.2 Non-R&D innovation expenditure
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3.2.3 Knowledge-intensive services exports
3.2.4 Sales of new to market and new to firm innovations
3.2.5 Licence and patent revenues from abroad
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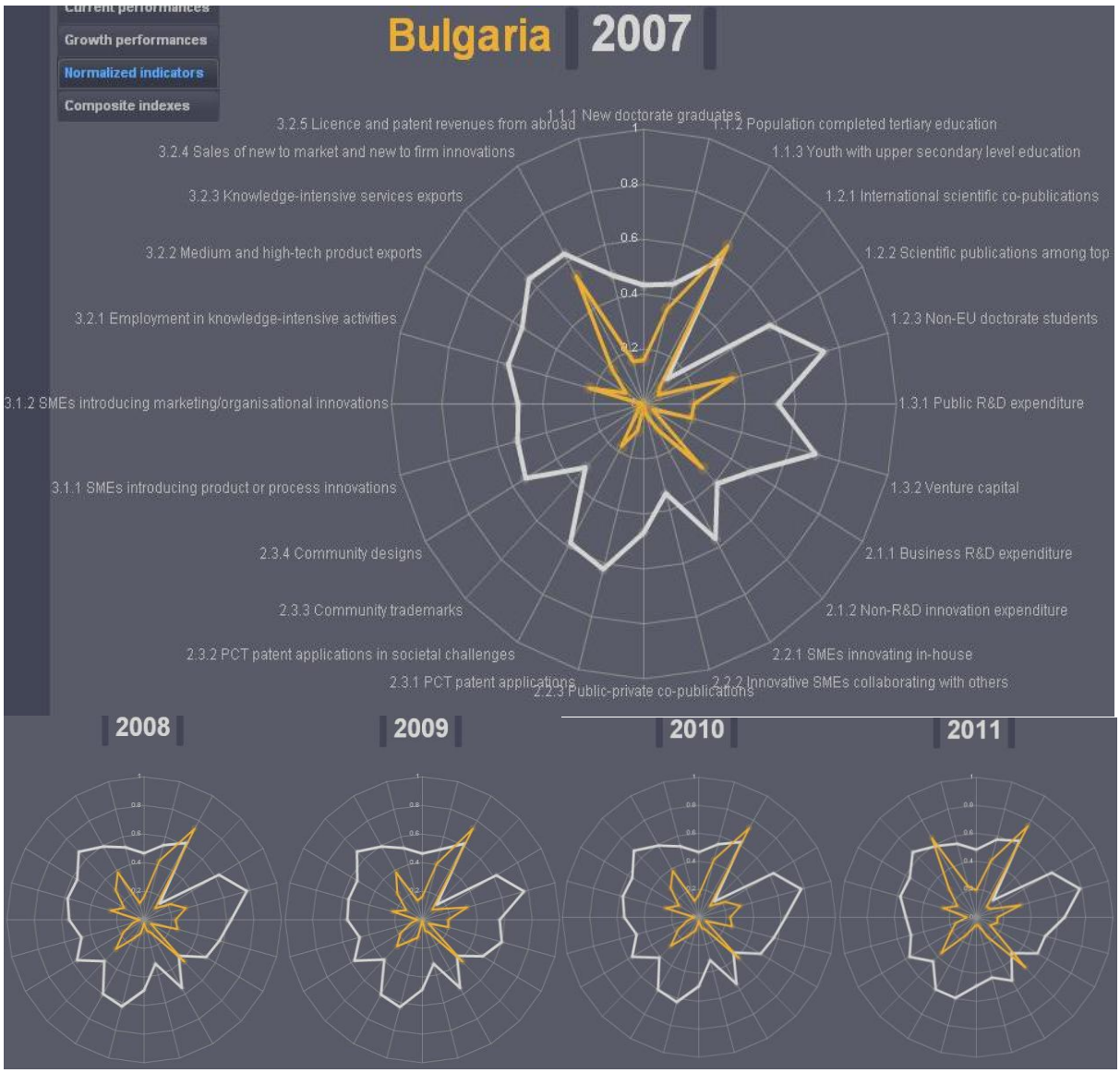
-10
-20


Current performances
Growth performances
Normalized indicators
Composite indexes
Bulgaria
2007
1.1.1 New doctorate graduates
1.1.2 Population completed tertiary education
1.1.3 Youth with upper secondary level education
1.2.1 International scientific co-publications
1.2.2 Scientific publications among top
1.2.3 Non-EU doctorate students
1.3.1 Public R&D expenditure
1.3.2 Venture capital
2.1.1 Business R&D expenditure
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3.2.3 Knowledge-intensive services exports
3.2.4 Sales of new to market and new to firm innovations
3.2.5 Licence and patent revenues from abroad
1
0.8
0.6
0.4
0.2
2008
2009
2010
2011

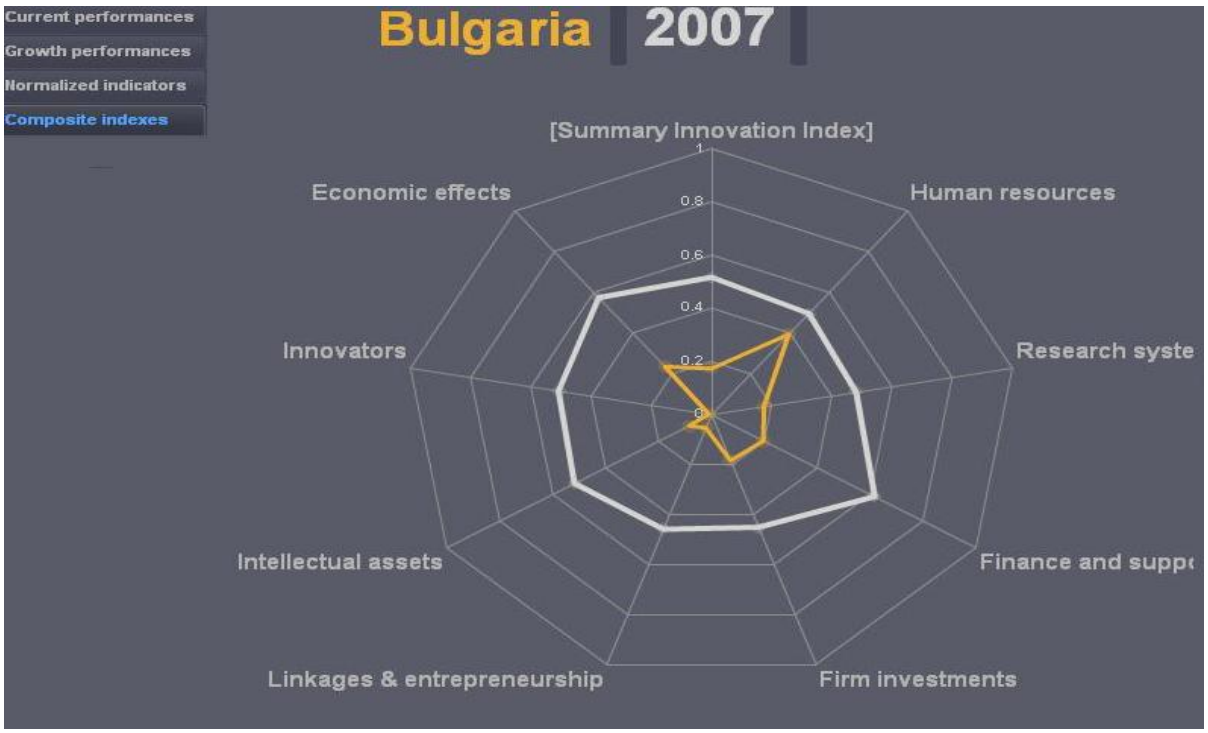

Fig. 1 Innovation potential of Bulgaria as part of the EU [4]

Finally, graphical interpretations shows that over the period the innovative potential of Bulgaria changed as of last place among 34 countries in Europe took three steps up (0.173 to 0.239) Support and financing activities of "lifelong learning", "Human Resources Management" and others. High is the percentage of Bulgarian citizens with higher education.

III Conclusion

If you want to stimulate growth in Europe, it must begin by SMEs. The entrepreneurial potential of Europe and Bulgaria in particular is not fully utilized - 45% of all Europeans would like to work for yourself if you have this option, but today only about 10 percent are self-employed. If we can increase that percentage in their economies will have millions of new innovative and creative enterprises to upgrade the economic foundation of Europe will strengthen, will enable it to create more jobs and make it more stable during the turbulent economic times. Therefore, we should focus all his attention to the promotion of entrepreneurship, which is part of the Strategy for the Development of Bulgaria and Europe - Development of a liberal education as a tool for the management of key competencies in education, innovation and business.

Bulgaria has a strategy for the development of research, developed with the understanding that research, technological development and innovation are the driving force of modern economics in modern societies. Instruments for conducting policy research and innovation aimed at national thematic programs in priority areas and sectoral programs with ministries and agencies [2]. Provides support to research centers in priority areas and specific mechanisms for conducting research to urgent needs arise.

Innovation is the best tool for the recovery of the Bulgarian economy and tackling societal challenges. Getting out of the financial and economic crisis will be based on export-oriented innovative companies. Stable macroeconomic and fiscal position of the country allows to improve environment for innovative export enterprises by introducing sustainable and modern state innovation policy.

The main strategic objective of the country in this area is the development of a competitive industrial base innovative and modern infrastructure for the conversion of the Bulgarian economy into a knowledge economy based on sustainable growth, with opportunities to meet the challenges of a globalizing world.

IV REFERENCES

[1] Petrova D., EFFICIENCY OF INVESTMENTS, 39th IGIP Symposium, Joint International IGIP-SEFI Annual Conference 2010,19th - 22ndSeptember 2010,Trnava, Slovakia,ISBN 978-2-87352-003-8, pp. 543-551.

[2] Petrova, D., H. Deneva, Regional Innovation Policy and Application of Innovative Technologies for Laser Cutting in Companies of Gabrovo and Its Region, „Research and Development in Mechanical Industry“ RaDMI 2012, 14-17 September 2012, Vrnjačka Banja, Serbia, SaTCIP Ltd., Technical-Mechanical School in Trstenik, ISBN 978-86-6075-036-7, Volume I, pp. 266-271.

[3] Petrova D., S. Dimitrova, Europe 2020 – The New Strategy for Smart, Susinable and Inclusive Growth and Bulgarian Industrial Competitiveness, Rezekne 2011, Latvia, Rezekne Higher Education Institution, Faculty of engineering, Latgale Sustainable Development Research Institute, scientific Institute for Regional Studies, Environment. Technology. Resources, Proceeding of the 8th International Scientific and Practical Conference June 20-22, 2011, Volume I, ISSN 1691-5402, pp. 333-339.

[4] www.europe.com

Thermal Insulation Materials From Sapropel And Hemp Shives (*Cannabis Sativa L.)*

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***Abstract*. In Latvia, sapropel is an organic lake sediment that is formed from the remains of aquatic animals and aquatic plants, containing mineral particles (sand, clay, calcium carbonate and other compounds). Hemp is a rapidly growing multi – functional energy plant. Hemp seeds and fibre have a very high value on the world market , but in the world when processing hemp, shives of hemp remain as waste. The solution is found in the resources available in Latvia to use them for increasing energy efficiency as a thermal insulation material. The aim of the research is to find out the properties of the thermal conductivity for lightweight concrete from sapropel and hemp shives to be used as a thermal insulation material. An application with the number P-12-200 is submitted to the LR Board of Patents on 20.12.2012. for granting of a patent to the "Hemp shives and sapropel for thermal insulation of buildings".**

***Keywords* : natural raw materials, hemp shives, sapropel, thermal conductivity, FOX600.**

I INTRODUCTION

Increasing of energy consumption in all economics sectors , as well as stocks decrease of fossil fuels, environmental pollution and climate changes - global warming, interest in the use of renewable energy resources in power generation and the use of new ecological building materials in construction and insulate old buildings.

The consumption of primary energy resources continuously increases all over the world. Now natural gas or oil is primary energy resources in Latvia and in many other countries and a sharp reduction of non-renewable mineral resources.

Using just a natural, renewable and efficient materials reduce the energy consumption of building heating and non-recyclable debris does not.

The EU, using various tools, actively tries to solve this problem. One of strategic activity direction is to increase the energy efficiency and determination of the standards for existing and planned buildings.

The results of projects implemented in European countries and Latvia show that integrated insulation of buildings can reduce the consumption of heating energy by 40-60% in comparison with initial consumption.

Living in Latvians climate conditions, you have to take into consideration high energy consumption for heating the buildings. Heating season lasts for 7 months a year in average.

The best effect of energy consumption reduction can be achieved by integrated solutions that include improvement of all weak phases of construction, thus increasing the energy efficiency of buildings.

In order achieve the maximal effect it is important to use new ecological building materials. It is important to balance the indicators of the energy efficiency of building material and consumed energy during production process of this building material. For the solution of this problem the use of local raw materials is topical in the production of building materials.

Therefore, the development and testing of new, innovative and natural building material - sapropel and hemp shives lightweight concrete.

Using sapropel construction are handled in Latvian overgrown lake treatment. Other hand, cannabis grow, absorb CO_2 and give off O_2, thereby directly tied hemp CO_2 does not escape into the atmosphere**.** When growing hemp does not require pesticides in plant disease-and pest-natural, which would increase the production costs. Therefore, combining these two Latvian available raw materials, will be able to solve the problem of Latvian energy issue.

II MATERIALS AND METHODS

Materials

For the scientific research , natural raw materials were obtained from a variety of local businesses. Sapropel was obtained from Ubogova Lake in the parish of Mākoņkalns, while hemp shives - from the Preiļi flax pre-processing shop. The lightweight concrete samples from sapropel and hemp shives for the determination of the thermal insulation were manufactured and tested during the period from October 2012 to April 2013 in the chemistry laboratory of the Faculty of Engineering of the Higher School of Rezekne and the testing laboratory of building materials of the Riga Technical University.

In the chemistry laboratory of the Faculty of Engineering of the Higher School of Rezekne, the samples were prepared for the experiment, which was carried out in the testing laboratory of building materials of the Riga Technical University with the thermal flow meter Fox 600. In total, six measurements were made, in which six compound mixes were checked.

Six different samples of ingredients in the form of plates were made in the laboratory: 350 x 350 x 50, one ingredient of which was sapropel (5,66% of sapropel, 94,34% of water) and the other constant ingredient was hemp shives. The water was used for mixing the ingredients. The mixture ratio (by weight) was as follows:

a) 2:1;
b) 2.5:1;
c) 3:1;
d) 3.5:1;
e) 4:1;
f) 5:1.

The mixture of raw materials was laid by layers in pre-made moulds, each layer firmly pressing (by hands). When the moulds were filled in, the mixture from the top was pressed so as the mass would remain dense. In the following way, each sample was processed.

The samples were initially hardened in the conditions of the chemistry laboratory of the Faculty of Engineering of the Higher School of Rezekne at + 20 ± 2 ^{0} C for the duration of 3-5 days, depending on the quantity of the binder substance, then the samples were removed from the mould. After removal from the moulds, the samples were continued to dry and harden in the laboratory conditions for 3-4 weeks to a complete drying (ref. Figure 1).

Figure 1. The drying process of the lightweight concrete of the new building material from sapropel and hemp shives

Methods

In the testing laboratory of building materials of the Riga Technical University, for the determination of the coefficient of thermal conductivity in the samples there was used Laser Comp FOX600 series instrument.

The general principle of the FOX heat flow meter instruments is based on onedimensional Fourier-Biot law:

$$q = -\lambda \left(\frac{dT}{dx}\right),$$

where

q is heat flux (W/m2) flowing through the sample,

λ is its thermal conductivity (W m-1 K-1),

dT/dx is temperature gradient (K m-1) on the isothermal flat surface.

If a flat sample is placed between two flat isothermal plates maintained at two different temperatures, and a uniform one-dimensional temperature field has been stabilized, the temperature field in the sample should be uniform within all the sample's volume (size of the plates is supposed to be much larger than thickness of the sample). The temperature gradient can be determined by measurements of the difference between temperatures of the hot and cold plates (ΔT = Thot –Tcold) and thickness of the sample Δx, because in this case average temperature gradient dT/dx is equal to -ΔT/Δx.

Before starting tests (i.e. measurements of thermal conductivity) of a sample with unknown thermal conductivity, the heat flow meter instrument must be calibrated using some certified sample (standard) having reliable known values of thermal conductivity λcal (T).

Electric signal from the transducer Q (μV) is proportional to the heat flux q:

$$q = \frac{\lambda(T_{cal})\Delta T_{cal}}{\Delta x_{cal}} = S_{cal}(T_{cal})Q$$

Because physical properties of the transducer change with temperature, temperature calibration of the instrument using the calibration standard is always necessary to get the temperature dependent calibration factor Scal (T). Dimension of the calibration factor is W m-2 μV-1 or W m-2 mV-1. A reciprocal value (sensitivity of the heat flow meter) is used in some laboratories. Each of the two transducers has its own temperature, so the calibration factors should be referred to the transducers' actual temperatures. Two separate sets of the calibration factors are measured during the calibration run.

The calibration factors Scal (T) are the instrument's characteristics. They are used

for thermal conductivity calculation during the test run:

$$\lambda_{test} = S_{cal}(T_{test})Q\Delta x_{test}/\Delta x_{test}$$

Similarly, because each plate has its own temperature the calibration factors should be calculated for plate's actual temperature. Average of

two thermal conductivity values is a final result of thermal conductivity test.

Typical value of thermal diffusivity a=λ/(Cpρ) of thermal insulation materials is about (4-7) 10-7 m2s-1 (Cpρ) is volumetric specific heat, Cp is specific heat at constant pressure, ρ is density). Fourier number (dimensionless thermal similarity parameter used in studying heat flow problems) Fo = at/(Δx/2)2 is about 9-16 per hour for 1" (25.4 mm) thick sample. So, it takes a fairly long time (not less than 0.5 hour for 1"-thick sample) to reach full temperature equilibrium to have Fo>>1. And 4"-thick sample needs about 16 times more time (about 8 hours) to reach the same temperature equilibrium. Experimental check showed that average value of two heat flow meters signals reaches equilibrium several times faster than their individual values. So, practically the duration of tests is shorter, because thermal conductivity value is calculated using the average value of the signal.

III Results and Discussion

The experiment resulted in a new composite material – a lightweight concrete from gyttja -clay and hemp shives. In order to ensure the operability of this material as a material of thermal insulation, its density and the conductivity λ were determined. The density of the material is in the range of 165,25 to 146,01 kg/m^3 (the average density ρ = 152,75 kg/m^3) (ref. Figure 2). The density ρ (kg/m^3) for the samples was determined according to the formula:

$$\rho = \frac{m}{V},$$

where m - is the mass of the sample and V – the volume of the sample.

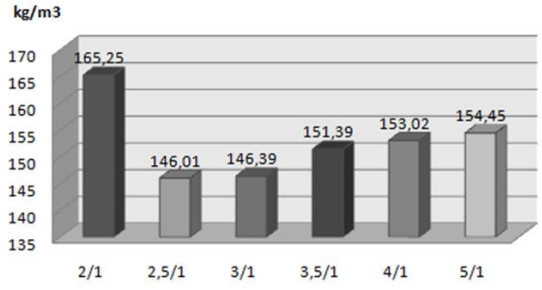

Figure 2. The sample density ρ depending on the composition ratio

Thermal conductivity was determined by the thermal flow meter Fox 600 (ref. Figure 3). The sample was placed in a device for several hours, after completion of the measurement the device showed the thermal conduction coefficient λ (w/mK). Coefficient λ of the thermal conductivity of the material, by changing proportions of sapropel in the samples, did not change.

Figure 3. LaserComp FOX600 in the testing laboratory of building materials of the Riga Technical University.

Practically, the coefficient λ of the thermal conductivity can be considered a constant value, as the average thermal conductivity λ is 0.05516 ± 0.005 w/mK. (Ref. Figure 4).

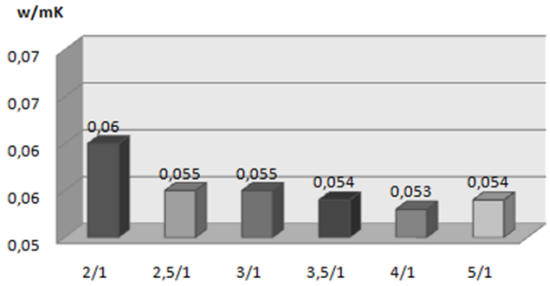

Figure 4. The sample thermal conductivity λ depending on the composition ratio

The findings were summarized in the summary table

TABLE 1

DENSITY/ /THERMAL CONDUCTIVITY RATIO TABLE

		Samples 350 x 350 x 50 mm	
Composition number	Ratio hemp/ sapropel	Density kg/m^3	Thermal conductivity λ (w/mK)
1	2 : 1	165,25	0.060
2	2,5 : 1	146,01	0.055
3	3 : 1	146,39	0.055
4	3,5 : 1	151,39	0.054
5	4 : 1	153,02	0.053
6	5 : 1	154,45	0.054

IV Conclusions

According to the results obtained (Figure 2), a certain correlation can be evidenced that the density of the new composite material is increased by increasing the quantity of sapropel in the sample. The first sample does not fit in this line and it could be explained by the fact that the sample was more pressed. It also slightly affected the thermal conductivity λ of the sample (Table 1). In other samples ranging from different compositions of sapropel and hemp , conductivity λ remains almost unchanged (Table 1), so in the resulting composite material, thesapropel quantity affects the thermal properties in the least.

Conductivity of natural thermal insulation materials is not much inferior to the artificial ones, but the energy consumption of 1 m^3 for production of the material is much lower (Figure 5).

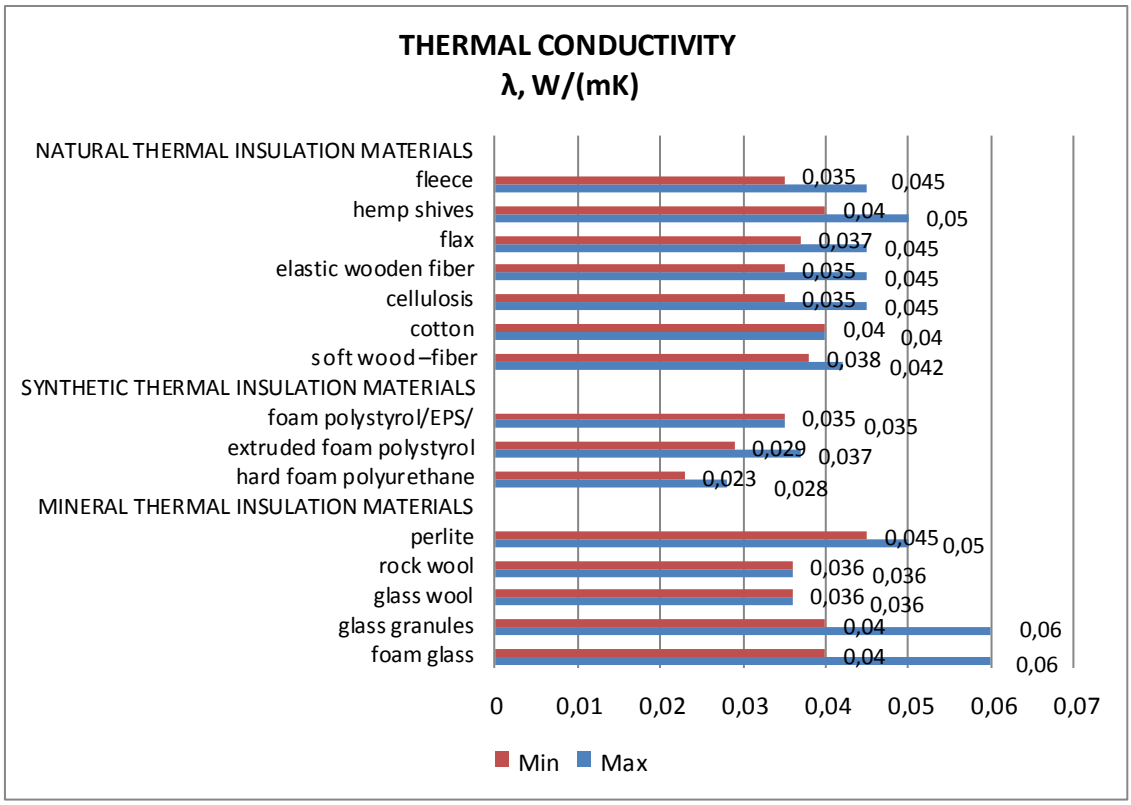

Figure 5. Thermal conductivity of different insulation materials

If you compare the natural thermal insulation material with synthetic or mineral materials for thermal insulation, hemp shives have very good thermal conduction properties (ref. Figure 5), but using the same ones, they also have negative aspects:

1) Not hold together in the prescribed form;
2) Dusty;
3) Not convenient to transport;
4) When insulating a building, you have to create a rigid body structure;
5) Permanent moulds must be used.

While using these two in Latvia available natural materials, these issues do not arise.

The buildings, constructed from hemp shives and sapropel lightweight concrete, have much less environmental impact than the conventional ones: less energy consumption of the raw material extraction, virtually no construction waste and the thermal insulation properties correspond to the modern requirements.

Working with such material does not pose a risk to the environment and human health.

It is essential that the natural thermal insulation materials, after rebuilding of the building or dismantling, get into nature, decompose and cause no pollution. In contrast, the chemical insulation foam or other artificial materials, naturally decomposing, are causing serious chemical pollution.

V References

[1] Borodiņecs A., Krēsliņš A. RTU recommendations Construction Standard LBN 002-01 for use in the design and construction of buildings, Riga, 2007th

[2] Appene I.; Hemp insulation or kanaizols http://www.em.gov.lv/images/modules/items/

[3] FOX600 and FOX800 Series Instruments Manual THEORY OF THE METHOD

[4] Insulation materials; http://www.ergliarods.lv/sites/default/files/Videi_draudzigi_izolacijas_materiali.pdf

[5] Nierobis L. Thermal insulation; http://www.waermedaemmstoffe.com/

[6] Allin, S. (2005). Building with Hemp, Seed Press, Rusheens, Kenmare, Co. Kerry, Ireland.

[7] Lācis A. Sapropel Latvian, State Geological Survey
[8] Dementev V. A.Removal of organic sediments from reservoirs and lakes and their processing https://springerlink3.metapress.com/content/358g641362323733/resource-secured/?target=fulltext.pdf&sid=hsk0h341jho04vvresamjwsl&sh=www.springerlink.com
[9] Elfordy S., Lucas F., Tancret F., Scudeller Y., Goudet L. (2008). Mechanical and thermal properties of lime and hemp concrete (‘‘hempcrete’’) manufactured by a projection process. Construction and Building Materials.
[10] Lukss J.; Insulation effects and problematic; magazine "Manager" http://www.em.gov.lv/images/modules/items/parvaldnieks_buvniec_kvalit_diskus_parvald.pdf (15.01.2013.)
[11] Liepa L., Grūbe G.; Without insulation will not do anymore; magazine professionals 'My house' http://mmp.multiprese.lv/index.php?n=588&a=4766

Estimation of River Utroya Ecological State in Intensive Organic Pollution Area Using Plankton Communities' Characteristics (Pskov Region)

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Abstract. **The changes in characteristics of phytoplankton and zooplankton communities in the river Utroya stretch with the active organic pollution were discussed. The paper shows the effects of pollution on the structural indicators of the communities (species composition, abundance, and biomass). Saprobical analysis was held. Assessment of ecological state of the river stretch was made.**

Keywords **– community structure, organic pollution, phytoplankton communities, saprobity, zooplankton communities.**

I Introduction

River Utroya (Ritupe) is a tributary of the river Velikaya that falls to the Pskovskoye-Chudskoye Lake. As the majority of small rivers in Pskov region, it is a typical plain river with low banks and sharply meandering channel. River has mixed feeding with prevalence of snow-fed. According to chemical composition water in riv. Utroya can be characterized as subsaline and slightly hard, according to ions composition water belongs to hydrocarbonate class [6].

As other small rivers of Pskov region, riv. Utroya is used not only for water intake but also for discharge of wastewater. Such kind of pollution is called active [2]. The main reason of riv. Utroya pollution on the territory of Pskov region is wastewater of rare settlements. Anthropogenic impact influences on biodiversity of water communities, decreases resistance of water ecosystems and self-purification capacity [7].

II Materials and methods

In 2012 ecological state of riv. Utroya in intensive pollution area was estimated using bioindication method. Phytoplankton and zooplankton communities were used as bioindicators. Samples were collected at 3 stations situated in 100 m from each other: station №2 – area of waste and natural waters mixing, station №1 – upper stream area (nominally reference conditions), station №3 – downstream area. Sampling and evaluation of materials were made by standard methods [4].

III Results and discussion

In phytoplankton of riv. Utroya researched area 44 algae taxons from 6 divisions have been found: *Cyanoprokaryota* – 6 (13.6%), *Euglenophyta* – 4 (9.1%), *Chrysophyta* – 1 (2.3%), *Bacillariophyta* – 21 (47.8%), *Dinophyta* – 2 (4.5%), *Chlorophyta* – 10 (22.7%). *Bacillariophyta* dominates in species amount that is typical for river plankton [5]. The most diverse in this group are genera *Navicula* and *Nitzschia*.

Green algae, mostly nitrophilous *Protococcophyceae* (*Scenedesmus, Pediastrum*), were especially abundant at station №3 in May.

Blue-green algae represented mainly by filamentous forms (*Phormidium, Lyngbia*) were abundant at station closed to source of organic pollution (station №2) in summer. Its biomass reached 59.2% from total phytoplankton biomass.

Quantitative phytoplankton characteristics (species amount, abundance and biomass) varied at different stations and seasons (Table 1).

The maximum species amount was found at station with reference conditions, minimum – at station №2.

According to biomass values water at reference station corresponds to oligotrophic zone, but trophicity level increases after discharge of waste water (station №2 and №3). The highest abundance and biomass values are registered at stations 1 and 3 in spring, at station 2 – in summer. Biomass decreases at all stations in September.

In phytoplankton 23 species are saprobionts (indicators of organic pollution of the water). Among them indicators of clear waters (o-saprobionts) count 1 species, indicators of mixed conditions (o-β, β-o-saprobionts) – 5 species. β-saprobionts (77.3%), which prefer moderately polluted waters, dominate. Indicators of high water pollution (α-β, α) presence at all stations. Their total amount counts 9.2%.

TABLE I

STRUCTURAL CHARACTERISTICS OF RIV. UTROYA PHYTOPLANKTON AT DIFFERENT STATIONS AND SEASONS 2012

Characteristics	Station 1	Station 2	Station 3
Spring			
Species amount	15	8	20
Total abundance, thousand cells/l	620	300	1080
Total biomass, g/m³	0.65	0.34	1.79
Summer			
Species amount	14	12	10
Total abundance, thousand cells/l	500	520	440
Total biomass, g/m³	0.56	0.98	0.54
Autumn			
Species amount	6	7	4
Total abundance, thousand cells/l	90	130	250
Total biomass, g/m³	0.14	0.17	0.10

Saprobity indexes slightly changed on stations in different seasons and varied from 1.95 till 2.26, that corresponds to β-mesosaprobic zone, III water quality class [8].

In zooplankton of riv. Utroya waste water discharge area following 20 species were found: rotifers (*Rotatoria*) represented by 2 species, copepods (*Copepoda*) – 5, cladoceran (*Cladocera*) – 13 species. During vegetation period zooplankton quantity varied in range 0.40 – 5.20 thousand organizms/m^3 and 0.004 – 0.072 g/m^3 (Table 2). Maximum abundance and biomass at all researched stations registered in autumn, moreover in zooplankton community filterers (*Bosmina coregoni*, *Ceriodaphnia qudrangula*, *Chydorus sphaericus*) dominated.

Shannon-Weaver index calculated according to zooplankton biomass varied from 1.5 till 2.8 bits/g. Low biodiversity was observed in spring during river flood.

Among zooplankton saprobionts β-o and β-saprobionts (indicators of slightly and moderately polluted waters) dominate (65% from all species amount). Saprobity indexes for zooplankton ranged from 1.51 till 1.98 and corresponded to moderately organic polluted waters (β-mesosaprobic zone). Maximum saprobity indexes were registered at station 3.

TABLE 2

ZOOPLANKTON ABUNDANCE (N; THOUSAND ORGANIZMS/M3) AND BIOMASS (B; G/M3) IN DIFFERENT SEASONS

Stations	**Spring**		**Summer**		**Autumn**	
	N	**B**	**N**	**B**	**N**	**B**
1	0.50	0.004	1.26	0.025	2.28	0.057
2	0.40	0.014	1.30	0.022	4.65	0.072
3	0.44	0.015	0.68	0.020	5.20	0.060

IV Conclusions

It should be noted that structural characteristics of plankton communities and saprobity indexes at reference station weren't much different from the same characteristics at stations influenced by active pollution. It allows to assume the existence of organic pollution sources situated upper stream from researched area. This hypothesis is confirmed by some hydrochemical water characteristics, using for estimation of water objects ecological state (Table 3)

TABLE 3

SOME HYDROCHEMICAL CHARACTERISTICS OF THE RIVER UTROYA (GOSNIORKH DATA FUND, 2012)

Characteristics	**Station №1**		**Station № 3**	
	May	**July**	**May**	**July**
Suspended matter, mg/l	6.3	2.9	3.9	2.5
Water colour, Pt-Co°, grad.	78	80	40	40
pH	7.92	7.92	8.05	8.04
Permanganate oxygen consumed, mg O/l	22.7	8.0	21.2	7.2
Biochemical oxygen demand – 5 day test , mg/l	1.47	2.27	1.44	0.99

According to concept of ecological modifications [1] plankton communities' characteristics define the state of river Utroya researched area as the anthropogenic ecological stress with elements of ecological regress.

V REFERENCES

[1] Abakumov V.A. Trends of the aqueous biocenoses' changes under environment pollution conditions. Problems of ecological monitoring and modeling of ecosystems. Leningrad, 1979. Vol. 2, pp. 37-48. [In Russian]

[2] Andrushajtis G.P., Melberga A.G., Rodionov V.I., Cimdin P.A. Implementation of rapid methods in surface water monitoring. Problems of baseline monitoring of environment conditions. Leningrad, 1984. Vol. 2, pp. 103-106. [In Russian]

[3] Barinova S.S., Medvedeva L.A., Anisimova O.V. Biodiversity of algae-indicators of environment. Tel-Aviv, 2006, 498 pp. [In Russian]

[4] Guidelines in methods of hydrobiological analysis of surface waters and bottom sediments / V.A. Abakumov et all. St. Petersburg, 1992, 220 pp. [In Russian]

[5] Okhapkin A.G. The history and main problems of river phytopancton researches. Botanical journal. 2000. Vol. 85. №10. pp. 1-10. [In Russian]

[6] Pskov region nature. Pskov, 1974, 172 pp. [In Russian]

[7] Trifonova I.S. Bioindication in limnological monitoring. Bioindication in fresh water ecosystems monitoring. St. Petersburg, 2007, pp. 23-28. [In Russian]

[8] Vykhristyuk L.A., Zinchenko T.D., Shitikov V.K. Integral assessment of plain rivers ecological state under anthropogenic impact. Scientific aspects of Russian ecological problems. St. Petersburg, 2001, 70 pp. [In Russian]

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