(Cabinet order No 685
28 December 2013)

Guidelines for Science, Technology Development, and Innovation 2014-2020

(Informative part)

Riga, 2013

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ABBREVIATIONS AND TERMS

BSR	Baltic Sea Region
CSB	Central Statistical Bureau
EPO	European Patent Office
ERDF	European Regional Development Fund
EU	European Union
EC	European Commission
ESF	European Social Fund
ESFRI	European Strategy Forum on Research Infrastructures
EU-27	The average among the 27 Member States of the European Union
ERIC	European Research Infrastructure Consortium
EUREKA	European Research Coordination Agency
IIT	Individual Income Tax
INTERREG	Community Initiative Program
GDP	Gross Domestic Product
ICT	Information and Communication Technologies
IT	Information Technology
IP	EU Framework Programme
IRC	Innovation Relay Centre
MES	Ministry of Education and Science
MC	Ministry of Culture
CIS	Cultural Information System
CIP	Competitiveness and Innovation Framework Programme
Latvia 2030	Sustainable Development Strategy of Latvia by 2030
LDDK	Employers' Confederation of Latvia
LIAA	Investment and Development Agency of Latvia
SCIL	Strategic Council of Innovations in Latvia
NLL	National Library of Latvia
LCCI	Latvian Chamber of Commerce and Industry
LAS	Latvian Academy of Science
LZP	Latvian Council of Science
CoM	Cabinet of Ministers
SMES	Small and Medium-sized Enterprises
NDP 2020	Latvian National Development Plan 2014-2020
NIS	National Innovation System
NCP	National Contact Point within the EU Framework Programme
NGO	Non-Governmental Organisations
OECD	Organisation for Economic Co-operation and Development
CSCC	Cross-Sectoral Coordination Centre

FTE	Full Time Equivalent
RIS	Regional Innovation Strategy
RC	Rectors' Council
CIT	Corporate Income Tax
NRC	National Research Centre
SC	State Chancellery
STDI	Development of Science, Technology and Innovation

INTRODUCTION

The implementation of the guidelines for the development of science and technology for 2009-2013, as well as the programme for promotion of commercial competitiveness and innovation for 2007-2013, end in 2013. For the development of medium term policy for science, technology and innovation (hereinafter referred to as STDI) for the period until 2020, as well as for implementation of further mentioned development planning documents, it is necessary to adopt a new policy planning document in the field of STDI: Guidelines for Science, Technology Development and Innovations for the years 2014-2020 (hereinafter referred to as the Guidelines).

Guidelines are developed based on the Latvian smart specialisation strategy (SSS) and taking into consideration delegation of third and fourth part of paragraph 13 of the Law on Scientific Activity, which instructs the MES to develop policy of science and technology and the ME to develop policy of innovation, as well as respecting the Government's action plan Declaration on tasks defined for implementation, proposed by the Cabinet of Ministers led by Valdis Dombrovskis in the field of science, technology and innovation.

With an Order of MES No 505 "On Establishment of Woking Group for Development of Draft Guidelines for Research an Innovation for 2014 - 2020" from 28 December, 2012, an inter-institutional working group has been created, including representatives from sectoral ministries, scientific institutions and science and economic growth-related NGOs.
Representatives of the Latvian Science Council, the Latvian Science Academy, the Latvian National point of contact, the society "Baltic Institute of Research,Technology and Innovation" (BIRTI), the Latvian Association of Large cities, the Latvian Association of Young Scientists, the Latvian Council of Rectors, the Higher Education Council, the Employers' Confederation of Latvia, the Latvian Chamber of Commerce and industry, the Latvian information and communication technology association, "Tilde" LLC, "Grindeks" JSC, theAssociation of the National Scientific Institute and scientific institutions have taken part in preparation of the Guidelines.

Taking into consideration the procedure for public participation in the process of development planning, established in the regulations of the Cabinet of Ministers No 970 from August 25, 2009 on "Procedures for public participation in the development planning process", MES has organised 10 meetings and consultations with the sectoral ministries, scientific institutions and non-governmental organisations and participated in the discussions organised by the social partners for deliberation of the Guidelines.

1. Linkage with the policy planning documents, conducted studies for *ex-post* evaluation and organised public consultations.

The main National long-term development planning document is "Sustainable Development Strategy of Latvia by 2030" adopted by Saeima on June 10, 2010. STDI policy objectives are related with the use of cultural, natural, economy and social capital established by the sustainable development strategy and relate directly to the 2nd and 3rd. Implementation of priorities "Innovative and efficient economy" and "Paradigm shift in education". STDI Guidelines are developed in accordance with the long term objectives of sustainable development strategy and priority lines of action.

STDI Guidelines are developed in accordance with medium-term national level planning document of hierarchically higher level: the National Development Plan for 2014-2020 (hereinafter referred to as the NDP2020). According to the vision of NDP2020, by 2020 Latvian Science will be concentrated in scientific institutes, which are competitive in the level of world's developed countries. An essential part of these studies shall be co-financed by private companies, universities and the private sector will work jointly on creation of new, globally competitive products. Collaborative work of science and business will continue to create new innovative and creative products and services, competitive in a global market. Areas covered in the Guidelines (STDI) shall be viewed in accordance with the NDP priority "Growth of National Economy", which provides that the growth of competitiveness of Latvian products and services and increase in export volumes, requires close commercial cooperation with the science, promoting the private sector's interest to invest in research and innovation. "NDP 2020 puts forward the following sectoral STDI objectives: (1) 1.5% of gross domestic product investments in research and development by the year 2020, purposefully focusing on enhancement of attraction of human resources, the development of innovative ideas, improvement of research infrastructure, collaboration of higher education, science and private sector, as well as the transfer of research and innovation in business; (2) by commercialisation of knowledge, promote creation and introduction in production of innovative, internationally competitive products with high added value, thus enhancing the output proportion of these products in the national economy.

Objectives and performance indicators of Latvia included in NDP 2020 are established in accordance with objectives of "Latvian National Reform Programme for implementation of "EU 2020" strategy" (hereinafter referred to as NRP), approved by the Cabinet of Ministers on November 16, 2010. NRP include a medium-term macroeconomic development scenario, the main macro-structural challenges (obstacles) and directions reforms in Latvian economy, as well as the quantitative targets of Latvia by 2020 for smart, sustainable and integrating strategy in the context of "Europe 2020" and the main policy directions for their achievement. In accordance with the main objective set in Europe 2020 to invest 3% of the EU GDP in research and development (hereinafter referred to as the R&D), with the programme Latvia has adopted a quantitative objective to increase the funding invested in R&D 1.5% of Gross Domestic Product (GDP) of Latvia by 2020.

In October 6, 2011 the European Commission published the proposals for regulations of the single strategic framework funds of the European Union (hereinafter - the EU) for the planning period of 2014–2020, where principles for establishment of funding available for EU Member States and the possible areas of support are set out, as well as issues of the EU Cohesion fund (hereinafter - the EU funds) policy management and implementation for years 2014-2020. A proposal for a regulation that establishes common rules for issues related with the development of the European Regional Development Fund, the European Social Fund, the

Cohesion Fund, the European Agricultural Fund for Rural Development and implementation of the European Fund for Maritime Affairs and Fisheries Management (hereinafter - the Proposal of general regulation) provides that the EU funds shall contribute to the economic, social and territorial cohesion in the EU, as well as support activities that insure implementation of "Europe 2020: A strategy for smart, sustainable and inclusive growth" adopted on June 17, 2010.

In appendix IV of "Ex-ante Conditionalities" of the proposal for general regulation, appropriate thematic and general ex-ante conditions are defined for each thematic objective and investment priority of the EU funds, as well as a concise and comprehensive set of objective criteria for their evaluation is provided. Ex-ante condition 1.1 "Research and innovation: The existence of a national or regional research and innovation strategic policy framework for smart specialisation, where appropriate, in line with the National Reform Programme, to leverage private research and innovation expenditure." (hereinafter referred to as the ex-ante condition 1.1).

In order to ensure execution of ex-ante conditionalities, in the meeting of the Cabinet of Ministers on November 20, 2012, an informative report, developed by the Ministry of Finance "On preparation of evaluation on fulfilment of the applicable ex ante conditionalities within the framework of unified strategic framework funds for the planning period 2014 - 2020" (protocol 65, § 29), which establishes institutions responsible and co-responsible for implementation of ex ante for ex ante conditions and criteria, as well as actions to be carried out for their implementation and deadlines. In this informative report is established that for execution of ex ante condition 1.1, the Ministry of Economy shall develop policy planning document for introduction of a modern industrial policy, Ministry of Education and Science in cooperation with the Ministry of Economy shall develop a policy planning document for introduction of research, technological development and innovation for the time period 2014-2020.

The National Industrial Policy framework for 2014-2020 (hereinafter - NIP) (supported by order No 282 adopted by the Cabinet of Ministers on June 28, 2013) is a medium-term policy planning document that covers all economic sectors and economic growth objectives and establishes the lines of action for the next seven years, in order to facilitate structural changes in the economy in favour of production of goods and services with greater added value, int.al., to increase the role of the industrial, manufacturing and service modernization and export complexity development.

Latvian Smart Specialisation Strategy (SSS) and the economic development strategy, which provides the restructuring of the economy and purposeful focusing of research and innovation resources in areas of knowledge specialisation, where the state has comparative advantages or exist assets, basing on which such advantages could be created. SSS is developed in accordance with the National Industrial Policy Guidelines 2014-2020 and the Regional Policy Guidelines 2013-2019, and its settings are included in these guidelines, as well as

- Education Development Guidelines 2014-2020;
- Information Society Development Guidelines 2014-2020
- Latvian Tourism Development Guidelines 2014-2020;
- Cultural Policy Guidelines 2014-2020 "Creative Latvia";
- Intellectual Property Rights Protection and Enforcement Guidelines 2014-2018.

STDI is developed in accordance with the settings of National Concept for Development of Latvian Higher education and universities for 2014-2020", which includes a private fundraising for the financing of research at the universities. Assessment of the situation in the economy, which is used in the development of Smart Specialisation Strategy,

is based on the analysis carried out within the framework of National Industrial Policy Guidelines, including analysis of comparative advantages of Latvian enterprises.

Studies and assessments used during the development of STDI guidelines

In January 2013, a study "Assessment of the current situation in research and development" have been carried out and an evaluation of the results of existing scientific performance is provided within its framework, capacity of available human resources is analysed and characteristic of financial instruments for research and development and comparison with other countries of the European Union is provided.

In order to ensure improvement of Latvian science system's development, science quality and competitiveness, an external evaluation of Latvian Science and Innovation policy is carried out within the framework of the Contract with the secretariat to the Nordic Council of Ministers until December 2013. Proposals for development of science and research received as a result of evaluation will provide an essential support for the sustainable planning of science and innovation policy. Likewise, the results of an assessment is planned to apply when making decisions about the implementation of the reforms in Latvian science, including consolidation of the scientific institutions and improvement of capacity of the competitive scientific institutions. While planning investments within the framework of the EU funds for the period 2014-2020, findings and recommendations of external evaluation of interim report of Latvian Science and Innovation policy are taken into account. The final report and recommendations will be taken into account in the development of research and innovation support programs and project selection criteria.

On 22 June 2013, Nordic Council of Ministers presented an interim report on "Science and innovation system analysis", which concludes that the current funding structure of science does not contribute to the development of science and research sector, links between the industry, research and higher education system need to be strengthened. The report also emphasises that the fundamental and applied research should be more focused on achievement of economic development goals.

Work on "National Space Strategy and the scientific and technical and economic justification for the development of Latvian participation in the European Space Agency's programs." is ongoing.

For development of Smart Specialisation an analysis of export potential of economic sectors[1] and Latvian knowledge capacity assessment[2]. In order to establish demand of Latvian entrepreneurs for research and technological development, discussions with entrepreneurs, industry associations and scientific institutions was organized and a survey among Latvian entrepreneurs was carried out on the knowledge needed for further development of the companies. For evaluation of Latvian science and research fields, an analysis of bibliometry and human resources was carried out. Analysis of bibliometry evaluates the results in the field of scientific publications, their quality, dynamics and institutional concentration. Within the framework of analysis of Human Resources, analysis of age structure of scientific workers, employed at the scientific institutions of Latvia was carried out.

On 4 July 2013, industry evaluation was presented to all interested at the Ministry of Education and Science, including scientific institutions and entrepreneurs. *The document draft can be found in the internet website http://izm.izm.gov.lv/upload_file/Ministrija//RIS3_LV_010713. pdf, 2013.*

[1] Procurement No IZM 13/24/ERDF

[2] Procurement No IZM 1-28/88

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On July 11, 2013, at the State Secretary meeting the informative report “About Smart Specialisation Strategies” was announced to inform the Cabinet of Ministers on progress of development of smart specialisation strategy and future actions to be carried out in order to develop the final conclusions on Smart Specialisation Strategy for inclusion in the Guidelines for the Development of Science, Technology and Innovation 2014-2020.

The regional aspect of innovation system determines that the development of science intensive sectors, promoting regional development, is based on the use of each region’s resources and conditions, is defined in the regional policy guidelines for the years 2013-2019 and in the evaluations conducted for their preparation. This document also analyses the impact of clustering, including ongoing projects.

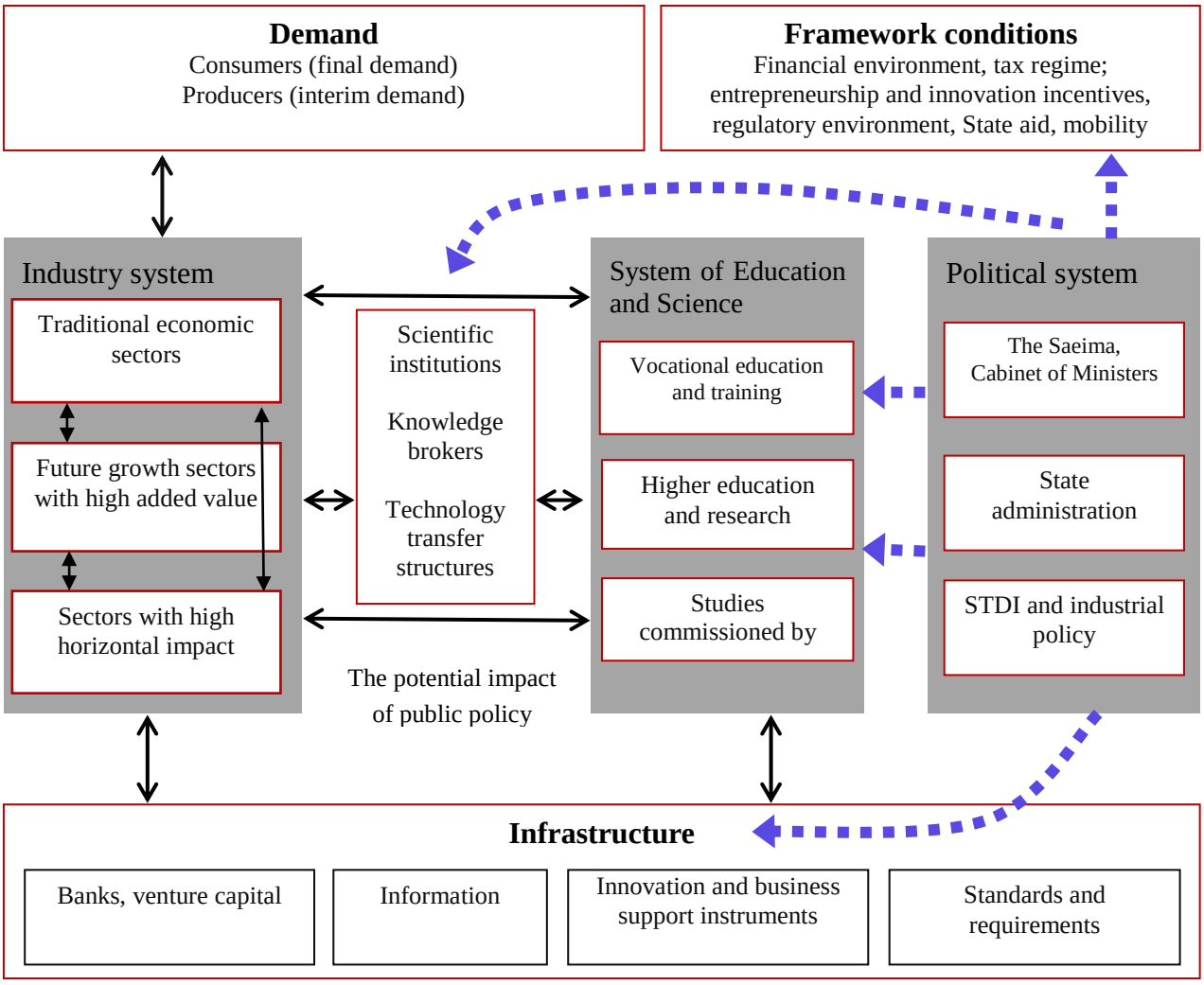
2. Characteristic of the current situation in the field of national science, technology and innovation policy

This section of the guidelines describes the essence of the STDI policy, management structure and Smart Specialisation Strategies of Latvia. A detailed description of the current situation in the field of STDI policy is provided in Appendix 1.

2.1. Science, technology and innovation development policy in research and innovation system of Latvia

Science, technology development and innovation guidelines for 2014-2020 implement a new horizontal approach to science and innovation policy, linking the research and industry sectors in a single system and targets the analysis of policy problems and suggested solutions to the science, technology and innovation sectors, and their relationship with industry issues. As a horizontal policy STDI affect issues of economy and industry development, business, law, education, and other sectoral issues, by building science, technology and innovation system, which connects between the organisations involved in transfer of knowledge and technology; State institutions of political and administration levels , research and knowledge transfer institutions, enterprises and infrastructure support tools.

1Figure 1 the conceptual model of national STDI model



Successful impact of research and innovations on economic development depends not only on the results of activities by involved institutions themselves, but to a much greater extent from their mutual cooperation, as well as of their capacity to influence social institutes-values, norms and legislative environment. The task of the State policy is to analyse problems and obstacles in the operation of all system components constantly and regularly, and to offer solutions for their prevention as quickly as possible.

2.2.The structure of governance in the field of development of science, technology and innovation

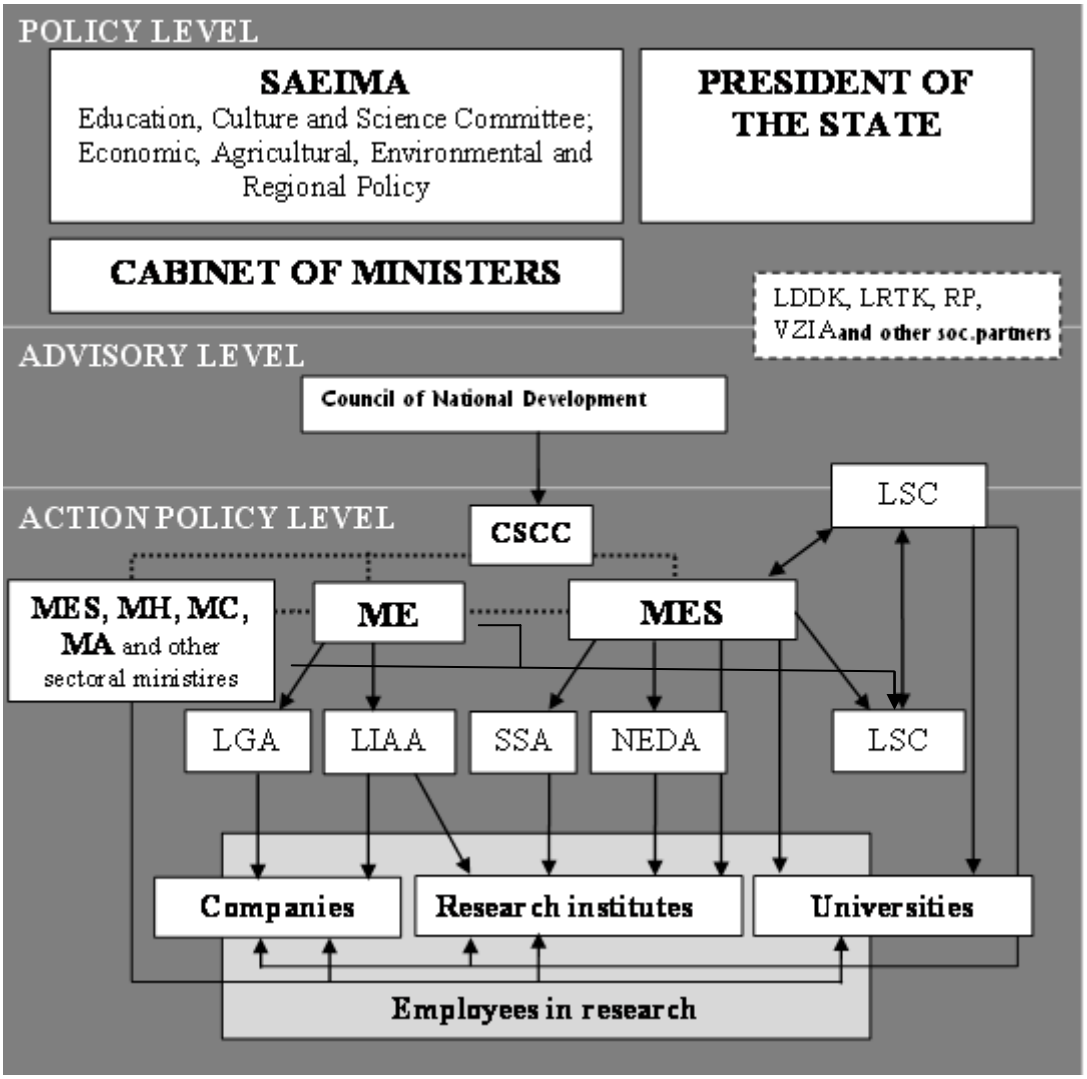
Institutions responsible for STDI are the Ministry of Education and Science (MES) and the Ministry of Economics (EM). MES develops STDI policies, coordinates its implementation and provides the representation of Latvia at the research management institutions of the European Union (Figure 2). In this process, the MES collaborates with ME and other sectoral ministries, and consults with the industry associations and social partners, including Employers‘ Confederation of Latvia (ECL), Latvian Chamber of Commerce and industry (LCCI), the Council of Rectors (CR), National Association of Scientific Institutions (NASI), Latvian Education and Science Workers Union (LESWU), etc. as needed. The

funding of STDI is administered by Study and Science Administration (SSA), the National Education Development Agency (NEDA) and the Latvian Science Council (LSC). Apart from the administration of financing instruments, SSA also supports the European Union framework programme (FP) operation of National Contact Point (NCP) and carries out other tasks delegated by MES. VIAA provides administration of the structural funds. LSC administrates the Fundamental and Applied research program and advise MES in science policy. In addition, some of the science representation and programme coordination functions are delegated to the Latvian Academy of Sciences (LAS). LAS science centre of national significance, with is created as an on scientific excellence-based membership organization, which main task is active involvement in formation of science policy, participation in scientific expertise, caring for involvement of new generations of researchers in science, safeguarding of scientific research ethics, discussion principles and traditions, international networking and promotion, as well as the popularization of science.

ME develops and coordinates the implementation of innovation policy. The administration of financial instruments related with promotion of knowledge transfer and company innovation capacity, which is provided by the LIAA and the Latvian Guarantee Agency (LGA).

Although the created STDI policy management system broadly defines the responsibilities in the field of STDI, it is characterised by the unclear division of the policy implementation, non-compliance of the functions with the level of institutions and duplication of individual functions, as well as *ad-hoc* policy coordination. In order to eliminate these deficiencies, management institution in planning of science and technology development policy has to be clearly defined and capacity of implementation of these functions has to be strengthened. In order to eliminate this gap, with the support of the Council of Nordic Ministers an elimination of science is carried out, the results of which will be made public at the beginning of 2014. Based on the results of this evaluation proposals for improving the management of STDI will be prepared.

2Figure 2. Following responsible institutions, functions and competence is established for implementation of Science, technology and innovation policy.



2.3.Smart Specialisation Strategy

2.3.1. Framework of Smart Specialisation Strategy

Smart Specialisation Strategy (SSS) foresees the development of vision, distinguishing of competitive advantages, choice of strategic priorities and policy that unlocks knowledge-based potential of the region, thus ensuring the growth of national economy.

The objective of SSS is to increase innovation capacity and establish innovation system fostering and supporting technological progress of national economy.

The task of SSS is to ensure nomination of development prioritisation and regular review, targeted focusing of the investments, including strategies for setting of appropriate policy instrument choice and development of monitoring system that focus on strengthening the competitiveness of Latvia in regional, European and global level.

[3]Based on many years of experience of the OECD in evaluation of regional innovation capacity and policy development, while developing smart specialisation strategy for promotion of innovation, the European Commission recommends the Member States choosing one of the following development strategies:

- growth, based on existing advantages (science or technology-driven growth);
- support for economic transformation (identification of new growth and development);
- catching up or movement towards a knowledge-based capacity development.

For the situation in Latvia, the main emphasize is on support for economy transformation, providing science and technology driven growth and progress towards a knowledge-based capacity development. Thus a new conceptual and complex strategy is created that includes and provides a balanced and complementary set of support instruments. At the same time it is necessary to promote development of not only technological innovation, but also non-technological innovation, as well as the development of entrepreneurial and creativity in all areas of the economy and social sphere. Schematic representation of the strategy is provided in appendix 2.

The choice of such strategy is associated with the identified structural challenges for transformation and sustainable development of Latvian national economy.

2.3.2. The challenges for transformation of Latvian national economy

The growth pattern in Latvian national economy is changing. By decreasing of large macroeconomic disproportions during the crisis, the economy of Latvia has become more stable and more balanced. However, it is important to ensure rapid, balanced and resistant against external shocks, economic growth of Latvia in the future.

Currently, the productivity level of national economy of Latvia is one of the lowest in the EU, economic advantage of Latvia is within the low income sectors, export structure mostly consist of low or medium-low technology industry production and export yield is low.

The competitive edge of Latvian national economy currently is the cheap labour – labour costs in Latvia are considerably lower than in the EU-15 Member States. Both cheap labour and relatively high profitability does not create incentives for changing the business model and creation of other competitive advantages. In the free labour movement, conditions will not be possible to maintain low labour costs continuously, hence the need to create incentives for new competitive advantages must be created.

For continuous development of sustainable national economy it is necessary to promote structural changes in the economy in favour for production of the goods and services with greater added value, int.al, increasing the role of the industry, modernisation of manufacturing and service and development of export complexity. This is an essential prerequisite for economic convergence of Latvian national economy with the developed EU countries and increase of the population welfare, which can be achieved by increasing the competitiveness of the Latvian economy based on innovation.

An essential precondition for the transition to innovative economy is strengthening of innovation system of Latvia, eliminating its shortcomings and promoting interaction among all subjects of innovation system: business, science and education, as well as the financial and regulatory systems.

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[3] OECD (2011), Regional and Innovation policy.

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Currently low level of innovation in Latvia shows that there are significant gaps in the existing innovation system. Identified weaknesses are related both separately with each subject of innovation system and their mutual interactions.

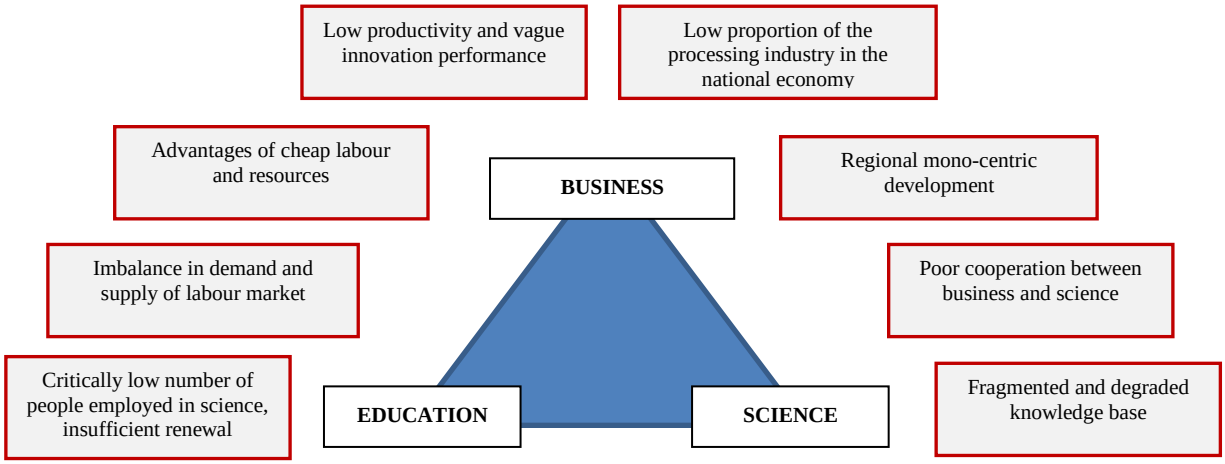
Problems of Latvian innovation system (Figure 11):

1) **The focus on innovation with the current business model is vague.**
   At the moment economic competitiveness is based on exploitation of cheap labour and natural resources, in the export structure dominates low or medium-low technology industries, yield of export production is low, energy intensity is high, the manufacturing industry's share in the national economy is insignificant, at the same time this sector has a significant role in the creation and absorption of innovation and technology. Productivity level of Latvian industry is significantly behind the EU average. The current low innovation capacity and insufficient knowledge absorption capacity in the business sector reduces the possibilities to achieve a rapid improvement of the situation.[4]
2) **Poor collaboration between the business sector and science, as well as insufficient use of creative and intellectual capital in the creation of innovation.** In order to make the innovation system effective, cooperation among all its elements is required. In Latvia's case, both cooperation between the research institutions and researchers and the industry representatives is weak, which significantly restricts adoption of new technologies and innovative solutions in the production. Insufficient utilisation of creative industry potential in creation of products and technologies with additional added value and unique niche products;
3) **Current education system does not ensure consistency between labour demand and supply.**
   If there will be no changes in educational system, this imbalance will persist in the medium term as well. In fields that are particularly important for the development of Latvia - engineering and natural sciences- in 2011 studied only 21% of the total student population;
4) **Insufficient capacity of science and research, technology development and innovation.**
   The number of employees in science, research, technology development and innovation in Latvia is too small and renewal of staff involved in these areas is insufficient. Despite the increase in the number of doctoral candidates during the recent years, it is not sufficient to ensure renewal of high-quality scientific staff and increase in the number of scientific personnel. The knowledge base is fragmented and degraded, as well as the infrastructure of research, technological development and innovation in particular, is underdeveloped. As a consequence there is a low number of *spin-of* as well as *start-up* companies, based in elaborations of the public research sector. A disproportionately low share of the base funding promotes non-strategic, "from project to project" oriented approach to the development of science;

[4] National Industrial Policy Guidelines for 2014-2020 (approved by the Order No. 282 of 28 June 2013 of the Cabinet of Ministers). http://polsis.mk.gov.lv/view.do?id=4391

5) **Regional mono-centric development** creates a hostile environment for business in regions, promotes decrease in population and ineffective use of resources in the region. Continued mono-centric development will decrease competitiveness of Latvia, decreases because the labour and infrastructure costs in mono-centre will increase, but other growth possibilities in the regions will not be used.

3Figure 3 Loopholes of innovation system and main challenges



Considering the mutual interaction of the innovation system's subjects, it is equally important to find solutions for development of the each subject, which together form an innovation capacity of Latvia, which is dynamic and evolves over time. The main task, by focusing public and attracting private resources, is to ensure that the national economy of Latvia could be able to overcome the various technological, social, and demographic challenges.

Cross-sectoral cooperation should also be promoted at the national and international level that focuses on transfer of creativity and newly created knowledge, thus developing creation of new services or products and/or increasing their value. By promoting linkage of technological and non-technological, as well as social and eco-innovation processes with business, the capacity of innovation will be strengthened, as well as more purposeful development of new products and services will be ensured. In addition, support for technology transfer services, further education, research and experiments are needed.

The EU has identified the following weak points in the system of innovation in Latvia:

- Cooperation between entrepreneurs and scientists still remain weak and the commercialisation of research results is low.
- Companies use the potential of universities insufficiently and their participation in 6 centres of competence (which is trying to bring together innovative companies and research institutions) is rather limited.
- Technology transfer contact points, which work in individual universities, show mediocre results, partly because the legal framework of the intellectual property is incomplete, which does not stimulate the universities to patent their inventions.

- In 2011 separate clusters, in such industries as electronics, as well as the chemical and pharmaceutical, space technology and logistics have been established, however, the amount of the added value is unclear.
- Latvia has made the first attempts of modernisation by establishing nine research centres of National significance; however, it seems that they focus disproportionately on academic science (Union competitiveness report 2011).

2.4. Trends of Economic transformation, priorities and Smart specialization fields

Choice of the transformation of national economy is closely related to the overall development on national economy level and advantages (existing and potential) of competitiveness both at the national level and regional scale. Consequently, in the case of Latvia, following transformation directions of national economy are necessary:

1 Change in production and export structure in traditional sectors of the national economy;

2 Growth of sectors, in which products and services with high added value exists or can be created;

3 Sectors with significant horizontal impact and contribution in transformation of national economy.

1 Change in production and export structure in traditional sectors of the national economy;

The current structure of the Latvian national economy is based on traditional sectors, the competitive edge of which is based on cheap labour and available natural resources. Although the traditional sectors of the national economy in the medium term will have a great contribution to the overall economic growth and job creation, it should be noted that both cheap labour and resource availability does not create incentives for changing business models and other comparative advantages. Consequently, in order to facilitate transformation of the national economy, it is necessary to promote structural changes in favour of the production of goods and services with a greater added value. For example, one of the exponents of added value is innovations, their development and promotion of extensive application plays an important role. In turn, the sector of creative industries and the design is one of the instruments contributing to innovation in the traditional sectors of the national economy.

Clustering is one of the instruments for the consolidation and efficient use of resources. In the case of Latvia, the most important sectoral clusters are forest and wood processing cluster, agriculture and food cluster, as well as metalworking and mechanical engineering cluster. These sectors show a markedly strong product liability, as well as set of workforce and science skills and abilities exist in the sector. Business structures of other production sectors experience a weaker interaction with other domestic companies and industries.

As for a small economy, identification of industries the development of which would be desirable and possible was and is necessary and preparation of specialists, science, technology and innovation should be matched purposefully and the availability of financial resources for successful development of Latvia should be ensured. Despite the low overall innovation capacity, Latvia has made considerable progress in individual industry-related technologies: surface technologies and coatings, materials, engines, turbines, pumps and nano-science. Some of the advantages are also associated with IT and management methods, audio-visual technology, health, pharmacy, chemistry and wood chemistry. So far in the field of research, Latvia mainly has specialised in such areas as biotechnology, ICT, energy, transportation technology, however, material science is recognized as the most important scientific specialisation in Latvia. Formerly the specialization areas in the economy of Latvia have been metalworking and mechanical engineering, wood and wood products, food processing. For public scientific institutions to become a driving force behind innovation, that provides the necessary infrastructure for innovation (testing laboratories, design offices, experimental workshops, pilot plants, etc.), innovation infrastructure shall be built on the basis of collaboration of public and private sector, such as public open access (available to traders) laboratories and experimental workshops and a pilot plants.

1. Priority: More efficient use of primary products for production of products with greater added value, creation of new materials and diversification of application. Non-technological innovation, creative industry potential for further exploitation sectors of greater added value products and services.

Following specialisations corresponds to this priority "knowledge-intensive Bio-Economy", "Biomedicine, medical technologies, bio-pharmaceuticals and biotechnology" and "Smart materials, technologies and engineering systems."

2 Future growth sectors in which exist or may be products and services with high added value

For sustainable development of the Latvian national economy it is necessary to diversify the manufacturing industry and the exportable service sector, thus achieving a faster medium-high and high-technology industry, as well as development of the knowledge-based sectors and cross-sectoral cooperation, which focuses on commercialisation of creativity and technological and non-technological innovation? This includes, for example, such emerging sectors as biotechnology, electronics and machinery construction.

2. priority: The creation of such innovation system, which provides support for creation of new products and technologies within the framework of existing sectors and cross-sectors, as well as new sectors with high growth potential, based on the growth of defining key sectors that provides an effective identification system for new products/services, and the ability to find and provide support for the creation of new products both in the existing sectoral and cross-sectoral frameworks and creating of new industries with high growth potential.

Following specialisations corresponds to this priority "Smart materials, technologies and engineering systems" and "Biomedicine, medical technologies, bio-pharmaceuticals and biotechnology"

3 Sectors with significant horizontal impact and contribution in transformation of national economy.

This group includes areas that form the basis for the development of new - innovation based - comparative advantages.

3.1 Innovative energy efficiency solutions and technologies

Low energy efficiency level results in both energy security and resource sustainability risks, as well as competitiveness risks. Increasing the level of energy efficiency with the help of innovative solutions in the national economy as a whole, is a sustainable and cost-effective way to reduce risk, simultaneously creating additional jobs and promoting economic growth.

In the Latvian national reform programme "EU 2020", a national goal to achieve major energy savings 0.670 Mtoe in 2020 is defined for implementation of the strategy , while in the Directive 2012/27/EU on energy efficiency, established mandatory liabilities for annual savings of 1.5% end energy correspond to 0,213 Mtoe in 2020. To achieve these objectives, the existing energy efficiency potential should be acquired to the full extent. The research shows that most of the potential energy savings with the help of the State aid instruments could be reached in the building heat supply, transportation and manufacturing sector.[56] The development of such innovative solutions and technologies for energy efficiency, which ensures a particularly high energy savings, is necessary for a successful acquisition of this potential.

3. Priority: Improvement of energy efficiency, which include the creation of new materials, production process optimization, technological innovation, the use of alternative energy sources and other solutions.

Area of specialization "Smart Energy" corresponds to this priority.

3.2 Development of information and communication technologies

New opportunities and solutions of ICT industry shall provide a greater contribution in the development of other sectors, significantly increasing their efficiency. In the Latvian National Reform Programme "EU 2020", need to increase the development of information and communication solutions (ICT) and implementation of single digital market, was mentioned as one of the sub-measures of reform directions, thus contributing the growth of national economy, which is related with the need to provide the increasing demand for more efficient solutions in business process management and analysis. Public data and information is a resource that includes unimplemented economic and social potential. The value of data increases by disclosing them, where they can be used for creation of new products and services, as well as in creation of innovation, scientific and research work. Open, secure and interoperable public data infrastructure is one of the main solutions to increase the economic growth of the State.

[5] http://em.gov.lv/em/2nd/?cat=30702

[6] http://em.gov.lv/em/2nd/?cat=30943

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In addition, equal access to the electronic communications throughout the territory of Latvia will increase the contribution of ICT in economic growth of all sectors of national economy and innovation.

Opening of the data held by the public administration imply an unrealized economic and social potential. By disclosing data to the public, they can be used for creation of new products and services, as well as in creation of innovation, scientific and research work. Open, secure and interoperable public data infrastructure is one of the main solutions to increase the economic growth of the State.

In the Information Society Development Guidelines for 2014-2020, priorities of ICT field in Latvia has been established, which are developed taking into consideration priorities set for The European Digital Agenda and objectives set by the European Commission for development of Single Digital Market: Development of ICT education and e-skills, widely available internet access, modern and efficient public administration, development of e-services and digital content, cross-border cooperation for development of the single digital market, as well as ICT research and innovation, facilitation of trust and security.

Association of ICT investment, the lines of action established by SGS, shall be viewed not just through the principle of open data, but also by promoting skills to use ICT. The contribution of the ICT sector should be facilitated by creating resources of digital content and ensuring their availability for creation new products and services. Accordingly the base of digital content should be developed and collaboration of ICT and other sectors should be promoted (development of language technologies, digitization of cultural and educational content, etc.).

4. Priority: Development of modern and contemporary ICT system in the private and public sectors.

This priority complies with an area of specialization "Information and communication technologies".

3.3 Improvement of the educational system

Education is one of the foundations of national competitiveness. Within medium and long-term, the national economies of developed countries will be faced with shortages of professional and highly qualified (mostly with college or higher education level) labour. [7]According to the medium and long-term prospects of Latvia's labour market, restructuring of the national economy is hampered by the shortage of appropriately prepared specialists. The main challenges we will face in the future, is insufficient number of qualified professionals, mainly in the fields of nature and engineering (both secondary and higher education levels), and the lack of highly qualified specialists with the skills required for the future-technical specialization, which is combined with business and troubleshooting skills.

For resolution of these challenges, it is not enough with the increase of the number of budget places; improvements of the education system as a whole are required,

[7] The Informative Report of the Ministry of Economics On medium- and long term forecasts of the labour market. http://www.em.gov.lv/images/modules/items/tsdep/darba_tirgus/EMZino_21062013.pdf

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including development of creative thinking and fostering the development of creative partnerships at all levels of education.

5. priority: A modern education system that corresponds to the future labour market demand that facilitates transformation of the national economy and development of competences, necessary for implementation of SSS priorities, enterprising spirit and creativity at all levels of education.

3.4 Increasing of science, research, and technology development and innovation capacity.

Sufficient scientific and research capacity is an important prerequisite for transformation of Latvia's national economy to the knowledge and innovation-based model. Unfortunately, the current science and research capacity is weak. This is evidenced by a small number of persons employed in science (ageing of scientists, insufficient number of doctoral students), underdeveloped science and research infrastructure, lack of well-equipped laboratories for implementation of technology-oriented projects, as well as a weak commercialisation potential of research results and poor cooperation between the scientific and economic sectors. Sufficient and high quality human capital, appropriate infrastructure, including the infrastructure required for technology development and innovation, and enhanced cooperation is a precondition for the investments in the research and innovation to be effective, if other circumstances are favourable.

Latvia has a comparative advantage in certain areas of knowledge of the natural sciences (in particular, solid state physics, organic chemistry, biochemistry and molecular biology, as well as computer science), engineering (particularly in electrical engineering and electronics, ceramic and composite materials, mechanics and biotechnology), medicine (particularly in the pharmaceutical, biomedical and medical technology) and agricultural sciences (particularly in agronomy and horticulture, forestry and food technologies). In these areas the knowledge base and human capital, which is the foundation of innovation capacities, creating and developing specialized higher educational and scientific institutions.

6. priority: Advanced knowledge base (basic science and scientific infrastructure) and human capital in areas of knowledge, in which Latvia has a comparative advantage and which are important in the process of transformation of the national economy: areas of knowledge related to the smart specialisation fields (1) knowledge-intensive bio-economy, (2) biomedical, medical technology, bio pharmacy and biotechnology, (3) intelligent materials, technologies and engineering systems, (4) smart energy, and (5) ICT, as well as key technologies identified by the EC (nanotechnology, micro-and nano-electronics, photonics, advanced materials and manufacturing systems, biotechnology).

3.5 Promotion of Territorial Cohesion

Significant differences in regional development exist in Latvia, which is also significant at the EU level. Currently regional mono-centric development that exists in Latvia creates a hostile environment for business in regions, promotes decrease in

population and ineffective use of resources in the region. Continued mono-centric development will decrease competitiveness of Latvia, decreases because the labour and infrastructure costs in mono-centre will increase, but other growth possibilities in the regions will not be used. Significantly different economic activity, service availability and accessibility, creates different standards for quality of life and development possibilities for population of territories, and encourages outflow of population to the more developed territories, which further reduces the growth prospects of less developed areas.

For facilitation of balanced development of Latvia, it is essential to promote more rapid development of all areas and increase of competitiveness. This can be achieved by more efficient use of the existing resources in regions and municipalities (infrastructure, natural, human resources, etc.).

7. Priority:

Studying of the existing resources of territories and specialization, proposing the prospective economic development opportunities and directions int.al. leading and prospective business directions in the municipal territories.

Transformation directions of national SSS, corresponding priorities and fields of specialisation are summarized in table 3.

1Table 1 Summary of transformation directions of Latvian Smart Specialisation Strategy, growth priorities and areas of specialisation

Directions of the national economy transformation	**Growth priorities**	**Smart Specialisation Strategy areas**
1. Change in production and export structure in traditional sectors of the national economy;	***1. Priority:*** More efficient use of primary products for production of greater added value products, creation of new materials and technologies and diversification of application. Wider use of non-technological innovations and Latvian creative industry potential to produce the greater added value products and services of national economy sectors.	**1. Knowledge-intensive bio-economy;** **2. Biomedicine, medical technologies, bio pharmacy and biotechnologies;** **3. Smart materials, technology and engineering systems** **4. Smart energy** **5. Information and communication technologies**
2. Future growth sectors in which exist or may be products and services with high added value	***2. priority:*** The creation of such innovation system, which provides support for creation of new products and technologies within the framework of existing sectors and cross-sectors, as well as new sectors with high growth potential, based on the growth of defining key sectors that provides an effective identification system for new products/services, and the ability to find and provide support for the creation of new products both in the existing sectoral and cross-sectoral frameworks and creating of new industries with high growth potential.	
3. Sectors with significant horizontal impact	***3. Priority:*** Improvement of energy efficiency, which include the creation of new materials, production process optimization, technological	

and contribution in transformation of national economy.	innovation, the use of alternative energy sources and other solutions.	
	4. Priority: Development of modern and contemporary ICT system in the private and public sectors.	
	5. priority: A modern education system that corresponds to the future labour market demand that facilitates transformation of the national economy and development of competences, necessary for implementation of SSS priorities, enterprising spirit and creativity at all levels of education.	
	6. priority: Advanced knowledge base (basic science and scientific infrastructure) and human capital in areas of knowledge, in which Latvia has a comparative advantage and which are important in the process of transformation of the national economy: areas of knowledge related to the Smart specialisation fields (1) knowledge-intensive bio-economy, (2) biomedical, medical technologies, bio pharmacy and biotechnology, (3) intelligent materials, technologies and engineering systems, (4) smart energy, and (5) ICT, as well as key technologies identified by the EC (nanotechnology, micro-and nano-electronics, photonics, advanced materials and manufacturing systems, biotechnology).	
	7. Priority: Studying of the existing resources of territories and specialization, proposing the prospective economic development opportunities and directions int.al. leading and prospective business directions in the municipal territories.	

Sufficient scientific and research capacity is an important prerequisite for transformation of Latvia's national economy to the knowledge and innovation-based model.

Science, technologies and innovation are the aggregate of sectors of national economy and their achievements, forming the base for economic growth, focusing on creation of products with greater added value. Along with the higher education and national economy sectors, it is a part of the national research and innovation system, in the framework of which a broad and deep knowledge base is being created, on the basis of which problems topical for society are addressed, globally competitive products of high added value and technologies are developed, as well as competitive higher education.

Therefore it is necessary to form globally competitive Latvian science, technology and innovation industry that could support the needs for development of the national economy and society.

3. Challenges and problems to be addressed

3.1.Inefficient and fragmented management of STDI

Fragmented structure of scientific institutions

There are 88 scientific institutions in Latvia (1 December 2013). 14 of them are derived from public entities or 13 national research institutes and the Latvian Academy of Science, 1 direct administration institution, 10 universities, 4 University departments, 3 commercial companies and 41 merchants and units established by merchants. From the point of view of efficient use of resources, int.al. use of administrative resources, as well as from the point of view of knowledge management, number of such separate institutional units is too large, especially in circumstances of poor cooperation and coordination.

Uncertainty and duplication of management functions

In the management of STDI there are functions that duplicates and is unnecessary fragmented (e.g., administration of research projects, promotion process), as well as some functions are not implemented (for example, there is no institution that would promote public significance of science and innovation).

Insufficient cooperation and coordination between the institutions of science, technology and innovation structures, higher education and industry

Fragmented institutional structure and institutional disassociation, evaluation and financing system of scientific institutions, and non-existence of policy implementation monitoring system has not contributed to the development of effective cooperation and coordination structure and formation of culture with the companies of the sector. In very limited public funding conditions, forms competition among institutions, driven by the institutional interests, which does not facilitate development of the industry. Functions of collegial and consultative institutions (LSC, SAK, and NAP) in an advisory level are too broad to focus attention on creation of closer cooperation and mutual synergy in research and innovation. Advisory forum for analysis of strategic issues and achievement of consensus in policy solutions and coordination between the science, higher education and industry is missing.

Insufficiently transparent and unfounded procedures for evaluation of grant applications and allocation of funding

Scientific expertise of research projects do not provide a qualitative apprehension on contribution that the research project has given to the science, the EU and national economy. For this reason, it is difficult to determine the appropriate priority directions of science, national research programmes and market-oriented research. State control audit in 2010 revealed that the established procedures are not followed through during evaluation of fundamental and applied research projects, as well as there are cases where experts value each other's submissions, thus getting into situation of conflict of interest.

Creation of new coordination mechanisms has been launched only recently

New coordination units have been created during the planning period of structural funds for 2007-2013 (technology transfer contact points at the universities, clusters,

associations of scientists and entrepreneurs, national research centres) and they operate only since recently, their impact still is insignificant and the results cannot be measured.

Lack of communication of the field in the public sector

There is a low awareness of the achievements in science and innovation, especially among young people. Little presence of science sphere is felt in the public environment. Promotion of science is not purposefully planned and is based on the individual activities of isolated enthusiasts, which does not promote the prestige and popularity of science and scientific professions among young people. At the level of public opinion and decision makers, significance of development of science and technology as a factor that promotes the economy is under-evaluated.

3.2.STDI financing problems

Insufficient funding of the industry for a prolonged period

Despite the priority of development of science and technologies that is declared in the national planning documents and norms established by the Law on Scientific Activities on annual increase of funding, according to the state budget funding, still ranks in a third lowest place among 27 countries of the EU. In 2013 as well, the total investments in R&D are provided with the support of the structural funds at the level of 2008. The State budget contribution in 2013 still is twice lower as it was in 2008 (2008 - 36.3 million LVL, 2013 – 17.3 million. LVL). Taking into consideration own investments of the scientific institutions, this difference is even greater (41.3 million LVL, in 2008). Proportion of R&D investments between the volume of the external fund financing, State budget and private sector investments are disproportionate compared with the more developed EU countries.

Financial investments in the infrastructure are not balanced by investments in the maintenance and development of human resources

Although by using the structural funds as a percentage of GDP, total funding for STDI has returned to its level of 2008 (76.27 million lats in 2013 vs. 65.75 million lats in 2008), though a significant proportion of the national budget is restructured and redirected for co-financing of structural funds projects. A significant proportion of the structural funds contribution (almost 50%) is directed towards the development of scientific infrastructure. Purchase of new buildings, laboratory equipment is not balanced by investments in human resources.

Fragmented financial instruments for science

Fragmented financial instruments for science leads to unnecessary bureaucratic obstacles for assurance of joint research and innovation process, because the universities, scientific institutions and merchants are forced to write numerous proposals and administer the implementation of projects, channelling resources for purposes that do not give direct scientific results.

The structure of state budget funding is promoting fragmentation and insufficient proportion of science base financing

A disproportionately low share of the base funding (only 21% of the necessary funds in 2010, 25% of the necessary funds in 2013) promotes non-strategic, “from project to project” oriented approach to the development of science. As well as the base financing is used for the co-financing of the EU structural funds and other international research projects.

In fact, the state budget is linked to the projects, thus additionally contributing fragmentation process and instability. In addition to the fragmentation of the foster grant funding small LSC amount for each grant, which provides only about 3 of the FA is employing scientists in each of them. There are no institutional grants, which would provide a greater attraction of scientific teams to the strategically important research directions. As well the volume of collaborative project funding provides cooperation of not more than 10 scientists from different scientific institutions. Similarly, the reduced state funding for the program is not sufficient for joining forces in addressing common scientific problems.

Low investment of universities in research

also according to the investment in research from GDP by higher education sector. With the index of 0.24% from GDP, Latvia ranks 21 among other 27 EU countries, leaving Bulgaria with 0.07%, Luxembourg with 0.19%, Hungary and Malta with 0.23%, Slovenia with 0.12 % and Slovakia with 0.17% of GDP % behind. Spending volume of Latvian higher education sector in 2010 depended on funding from the structural funds of the EU, while grants for higher education from the State budget decreased under the influence of economical crisis, the universities lacked the funding for implementation of research projects. Since 2009, development of Scientific activities and provision of infrastructure was completely suspended at the universities and colleges, which in 2008 totalled 5.63 million lats.

3.3.Problems with human resources

Critically low number of people employed in science and insufficient renewal

Despite EU funding for master's and doctoral studies during the previous years, number of scientific personnel in both the public and private sectors in Latvia is still critically low: 0.57% of the total number of employees (in Lithuania: 0,88%, in Estonia: 0.92%), to ensure the implementation of the State's economic strategy and sustainable growth. Number of employees in scientific research work correlates with the amount of funding available to the sector. Employed staff continuously drain away from the sector due to its instability and unpredictable nature. Despite the increase in the number of doctoral candidates during the recent years, it is not sufficient to ensure renewal of high-quality scientific staff and increase in the number of scientific personnel.

Overload of scientists and lack of career development prospects

In Latvia and several other EU Member States, where the private sector is not as science-capacious, most scientists belong to the university sector, which also has a low income. To ensure at least a moderate level of remuneration, the lecturers involved in the work at the universities, often work in several universities at the same time and additionally perform research work, as well as manage research projects and prepare applications to attract financing. The combination of all of these obligations is incompatible with decent quality and preservation of work ability. Taking into consideration that there is a high mobility in the international research environment such working conditions lead to an increased brain drain risk of the brightest young scientists.

Non-competitive remuneration of employees in science

There are major differences in remuneration. The remuneration is directly dependent on the possibilities for the particular science sub-sector to involve in the projects of structural funds. In some areas of human sciences, which don't have such opportunities, remuneration for scientific workers is funded solely from the national budget-base funding, which has led to a situation where the staff work load is artificially reduced to ensure the payment of wages

within the existing financial limits. This approach creates a risk for a significant drain of human resources and for the existence of the appropriate science sub-sectors.

Non-existent support mechanism to attract industry scientists

After completion of doctoral and PhD degree new potential researchers are not used because there is no special post-doctoral grant for young researchers. To compete for grants or funding LSC, young researchers are not yet able to do so, taking into account the total number of the publications criteria. Such a situation develops the risk of outflow of young scientists from industry, including to foreign countries.

Ageing of science workers

There is a lack of motivation and opportunities to attract young professionals to the scientific and academic work. Serious reason for lack of interest in research work is the low level of remuneration and limited career opportunities in scientific institutions in comparison with other EU Member States. As a result in 2012, 3462 Doctors of Science worked in Latvia (2006: 3603 Doctors of Science), 51.5% of them are older than 55. On the other hand, the proportion of young scientists up to age of 34 was 8.5% among the PhDs in 2009. Compared with 27 EU countries Latvia still has few PhDs. In Latvia there are 0.5 Doctors of Science per 100 residents, while on average in the EU27 there are 1.5 Doctors of Science per 1000 residents.

3.4.Science competitiveness problems

A small number of international scientific articles

Number of scientific publications is directly related with the number of employed in STI sector and industry funding. Number of employees in science and international publications in Latvia is tiny, it is less than in Lithuania and Estonia, and however, the overall number of international publications corresponds to the number of employees in science. According to the funding used for preparation of one publication, costs of one Latvian publication is more than 3 times less than in Finland, Sweden, Denmark, Austria, etc. There exist well identified obstacles related with placement of publications in international databases and access to them. Additional funding is necessary in order to ensure open access to publications, which would provide higher rate of quotability and recognition.

Many publications of Latvian scientific institutions are not registered in the international registers

Therefore, compared with Lithuania and Estonia, which have ensured registration of their national scientific publications and thus eased publication opportunities, the opportunity to promote flow of scientific information and increase the number of publications, is not used.

Low number of registered intellectual property

Although the number of patents that were applied for by Latvian residents outside of Latvia is insignificant, however, in relation to the funding allocated to R&D, Latvian achievements can be considered as good and is comparable with indicators of such developed countries as Norway, Switzerland, Sweden, Israel, France and the United Kingdom. In the conditions of reduced base funding, research institutions do not have access to funds for the registration and maintenance of patents.

Insufficiently developed international cooperation

Membership experience in IP indicates several international co-management problems. Insufficient administrative capacity of national science (science has insufficient capacity for representation in Brussels for defence of projects and participation), the scientific capacity of science institutions in administration of science is little, lacks targeted training for preparation of project applications. As a result, the financial gain from participation in the IP is insignificant; Latvia is investing in IP five times more, as it recovers from the participation in IP projects. Participation in IP projects is limited by both fragmentation of scientific institutions and unavailability of co-financing from the State Budget, resulting from the reduced base funding for science. The newly formed international support structures (NCP and CSCC) are not supported with resources (remuneration funding). Uncertainty about availability of state budget co-financing hinders participation in such programs as EUREKA and ESFRI.

3.5. Poor collaboration between the business sector and science, as well as insufficient use of creative and intellectual capital in the creation of innovation

Insufficient cooperation between the scientific institutions and industry companies

Underdeveloped cooperation between scientific institutions and scientists and industry, significantly restricts taking over and implementing of new technologies and innovative solutions. Cooperation is insufficient both in identification of potentially commercializable technologies and definition of needs in research and in implementation of research results and takeover and implementation of research results. During the recent years, various initiatives are started for promotion of cooperation (competence centres, technology transfer contact points, support of cluster initiatives), but they are relatively new and it is necessary to provide their long-term development, to ensure the development of cooperation culture at all stages of scientific activities and innovation. At the same time, during the past few years funding for scientific institutions for implementation of industry ordered of market oriented research is critically reduced (in 2012: 110 800 lats, in 2013: 151 800 lats) and an effective application of ERDF funding for this purpose is precluded by lack of co-funding for business-related projects (50% or more).

Underdeveloped skills and opportunities for the knowledge management and commercialisation in the scientific institutions

Poorly developed cooperation between scientific institutes and companies, as well as the limited opportunities and motivation of scientific institutions to provide services for the private sector and insufficiently developed knowledge management and commercialisation, do not provide a return on investment. In 2012, research institutes and universities attracted 6.7 million. Lats from the corporate sector, which formed 8.5% of the total funding of research and development for Institutes and Universities. At the same time support system for forming and development of newly established companies on the base of research results, which would allow creating an innovative companies with the potential of rapid growth is underdeveloped.

Underdeveloped infrastructure of technology transfer

Technology transfer and innovation infrastructure (technology development centres, incubators, parks, prototyping laboratories, experimental plants) is required for the

development of new technologies and the commercialisation of research results. Latvian entrepreneurs, especially small and medium-sized enterprises and scientists cannot implement innovation process in the relevant technology transfer phase, before the product is ready for production, because the technology transfer infrastructure is not sufficiently developed.

Science institutions lack product promotion and marketing capacity

There is a lack of financial instruments for support of the product promotion and marketing activities. Innovation infrastructure which is necessary for science and would allow creating the prototypes of new products and technologies for introduction in the market is not funded and ensured. Forecast studies for products that could be marketed in the future is non-existent, scientific institutions have no specialists with this competence and such specialists are not being prepared.

Insufficient attention is paid to development of knowledge and new technology absorption capacity

In the sphere of innovation, orientation towards creation of new products has been dominated, which, taking into consideration the common potential of science and technologies, as well as the small number of companies, has not always been reasonable. Although, with the support of structural funds, a number of instruments for absorption of technologies through purchase of new equipment and staff training in their use has been implemented, no instruments has been developed for strengthening of absorption ability at the companies, as well as there are no instruments that would promote the involvement of scientists in production companies (e.g., company subsidized scientist position) and research and development activities in the company or outside the company for creation of new and original designs.

Weak performance of innovation and limited capacity of the companies to invest in research and innovation

So far Latvian companies mainly benefited from such advantages of competition, which are based on lower labour costs rather than innovation. According to Eurostat, during the period from 2008 to 2010, only 29.9% of Latvian companies on average (52.9% EU average) were innovative. In 2012 expenditure of the business sector for R&D was 24.3 million LVL or 24% of total investments of R&D (54.9% on average in the EU, data on 2011). Latvian business structure mainly consists of small and medium-sized enterprises, which are limited in both human resources and financial resources for development and implementation of the research and innovation, as well as limited opportunities to attract funding due to the high technological and business risks.

Low productivity and the industry is dominated by low-technology sectors

Productivity level of Latvian industry is significantly behind the EU average. The current low innovation capacity and insufficient absorption capacity of the latest knowledge and technology in the business sector reduces the possibilities to achieve a rapid improvement of the situation. The export structure is dominated by low or medium-low technology industries, their yield of production and export is low. The share of processing industry in the national economy is low, but at the same time the processing industry and the related services have a crucial role in creation of innovation and technologies and their adoption.

3.6.Risk assessment for achievement of the objectives

In order to achieve the objective of contributing to the NAP in research and development to 1.5% of GDP is required to implement the following conditions:

1) Public funding should increase in accordance with the planning - public investment is an essential part for execution of the common plan;
2) The instruments stimulating contribution from entrepreneurs should be approved as early as possible (e.g., granting discounts for corporate income tax).
3) Efficiency assessment of instruments should be carried out on a regular basis and inefficient instruments should be replaced with new, more efficient ones.
4) Execution of the Guideline implementation plan is an essential prerequisite for the achievement of the objectives.
5) Execution of ex-ante conditionalities is a precondition for receiving funding from the EU structural funds. Thus the approval and commencement of implementation of science, technology and innovation Guidelines is one part of the conditions which brings closer to the achievement of the objective.

If the documented decision and action plan of Guidelines for Science, technology and innovation for the development of guidelines for the 2014-2020 is not executed, it threatens the implementation of ex-ante conditionalities that are necessary in order to receive financing from the EU structural funds. If the measures included in the action plan of Guidelines are not implemented, NDP objectives on increase of investment level to 1.5% of gross domestic product in research and development by 2020 and creation and introduction in production of innovative, internationally competitive products with high added value, in order to increase output proportion of these products in the national economy, and the aim of Smart Specialisation Strategies to increase the innovation capacity of the Latvian economy and build an innovation system that facilitates and supports the technological advancement of the economy cannot be reached.

4. SWOT analysis of Latvia's science, technology and innovation industry

SWOT analysis of Latvia's science, technology and innovation industry (**Error! Not a valid bookmark self-reference.**Not a valid bookmark self-reference.) shows that STDI field in Latvia is not homogeneous, and it is characterized by a relatively superior performance in certain areas of knowledge, and stagnation in others. In physics, for example, relatively higher number of publications and quotability is in the sphere of solid state physics, optics and photonics, as well as atomic, molecular and chemical physic; medicine - pharmacology and pharmacy; materials science - ceramics, composites and multidisciplinary materials science, environmental biotechnology - Biotechnology and applied microbiology. Due to the crisis and lack of lasting funding of the sector, the common knowledge base is depleted. In some areas of science, such as the social sciences and humanities, none of areas of expertise and quality of research activity reaches the world average. Number of people employed in the science is insufficient, ageing of human capital is ongoing and the regeneration is not sufficient. Measures of the previous period for regeneration of human capital in science were not sufficient and they were not focused on the priority areas of economic development. However, there are science sectors with good traditions and where separate areas of knowledge present higher quality of research activity than the world average. In individual key areas and technologies that are significant for competitiveness of Latvia and Europe, Latvia has a comparative advantage in certain areas of knowledge of the natural sciences (in

particular, solid state physics, organic chemistry, biochemistry and molecular biology, as well as computer science), engineering (particularly in electrical engineering and electronics, ceramic and composite materials, mechanics and biotechnology), medicine (particularly in the pharmaceutical, biomedical and medical technology) and agricultural sciences (particularly in, agronomy and horticulture, forestry and food technologies). Moreover an active research in Latvia is ongoing in those technology sectors, in which according to EC forecasts the largest global market potential is predicted. Latvia already has certain elaboration fore-runs and comparative advantages in the fields of biotechnology, nanotechnology, photonics, advanced materials and micro- and nano-electronics (Figure 12).

Also in Latvia there are several sectors of national economy, such as forestry, timber production and metalworking and mechanical engineering, food industry and agriculture, as well as the chemical industry, which, based on the opportunities of the related diversification[8], presents the largest export value growth potential. Which have a high growth potential. However, not in all of these sectors, there is a demand for research and knowledge. So far Latvian companies mainly benefited from such advantages of competition, which are based on lower labour costs rather than innovation. So far Latvian companies mainly benefited from such advantages of competition, which are based on lower labour costs rather than innovation. In some areas, for example in the forestry and pharmaceutical industry a good cooperation between science and industry has been established, industry investment in research and development is not significant, there is a fragmentation of human resources and geographic fragmentation of institutional infrastructure, especially in Riga, as well as low mobility of researchers between the public and private sectors. The link between science and industry is weak, and the scientific interests are focused on the research of basic science problems, rather than on the needs of the industry. The investments of the EU funds during the previous periods in STDI sector has contributed to the consolidation of sector's resources. 9 NRC has been established for consolidation of resources. During the EU structural fund programming period for 2007-2013 with the financial support of ERDF nine national research centres (NRC) are being created and developed, which are existing research infrastructure of different branches of science, used by NRC and other scientific institutions and merchants for interdisciplinary research. Cooperation strategies of NRC include a collaborative linkage with one or more European research infrastructures contained in ESFRI "Roadmap". Following NRC are developed in Latvia:

1) Information, communication and signal processing technology;
2) Nano-structured and multifunctional materials, structures and technology;
3) Pharmacy and Biomedicine;
4) Public health and clinical medicine;
5) Technologies for sustainable energy and environment resource extraction and use;
6) Forest and water resources;
7) Use of agricultural resources and food;
8) Latvian language, heritage and creative technologies;
9) Socio-economic and public management.

[8] Related diversification is a process, by applying to which, enterprises diversify their products by offering more sophisticated products with higher value added within the framework of research and innovations basing on previously gained knowledge, production factors and scale[8].

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At the same time, there is still a significant fragmentation of human resources and infrastructure, which does not contribute to the formation of critical mass in important areas of national economy.

4 SWOT analysis of Latvia's science, technology and innovation industry (Error!)

Strengths	Weaknesses
▪ In Latvia there are fields of science with high excellence and traditions that can serve as a foundation for further growth ▪ Knowledge fields with the scientific activity and quality above the average global level exist in almost all science sectors. ▪ In several areas of knowledge offered expertise meet the industry demand ▪ In some areas there is a relatively good cooperation between scientific institutions and companies ▪ With the support of the EU funds reconstruction of human capital is started and the number of PhD students and earned doctoral degrees is slightly increased. ▪ Within the framework of ERDF Programme, entrepreneurs and research institutions collaborate in specific studies ▪ Collaborative forms (NRC), integrated by research institutions are established. ▪ Within the framework of cluster program, science and industry cooperation platforms are created.	▪ Critically low number of people employed in science and insufficient renewal ▪ Fragmented STDI resources (human resources and infrastructure) ▪ Low level of R&D investments: persistent lack of funding for the sector, small scale financing tools, low proportion of private-sector investment in research ▪ Research subjects are not focused on the needs of the industry, little applied research ▪ Low mobility of researchers between the public and private sectors ▪ Inefficient and fragmented STDI management, and lack of cooperation and coordination between scientific institutions, higher education and industry ▪ Insufficiently transparent and unfounded procedures for evaluation of grant applications and allocation of funding ▪ Financial investments in the infrastructure are not balanced by investments in the maintenance and development of human resources ▪ Non-competitive remuneration for scientists, fragmented financial instruments ▪ Non existent support mechanism to attract industry scientists ▪ Low activity of scientific activities ▪ Insufficiently developed international cooperation ▪ Insufficient SI skills and abilities in the management of created knowledge, commercialisation, int.al. product promotion and marketing ▪ Underdeveloped technology transfer infrastructure and lack of instruments for engagement of scientists in production enterprises

Opportunities	Threats
▪ Development of ICT and use of on-demand computing power enables performing studies in certain sectors equivalent to major laboratories ▪ Opportunity to take part in scientific programs of the European Union ▪ General knowledge availability in fields of narrow specialization allows the use of leading and latest research ▪ Relatively specialized Latvian economy allows to search associated diversification opportunities, new products and create science specialisation areas according to market demand ▪ The Latvian economy has considerable potential for development while moving towards high added value and innovation-based economy ▪ To change the scientific areas of specialization according to industry demand ▪ Attraction of qualified researchers from abroad ▪ Preparation of human resources, to be able to use future market opportunities ▪ R&D in those key technology fields where Latvia already has the asset base and achievements ▪ Attract foreign investment in those fields, where research and technology development expertise is present, while the industry is underdeveloped	▪ Inability of science field to adapt to the rapidly changing requirements ▪ Inability of the field of science to quickly mobilize human resources in order to take advantage of new opportunities ▪ Entrepreneurs of individual sectors, such as pharmacy, electronics, energy, environmental technology, food technology, mechanical engineering etc., will purchase services outside Latvia

5. The aims of the science, technology and innovation development policy

Science, technologies and innovation are the aggregate of sectors of national economy and their achievements, forming the base for economic growth, focusing on creation of products with greater added value. Along with the higher education and national economy sectors, it is a part of the national research and innovation system, in the framework of which a broad and deep knowledge base is being created, on the basis of which problems topical for society are addressed, developed globally competitive products of high added value and technologies, competitive higher education. Through higher education and direct cooperation with industry and other sectors of the economy, nature, life, land and agriculture, information technology and engineering sciences provide absorption capacity of national economy knowledge and formation of innovation potential. Innovation support infrastructure - testing laboratories, design offices, mechanical workshops, pilot production facilities - is necessary for personalisation of knowledge in the products and technologies. Social sciences constitute an understanding of developments in society and address the problems of social development of society, including those that are related to science, technology and innovation processes. Human sciences form the identity of community and are a source of additional social values in creation of new products and technology.

5.1. Targets of the NDP 2020. Lines of activity "Advanced research, innovation and higher education"

NDP 2020 puts forward the following objectives for DTSI field:

- **Investments in research and developments of 1.5% of gross domestic product in 2020** by targeted promotion of attraction of human resources, development of innovative ideas, development of research infrastructure, cooperation of higher education, science and private sector, as well as transfer of research and innovation in the business;
- By commercialisation of knowledge, to foster creation and introduction into production of innovative, internationally competitive products with high added value, thus increasing the output of products mentioned the proportion of the national economy.

Following target is nominated for Smart Specialisation Strategy:

- To increase innovation capacity and establish innovation system fostering and supporting technological progress of national economy.

The aim of the science, technology and innovation development policy:

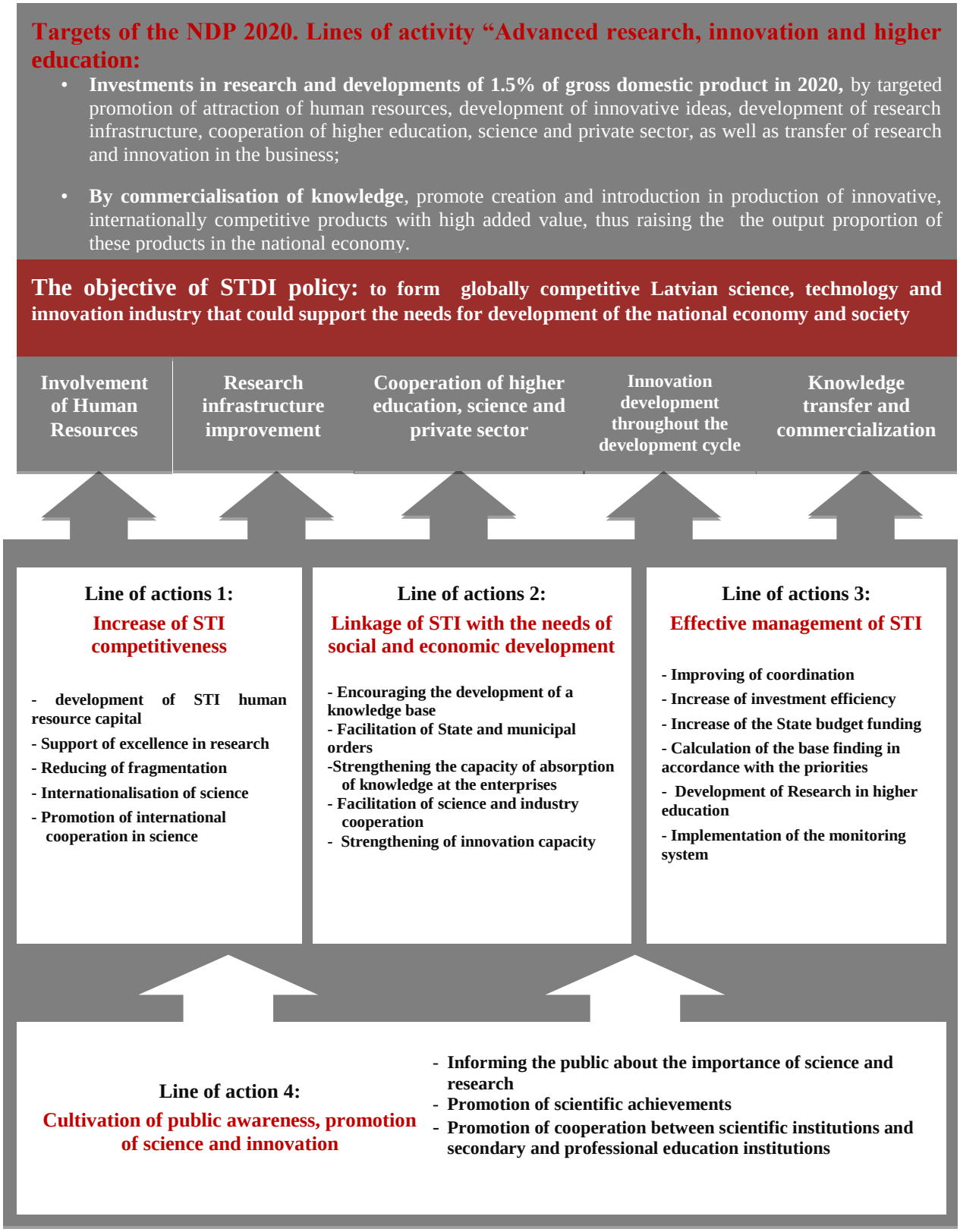
Therefore it is necessary to form globally competitive Latvian science, technology and innovation industry that could support the needs for development of the national economy and society.

Sub-targets:

- To develop human resource capital of Science, Technology and Innovation sector, by increasing the number of people employed in scientific research institutions and the business sector at least up to 7000 by 2020, focusing the increase in the identified knowledge specialisation areas;
- To increase the proportion of high and medium technologies;
- To promote the international competitiveness of Latvian science by focusing research in smaller number of larger and stronger institutions, promoting the increase the number of scientific articles published in a recognised international databases up to 1500 articles and number of inventions up to 50 intellectual property units a year;

- To modernize and integrate research and education sectors, increasing their ability to respond to future challenges in research, technology development and innovation, and increasing the mobility of education sector;
- To increase the return on investment of scientific institutions in research and development, creating a more efficient transfer of knowledge and technology environment
- To strengthen the innovation capacity of enterprises through the development of the demand for new knowledge and technologies, and promoting private sector investment in R&D, ensuring that by the year 2020, at least 48% of the total investments in R&D is made by the business sector;
- To optimize the management of science, technology and innovation sector, ensuring an effective coordination and increase of R&D investments;
- To create a demand for science and innovation, informing the public about the scientific accomplishments and promoting innovative activities and development of technologies.

5Figure 5 Structure of STDI objectives and lines of action



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6. Basic principles of the science, technology and innovation development policy

STDI policy guidelines aim to promote the sustainable, stable growth and increased investment capacity and competitiveness of STDI sector in promotion of general well-being, quality of life and economic sustainability. The set basic principles are also linked to the key principles established in the draft of Education Development Guidelines for 2014-2020[9], with particular emphasis on linking the principles of knowledge society and lifelong learning.

The consistent observation of STDI policy principles is essential for further development of all major elements of the system and implementation of policy lines of action. Following policy principles of STDI are established:

Priority of human resource capital and talent. STDI policy is created while acknowledging that the most important potential of the sector are highly qualified industry professionals and researchers, which is the main potential for development and creation of the necessary changes. Investments in infrastructure and other elements of the system are evaluated and compared with the priority investments in human resource capital.

Excellence and quality. Financing of science and technology capacity building measures is closely related to the measurement of international excellence through publications and their quotation, registered and sold patents and licenses.

Integration with industry

Integration of research with industry is a vital component of the innovation system.

Sustainability and balance. 50% balance of finance available for national scientific institutions and competitive funding is achieved in the scientific activity financing model, thus providing the strategic development of research-driven development and administrative capacity of institutions in the management of science.

The principle of cooperation. The institutions working in the STDI sector cooperate in searching for new solutions and best development options for the sector and research, by creating joint projects and collaborative platforms both with institutions of public sector and universities and private sector organisations. Interdisciplinary projects and cooperation between science and industry partnership serves as an evaluation criterion for the granting of public funds, priority support is given to projects and activity models, which go beyond the institutional limits.

The principle of an integrated approach. STDI policy is focused on the development of science and technological development sector potential and increase of quality, promoting the integration of technological and social innovation, development of science and higher education base, int.al. developing humanitarian and national culture and identity-related science fields.

Investment complementarity principle. Mutual complementarity in the public and private sector investment is provided through coordinated investments in addressing the same challenges. In addition, the EU fund investments will be made through such funding instruments that will increase private sector investment and promote cooperation between scientific institutions and industry. This approach is important, so that the investment in

[9] Education Development Guidelines for 2014-2020; Project. Ministry of Education and Science 2013. page 96 http://izm.izm.gov.lv/upload_file/2013/IAP_2020_projekts_pa.pdf

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research and innovation would be focused on framework of not just single source of financing, but the synergy of different funding sources could be achieved.

The participation principle Decision making in STDI industry takes place by broad involvement of public and private research institutions, scientists, industry and interested private sector organizations, discussing the proposed solutions and changes and respecting the views expressed and arguments.

Openness and transparency. Management and decision-making process of the STDI sector is open and the relevant information is available to the public, ensuring application of fair and rational evaluation criteria and decision-making in the public interest.

Knowledge transfer. STDI policy instruments are focused on use and introduction of new solutions and products created by the Science and research in the real production sector, thus ensuring economic growth and increasing competitiveness.

The principle of polycentric development. Investments of STDI sector adheres to the principles of balanced polycentric economy development, thereby ensuring greater overall economic growth and increase of competitiveness.

7. Lines of action for the implementation of the guidelines

7.1.Line of action no 1: Increasing the competitiveness of STI field

7.1.1. Develop the human resource capital of the field

Sufficient and high quality human resource capital along with other favourable conditions is a necessary base condition, so that the investments in research and innovation would be effective. Human resource capital with highly skilled specialists and researchers both in science and research, and in business. Renewal and development of human resource capital increase of number of people employed in the field of science and technology development is the top priority of the sector. Within the framework of Smart Specialisation Strategies, following fields in which the human resource capital needs to be increased are identified : natural sciences (physics, chemistry, biology), engineering (computer science, materials science, biotechnology), medicine (int.al. pharmacy), agricultural science (int. al. forestry), social sciences, in the areas which study human development and its challenges, and the humanities and arts, which form national and European identity and create cultural heritage-based innovations.

Number of employees in the scientific research is directly related to the demand of scientific work and the amount of funding for the industry and its structure. It is important that investments in the STDI infrastructure are balanced by investments in human capital development, without creating expensive laboratories and other stocks of expensive technological equipment that are not used due to lack of appropriate specialists.

Implement measures to attract young scientists and career development

In order to ensure the required number of scientific personnel, measures should be implemented and further support of doctoral studies should be continued. In particular, it is necessary to increase the number of doctorates in nature, life, information technology, forestry, agriculture and engineering sciences, including increase of proportion of doctoral thesis which studies the problems of STI industry (private sector).

Tasks to be implemented:

- Dissertation process improvement;
- Involve doctoral students from State budget-funded programmes and projects;
- Grant excellence scholarships for doctoral candidates who demonstrate high research potential;
- Prepare master students and PhD students for specific industry partners; establishing of priority by allocating state budget grants for funding master's and doctoral studies;
- To promote the sharing of higher education resources and moving towards unified science quality standards, creating of research-based PhD, improving ties with research institutions and national economy, creating a thematic doctoral study centres and providing support for infrastructure renovation, purchase of equipment and installations, int.al. distance learning, ICT solutions and software;
- Include safeguarding of PhD jobs as assessment criteria for doctoral studies program development and improvement projects;
- Support research-driven, third-cycle studies in art and design, and their association with industrial innovation;
- Include a doctoral thesis developer jobs in scientific group projects.

To support new research and development careers in scientific institutions of Latvia or in the industry

During the planning period of EU structural funds for 2007-2013 funds were granted to the Universities and scientific institutions and laboratories for the improvement of the infrastructure and equipping with modern hardware, supported attraction of human resources to science, including the preparation of a new doctors that will give results during the next five-year period. Young scientists who have not yet acquired permanent work is the most mobile part of Science human resources, which in the context of globalization can find a job anywhere in the world. Therefore, it is necessary to provide an opportunity for young researchers to participate in research projects and obtain the right to exercise individual post-doctoral research in the Latvian research institutions and companies on a competitive basis. This activity is focused both on those young researchers who have obtained a doctoral degree in Latvia, as well as those who obtained it at a foreign institution. Thereby, facilitating return migration of Latvian scientists and internationalization of Latvian science.

Tasks to be implemented:

- Create national post-doctoral grant system;
- Support scientific teams, which carry out applied research in order to develop an innovative solutions for practical industry or addressing societal challenges, providing jobs for young scientists within the framework of the projects;
- To support implementation of individual post-doctoral R&D projects, including the establishment of grant scheme for creation of post-doctoral jobs at enterprises.

To provide competitive salaries to the scientists funded from the State budget

Reduction of base funding for science up to 25% of required by law, has resulted in a situation that in some scientific institutions are concluded contracts with scientists indicating decreased workloads 0.2-0.5 of full workload, although actually they are working full-time. Monthly remuneration in such cases is reduced up to Ls 60 lats per month. This situation is most often observed in Humanities sciences sectors, creating a very high risk of outflow of scientists to other sectors of the economy and endangering the existence of these branches of science. In other fields of science, base funding shortfall is compensated by supplementation of salaries of scientific staff from funding of international projects. Although this practice generally can be encouraged, it is important to maintain an optimal balance between the State budget financing and financing to be attracted on a competitive basis, so that the remuneration of scientific personnel could be competitive in all disciplines.

Tasks to be implemented:

- Provide 100% allocation of the estimated base funding.
- Task execution is linked to the progressive increase in the science base funding (see Task 4.2.1.1.)
- Introduce the unity principle of pedagogical and research work, which provides involvement of academic staff in research and involvement of scientists working for scientific institutes, in the teaching of certain subjects at the Universities.

7.1.2. Develop excellence in research

Research excellence is directly linked to the human resource capital of STDI sector - scientists and their cooperation partners, both locally and internationally. During the recent years with the help of ESF, number of scientific publications by Latvian scientists in peer-reviewed scientific publications has almost doubled; this increase is primarily seen as the publication of conference article collections instead of the world's best scientific journals. In addition, the most quoted are these articles of Latvian scientists, have been created in

collaboration with England, France, Germany and the Scandinavian countries, as well as Japan and the United States. Therefore, in order to enhance the visibility of the scientific performance and competitiveness, it is necessary to provide direct funding for projects of excellence and incorporate the requirements of excellence in other financial instruments, as well as support formation of STI human resource capital by engaging in scientific networks of excellence.

Tasks to be implemented:

- Continue to implement the fundamental and applied research programs, reinforcing importance of research excellence focused criteria in the allocation of funding;
- To support the groups of scientists who carry out development of unique/practically applicable products (e.g., modelling tools) for the needs of Latvia;
- After the completion of the international assessments, to develop a plan of measures for development of Latvian science sectors, according to the specifics of each sector and identified challenges;
- Include the requirement to publish research results in high-quality scientific editions in the criteria for funding instruments (allocated both on a base and on a competitive basis);
- To support the integration of Latvian scientists in international scientific networks of excellence and integration into the European research area, using joint mobility projects (the task is interrelated with task 1.4).
- Support involvement of international editors in publications of Latvian scientific institutions, their issue and inclusion in databases of international scientific publications;
- Provide acquisition and maintenance of national licenses for international scientific literature databases.

7.1.3. Reduce STDI resource fragmentation

In order to increase the potential of Latvian scientific institutions, achieve effective use of STI resources and optimize the administration costs, it is necessary reduce fragmentation of the scientific institutions, ensuring that Latvia has more internationally significant institutions and sector is more attractive and open to scientists from all over the world. Research infrastructure is a necessary condition for high quality human resource capital development. Infrastructure investments must be closely linked with the human resource capital formation; they must be reasonable and must facilitate pooling of infrastructure, as well as opportunities for organizations to maintain it.

One of the major obstacles in the consolidation of research institutions is institutional isolation and a desire to preserve the identity of scientific institutions and self-governance. Experience of formation of National Research Centres (NRC) shows that collaborative arrangements of coordination of scientific institutions can be implemented and developed more successfully without prejudice to the legal status of the Scientific Institutes and reorganization of institutions, by creating new and flexible forms of cooperation basing on excellence and cooperation strategies, which may be the first step in further consolidation. Latvia is still much geographically in one place, for example, too little scientific institutions located in Riga, which cannot provide excellence in scientific activities, resource acquisition and efficient use. It is therefore necessary to promote further consolidation of the scientific institutions based on excellence, contribution to the development of society and national economy, and their development potential, and to develop enhanced cooperation model for scientific and higher education institutions, promoting flexible forms of cooperation and coordination.

Tasks to be implemented:

- Promote further development of NRC and engage new scientific institutions in use of NRS infrastructure;

- Create new excellence centres in the areas of Smart Specialisation, which provides technology transfer and development of human resources;
- Complete the existing and to be purchased or established common infrastructure data base in the structure of academic base network, and ensure that it is accessible to all interested parties;
- Provide analysis of infrastructure creation or purchase purposefulness, by planning the number of infrastructure users and planned usage intensity, economic return and prevention of duplication risks;
- Continue work on involvement of Latvian scientific institutions in ERIC platforms;
- Continue to work on proposals for research infrastructure projects that would be included in research infrastructure development plan of European significance.
- Increase the minimum criteria for the existence of a scientific institution according to the specific of science sector (number of Ph.D., turnover, percentage of applied research) and stop financing those institutions that do not reach established results.
- Combining Research Institutes for grant applications, as well as reinforced use of the existing infrastructure should be facilitated:
  - By stimulating purchase of research equipment rental, as opposed to the investments in new equipment.
  - By giving priority in evaluation criteria to institutions that has joined together, demonstrating enhanced use of existing equipment within projects.

7.1.4. Support the internationalisation of science and international cooperation

International cooperation in the STI sector is both accumulation and transfer of knowledge and experience, but also it is an important direction for the development of the sector and provision of financial and other resources. Foreign funding in the financial structure of STI sector exceeds 50% (50.4% in 2012), which is a major financial resource that has to be effectively managed and used. One of the most essential indicators of quality and competitiveness of science is the performance of Latvian scientists in the international scientific research programs. Latvian scientists and institutions successfully participate in the EU Framework programmes. Latvia ranks 11 among 27 EU member States, with a success rate of 22.1% (EU-27 countries average of 21.6%).

Tasks to be implemented:

- To support participation of Latvia in the research and technology development programs of the EU and BSR (Horizon2020, EUREKA, Eurostars, ECSEL, COST, Bonus, KIC, etc.);
- Improve operation of the National Contact Point providing proactive addressing of the target groups and support for project preparation and attraction of partners.
- Ensure a closer association with the Horizon 2020 programme committee representation and implementation of international programmes and, by using LSC and LZA department meetings in Latvia and other consultative platforms for formulation of the opinion, and support the coordination of opinions with Lithuania and Estonia;
- Create a financial instruments for support of project preparation and provision of co-financing, including additional incentive for collaborative projects that involve partners in Lithuania and Estonia in the technology development spheres with the EU Member States and other countries around the world;
- Ensure participation in the European Space Agency projects;
- Support participation of Latvia in international scientific cooperation organisations and associations
- Ensure recognition and competitiveness of research conducted in Latvia in the international arena;
- Provide opportunities to young scientists who obtained doctoral degrees in other countries around the world, to participate in the scientific group projects and implement post-doctoral projects at the Latvian scientific institutions and companies
- Provide opportunities to young Latvian scientists to participate in the scientific group projects and implement post-doctoral projects at the foreign scientific institutions and companies

7.2.Line of actions 2: Linkage of science, technology and innovation with the needs of social and economic development

Research and innovation that meets the social and economic development needs, enables the country to tackle major societal challenges and provide the best possible return on investment from research and development. Research and innovation in all branches of science, is a source of added value, which is the foundation of competitiveness and uniqueness of the society. In order to ensure link of STI with social and economic needs, it is necessary to promote demand both from sectoral ministries and municipalities, as well as the industry demand for solutions offered by science, technology and innovation. It is therefore important that research and development investments are secured through such support instruments, which increase a) investment of sector and industry in research and development, and b) promote cooperation between scientific institutions and industry, and industry ministries and municipalities, c) supports the commercialisation and application of research results.

7.2.1. Building of knowledge base and focusing of the research on directions important for the society development.

A broad and high grade **knowledge base** is a prerequisite, which along with the human resource capital is necessary so that the eco-system of innovation would create new knowledge. A deep and thorough knowledge is accumulated in **six major sectors of natural sciences; engineering; life sciences and medicine; agricultural science; as well as social and humanities sciences.** The **aggregate of all this knowledge** is a base for creation of new knowledge in a result of mutual interaction, which answers to current issues and solutions of topical problems. In order to ensure a broad and deep knowledge base in all areas of science and focus Latvian scientific research institutions on development directions important for Latvia and key technologies identified by EC, implemented state-budget funded programs and projects in the time period from 2014 - 2017 has to be focused in the following priority areas:

Environment, climate and energy - environment, ecosystems and biodiversity, extraction of renewable resources, energy independence, technologies for increasing the security of electric power supply, development of low carbon-intensive production, climate change mitigation and adaptation to climate changes.

Innovative and advanced materials and smart technologies - multifunctional materials and composites; nanotechnology and photonics; informatics; computer science; information and communication technologies, signal processing technologies.

Public health - prevention, diagnosis, treatment, clinical medicine, treatment methods and technologies, medical and biomedical technologies.

Exploring of local resources and sustainable use - subterranean depths, water, agricultural and forest resource acquisition and food technologies, biotechnologies.

Sustainable development of the State and society **- society, governance, resources, economy, demography, environment.**

Letonika - Latvian history, language, culture, values.

7.2.2. Promote the orders from industry ministries and municipalities

Research, technology and innovation order from national economy sectors provide a demand for research, new technologies and innovative solutions and focus it in directions significant for society.

Tasks to be implemented:

- Continue to implement the national research programmes;
- Engage industry, ministries of other sectors and municipalities in the formulation of State Research Programs, regular monitoring of progress and financing;
- Make full use of design as an instrument for promotion of innovation also in traditional industries.

7.2.3. Integration of education, science development, technology, innovation and business

The aim of this line of action is improvement of the cooperation abilities for scientists and scientific institutions, promotion of scientific activity on application in compliance with industry and market demand for new technologies and innovative solutions. Ensure use of research results funded from public resources for creation of innovative products and services.

Tasks to be implemented:

- Assign priority to such doctoral and post-doctoral research, that is associated with tackling of scientific or technological problems identified by the industry (See task 1.1);
- Assign priority to the creation of forecast study courses of future market products and incorporate them into a science and technology development related programs;
- Develop an institutional integration model for provision of internship placements and collaboration with universities in the State and municipal companies through accumulated experience in medical education for provision of residency;
- Create innovation grants for students and academic staff, particularly in the STEM areas, for strengthening of cooperation with industry and the entrepreneurial activities and support for achieving excellence in learning, developing science-based innovative solutions, for solving of topical and practical business and other external customer problems, encouraging cooperation of research centres, universities and businesses and training and the attraction of new specialists in science;
- Create a single technology transfer platform, which includes formation of 2-3 technology transfer centres, in which the technology transfer experts would be concentrated and widened technology transfer services, thus providing support for economic rationality research results and technological feasibility test. Protection of Intellectual Property and development and implementation of commercialisation strategy (*fund "proof of concept"),* as well as by providing a support for such research, which goal is to create new commercialisable knowledge and technology. The task of the single technology transfer platform is to increase income of scientific institutions from knowledge commercialisation by licensing them or creating new companies;
- Continue to development of Technology transfer contact points established at the universities for the support of technology transfer and innovations;
- Establish a Centre for creative industries;
- Ensure wider accessibility to the scientific infrastructure for entrepreneurs, improving management of scientific infrastructure and other assets that are at the disposal of the scientific institutes, simultaneously developing scientific infrastructure in areas identified in the fields, where demand of education, research and industry has formed and which are created according to the open access principles;
- Continue development of competence centres as a long term platform for cooperation of scientific institutions and entrepreneurs, by providing support for implementation of industry ordered research and product development projects, by co-financing both individual and cooperation projects and by targeting support for research and product development projects with higher potential economic returns and the capacity to attract investments for their introduction in production.

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7.2.4. Strengthening of innovation and knowledge absorption capacity in the companies

The aim this line of action is to increase the ability of the companies to develop innovation-based advantages of competitiveness, by moving additional resources both for the formation of companies' internal research and innovation capacity and technology and gaining the knowledge outside the company. As well as encouraging formation of new innovative companies with rapid growth potential and facilitating the fund attraction in their early phase of development.

Tasks to be implemented:

- Introduce a corporate income tax discounts on investments made in R&D, especially if the research was carried out in cooperation with scientific institutions;
- Extend the early phase investment instrument spectrum and volume, in order to ensure support for business ideas with the rapid growth and export potential at the phase of development of the necessary funding products and business model development;
- Improve the SMEs approach to new product and technology development services (innovation "vouchers") by providing support for purchase of services related with research and product development, while expanding the range of service providers; Ensure pre-incubation and incubation services for newly established companies both by developing a network of business incubators in the regions and by development of technology incubators, which focus on the commercialisation of research results through start-up companies;
- Facilitate potential of non-technological innovations and Latvian creative industry for development of more efficient business models, services and products and for increasing their value;
- Implement measures for the general public, in order to inform and motivate to engage in innovation and entrepreneurial activities.

7.3.Line of actions 3: Effective management of STI industry

This line of action provides increase of efficiency of scientific management system. This can be achieved by improving coordination, reducing the administrative burden and through the effective use of the State budget funding.

7.3.1. Improving of coordination

Science, technology and innovation policy management is characterized by the *ad-hoc* coordination between the Ministry of Education and Science, the Ministry of Economy and other sectoral ministries. Creating and implementing science, technology and innovation policy of unified content, calls for a closer cooperation between the ministries and involvement of researchers and industry in setting of priorities for investment, policy formulation and monitoring of its results, if necessary, in order to reformulate the operational priorities for investment and thereby stimulate development of innovation and culture and ensure implementation of Smart Specialization Strategy. As indicated by the European Commission and its experts, Smart Specialization Strategy implementation is based on a process, not a fixed choices, so the monitoring system must be flexible, capable of timely identification of changes in one element of the strategy, by offering appropriate adjustment in part of action of the strategy. One of the most flexible institutional solutions, in which a wide range of expert time can be involved, which would be able to deal with the challenges of monitoring, is a consultative institution format. It is therefore necessary to establish the Strategic Innovation Council of Latvia (SCIL), the goal is to provide a forum in which with the participation of researchers, research funders and result users (industry), tactical objectives of SSS would be jointly put forward and their achievement monitored, as well as designed and monitored system for indicator monitoring of the effectiveness of activities to be

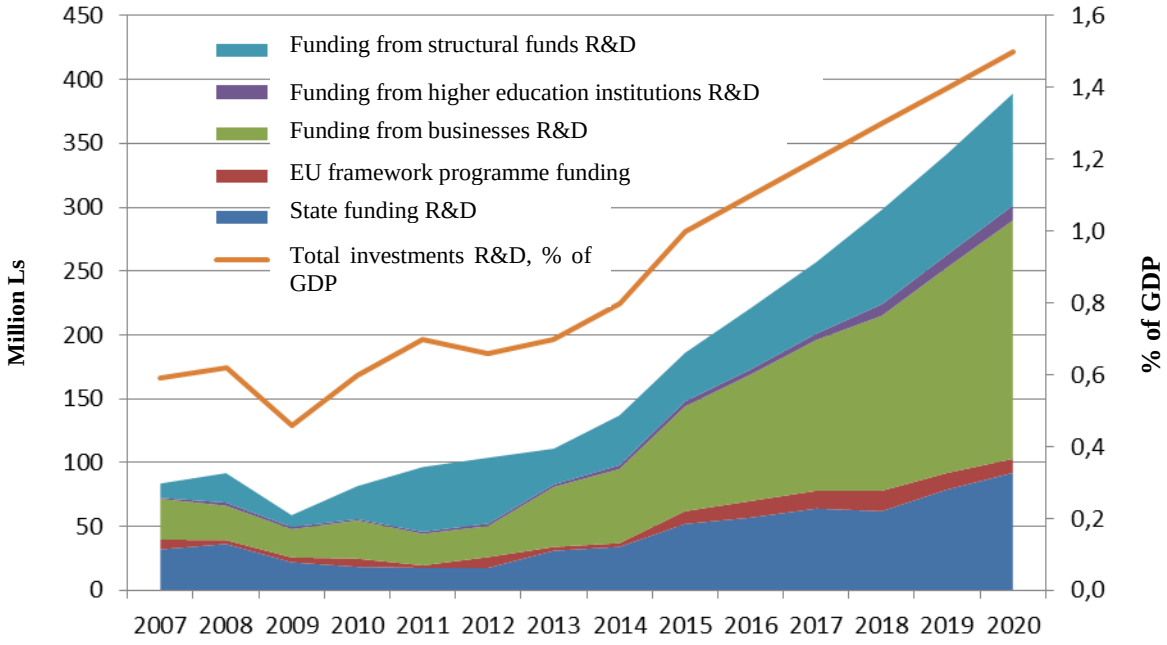
implemented for provision of SSS; and which would work to ensure the creation of innovation capacity, research and industry integration and public understanding of research as a creative activity creating public values that promote the development and competitiveness of Latvia.

Tasks to be implemented:

- Develop an institutional model for management of science, technology and innovation development, that provides consolidation of the sector's administrative management resources and coordination of use of Ministry of Education and Science and Ministry of Economy, and other sectoral ministries resources;
- Form SCIL for monitoring of SSS of Latvia, whose mission is to provide a forum in which through the participation of researchers, research funders and result users (industry), tactical objectives of SSS would be jointly put forward and their achievement monitored, as well as designed and monitored system for indicator monitoring of the effectiveness of activities to be implemented for provision of SSS;
- Create a portal of scientific activity, which serves as a site for exchange of information and reporting.

7.3.2. Increase of investment efficiency

National Development Plan 2014-2020 provides increase of total funding of science, int.al. Increase of private investment volume in 2020, reaching 1.5% of GDP. It is planned that already by 2015, the total increase in investment for research and development amounts to 1% of GDP, or roughly 169.2 million lats. In order to achieve the set objective of 1.5% by 2020, it is necessary to establish a balanced STDI funding structure, which consists of a wide range of institutional arrangements and financing instruments. Taking into account that the strategic goal is to significantly increase private sector investment in the overall science and technology funding structure, instruments that encourage private sector and foreign investments, including attraction of funding from the EU Framework Horizonts2020, should be designed (**Error! Reference source not found.**6).



7.3.3. Increase of the State budget funding for STDI

To ensure that the funding structure of STDI ensures sustainability and development, is of vital importance to increase the state budget funding share level an early stage. The proportion of the state budget funds and the European Union funding should be equalized already in 2015 - 2016, and prevalence of state budget financing should be increased during the subsequent years. Change trajectory of required increase in funding during the period between 2014 - 2020 (Table Table).

22 Total needed State funding for scientific research work in 2014-2020 (million EUR)

	2015	2016	2017	2018	2019	2020
Funding	57	73	91	104	117	131

7.3.4. Calculation and allocation of institutional or base funding in accordance with policy settings

Institutional or base funding aims to ensure the operation stability of scientific institutions. From 2009-2013 operating expenses of national scientific institutions were funded for about 25% of the amount calculated. This level of funding has created a critical situation in the remuneration of scientists, maintenance of scientific institutions, provision of co-financing and value added tax liabilities for international R&D projects, as well as in infrastructure maintenance at the national level. In order to implement the measures planned for development of STDI, firstly, by 2015 it is needed to renew scientific institution base funding in accordance with the volume established in the legislation. Although the number of scientific institutions after consolidation measures may decrease and the largest increase of research employees is planned in the industry, it is expected that with the increasing importance of research and the role of scientific institutions in the national economy, the number of employees in the scientific and public institutions will not decrease and gradually increase. Therefore, the optimum base funding amount for 2015 is 46 million. EUR that corresponds to the full estimated funding of 1880 expressed as elected scientific personnel full time equivalent (FTE) and with associated infrastructure and technical personnel. By 2020, it is planned to increase the number of the scientific staff from 1880 to 3000 FTE, initially intending to increase the funding from ERDF financed temporary work places for doctoral candidates and young scientists, which will gradually replace the base and funds allocated on a competitive basis. This way providing increase of base funded FTE for approximately 250 units annually (Table 5).

3Table 3 Graph of institutional funding increase (million EUR)

	2015	2016	2017	2018	2019	2020
FTE of research staff.	1880	2000	2250	2500	2750	3000
The necessary base funding (million EUR)	46	51	58	64	71	77
Medium term provided by the law On Budget (million EUR)	24	38				
Additionally needed funding (million EUR)	22	13	58	64	71	77

7.3.5. Gradual increase of R&D funding granted in a tender procedure

The aim of the funding awarded under tender procedure is to provide research quality. Funding awarded from the State Budged under tender procedure within the time period from 2009 - 2013, including funding of National Research Programs, Fundamental and Applied research and Market-oriented research program was almost 9 million lats per year. Taking into consideration that the EU funding will gradually decrease, the State budget financing should gradually be increased. Schedule for increase of funding under a tendering procedure from the State budget programs "Provision of Scientific activity", "National Research Programmes" and "Market-oriented research" (Table)

4Table 4 Schedule for increase of funding under a tendering procedure (million EUR)

	2015	2016	2017	2018	2019	2020
The funds allocated by tender (million EUR)	11	22	33	40	46	54
Medium term provided by the law On Budget (million EUR)	11	11				
Additionally needed funding (million EUR)	0	11	33	40	46	54

7.3.6. Creation of new financial instruments, appropriate for aims and tasks of DTSI policy.

The existing array of funding instruments, structure and conditions only partly corresponds to STDI policy objectives. Reducing the State budget funding for science, we discontinued financing instruments, which is focused on the formation of link between science, higher education and industry such as "Market-oriented research". These financial instruments should be restored. As well as, new financial instruments, which are focused on the science and restoration of the human resource capital and industry innovation and knowledge absorption capacities, must be created. In addition, should be provided compliance of financing instruments with the policies outlined in STDI - Excellence, high economic and social value, transparency of policy planning and implementation process and procedures to prevent conflicts of interest and corruption.

Tasks to be implemented:

- Carry out an impact assessment of financing instruments awarded under a tender procedure;
- Review the structure of financing instruments awarded under a tender procedure and the regulatory framework for existing financial instruments, and to ensure its conformity with the STDI policy objectives and core principles;
- Gradually increase the funding of MES financing instrument State research programs, Fundamental and applied research, "Market-oriented research" and ensure participation in Eureka and EUROSTARS projects;
- Create new financial instruments awarded under tender procedure that comply to the objectives and fundamental principles of STDI, such as career development grants, State order programmes, mobility grants, etc., by 2017.

7.3.7. Support the research in higher education (HE investments)

While the State budget allocations in higher educations decreased, university expenses for research work proportionally decreased as well. Investment of Latvian higher education sector in research from 2009 - 2013 primarily depended on financing from the EU structural

funds. With the renewal of funding for higher education and along with the increase of university revenue, it is expected that investments in research from universities will increase.

Tasks to be implemented:

- While developing rules and criteria for allocation of financing instruments under the tender procedure that contribute to the University's own investment in research and motivates the universities to attract the investments in research by commercialisation of the created knowledge;
- Determine the criteria for investments attracted by the universities and own investments in scientific research simultaneously with the accreditation and licensing of higher education studies and programs;
- Renew instruments for academic research personnel financing

7.3.8. Development of policy implementation monitoring and impact assessment system

In order to ensure the implementation of STDI policy and achievement of the proposed goals, it is necessary to create a high-quality and sustainable monitoring system that links together regulatory, scientific and higher education institutions. Since implementation and impact studies on action policy in Latvia is not developed, involvement of higher education and scientific institutions is a vital element of the monitoring system. It is necessary that the researchers of social sciences are data generation, which would allow following the progress of the achievement of the objectives and related factors. Currently only few individual scientists are involved in research of issues and problems related to science, technologies and innovations. Therefore it is necessary to create a capacity of policy analysis at the higher education and scientific institutions. Moreover, this capacity should be developed in close cooperation with the Ministry of Education and Science, as well as by involving doctoral and masters level students, thus promoting also human resource capital of the sector in general, and, indirectly, also the management. In this way in a long term could be achieved that adequate analytical capacity is formed in Latvia and its sustainability is ensured.

Tasks to be implemented:

- Develop monitoring system for implementation of STDI and Smart Specialisation Strategy policy, providing development and quality assurance system of research policy, which is focused on development of policy implementation capacity analysis in public administration, higher education and research institutions;

7.4.Line of actions 4: Rising of public awareness, promotion of science and innovation

Motivation for attraction of young talented people to science and technology development is formed at the school and it is affected by public perceptions and the prevailing stereotypes about job and career opportunities in science and innovation area, level of remuneration, prestige of scientist's profession. Thoughtfully organized science and innovation, as well as the promotion of sectoral developments may have a positive impact on this original choice of profession. Promotion of public awareness and education about the science, technology and innovation sector plays an important role in creating motivation for the choice of profession and career development. The target audience of informative measures primarily are the pupils, teachers, trainers, students, existing and future entrepreneurs, as well as the whole society.

In order to promote the prestige of the scientist's profession, in addition to the already existing measures, following tasks have to be carried out:

- Develop a communication plan for STDI industry;
- Create programs dedicated to STDI and include them in the public procurement for the national public media;
- Include contributions to the promotion of scientific research performance evaluation and calculation of the base funding;
- Provide a support to the professional scientific organisations for implementation of science promotion measures;
- Strengthen cooperation between general and vocational educational institutions and scientific institutions and establishments;
- Provide support for measures aimed at improving science, math and reading skills of the pupils and appeal of math, science, engineering and IT studies according to age and sex of the pupils;
- Development of interactive science centres in Riga and regions of Latvia.

8. Results of the development of science, technology and innovation policy and indicators of their achievement

The main indicator of the achievement of the objective of STDI policy "to form globally competitive Latvian science, technology and innovation industry that could support the needs for development of the national economy and society" is the position of Latvia in the European innovation index group, the base value of which (2012) is *"modest"*. By 2020 is planned to reach position *"followers"*. To achieve this, it is necessary to increase the investment in R&D until at least 1.5% of gross domestic product by 2020. The achievement of this objective is planned by targeted promotion of attraction of human resources, development of innovative ideas, development of research infrastructure, cooperation of higher education, science and private sector, as well as transfer of research and innovation in the business (Table 5). Moreover, STDI policy envisages that by commercialisation of knowledge, to foster creation and introduction into production of innovative, internationally competitive products with high added value , thus increasing the output of products mentioned the proportion of the national economy.

5Table 5 Indicators of achievement of STDI policy results.

STDI policy result	**Aim reaching indicators**	**Base value (year)**	**2014**	**2017**	**2020**
Position in the European Innovation Index Group	European Innovation Index Group	"modest" (2012)	"modest"	"modest"	“moderate”
Investments in R&D in the amount of 1.5% of gross domestic product in 2020	Proportion of high and medium-high technology industries in Latvian merchandise export	23.8% (2012)	24 %	27.5%	31%
	Proportional increase of the private sector investments in research and development (private sector investments in research and development, % of total investment)	24,8 (2012)	42	46	48
	The number of scientific personnel in research and development	5593 (2013)	5700	6300	7000
	The number of	22.7	18	21	23

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	researchers employed in the private sector (% of the total, according to full-time equivalent)	(2011)			
	Number of students that earned degree in universities or colleges (thousands/people)	24.8 (2011)	23.9	24.1	24.6
	Proportion (%) of population aged 30-34 with a higher education.	36 (2012)	37	38	40
	Granted European patents, applied from the scientists that reside in Latvia	11 (2011)	13	26	50
Creation and implementation in production of innovative and internationally competitive products with high added value	The proportion of innovative companies (% of all companies)	29.9 (2010)	30	35	40
Promotion of international competitiveness in science	A smaller number of stronger State-funded scientific institutions	42 (2013)	40	30	20
	Scientific articles published in international databases	1043 (2012)	1100	1300	1500
	Success rates for membership in the EU framework program	20.5% (2013)	22 %	25 %	30 %

Data source: MES, CSB. Forecasts: MES, CSCC

9. Impact on the State budget and the assessment of municipal budgets

In order to enforce the guidelines, Ministry of Education and Science plans to attract such funding sources for covering of costs:

1. State budget allocation from general revenue,
2. Co-financing from the EU structural funds,
3. Private sector investments,
4. European Union funding for research and technological development programme cooperation projects.

6Table 6 Effect of the policy planning document to the state and municipal budgets

	The following three years (million EUR)		
	2014.	2015	2016
The total variation in budget revenue int.al.:	Na	na	na
Changes to the national budget revenue	Na	na	na
Changes to the municipal budget revenue	Na	na	na
The total variation in budget revenue int.al.:	+ 3.1	+ 27	+ 16
Changes to the national budget expenditure	+ 3.1	+ 27	+ 16
Changes to the municipal budget expenditure	Na	na	na
Total financial impact:	-3.1	-27	-16
Financial impact on the State budget	-3.1	-27	-16
Financial impact on the Municipal budget	na		
Detailed income and expenditure account (if necessary, a detailed income and expenditure account is added to the policy planning document in Annex 1. Impact on State and municipal budgets is indicated individually for State and municipal budget)	The required total State Budget funding for 2014 - 2020 is provided - 603 million. EUR. Overall funding from the structural funds for this period is planned 548 million. EUR (of which managed by MES - 321 million. EUR, ME - 221 million. EUR and MC - 6 million. EUR). Currently, the medium term budget provided by law for 2014 is 30.4 million. EUR, by the year 2015 - 39 million EUR, by the year 2016 - 49 million EUR, which is not enough for achievement of targets set by the National Development Plan for 2020 - reach investments in R&D in the amount of 1.5% of GDP (according to forecasts from November 2013, it amounts to ~ 554 million EUR). The expected State budget share is ~ 35-40% of the total investment, due to the gradual decrease of EU structural funds investment, which will need to be		

	replaced with the State budget.			
Other information	The impact of the Guidelines on the State budget as a whole has a positive impact, since the scientific work in the medium and long term provides extra income to the State budget from creation of high added value, knowledge and growth of the State export, which significantly exceed the State budget investment in R&D and innovation. However, it is difficult to directly calculate such income to the State budget and it is not carried out.			
Changes in budget expenditure from 2017 to 2020	2017 -18 million. EUR	Milli on. EUR	M million. EUR	illion. EUR

After reaching the objectives established in the Science, Technology Development and Innovation Policy, a positive impact on State and local budgets will be indirectly reached, because it will ensure the development of science and research, contribute to the implementation of the applied research results and commercialisation, which will promote social and economic development of the sector and the national economy, as well as tax increases.

10.Planning of future actions

No	Task	Responsible institution	Participating institutions	Execution deadline	Indicative funding, source of funding
Line of actions 1: Increasing the competitiveness of STI field					
Develop the human resource capital of the field					
Implement measures to attract young scientists and career development					
Support for doctoral studies, int.al., excellence scholarships and joint doctoral programmes					
1	Improve the quality of the promotional process	MES	RC, LSC	01.12.2015.	Within the existing budget
2	Incorporate requirements for the employment of doctoral students in research projects and programmes financed from the State budget and the structural funds; Include safeguarding of PhD jobs, as well as implementation of unified university and scientific institute doctoral program, as assessment criteria for doctoral studies program development and improvement projects;	MES	MA, MH, MC, RC	01.07.2014.	Within the framework of the existing budget
3	Support geographically spatial concentration of STEM studies at the institutions of higher education, while improving infrastructure (renovation and reconstruction) and providing the necessary material, equipment, database, equipment software purchase;	MES	RC	01.07.2020	14.23 million.EUR (EU SF)

4	Create a criteria for allocation of grants from the State budget for financing of doctoral and mater degree studies, granting priority for preparation of master and doctoral graduates for specific industry partners	MES	RC	01.01.2015.	Within the framework of the existing budget
5	Provide competition based excellence scholarships to those doctoral candidates who exhibit the highest potential	MES	CHE, RC	01.07.2016.	Additional SB 0.85 million EUR (100 * 85 372 EUR) 2016 - 0.17 million EUR 2017 - 0.17 million EUR 2018 - 0.17 million EUR 2019 - 0.17 million EUR 2020 - 0.17 million EUR
6	To promote the sharing of higher education resources and moving towards unified science quality standards, creating of research-based PhD, improving ties with research institutions and national economy, creating a thematic doctoral study centres and providing support for infrastructure renovation, purchase of equipment and installations, int.al. distance learning, ICT solutions and software;	MES structural funds	RC	31.12.2020.	29.88 million.EUR (EU SF)
To support a young scientist in launching of the career in the scientific institutions of Latvia or in the industry					
7	Support scientific teams, which carry out applied research in order to develop an innovative solutions for practical industry or addressing societal challenges, providing jobs for young scientists within the framework of the projects;	MES, structural funds	ME, MC, MA, MH, MEPRD, LSC, LAS, universities and research institutes	01.01.2015	42.69 million EUR (EU SF)

8	To support implementation of individual post-doctoral R&D projects, including the establishment of grant scheme for creation of post-doctoral jobs at enterprises.	MES, structural funds	EM, FM	31.12.2018	64.03 million.EUR (EU SF)
To provide competitive salaries to the scientists funded from the State budget					
9	Provide 100% allocation of the estimated base funding in accordance with the established regulations.	MES	LSC, LAS	01.01.2015	The estimated required SB funding 367 million EUR EUR Including: 2015 46 million.EUR (EU SF) 2016 - 51 million EUR 2017 - 58 million EUR 2018 - 64 million EUR 2019 - 71 million EUR 2020 - 77 million EUR
To support excellence in research					
10	Continue to implement the fundamental and applied research programs, reinforcing importance of research excellence focused criteria in the allocation of funding	MES	LZP	31.12.2020.	The estimated required SB funding 103 million EUR Including: 2015 - 5.5 million EUR 2016 - 11 million EUR 2017 - 16.5 million EUR 2018 - 20 million EUR 2019 - 23 million EUR 2020 - 27 million EUR
11	Include the requirement to publish research results in high-quality scientific editions in the criteria for funding instruments (allocated both on a base and on a	MES	LZP	01.07.2014.	Within the framework of the existing budget

	competitive basis);				
12	Support involvement of international editors in publications of Latvian scientific institutions, their issue and inclusion in databases of international scientific publications;	MES, structural funds	LSC, LAS	31.01.2020	Within the framework of the existing budget
13	Provide acquisition and maintenance of national licenses for international scientific literature databases.	MES	NLL	31. 12.2020	Additional funding of 12 million EUR from the SB 2015 - 2 million EUR 2016 - 2 million EUR 2017 - 2 million EUR 2018 - 2 million EUR 2019 - 2 million EUR 2020 - 2 million EUR
<u>Reduce STDI resource fragmentation</u>					
14	Complete the existing and to be purchased or established common infrastructure data base in the structure of academic base network, and ensure that it is accessible to all interested parties;	MES	ME, MC, MA, MH, MEPRD, LSC, LAS, universities and research institutes	01.01.2015	Within the framework of the existing budget
15	Provide analysis of infrastructure creation or purchase purposefulness, by planning the number of infrastructure users and planned usage intensity, economic return and prevention of duplication risks;	MES	ME, MC, MA, MH, MEPRD, LSC, LAS, universities and research institutes	01.01.2015	Within the framework of the existing budget
16	Continue to work on involvement of Latvian scientific institutions in ERIC platforms and on proposals and research infrastructure projects that would be included	MES	ME, MC, MA, MH, MEPRD, LSC, LAS,	31.12.2020 .	Within the framework of the existing budget, additional SB to be

	in research infrastructure development plan of European significance.		universities and research institutes		planned from 2015.
17	Increase the minimum criteria for the existence of a scientific institution according to the specificities of the science sector (number of Ph.D., turnover, percentage of applied research) and stop financing those institutions that do not reach established results	MES		31.12.2015	Within the framework of the existing budget
18	Support building of institutional excellence of scientific institutions, int.al. targeted merger and territorial or functional integration measures; Further development of NRC and engagement of new scientific institutions in use of NRC infrastructure; improvement of development strategy and action plan for joint scientific institutions; improvement of R&D support infrastructure and facilities, including open access laboratories and pilot plants, research personnel development activities and integration with HE and industry.	MES	ME, MC, MA, MH, MEPRD, LSC, LAS, universities and research institutes	31.12.2020.	115.25 million EUR (EU SF)
Internationalization of science and international cooperation					
19	Strengthen National Contact Point activities, linking it to Horizonts2020 committee representation and providing support for project preparation and participation in the program	MES	LSC, NCP, ME	01.01.2015	Additional funding of 0.84 million from the SB EUR 2015 - 0.14 million EUR 2016 - 0.14 million EUR 2017 - 0.14 million EUR 2018 - 0.14 million EUR 2019 - 0.14 million EUR 2020 - 0.14 million EUR

20	To promote participation of Latvia in the research and technology development programs of the EU (HORIZON 2020, EUREKA, Eurostars, ECSEL, COST, Bonus, KIC etc.); Ensure financial support for BALTIC BONUS, i.e. BALTIC HORIZON 2020, program project preparation of articles 185 and 187, providing additional support for projects involving cooperation with Lithuania and Estonia	MES, structural funds	NCP, LSC, LAS	31.12.2020	18.33 million EUR (EU SF)
21	Ensure participation in the European Space Agency projects;	MES	LZP	31.12.2020	Additional funding of 8.1 million from the SB EUR 2015 - 1.35 million EUR 2016 - 1.35 million EUR 2017 - 1.35 million EUR 2018 - 1.35 million EUR 2019 - 1.35 million EUR 2020 - 1.35 million EUR
22	Support participation of Latvia in international scientific cooperation organisations and associations	MES	LSC, LAS	31.12.2020	Within the framework of the existing budget
23	To provide opportunities to young scientists who obtained doctoral degrees in other countries around the world, to participate in the scientific group projects and implement post-doctoral projects at the Latvian scientific institutions and companies	MES, structural funds	NCP	01.01.2015	Within the framework of the existing budget
24	To provide opportunities to young scientists to participate in the scientific group projects and implement post-doctoral projects at the Latvian scientific institutions and companies	MES, structural funds	NCP	01.01.2015	Within the framework of the existing budget
Line of actions 2: Linkage of science, technology and innovation with the needs of social and economic					

development					
Building of a knowledge base and focusing of the research on directions important for the society development.					
Promote the orders from industry ministries and municipalities					
25	Continue to implement the National Research Programs involving ministries of industry, other industries and the municipalities in their formulation and financing;	MES	LSC, LAS, universities and research institutes	31.12.2020	The estimated required SB funding 103 million EUR Including: 2015 - 5.5 million EUR 2016 - 11 million EUR 2017 - 16.5 million EUR 2018 - 20 million EUR 2019 - 23 million EUR 2020 - 27 million EUR
26	Encourage investments of state and municipal capital companies in research, using state asset supervision mechanisms.	MES	CSCC, ME, MF	31.12.2020	Within the framework of the existing budget
Promotion of commercialisation of science and industry collaboration and research results					
27	Assign priority to such doctoral and post-doctoral research, that is associated with tackling of scientific or technological problems identified by the industry;	MES	ME, MC, MA, MH, MEPRD, LSC, LAS, universities and research institutes	31.12.2020	Within the framework of the existing budget
28	Ensure involvement of doctoral students in companies and public scientific institutes, interested in the theme of dissertation.	MES	ME, MC, MA, MH, MEPRD, LSC, LAS,	31.12.2020	Within budget, i.e. within the framework of the terms of specific program and

			universities and research institutes		project funding.
29	Create *Forecast study* courses for future market products and incorporate them into a science and technology development related programs.	MES	CHE, Rector Council	01.07.2016	Within the framework of the existing budget
30	Creation of interdisciplinary studies program, combining management and engineering sciences, devoting a certain amount of course for technology transfer and absorption.	MES	CHE, Rector Council	31.12.2014	Within the framework of the existing budget
31	Create a single technology transfer platform, which includes formation of 2-3 technology transfer centres, in which the technology transfer experts would be concentrated and widened technology transfer services, thus providing support for economic rationality research results and technological feasibility test, Protection of Intellectual Property and development and implementation of commercialisation strategy (*fund "proof of concept")* enterprises.	ME	MES, scientific institutions, universities	31.12.2015 30.12.2020	58.24 million. EUR (EU SF, State budget
32	Integrate education with practical work during the higher education process, extending opportunities for internship placements, creating Learning Laboratories, where both the learning process and the provision of services take place.	MES	ME, CHE, Rector Council, universities	31.12.2015	Within the framework of the existing budget
33	Create a Centre for creative industries in Miera Street tobacco factory,	MC	universities	2018	6 million EUR (EU SF)
34	Develop an institutional integration model for provision of internship placements and collaboration with universities in the State and municipal companies	MES	ME, CHE, Rector Council,	01.01.2015	Within the framework of the existing budget

	through accumulated experience in medical education for provision of residency.		universities		
35	Create a support instrument for creation of job placements for young scientists in companies, provided that young scientists that have obtained a Doctor's degree, can apply for grants. The instrument simultaneously promotes the knowledge absorption capacity of the companies and understanding of the potential use of the STDI potential;	MES	ME, LDDK, LCCI	01.06.2014	Within the framework of the existing budget
36	Support development of innovative research for the needs of private sector and the commercialisation of research results according to Smart Specialization Strategy;	MES, structural funds	ME, LIAA, LSC	31.12.2020	34 million EUR (EU SF)
37	Develop competence centres as a long term platform for cooperation of scientific institutions and entrepreneurs, by providing support for implementation of industry ordered research and product development projects, by co-financing both individual and cooperation projects	ME	MES	31.12.2020	73.0 million EUR (EU SF)
Strengthening of innovation capacity in the companies					
38	Provide support to SMES in research and product development, including development of non-technological innovation, purchase of services (innovation and design vouchers),	ME	LIAA	02.01.2015 30.12.2020	5.0 million EUR (EU SF)
39	Ensure pre-incubation and incubation services for newly established companies within the framework of business incubators	ME	LIAA	02.01.2015 30.12.2020	25 million EUR (EU SF)
40	Create a support tool that is focused on commercialisation of research results by creating start-	ME	LIAA, LGA	02.01.2015 30.12.2020	20 million EUR (EU SF)

	up companies, providing incubation services and facilitating the fund attraction in their early phase of development.				
41	Implement measures to raise public awareness and involvement in innovation and entrepreneurial activity (motivational program).	ME	LIAA	02.01.2015 30.12.2020	5.0 million EUR (EU SF)
42	Provide funding for implementation of technologically intensive business ideas with rapid growth potential in their early stage of development (*"seed"* and start-up risk investment instruments)	ME	LGA	02.01.2015 30.12.2020	40 million. EUR (EU SF)
Line of actions 3: Effective management of STI industry					
Improving coordination and reducing administrative burdens					
43	Develop an institutional model for management of science, technology and innovation development, that provides establishing of one-stop Innovation Agency, consolidating the sector's administrative management resources and envisaging coordination of use of Ministry of Education and Science and Ministry of Economy, and other sectoral ministries resources;	MES, ME	CSCC, MC, MA, MH, MEPRD, LSC, LAS, universities and research institutes	01.04.2014	Within the framework of the existing budget
Increase of investment efficiency					
Increase of the State budget funding for STDI					
44	Increase of institutional funding in the annual State budget	MES, MA, MH, MC		According to the annual State budget	See paragraph 10 (367 million EUR)

				development schedule	
45	Gradual increase of R&D funding granted in a tender procedure	MES, MA, MH, MC		According to the annual State budget development schedule	See paragraphs 11 and 26 (206 million EUR)
46	Carry out social and economic impact assessment of financing instruments awarded under a tender procedure;	MES		01.07.2016	Within the framework of the existing budget
48	Review the structure of financing instruments awarded under a tender procedure and the regulatory framework for existing financial instruments, and to ensure its conformity with the STDI policy objectives and core principles;	MES	LZP	01.07.2017	Within the framework of the existing budget
49	Create new financial instruments awarded under tender procedure that comply to the objectives and fundamental principles of STDI	MES	LSC	01.01.2017	Within the framework of the existing budget
Support the research in higher education (HE investments)					
50	Develop rules and criteria for allocation of financing instruments that contribute to the University's own investment in research and motivates the universities to attract the investments in research by commercialisation of the created knowledge;	MES	CHE, RC	01.01.2015	Within the framework of the existing budget

51	Introduce the unity principle of pedagogical and research work, which provides involvement of academic staff in research and involvement of scientists working for scientific institutes, in the teaching of certain subjects at the Universities.	MES	LSC, CHE, RC	01.01.2015	Within the framework of the existing budget
52	Restore State budget funding for provision of scientific activities in universities	MES	CHE, RC	01.01.2015	Additionally Additional funding of 6.96 million EUR from the SB Including: 2015 - 1.16 million EUR 2016 - 1.16 million EUR 2017 - 1.16 million EUR 2018 - 1.16 million EUR 2019 - 1.16 million EUR 2020 - 1.16 million EUR
Development of policy implementation monitoring and impact assessment system					
53	Develop monitoring system for implementation of STDI and Smart Specialisation Strategy policy, providing development and quality assurance system of research policy, which is focused on development of policy implementation capacity analysis in public administration, higher education and research institutions;	MES, structural funds	ME, MC, MA, MH, MEPRD, LSC, LAS, universities and research institutes	01.01.2015 01.07.2015	2 million EUR (EU SF)
54	Review report on the progress of implementation of the guidelines.	MES	CSCC, ME, MC, MA, MH, MEPRD, LSC, LAS, universities and research	01.12.2016	Within the framework of the existing budget

			institutes		
55	Submission of the report to the Cabinet of Ministers on ex post evaluation of implementation of the guidelines.	MES	CSCC, ME, MC, MA, MH, MEPRD, LSC, LAS, universities and research institutes	01.12.2020	Within the framework of the existing budget
Line of actions 4: Cultivation of public awareness, promotion of science and innovation					
56	Develop a communications plan for STI industry.	MES	NGO of LAS, ME sector	01.06.2014	Within the framework of the existing budget
57	Create programs dedicated to STDI and include them in the public procurement for the national public media;	MES	SC, NEMMC	01.06.2015	Within the framework of the existing budget
58	Include contributions to the promotion of scientific research performance evaluation and base funding development criterion;	MES	LSC	01.01.2015	Within the framework of the existing budget
59	Provide a support to the professional scientific organisations for implementation of science promotion measures	MES	NGO of LAS sector	31.12.2020	Additionally Additional funding of 1.002 million EUR from the SB Including: 2015 - 0.167 million EUR 2016 - 0.167 million EUR 2017 - 0.167 million EUR 2018 - 0.167 million EUR 2019 - 0.167 million EUR 2020 - 0.167 million EUR
60	Support cooperation between general and vocational	MES	NGO of the	31.12.2020	Additionally

	educational institutions and scientific institutions and establishments;		sector, SA, ECL, LCCI		Additional funding of 1.002 million EUR from the SB Including: 2015 - 0.167 million EUR 2016 - 0.167 million EUR 2017 - 0.167 million EUR 2018 - 0.167 million EUR 2019 - 0.167 million EUR 2020 - 0.167 million EUR
61	Development of interactive science centres in Riga and regions of Latvia	MES	ME	31.12.2020	Additional funding of 10 million from the SB EUR, including 2018 - 2 million EUR 2019 - 4 million EUR 2020 - 4 million EUR

11. Reporting and evaluation procedure

The Ministry of Education and Science is the responsible authority for coordination of implementation of the Guidelines.

Institutions responsible for implementation of the measures falling within their competence: the Ministry of Economy, the Ministry of Finance, the Ministry of Environmental Protection and Regional Development, the Ministry of Agriculture, submit to the MES information about progress and results of the tasks and activities within the framework of their competence set out in the Guidelines. MES carries out an interim evaluation in 2016.

In order to evaluate the implementation of the Guidelines, the Ministry of Education and Science prepares an informative report on implementation of the Guidelines and submits it to the Cabinet of Ministers on 1 December 2016.

If necessary, the Ministry of Education and Science prepares and submits proposals for actualisation of Guidelines or action plan. After expiry of the operational period of the Guidelines, the MES will carry out *ex-post* evaluation of Guidelines.

Minister of Education
and Science Vjačeslavs Dombrovskis

Appendix 1

Characteristic of the current situation in the field of national science, technology and innovation policy

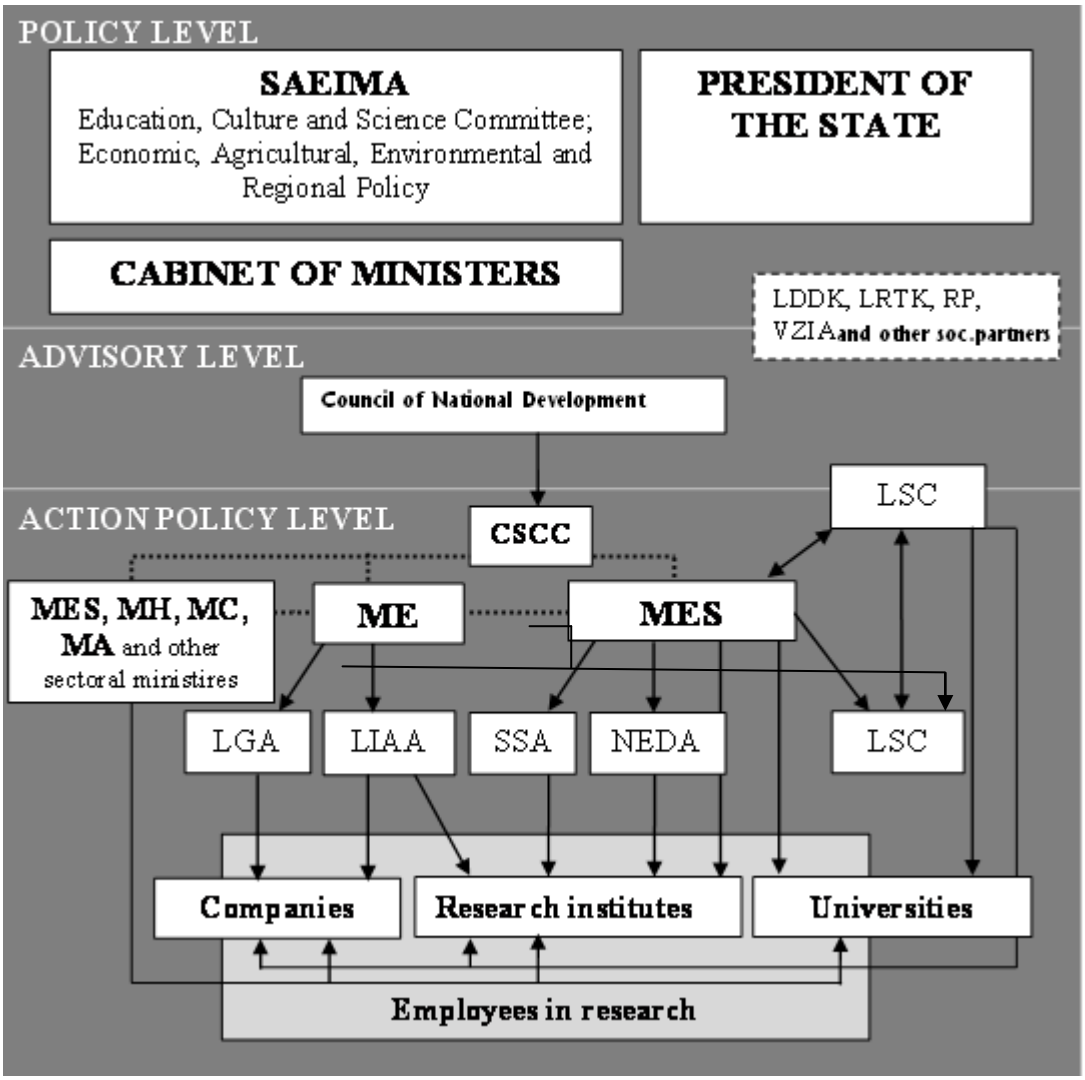
12.The structure of governance in the field of development of science, technology and innovation

Institutions responsible for STDI are the Ministry of Education and Science (MES) and the Ministry of Economics (EM). The MES develops STDI policies, coordinates its implementation and provides the representation of Latvia at the research management institutions of the European Union (Figure 2). In this process, the MES collaborates with the ME and other sectoral ministries, and consults with the industry associations and social partners, including Employers‘ Confederation of Latvia (ECL), Latvian Chamber of Commerce and industry (LCCI), the Council of Rectors (CR), National Association of Scientific Institutions (NASI), Latvian Education and Science Workers Union (LESWU), etc. as needed. STDI funding instruments are administered by Study and Science Administration (SSA), the National Education Development Agency (NEDA) and the Latvian Science Council (LSC). Apart from the administration of financing instruments, SSA also supports the European Union framework programme (FP) operation of National Contact Point (NCP) and carries out other tasks delegated by the MES. VIAA provides administration of the structural funds. LSC administrates the Fundamental and Applied research program and advise the MES in science policy. In addition, some of the science representation and programme coordination functions are delegated to the Latvian Academy of Sciences (LAS). LAS science centre of national significance, which is created as an on-scientific-excellence-based membership organization, which main task is the active involvement in formation of science policy, participation in scientific expertise, caring for involvement of new generations of researchers in science, safeguarding of scientific research ethics, discussion principles and traditions, international networking and promotion, as well as the popularization of science.

The ME develops and coordinates the implementation of the innovation policy. The administration of financial instruments related with promotion of knowledge transfer and company innovation capacity, which is provided by the LIAA and the Latvian Guarantee Agency (LGA).

Although the created STDI policy management system broadly defines the responsibilities in the field of STDI, it is characterised by the unclear division of the policy implementation, non-compliance of the functions with the level of institutions and duplication of individual functions, as well as *ad-hoc* policy coordination. In order to eliminate these deficiencies, management institution in planning of science and technology development policy has to be clearly defined and capacity of implementation of these functions has to be strengthened. In order to eliminate this gap, with the support of the Council of Nordic Ministers an elimination of science is carried out, the results of which will be made public at the beginning of 2014. Based on the results of this evaluation proposals for improving the management of STDI will be prepared.

6 Following responsible institutions, functions and competence is established for implementation of Science, technology and innovation policy.



13.The main planning documents and tasks put forward in the STDI area during the previous programming period (2009-2013)

During the previous programming period STDI nominated goals and objectives in the following planning documents:

- National Development Plan 2007-2013
- Guidelines for Science, Technology Development, and Innovation 2009-2013
- Education development guidelines 2007-2013 (provided increasing the role of science and scientific research at the universities);
- Business Competitiveness and Innovation Framework Programme 2007-2013.

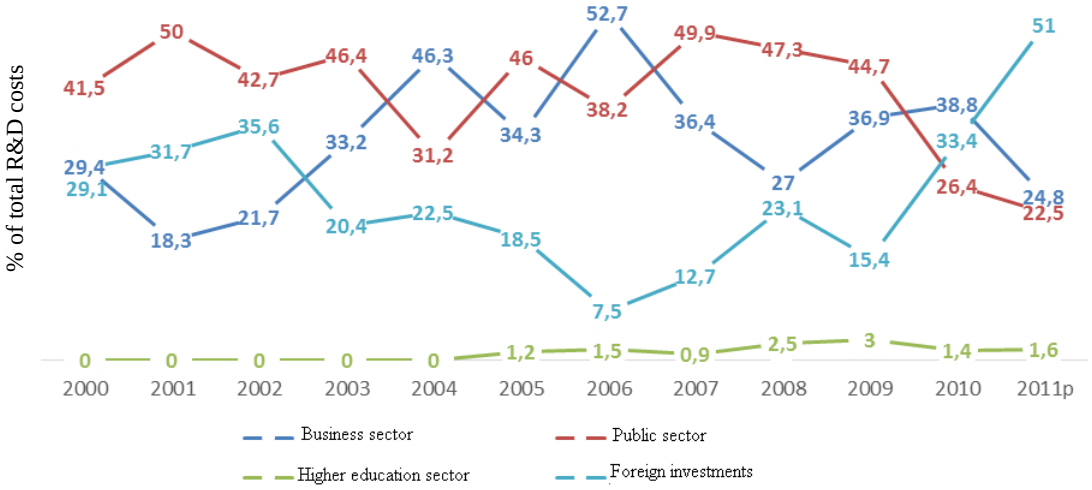
During the economic crisis in 2009, the total funding for science was reduced by 60%, and in the post-crisis period State funding is still growing too slow, which has largely restricted progress towards achieving the goals proposed during previous programming period. Report on the situation in STDI sector, as well as on the identified challenges is provided in the section these Guidelines "Formulation of problems in Research, Technological Development and Innovation Policy field".

IZMPam_171213.2020; Guidelines for Science, Technology Development and Innovation 2014-2020

14.Funding for scientific activities and innovation

In Latvia the total funding for research, after a significant decline in 2009, continues to grow steadily and in 2012 it was 0.66% of GDP or 102.2 million. It should be noted that growth during the recent years is achieved due to increase in foreign funding, primarily EU structural funding for research activities. Latvia is the only EU country in which half of the investment comes from external sources (mainly sources of assistance). This funding structure is disproportionate and do not ensure the sustainability and development of the sector.

72 Funding for scientific research work in 2000-2011 (million LVL).



Source: CSB data

Latvian indicators on investments in research and development still lag behind objective, set out for implementation of strategy in the Latvian National Reform Programme "Europe 2020", which provides increasing the total amount of Latvia's investments in research and development to 1.5% of GDP by 2020 and the respective "Europe 2020" strategy objective, which provides increasing the total amount of investments in research and development to 3% of GDP.

For financing of Science and Innovation policy, two types of instruments are used: institutional funding and funding allocated on a competitive basis. These instruments are funded from the State budget, EU funds, EU research and innovation programmes (such as EU framework programme) and private funds.

The MES State budget program 05.00.00 "Science", the total amount of which in 2013 was 16.4 million lats, is formed by science base funding, funds for administration of science and funding for provision of scientific activity (Table). This funding must ensure operation of State research institutes, national universities and research institutes of the State universities, implementation of national research programs (int. al. encouraging development of new technologies and products and promoting development of technology-oriented industries), LSC and LAS activities and integration of Latvian scientists in the European Research Area.

71 Total State budget funds in the program 05.00.00 "Science" 2007 – 2013 (million LVL).

State budget programs	2007	2008	2009	2010	2011	2012	2013
Total	32.3	36.3	22	17.2	16.4	16.6	16.4

As a result of budgetary consolidation the total State funding for science in 2009 was reduced by 60% As a result, the State budget-funded research volume significantly decreased, that left a lasting negative impact on the ability of research institutions to develop human resources and participate in EU research programs, int.al. inability to provide the necessary co-financing. Also in 2013 only 25% of the base amount of funding required for ensuring of their operation was granted to the scientific institutions.

According to the information provided by scientific institutions, due to the lack of financial resources, each year Latvian scientific institutions have to refuse participation in two to six large budget research projects of European FP. Thus, insufficient base funding is one of the main reasons for the low Latvian indicators of participation of scientific institutions in EU programmes (in terms of number of applications and the amount of funding requested, Latvia ranks 25th among the EU-28 states). Greater diversion of Latvian research institutions budget for development goals would allow them to strengthen competitiveness in the EU, which in turn would provide additional funding for the Latvian science from implementation of EU research programs.

In this planning period, Latvia as EU Member State, by implementing the EU regional policy, had access to financial assistance provided by the EU for economic and social development. The major financial instruments are EU funds: The European Regional Development Fund (ERDF), European Social Fund (ESF) and the Cohesion Fund (CF). In addition, Latvia receives funds within the framework of EC initiative *Equal* and *Interreg*. During the 2007 - 2013 programming period, the investment in science and research in infrastructure were made to promote the development of the knowledge economy. Within the framework of operational programme "Human Resources and Employment" and "Enterprise and Innovations" around 260 million Lats diverted for STDI sector.

Support measures for science, technology development and innovation, implemented by MES and ME and financed by the EU Structural Funds during the 2009-2013 period have been particularly important, because the State and private investment in research, science and innovation during this period was very low.

Private sector investment in research and development in Latvia (0.2% of GDP) is much lower than in the EU-27 (1.2% of GDP), Estonia (1.5% of GDP).

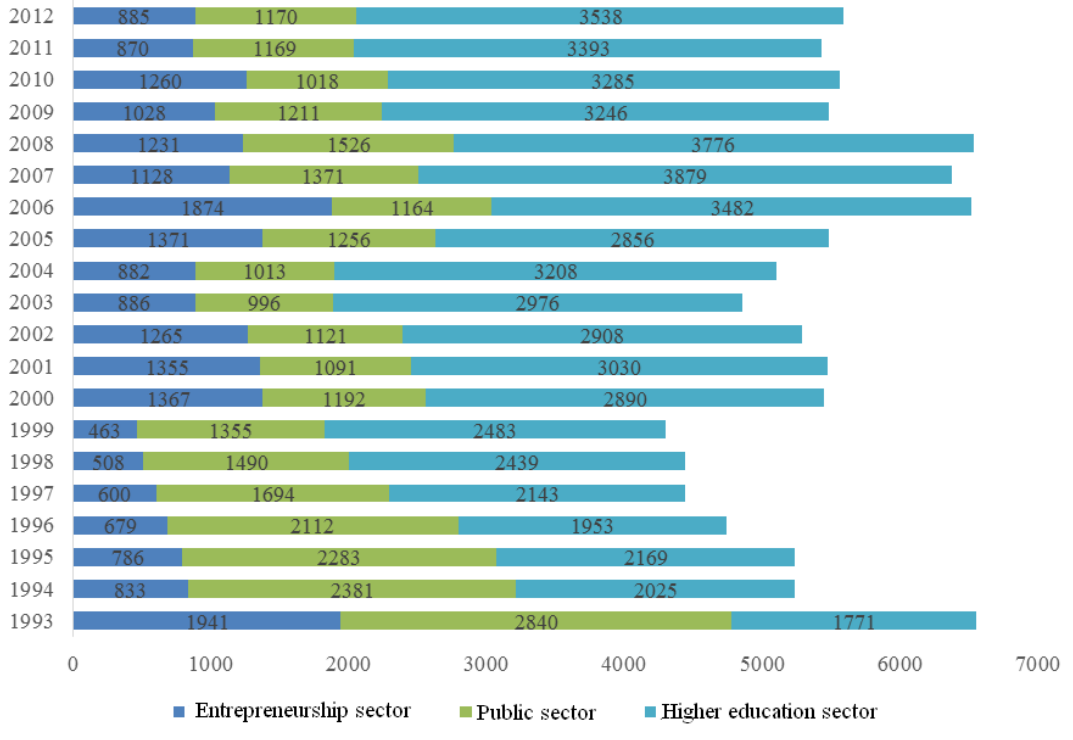
According to the CSB data, investments in research and development in 2009 was made by 264 companies, 267 in 2010 and in 2011 - 393 companies. This shows that private sector activated investments in research and development during the post-crisis period. However, it is necessary achieve that the private sector invest in research and development more than half of the total investment, which is typical for the EU-27 and particularly innovative countries (~ 65% in Finland, Sweden ~ 57%) thus ensuring competitiveness of national economies of these countries in the global market.

In the next programming period 2014 - 2020, similarly to the current, EU funding represent a significant proportion of sectoral budget. To ensure that the funding structure of STDI ensures sustainability and development of the sector, it is necessary to increase the volume of both the State budget and private and university sector funding. In order to ensure stable development of science, especially renewal of human resources in science, the proportion of the state budget financing and financing from EU funds should level out in 2015-2016 and during subsequent years the proportion of the State budget financing should increase.

15.Human resources in science

In the field of research in Latvia are employed 5593 (2012) researchers, ~ 63% of them in the higher education sector, ~21% in public sector and ~ 16% in private sector (8). This employment structure corresponds to the structure of the national economy, which is based on low or medium-low technology industries and in which is a low proportion of manufacturing industry. At the same time the sector plays a key role in the creation and absorption innovation and technology. The low level of scientific research employees in the private sector indicates insufficient knowledge absorption capacity of the industry and does not contribute to scientific and industrial cooperation. In order to ensure the achievement of economic development objectives, Smart Specialization Strategy envisages the need to increase the number of researchers, to at least until 7000, providing greater increase in the private sector. While NDP 2014-2020 for assurance of more effective knowledge transfer, creation of new and innovative products and services provides increase the number of researches of the private sector to 23% until 2020, by establishing increase of number of researchers in engineering sciences and technology as a priority.

8 Researchers engaged in scientific research work in different sectors according to the full-time equivalent



Source: CSB data

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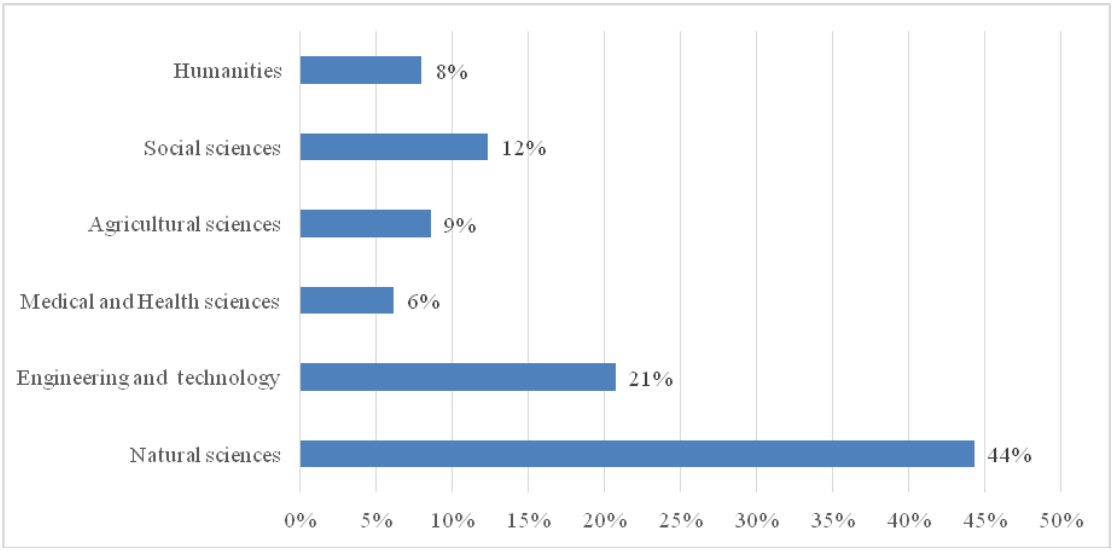
Currently (2013) 601 researchers are employed in engineering sciences and technology, natural sciences: 1418, agricultural sciences: 279, medicine and health: 304, social sciences: 440 researchers, and in humanities: 272 researchers. Age structure of scientific personnel (2013), shows that the science sector is experiencing ageing of human resources: 42% of researchers are older than 50 years. The greatest ageing problem is mathematics science, where 77% of researchers are over 50 years old, and in physics, chemistry and biology sciences where 44-47% of researchers are over 50 years old. Proportionally the youngest scientists and researchers are in computer science and informatics, as well as in land and associated environmental sciences.

Overall, in the Latvian science and research employment a gender balance can be observed. According to the data provided by scientific institutions on 1 July 2013, 51% of women and 49% men were employed in science and research. However, there are fields of science where there are clear differences in the field of gender representation (**Error! Reference source not found.**)

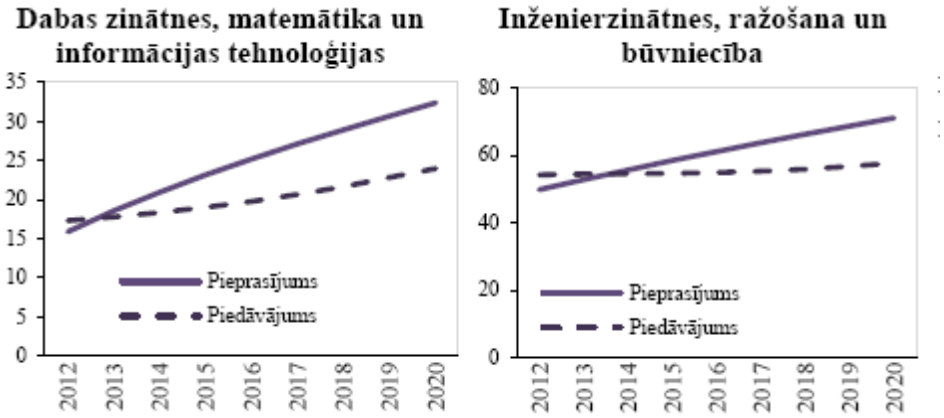
Figure 4 Structure of genders employed in science and research as of 1 July 2013.



Although since 2009, the number of doctoral degree graduates is grown rapidly (9), the relative number of doctors in Latvia (2012) is still only 0.5 doctors of science per 100 inhabitants, which is below the EU-27 average: 1.5 doctors of science per 100 inhabitants. For the creation of innovative products and services contribution of mathematics, information technology and engineering is essential. The specialists of these fields are required in various producing sectors of the economy, such as the timber industry, metal processing, agriculture, construction, etc. In 2012, 39% of all PhD graduates obtained the Doctor's degree in these fields. Although this indicator is above the EU-27 average 32.6% (43.5% in Estonia, 40.3% in Lithuania, 41.7% in Sweden), with regard to the age structure of this industry, it is not sufficient for renewal of human resources and increase of number.

The need for continued targeted increase of number of highly qualified specialists in natural sciences and in engineering is also supported by medium and long-term labour market forecasts developed by Ministry of Economy. In order for the most promising growth sectors such as manufacturing, to be competitive in the medium and long term, more than 80% of the total growth in the industry must be ensured by productivity growth, transfer of technologies in production, development

of research and innovation. Non-compliance of labour market demand and supply and deficit of the relevant specialists with higher education is projected in the sectors of natural sciences, mathematics, information technology and engineering within the time period until 2020 (**Error! Reference source not found.**).

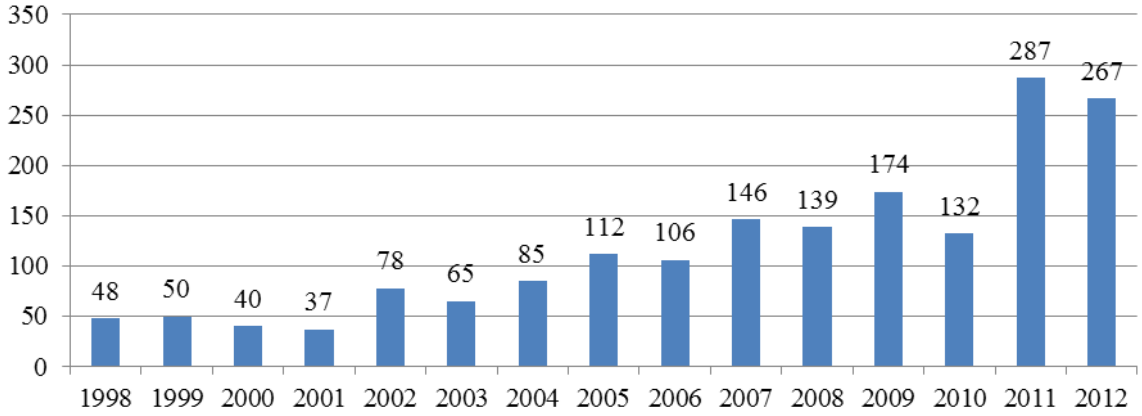


**Translation of the graphs. Left: Natural sciences, mathematics and information technology, Demand, Supply; Right: Engineering, manufacturing and construction, Demand, Supply.*

Source: Ministry of Economics of LR, 2013.

These projected disproportions cannot be eliminated without rearrangement of pre-emptive measures, int.al. in higher education (continuing to increase the number of budget places in natural and engineering programs, as well as providing improvement in teaching natural sciences and mathematics in primary and secondary education).

9 Number of Doctoral degree holders from 1998 - 2012



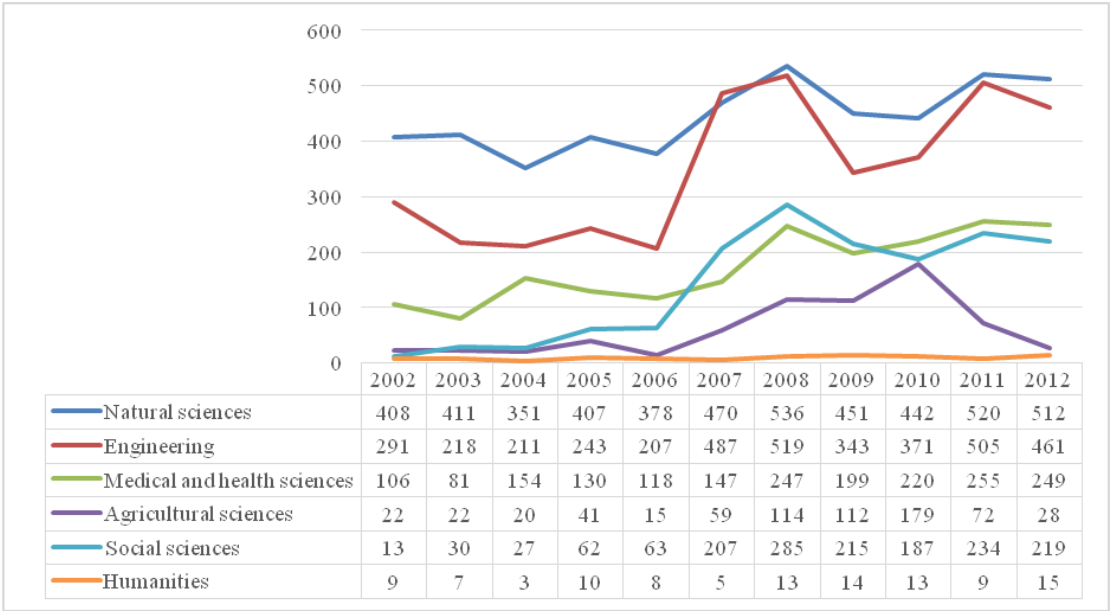
Source: MES

16.Research results - publications and quotability

The scientific performance results are published in original scientific articles in peer-reviewed scientific journals, peer-reviewed monographs and patents. Number of scientific articles and their quotability is one of the main scientific activity indicators. Detailed analysis of number of articles and their quotability has been carried out while developing Smart Specialization Strategies.

Total share of Latvia according to the number of publications in the world is 0.05%, while in the European Union it is 0.14%. Although the total number of publications is small, it has almost doubled during 2007-2012: increasing from 536 publications in 2006 to 1043 publications in 2012.

Comparison of publication number according to the six categories of OECD science sectors shows dynamics of publication number. Due to the different cultural and scientific publication strategy within the framework of science sectors, these volumes cannot be mutually compared (**Error! Reference source not found.**). For example, in information technology sciences publishing in conference proceedings is preferred, while for large volume publications in human sciences, books and monographs are preferred. Therefore, the dynamics of the development is shown within the framework of each sector. A trend of increasing number of publications is seen in all areas of science, except for human sciences, where publications are conducted in very small quantities and the amount is not increasing. While analysing *Web of Science* in terms of 254 sub-fields of science, there are on average only 2.52 publications in humanities, but in social sciences 20.03 publications; 19.54 publications in agricultural sciences; 57.76 publications in medicine and health sciences; on average 36.04 publications in engineering and technology sciences and 64.29 publications in natural sciences annually.



	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Natural sciences	408	411	351	407	378	470	536	451	442	520	512
Engineering	291	218	211	243	207	487	519	343	371	505	461
Medical and health sciences	106	81	154	130	118	147	247	199	220	255	249
Agricultural sciences	22	22	20	41	15	59	114	112	179	72	28
Social sciences	13	30	27	62	63	207	285	215	187	234	219
Humanities	9	7	3	10	8	5	13	14	13	9	15

Source: Thomson Reuters, 2013

While comparing the number of publications within particular industries of OECD scientific fields, the highest publication activity in natural sciences is fluid and plasma physics (0.18%) and solid-state physics (0.17%). A significant edge over Latvian average (0.0445%) shows also organic chemistry (0.14%) and polymer science (0.13%). Atomic, molecular and chemistry physics (0.08%), computer science information systems (0.08%) and computer science theory (0.07%), optics (0.08%) and also applied mathematics exceed the proportion almost two times in comparison with the number of average publications in the world in the respective field.

Relatively good performance is also in engineering, where leadership is held by composite material science (0.43%), which is almost 10 times the average

proportion of Latvian publications in the world and 12 times the EU. Relatively high results are also shown by ceramic material science (0.15%), mechanics (0.17%) and nuclear technology field (0.16%). Ceramic material science (0.59%), mechanics (0.50%), nuclear technologies (0.40%), multidisciplinary material science (0.39%), spectroscopic (0.36%), nanotechnologies (0.31%) and biomedicine engineering science (0.31%) have relatively very good results in comparison with the European Union.

Oncology, cardiovascular systems, peripheral vascular diseases, surgery, general and internal medicine, clinical neurology, endocrinology, radiology, gastroenterology and hepatology, gynaecology, psychiatry and respiratory systems are above the average among medical and health sciences. Pharmacology and pharmacy, neuroscience, immunology, pathology, toxicology and experimental medicine are above the mean value of general medicine. Among health sciences, Environmental and occupational health, infectious diseases and rehabilitation are above the average indicator of number of publications.

In terms of quotability sub-sectors medical and health sciences show results above the global average, with the exception of rehabilitation, which total of 51 publications are quoted only 2 times in 11 years. The most quoted is general and internal medicine (34.21 quote per 1 publication), followed by infectious diseases (14.18), immunology (13.16), cardiovascular diseases (7.92), pharmacy and pharmacology (7.32), oncology (7.22) and peripheral vascular sub-sector (6.87).

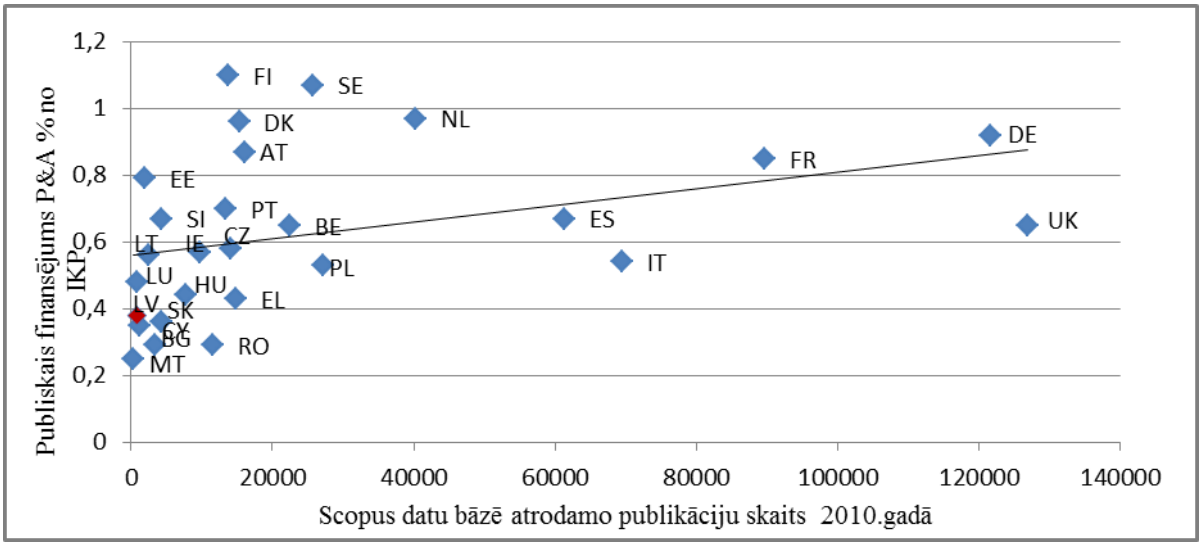
In assessment of sub-sectors of agricultural sciences, multidisciplinary agriculture, agronomy and horticulture are over the total average number of publications (71.22). Forestry and food science stays slightly below the average. In comparison with the worldwide and EU the number of publications in horticulture, agronomy and forestry fields exceeds the average proportion of Latvia's publications (0.12- 0.15%). Dynamics of publications in horticulture is equivalent to the EU and global level. In the field of agricultural sciences only three sub-fields present quotability results which are higher than the world average: food science and technologies (2.83), agronomy (1.86) and horticulture (1.80).

Although increased activity of publications in social sciences can be observed, however, substantial part of total number of publications consists of conference articles and abstracts. In the assessment of sub-sectors, relatively better results in terms of the number of publications are shown by psychology, economics, management science, education and special education, the sub-sector of social issues, planning and development, as well as the environmental studies and social and economic geography. In terms of quality social sciences in all its sub-fields which showed the number of publications above Latvia's average is below the world level in terms of number of quotations per one publication.

Number of international publications in human sciences is very small. This may partly be explained by the industry publication strategy in mostly large volume works and use of Latvian language. At the same time, such dynamics of international publications identifies alienation from international developments in the fields of human sciences and the need for support in internationalization of these sectors.

Efficiency of scientific work is characterized by the ratio of publications per public funding. For comparison is chosen SCOPUS database, which allows to compare data between countries in a transparent way (10).

10 Number of publications per R&D funding % of GDP in 2010



Source: SC Imago data, Eurostat data

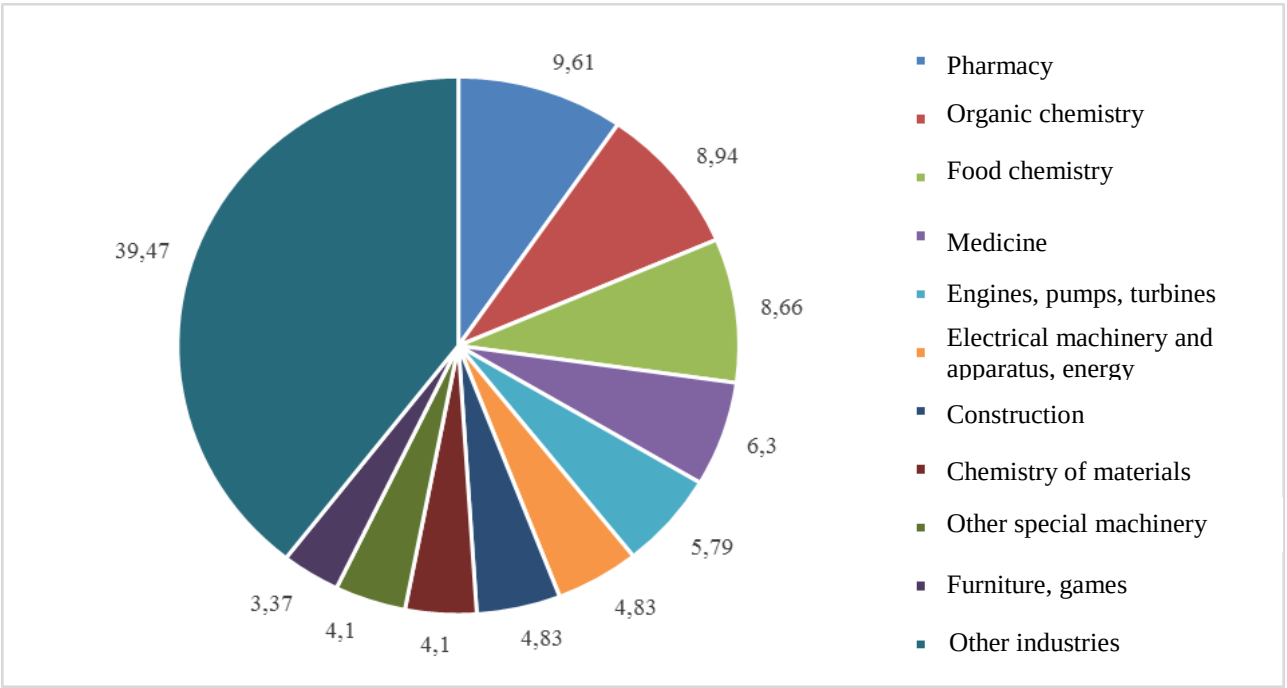
**Translation of the graph. Vertical axis: Public funding R&D % of GDP. Horizontal axis: Number of publications found in the Scopus database in 2010.*

Latvia is pictured below the axis inserted in the figure. It shows that the ratio of the number of publications is greater than the % of GDP of allocated public funding, i.e. public funds are used effectively and it also points to the fact that Latvia has relatively high potential to improve publication performance with the increase of public funding. Different situation is with countries which are located above the axis (Estonia, Finland), the public funding of which higher proportion is regarding % of GDP for the number of publications and public funding of publications is less effective. Results with regard to publications can be explained by the fact that, unlike in the EU-27 countries (including Estonia and Lithuania) the number of Latvian researchers tends to fall, because of the relatively small state budget funding for science.

17.Patents

Number of patents applied for in the European Patent Office (EPO) per million residents, characterizes activity of entrepreneurs and scientific institutions in

11Figure 9. The number of patent applications in the sectors of science % from 1997-2011



18.International cooperation

During the previous programming period (2007-2013) Latvian scientists and scientific institutions took part in various international cooperation programmes. 7.FP[11], int.al., ERA-NET[12] and ERA-NET Plus projects, COST program[13], Article 185 of the EU Treaty program[14], int.al., EUREKA[15] and Eurostars[16], BONUS program [17], and Article 187 of the EU Treaty program, and Joint Technology Initiatives, int.al., ARTEMIS [18] computer systems.

Latvia obtained in 1999 the membership in the EU framework programmes (FP), which is a scientific excellence program of in which all EU Member States compete, plus Norway and Switzerland. Although overall membership of Latvia in FP can be rated as successful, current financial contributions to Latvia, compared to the amount of contributions to the EU budget, can be evaluated as low . shows the membership of Latvian scientists in the projects, acquired number of contracts and funding attracted for implementation of projects. For the 7th FP Latvia was a partner in 145 scientific projects managed by other countries and 72 scientific institutions of Latvia and 52 businesses took part in them. The proportion of Latvian participants in implementation of FP projects decreases, but the number of executable contracts and the EC financial contribution to projects where participants from Latvia are involved, is growing.

82 Latvian participation in the Framework Programme

Framework programme	5th FP	6th FP	7th FP
Time period	1999-2002	2002-2006	2007-2013 (March)
Number of project applications submitted by Latvia	640	1027	1029
Number of executed contracts	195	218	211
EC financial contribution to the proposals of Latvian participants (millions EUR)	14.6	21.6	28.4
Achievement rate,% (participants from Latvia)	30 %	21 %	20.5%

Source: NCP data

[11] FP of the European Community during 2009-2013

[12] ERA-NET projects

[13] *(Cooperation Europeenne dans le Domaine de la Recherche Scientifique et Technique)* is international cooperation support program designed to support cooperation of scientists at the European level in various fields science and technology.

[14] programme of Article 185.

[15] European international cooperation incentive program to develop new, competitive products, technologies, processes and services.

[16] Joint initiative of Article 185 of the European Community Treaty to promote international cooperation in research, development and implementation of market demanded, competitive technologies, products and services.

[17] Initiative of Article 185 of the European Community Treaty is related to studies of the Baltic Sea ecosystem structure and functions.

[18] advanced research and technology in the area of embedded intelligence and systems, as part of the ARTEMIS Joint venture

According to the information gathered by the EC about the success of Latvia in the 7th FP (until 2011.03.16.), for participation in the 7th FP 636 project proposals are submitted with 800 participants from Latvia and registered 150.66 million. EUR for financing of projects. In respect of the number of applications submitted to the project and the amount of funding requested, Latvia ranks 25th position among the EU-27 countries. From the number of announced projects until 16 March 2011, 131 Latvian projects were supported with 177 participants and 16.81 million EUR funding. Thus, Latvia is ranked 11th among the EU-27 member states with success rate: 22.1% (EU-27 average: 21.6%) and 24th with funds raised and in terms of success rate: 11.2%[19]. Latvia's success rate in March 2013 was 20.5%, 1029 project applications supported in 211 cases (see Figure 7).

According to the EC estimates on the exchange of knowledge, where knowledge acquired within the framework of one project returns to the project participants in a combined way, benefiting from the experience of other countries[20]. The estimated coefficient indicates that on average the EU-27 countries (including Norway and Switzerland), by investing 1 EUR has acquired 29 EUR, but the new Member States, considerably more, for example, Estonia around 75 EUR, Slovenia, about 70 EUR, Latvia, about 50 EUR. The 6th FP impact assessment carried out by EC indicates that the effectiveness of the country is characterized not only by financial benefits, but also knowledge and experience gained by scientists.

Latvia also participates in several ERA initiatives, EUREKA, EUROSTARS and BONUS programs and bilateral cooperation projects with Lithuania, Taiwan, Belarus and France. Areas of cooperation in higher education, research and innovation development of Baltic States are determined by Memorandum of Understanding signed by Ministers of Science and Education of the Baltic states of 29 November 2012. The memorandum provides preparation of an overview of the research infrastructure in the Baltic States, creating of a single online database of scientific infrastructure of the Baltic States and coordination of Smart Specialization Strategies. Since 2004 Latvia participates in programs financed within the framework of the EEA financial instrument and bilateral finance instrument of the Norwegian Government. Academic research and studies of cross-border co-operation are implemented within their framework.

19. Research infrastructures

The development of global level scientific infrastructure in Latvia is reachable, by tight integration in the research infrastructure of the European Union. EU policy in creation and coordination of research infrastructures began after the French Presidency and the European Science Foundation conference in Strasbourg in 2000, after which a working paper "Research Infrastructures in the European Research Area" was published.[21] Report of High Level Experts in 2002 recommended the establishment of ESFRI[22]. The report highlights that ESFRI analyses existing and to be created European research infrastructures, determines the criteria for European

[19] European Commission. Innovation Union Competitiveness report. Brussels:

[20] *European Commission. Innovation Union Competitiveness report. Brussels:* (page 17)

[21] *Commission working document "A European Research Area for Infrastructures" ;* ftp://ftp.cordis.europa.eu/pub/improving/docs/infrastructures_sec_2001_356.pdf;

[22] *Report of the Expert Group "Support for Policy-Making on Research Infrastructures in the European Research Area"* ftp://ftp.cordis.europa.eu/pub/era/docs/era_infragroup_0202.pdf

research infrastructures, their extent and transnational nature (infrastructures are deployed in several countries).

In 2004, ESFRI adopted the decision to develop a "Roadmap" for research infrastructures in Europe for the next 10-20 years[23]. Within the framework of ESFRI "Roadmap" a review of European level research infrastructures is prepared, as well as the implementation of one of the main objectives of the "Roadmap" is implemented: a simplified Member States decision-making procedure for participation in the European research infrastructures. In 2006, during the meeting ESFRI agreed on the text[24] of the "Roadmap" report, which provided its regular updating with information on progress of creation of European Research Infrastructures. The "Roadmap" has been updated twice: in 2008 and 2010[25]. Formation of 48 European Research infrastructures, recommended by ESFRI "Roadmap 2010" is a priority at European level, and consists of the following sectors: biology, medicine, physics and engineering, energy, environment, social sciences and humanities, as well as the field of analysis of materials.

Flagship initiative "Innovation Union" of "Europe 2020" strategy emphasizes the high importance of such well-functioning EU space, in which the researchers , scientific knowledge and technology moves freely and is closely associated with the access to various EU Research Infrastructures. The aim of "Innovation Union" is to complete or implement 60% of the European research infrastructures established by ESFRI until 2015, which will reach 54% of the target in 2013. In the EC report on "EU 2020" flagship initiative "Innovation Union" developments in the 2011[26] is recognized that ESFRI research infrastructures is a way how EU Member States work together and pool resources for the common European interest projects.

The legal form of the European research infrastructures is embedded in the ERIC Regulation [27], where are set only the standard legal form and procedural rules governing setting up of individual ERIC[28]. Each European research infrastructure is formed and implemented with relevant decisions of the EC on ERIC.

Several Latvian research institutes have expressed their willingness to join the established ERIC infrastructures. However, due to the fact that the research infrastructure is funded by ERIC consortium member states themselves, participation of research institutes in ERIC also creates a long-term commitment for the State budget. Therefore sustainable decisions that result from a thorough economic feasibility analysis and evaluation of the relevant scientific potential have to be taken on these issues. Based on the results of the survey of research institutions and scientific discussions it has been established that for Latvian scientific institutions is useful to incorporate into 9 research infrastructure objects of European significance,

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[23] *Esfri European roadmap for communications on the research infrastructure-17.12.2004.*

[24] *Esfri roadmap report for pan-European research infrastructure-19.10.2006.; ftp://ftp.cordis.europa.eu/pub/esfri/docs/esfri-roadmap-report-26092006_en.pdf*

[25] *Available at*: http://www.era.gv.at/attach/esfri-strategy_report_and_roadmap.pdf

[26] *Report from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on State of the Innovation Union 2011* http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0849:FIN:lv:PDF

[27] *Council Regulation (EC) No 723/2009 of 25 June 2009 on the Community legal framework for a European Research Infrastructure Consortium (ERIC).*

[28] *Informational letter on the regulation of the Community legal framework applied for the European Research Infrastructure Consortium (ERIC), members of the Implementation Committee*

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which is being negotiated with the EU institutions and the Member States. Additionally it is necessary to create a list (roadmap) of national level research infrastructure, which would allow qualifying for the support of various EU programs, int.al. within the framework of ESFRI.

During the EU structural fund programming period for 2007-2013 with the financial support of ERDF nine national research centres (NRC) are being created and developed, which are existing research infrastructure of different branches of science, used by NRC and other scientific institutions and merchants for interdisciplinary research. Cooperation strategies of NRC include a collaborative linkage with one or more European research infrastructures contained in ESFRI "Roadmap". Following NRC are developed in Latvia:

10) Information, communication and signal processing technology;
11) Nano-structured and multifunctional materials, structures and technology;
12) Pharmacy and Biomedicine;
13) Public health and clinical medicine;
14) Technologies for sustainable energy and environment resource extraction and use;
15) Forest and water resources;
16) Use of agricultural resources and food;
17) Latvian language, heritage and creative technologies;
18) Socio-economic and public management.

NRC cooperation strategies envisage involvement in the following European Research Infrastructures:

19) European Infrastructure of Open Screening Platforms for Chemical Biology – EU-OPENSCREEN,
20) Bio banking and Bimolecular resources Research infrastructure – BBMR
21) Common language resources and Technology infrastructure-CLARIN
22) European Social Survey-ESS
23) European Spallation source – ESS neutron
24) European Life-Science Infrastructure For Biological Information – ELIXIR,
25) An Integrated Structural Biology infrastructure for Europe – INSTRUCT
26) Partnership for Advanced Computing in Europe-PRAC.

20.Business innovation capacity[29]

Although innovation is critical for growth of business and competitiveness, so far Latvian companies mainly benefited from such advantages of competition, which are based on lower labour costs rather than innovation. According to *Eurostat*, during the period from 2008 to 2010, only 29.9% of Latvian companies on average (52.9% EU average) were innovative. Latvian business structure mainly consists of small and medium-sized enterprises, which are limited in both human resources and financial resources for development and implementation of the research and innovation, as well as limited opportunities to attract funding due to the high technological and business risk. In the business sector only 885 scientific workers was employed in 2012, which accounted for about 16% of the total scientific research workers.

[29] *Innovation capacity is based on the human resource capital – highly skilled researchers in the science, entrepreneurs open to opportunities and skilled professionals. Likewise, innovation capacity is formed by an appropriate research infrastructure for both the public and private sectors.*

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Business innovation activities are mainly dominated by transfer of existing technologies and nearly 77% of business investment in technological innovation forms investment in machinery and equipment and a lot less resources are diverted for research and development activities in the company or ordering outside the company that would allow to create a unique competitive advantages and add more value to the company's products or services. In 2012 the business sector invested in research and development 24.3 million lats or only 24% of the total research and development investments.

Poorly developed cooperation between research institutes and companies, as well as limited the abilities and incentives of research institutions to provide services to the private sector and an underdeveloped management and commercialisation of generated knowledge, does not provide return on public investments through licensing of inventions, research consultancy services, development of new products and technologies in the production, formation of new, innovative, knowledge-based companies, development of new market niches.

In 2012, research institutes and universities attracted 6.7 million lats from the corporate sector, which formed 8.5% of the total funding for research institutes and funding for University research and development.

For facilitation of cooperation between research institutions and entrepreneurs, in 2011 was launched creation of long-term cooperation platform by supporting establishment and functioning of competence centres in six major sectors of national economy of Latvia (pharmaceutical and chemical industry, information and communications technologies, forest sector, electrical and optical equipment, environmental, bioenergetics and biotechnology industry, transport and mechanical engineering). Competence centres bring together various industry partners and research institutions, and access for support of research and development of new products in the fields which is defined as perspective and necessary by companies of the sector.

For improvement of research results transfer, support is provided for operation of eight technology transfer contact points in universities. On-going efforts of contact points yielded positive effect on promotion of industrial property management aspect in the scientific environment and identification and patenting of research results, but insufficient changes are achieved in the intensification of cooperation with companies, industry partners and attraction of investors for commercialisation of ideas. At the same time it is identified that the existing technology transfer support model restricts the availability of technology transfer and provides support only to universities, no funding is available for feasibility studies of research results and technical and economical preliminary research, to justify and validate commercialisation potential of the resulting intellectual property, as well as there are no instruments for the transfer of research results by creating spin-off companies, in cooperation with the providers of incubation services and venture investors.[30]

Support for development of new innovative business is provided within the framework of business incubators and financial instruments. At the same time it should be noted that the created network of business incubators is primarily active in regions and its basic function is to promote business activity, hence a relatively low proportion of companies with rapid growth and export potential are operating within incubators. Just in 2013 by collaboration of University of Latvia and Riga Technical

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[30] *newly established company*

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University "Green" technology incubator was launched, which will aim to develop a technology-intensive business ideas and raise funds for their implementation in an early development phase. Creative Industries Incubator operates in Riga, which is supported by around 100 creative industry companies.

Minister for Education and Science Vjačeslavs Dombrovskis

(Cabinet order No 685
28 December 2013)

Summary of
Science, technology development and Innovation Guidelines for 2014-2020

State Science, Technology Development and Innovation Guidelines for 2014-2020 (hereinafter referred to as the Guidelines) is a medium-term policy planning document that identifies national goals and priorities for science, technology and innovation for the period up to 2020. Science, Technology Development, and Innovation Guidelines in the national development planning system is a part of Smart Specialisation Strategy and promotes achievement of the objectives defined in the national long-term and medium-term policy planning documents.

Guidelines are developed:

1) taking into consideration third and fourth part of Article 13 of the delegation of Law On Scientific Activity scientific activity, which instructs the Ministry of Education and Science to develop policy of science and technology development and the Ministry of Economics to develop innovation policy;

2) taking into consideration tasks defined in the Government Action plan Declaration for implementation of activities to be carried out by the Cabinet of Ministers led by Valdis Dombrovskis in the scientific, technological development and innovation field;

3) taking into consideration ex-ante conditions for research and innovation (Condition 1.1.) of the EU Cohesion Policy Joint Strategic Framework Regulation Fund proposal for 2014-2020 programming period, including Smart Specialization Strategies as economic development strategy. Smart Specialisation Strategy (SSS) foresee the development of vision, distinguishing of competitive advantages, choice of strategic priorities and policy that unlocks knowledge-based potential of the region, thus ensuring the growth of national economy.

4) while executing the task given during the meeting of the Cabinet of Ministers on 20 November 2012 (Minutes 65 29th§), which determines the institutions responsible and co-responsible for execution of *ex-ante* conditions, as well as actions to be carried out for implementation of conditions and terms of implementation. In this informative report is established that for execution of ex-ante condition 1.1, the Ministry of Economy shall develop policy planning document for introduction of a modern industrial policy, The Ministry of Education and Science in cooperation with the Ministry of Economy shall develop a policy planning document for introduction of research, technological development and innovation for the time period 2014-2020.

With an Order of the MES 505 “On Establishment of Woking Group for Development of Draft Guidelines for Research an Innovation

for 2014 - 2020" from 28 December 28 2012, an inter-institutional working group has been created, including representatives from sectoral ministries, scientific institutions and science and economic growth-related NGOs.

For development of the Guidelines both national and international studies and assessments have been used, including interim results of external evaluation of Latvian science and innovation policy, carried out within the framework of the agreement with the Secretariat Nordic Council of Ministers[31]. For justification of choice of Smart Specialization Strategies, the Ministry of Education has implemented analysis of export capacity assessment of national economy sectors and questioning of Latvian entrepreneurs on potential areas of Smart Specialization Strategies, supply of science sector and future development prospects. The results of findings of evaluations and recommendations are discussed with entrepreneurs, industry associations and scientific institutions.

Prerequisite for implementation Guidelines is implementation of objectives established in the National Development Plan for 2014–2020. Investments in research and development should increase by reaching 1.5% of GDP in 2020, by targeted promotion of attraction of human resources, development of innovative ideas, development of research infrastructure, cooperation of higher education, science and private sector, as well as transfer of research and innovation in the business.

Structure of the Guideline objectives and lines of actions is designed achieve the objectives and tasks of Smart Specialisation Strategies.

The main objective of science, technology, and innovation policy is development of Latvian knowledge base and innovation capacity, as well as coordination of the innovation system.

For achievement of this objective six sub-objectives and relevant lines of action are set:

● to develop human resource capital of Science, Technology and Innovation sector, by increasing the number of people employed in scientific research institutions and the business sector at least up to 7 by 2020, focusing the increase in the identified knowledge specialisation areas;

● to promote the international competitiveness of Latvian science by focusing research in smaller number of larger and stronger institutions, promoting the increase the number of scientific articles published in a

[31] *After completion of the project, results of external evaluation of Latvian science and Innovation policy will be available at MES web page* http://izm.izm.gov.lv.

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recognised international databases up to 1500 articles and number of inventions up to 50 intellectual property units a year;

● to modernize and integrate research and education sectors, increasing their ability to respond to future challenges in research, technology development and innovation, and increasing the mobility of education sector;

● to create a more efficient knowledge transfer environment and strengthen corporate absorption and innovation capacity by cultivation of demand for new knowledge, and ability of scientific institutions to respond to this growing demand;

● to optimize the management of science, technology and innovation sector, ensuring an effective coordination and increase of R&D investments;

● to create a demand for science and innovation, informing the public about the scientific accomplishments and promoting innovative activities and development of technologies.

Planned sources for implementation of the Guidelines are State budget, international funding, including Structural Funds of the European Union, European Union funding for research and technology development programs for co-operation projects, private sector investments. In order to reach the volume of funding for science, established in the National Development Plan for 2014-2020, the required total State budget funding for 2014-2020 is provided in the amount of 603 million EUR, and during the period of time until 2020, the budget grant amount is distributed as follows: 30 million EUR in 2014, 57 million EUR in 2015, 73 million EUR in 2016, 91 million EUR in 2017, 104 million EUR in 2018, 117 million EUR in 2019, 131 million EUR in 2020. The total planned funding via structural funds for this period is 558 million EUR (of which 331 mllion eur for the Ministry of Education and Science, 221 million eur for the Ministry of Economy and 6 million EUR for the Ministry of Culture).

After reaching the objectives established in the Science, Technology Development and Innovation Policy, a positive impact on State and local budgets will be reached indirectly, because it will ensure the development of science and research, contribute to the implementation of the applied research results and commercialisation, which will promote social and economic development of the sector and the national economy, as well as tax increases.

Minister for Education and Science Vjačeslavs Dombrovskis

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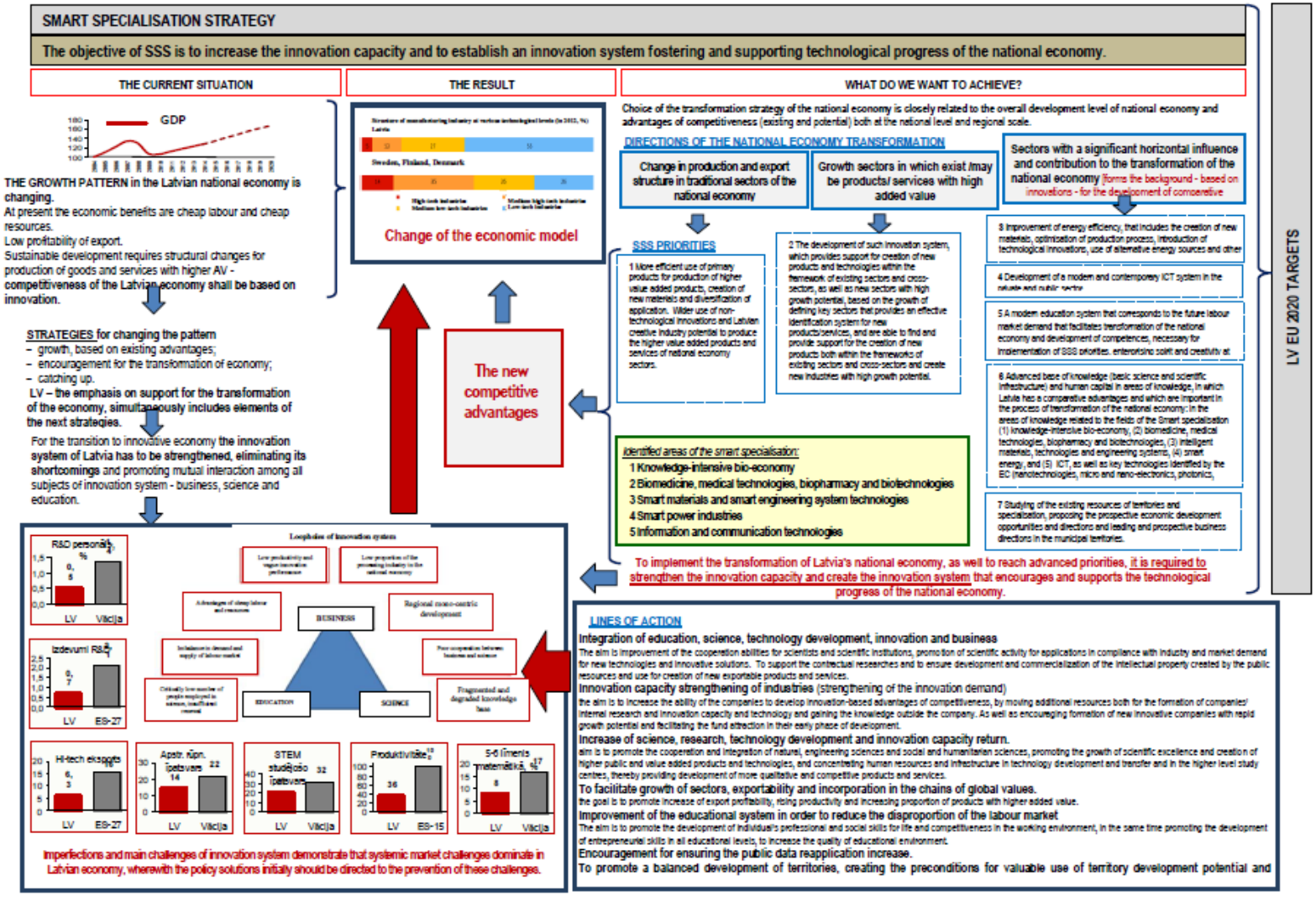
SMART SPECIALISATION STRATEGY
The objective of SSS is to increase the innovation capacity and to establish an innovation system fostering and supporting technological progress of the national economy.
THE CURRENT SITUATION
THE RESULT
WHAT DO WE WANT TO ACHIEVE?
GDP
THE GROWTH PATTERN in the Latvian national economy is changing.
At present the economic benefits are cheap labour and cheap resources.
Low profitability of export.
Sustainable development requires structural changes for production of goods and services with higher AV - competitiveness of the Latvian economy shall be based on innovation.
STRATEGIES for changing the pattern
– growth, based on existing advantages;
– encouragement for the transformation of economy;
– catching up.
LV – the emphasis on support for the transformation of the economy, simultaneously includes elements of the next strategies.
For the transition to innovative economy the innovation system of Latvia has to be strengthened, eliminating its shortcomings and promoting mutual interaction among all subjects of innovation system - business, science and education.
Change of the economic model
The new competitive advantages
Choice of the transformation strategy of the national economy is closely related to the overall development level of national economy and advantages of competitiveness (existing and potential) both at the national level and regional scale.
DIRECTIONS OF THE NATIONAL ECONOMY TRANSFORMATION
Change in production and export structure in traditional sectors of the national economy
Growth sectors in which exist /may be products/ services with high added value
Sectors with a significant horizontal influence and contribution to the transformation of the national economy forms the background - based on innovations - for the development of competitive
SSS PRIORITIES
1 More efficient use of primary products for production of higher value added products, creation of new materials and diversification of application. Wider use of non-technological innovations and Latvian creative industry potential to produce the higher value added products and services of national economy sectors.
2 The development of such innovation system, which provides support for creation of new products and technologies within the framework of existing sectors and cross-sectors, as well as new sectors with high growth potential, based on the growth of defining key sectors that provides an effective identification system for new products/services, and are able to find and provide support for the creation of new products both within the frameworks of existing sectors and cross-sectors and create new industries with high growth potential.
3 Improvement of energy efficiency, that includes the creation of new materials, optimisation of production process, introduction of technological innovations, use of alternative energy sources and other
4 Development of a modern and contemporary ICT system in the private and public sector
5 A modern education system that corresponds to the future labour market demand that facilitates transformation of the national economy and development of competences, necessary for implementation of SSS priorities. enterprising spirit and creativity at
6 Advanced base of knowledge (basic science and scientific infrastructure) and human capital in areas of knowledge, in which Latvia has a comparative advantages and which are important in the process of transformation of the national economy: in the areas of knowledge related to the fields of the Smart specialization (1) knowledge-intensive bio-economy, (2) biomedicine, medical technologies, biopharmacy and biotechnologies, (3) intelligent materials, technologies and engineering systems, (4) smart energy, and (5) ICT, as well as key technologies identified by the EC (nanotechnologies, micro and nano-electronics, photonics,
7 Studying of the existing resources of territories and specialisation, proposing the prospective economic development opportunities and directions and leading and prospective business directions in the municipal territories.
identified areas of the smart specialisation:
1 Knowledge-intensive bio-economy
2 Biomedicine, medical technologies, biopharmacy and biotechnologies
3 Smart materials and smart engineering system technologies
4 Smart power industries
5 Information and communication technologies
To implement the transformation of Latvia's national economy, as well to reach advanced priorities, it is required to strengthen the innovation capacity and create the innovation system that encourages and supports the technological progress of the national economy.
LV EU 2020 TARGETS
Loopholes of innovation system
BUSINESS
EDUCATION
SCIENCE
R&D personnel
Izdevumi R&D
Hi-tech eksports
Apstr. rūpn. ipatsvars
STEM studējošo ipatsvars
Produktivitāte
5-6 līmenis matemātikā
LV
Vācija
ES-27
ES-15
Imperfections and main challenges of innovation system demonstrate that systemic market challenges dominate in Latvian economy, wherewith the policy solutions initially should be directed to the prevention of these challenges.
LINES OF ACTION
Integration of education, science, technology development, innovation and business
The aim is improvement of the cooperation abilities for scientists and scientific institutions, promotion of scientific activity for applications in compliance with industry and market demand for new technologies and innovative solutions. To support the contractual researches and to ensure development and commercialization of the intellectual property created by the public resources and use for creation of new exportable products and services.
Innovation capacity strengthening of industries (strengthening of the innovation demand)
the aim is to increase the ability of the companies to develop innovation-based advantages of competitiveness, by moving additional resources both for the formation of companies' internal research and innovation capacity and technology and gaining the knowledge outside the company. As well as encouraging formation of new innovative companies with rapid growth potential and facilitating the fund attraction in their early phase of development.
Increase of science, research, technology development and innovation capacity return.
aim is to promote the cooperation and integration of natural, engineering sciences and social and humanitarian sciences, promoting the growth of scientific excellence and creation of higher public and value added products and technologies, and concentrating human resources and infrastructure in technology development and transfer and in the higher level study centres, thereby providing development of more qualitative and competitive products and services.
To facilitate growth of sectors, exportability and incorporation in the chains of global values.
the goal is to promote increase of export profitability, rising productivity and increasing proportion of products with higher added value.
Improvement of the educational system in order to reduce the disproportion of the labour market
The aim is to promote the development of individual's professional and social skills for life and competitiveness in the working environment, in the same time promoting the development of entrepreneurial skills in all educational levels, to increase the quality of educational environment.
Encouragement for ensuring the public data reapplication increase.
To promote a balanced development of territories, creating the preconditions for valuable use of territory development potential and

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