



InnoHPC project

High-performance Computing for Effective Innovation in the Danube Region

**Output 3.1. Digital Transformation of Industry Guidelines
with High-Performance Computing**

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Table of Contents

THE DANUBE REGION GUIDELINES	3
THE GUIDELINES AND EUSDR	6
NATIONAL LEVEL GUIDELINES	8
AUSTRIA	8
BOSNIA AND HERZEGOVINA	13
BULGARIA	15
CROATIA	17
CZECH REPUBLIC	19
GERMANY	21
HUNGARY	25
MONTENEGRO	28
MOLDOVA	31
ROMANIA	35
SERBIA	38
SLOVAKIA	41
SLOVENIA	45
UKRAINE	50

The Danube Region Guidelines

High-performance computing (HPC) is an emerging general-purpose technology. It can improve framework conditions for innovations by drastically increasing effectiveness of innovations and reducing product development time. The possibility of remote access makes it an excellent technological platform for enhancing innovativeness throughout the Danube region without the needs for excessive investments in expensive infrastructure and enables creation of transnational value-chains, connecting industrial organizations and institutions of knowledge throughout the region and beyond.

To increase awareness, disseminate the technology throughout the region and reap the benefits of HPC, policy-makers on local, regional, national and Danube region levels, business support organizations, enterprises and the institutions of knowledge should join forces. Notwithstanding immense regional nuances, which require context-specific measures and approaches, their actions should follow the five general guidelines.

Guideline 1: Accelerate awareness of the digital transformation and role of high-performance computing in this process. Digital transformation and high-performance computing go hand in hand; the full potential of digitalization can only be realized with meaningful application of high-performance computing in industrial research and development. However, the its immense applicability is poorly understood by the industry and this is a big obstacle to its dissemination and application. Increased awareness will be the major step towards its utilization throughout the region.

Guideline 2: Continue, enhance and target support for knowledge-exchange and cooperation between universities and industry. There are many schemes on various levels, from regional to European, encouraging knowledge-exchange and cooperation between universities and industry. However, it is vital that they become more targeted on industrial research, training and development of

infrastructure that will enhance digital transformation of industry, including application of high-performance computing. This will also contribute to better utilization of already existing infrastructure.

Guideline 3: Promote, educate and train for Industry 4.0 throughout the

Danube region. While westernmost parts of the Danube region are relatively well prepared to transition to Industry 4.0, its eastern parts are lagging behind. This situation will contribute to perpetuating gap in competitiveness and innovativeness. It is vital to promote Industry 4.0 to industry and institutions of knowledge alike, to include relevant aspects to education at all levels (for example, by developing appropriate materials in STEM education) and to develop (re)training for active labor force. This can provide opportunities for cooperation and exchange of experience in transnational partnerships in the Danube region.

Guideline 4: Support regional infrastructure for research and

development. There is a significant gap in regional (sub-national) soft and hard infrastructure for research and development between east and west of the Danube region. While regional research infrastructure in westernmost parts of the Danube region is relatively well developed, there is a need to upgrade it with the focus to support implementation of Industry 4.0 with application of high-performance computing. In eastern parts of the Danube region it is important to significantly upgrade regional (subnational) infrastructure for research and development, with the main purpose for it to support Industry 4.0 and high-performance computing utilization.

Guideline 5: Harmonize relevant legal regulation for digitalization and

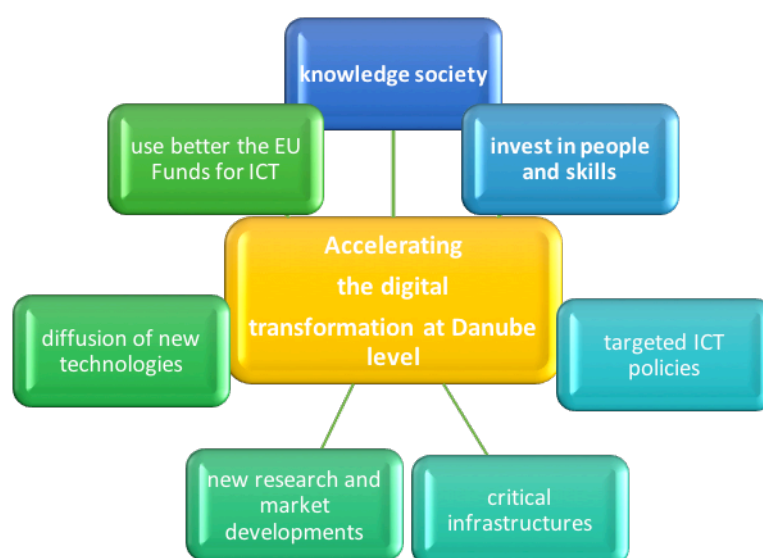
its enforcement. In order to enable cross-regional cooperation and formation of transnational value chains, it is vital to harmonize relevant legislation. While EU members are bound to follow the relevant EU directives and regulations, it is vital to ensure, first, the harmonization of legislation with non-EU Danube region countries and, equally importantly, ensure its efficient and timely enforcement throughout the region. For example, formation of transnational value chains and cooperation between the industry and academia can only be possible if the issues of intellectual property rights

are resolved. This is especially important with high-performance computing, where most of the work is conducted in cooperation with academic HPC providers and through distance access.

The Guidelines and EUSDR

Implementation of Digital Transformation of Industry Guidelines with High-Performance Computing is in line with EUSDR and its Action Plan. Implementation of EUSDR Action Plan will contribute to the implementation of the guidelines and at the same time, any action alongside the Guidelines will support implementation of the EUSDR.

Below are the key elements of EUSDR Action Plan that are relevant for these Guidelines.



„Cooperation among Danube countries has particular importance as regards to coordination of Research and Innovation (R&I) activities since they contribute significantly to competitiveness and economic growth of the macro-region and are at the same time the areas where cooperation and knowledge sharing across borders may crucially contribute to achieving best results.”

Gnamus et al., 2014

Digital transformation of Industry Guidelines at Danube region level

EUSDR	PA7: To develop the knowledge society through research, education and information technologies PA8: Competitiveness PA9: To invest in people and skills
EUSDR Action Plan	To develop and implement strategies to improve the provision and uptake of Information and Communication Technologies in the Danube Region <ul style="list-style-type: none"> • To improve the coverage and penetration of broadband in rural areas • To support certain parts of society in particular need for targeted ICT policies, such as groups with a low uptake, those excluded from access or others with particular training needs To draw up internet strategies <ul style="list-style-type: none"> • To increase the availability of internet access • To protect the freedom of expression on the web • To protect critical infrastructures. To use e-content and e-services to improve the efficiency and effectiveness of public and private services

<ul style="list-style-type: none"> • To increase the availability of technical infrastructure such as broadband and technical equipment • To use better the EU Funds for ICT • To create synergies between the building of energy, transport and telecom networks, in order to reduce the cost of broadband installation
<p>To stimulate the emergence of innovative ideas for products and services and their wide validation in the field of the Information Society, using the concept of Living Labs</p>
<ul style="list-style-type: none"> • To establish Living Labs through which businesses, universities and public administration jointly develop new products by involving customers/users from very early stages, including design • To support openness to new research and market developments in a public and people oriented approach • To support the development of initiatives to stimulate the creation of new markets, the diffusion of new technologies, enhancement of intellectual property protection and standards and impact assessments of new legislative or regulatory proposals on innovation
<p>To foster cooperation and exchange of knowledge between SMEs, academia and the public sector in areas of competence in the Danube Region</p>
<ul style="list-style-type: none"> • To promote actions supporting the internationalisation of SMEs and facilitating interdisciplinary cooperation
<p>To improve framework conditions for SMEs in areas where competitive infrastructure is missing</p>
<ul style="list-style-type: none"> • To construct joined or networked industrial and technological parks, as well as transportation, logistics and exhibition centres • To support investments in competitive infrastructure for SME, especially in rural and border regions

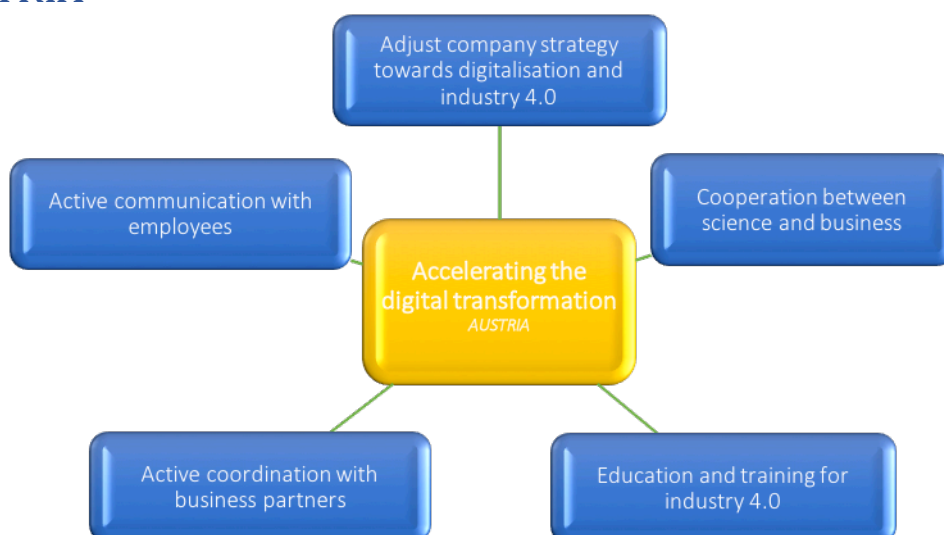
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- [European Commission \(2010\), European Union Strategy for Danube Region, European Commission \(2010\), EUSDR Action Plan;](#)
- [Gnamus A, Hegyi F.B, Perez, SE \(2014\), Developing Danube R&I Projects across Borders – How to Make the Joint Use of EU-Funds a Reality?, S3 Policy Brief Series n° 10/2014, European Commission, JRC-IPTS](#)

Guidelines and the National level

Implementation of Digital Transformation of Industry Guidelines with High-Performance Computing is a multi-level strategic process, which must take national nuances into account. As such it is in line with a number of strategic documents and action plans on the national level. Below are the guidelines, recommendations and key aspects of national strategic documents, which will contribute to implementation of the Danube region Guidelines.

AUSTRIA



“Digitalisation is the future, and our companies must engage with their future in order to have a future.”

Josef FRITZ,
Managing Partner,
BOARD SEARCH

Digital transformation of Industry Guidelines at national level: Austria

Recommendations for business

Integrate digital transformation into company strategy

- Digital transformation should not only be managed within the framework of the day-to-day business but should be systematically integrated into the company strategy. This reduces the risk of operational steps in the wrong direction, facilitates the communication with the employees and ensures the anchorage of the topic in the top management. Companies must have IT strategy that sets some fundamental principles. For instance, each company should decide at the very beginning of the digital transformation that either it prefers to build, host and maintain its own server and/or HPC infrastructure and to train and pay for own IT experts (because of for instance some security considerations); or it is going to achieve digital transformation in a cost-effective way and outsources these IT

infrastructures into third-party HPC data centres. The third way that the companies can follow is a hybrid solution, where some IT infrastructures are maintained always in house, but more expensive IT resources (e.g.: virtualized, large-scale HPC platforms and various other services) are rented from third-party HPC data centres and use only on demand.

Coordinate with stakeholders in the value-added network

- Companies should coordinate as early as possible and proactively with the relevant stakeholders in their value-added network, so that their own company can influence the establishment of technical standards as far as possible and in any case, does not miss any development in its value-added network. Nowadays, in the changing market conditions any new achievements on the fields of HPC, big data or IoT can be critical for preserving competitiveness of any enterprise and for the successful accomplishments of Industry 4.0 requirements. Leaving these activities entirely up to other players brings the risk of being substituted in the value-added network by other actors.

Ensure IT and data security

- A proactive strategy to ensure in-house IT and data security is a must for companies who want to secure their place in successful value-added networks. Furthermore, ensuring secure access to IT-resources outsourced various HPC data centres is also a fundamental issue for the members of competitive value-added networks.
- The importance of IT and data security continues to grow in times of the Industrial Internet of Things and has not only technical but also direct competitive effects.

Develop your own data strategy

- Without a clear data strategy, the potential benefit of data, big data analytics and the secure, on-demand usage of third party HPC architectures cannot be realized.
- Every company should design and evolve such a data strategy for itself and, if necessary, coordinate it with partners in the value-added network.

Active communication with employees

- The issue of industry 4.0 creates uncertainty and anxiety on the part of the employees.
- This can best be countered with transparency and active communication.
- Employees must be actively integrated in industry 4.0 projects, then they can also make their requirements meaningful and contribute to the success of digital transformation.

Training for employees

- Enterprises should be as active as possible in order to support their employees in a well-founded education and training in topics relevant to industry 4.0 (including basic knowledge on the fields HPC and cloud computing, data analytics as well as

	<p>IT-security).</p> <ul style="list-style-type: none"> • Co-operation between companies and educational institutions is important for designing tailored and economically oriented courses and curricula in order to prepare existing and future employees for industry 4.0.
	<p>Launch new business models as intra-entrepreneurships</p> <ul style="list-style-type: none"> • A new disruptive business model cannot simply be built up within the old business model due to target conflicts. Instead, companies should better separate business units from the core business, concentrating only on the growth opportunities of the disruptive business, such as a start-up within an established company. However, making such a clear separation is not always an easy task or sometimes it is simply not possible, because the new technologies affect many branches and levels of the old business model. Therefore, companies should also investigate and understand what are the influences of the IT technologies spread widely in the last decade, like on-demand large-scale HPC services, virtualization, big data analytics and machine learning methods to their conventional business and how to extend or reorganize these activities and models to remain competitive.
<p>Recommendations for Policy</p>	<p>Accelerate awareness of the digital transformation</p> <ul style="list-style-type: none"> • Politics - from legislators to political interest groups - should make every company in Austria understand the opportunities and risks of the digital transformation. • All awareness-raising measures are required: communication campaigns, political initiatives, commissioning of studies and dissemination of the study results, etc. <p>Promoting and education and training system for industry 4.0</p> <ul style="list-style-type: none"> • Politics should create and support new training programmes and opportunities. • A strong focus should be put on digital competencies and MINT subjects (mathematics, computer science, natural sciences and technology), starting already from elementary school on. • On the one hand, technical studies should be differentiated by putting more emphasis to those fields of natural and computer science that are directly or indirectly necessary for industry 4.0 (such as some basics of cyber physical systems and data analytics as well as some background knowledge about the connected underlying technologies like machine learning algorithms, distributed programming skills on large-scale HPC architectures, IT-security, etc.). On the other hand, these technical studies should be combined with entrepreneurship knowledge. • Generally, interdisciplinary approach in the education system should be fostered. <p>Promotion of technology with service and business model innovation</p>

	<ul style="list-style-type: none"> • The majority of today's funding mechanisms aims at research and technology development. • Politics should open up of this technology promotion towards service innovations and - which would be a genuine innovation in promotion technology - to support business model innovations with public funding.
<p>Strategy of the Federal Government for Research, Technology and Innovation: „Exploit knowledge, increase added value Activating the potential of innovation”</p>	<p>Harmonize legal regulations for digitization</p>
	<ul style="list-style-type: none"> • Digital transformation affects many areas of the economy and society and requires sensible regulations. • Companies are calling for greater flexibility in the organization of working time, as well as the most comprehensive harmonization of data protection rules. • Since Industry 4.0 allows many data-driven innovations, policy can support (indirectly) innovation, particularly through the harmonization of data protection regulations.
	<p>Innovation and company research</p>
<ul style="list-style-type: none"> • Strengthen the support and providing access to expensive (academic) high-tech resources (e.g.: to academic and third-party laboratories and HPC data centres) for activating and increasing company research and the innovative performance of companies. • Demand-side stimulation of innovation, in particular through increased use of innovation-promoting approaches in procurement (such as competitive dialogue or functional performance description). • Intensify innovation in the public sector (such as energy efficiency in public buildings, e-governance, e-health) and public infrastructures. • Improve frame conditions and intensity of efforts to establish further research-intensive companies and the development of headquarter functions. • Implementation of an innovation-oriented infrastructure policy, for example through innovation-promoting procurement as well as high-tech investments in the domestic infrastructure and, at the same time, support for the technology companies in export. 	
<p>Cooperation between science and business</p>	
<ul style="list-style-type: none"> • Further development of support measures for research cooperation, networks and strategic alliances with a focus on excellence and sustainability (such as COMET, Bridge, COIN) and models of thematic fundamental research (like CDG). • Strengthen the leverage and transfer function of clusters and intermediaries. • Identification of strengths for pooling resources and exploiting synergies, as well as supporting the development of research and development (guiding) themes (between industry and science / research). • Fostering the involvement of Austrian companies and scientific and research facilities in EU and international programs. 	

- Support enterprises in securing and enforcing intellectual property and its exploitation.
- Develop initiatives to strengthen human potential in the area of applied research and strengthen inter-sectoral and international mobility.

Business start-ups and risk capital financing

- Creation of a legal framework to increase the equity capital of young technology and growth-oriented enterprises.
- Expansion of the risk capital initiative for the stimulation of early stage investments taking into account the developments so far.
- Optimization and completion of the already existing support measures for technology-based and innovative start-ups, in particular measures for the start-up phase (see Pre-seed, Seed-financing, Business Angels, Technology Marketing etc.).
- Strengthening financial competency and entrepreneurship at the universities, among other things through the establishment of knowledge transfer centres.
- Development of new financing models with venture capital participation for the exploitation of university intellectual property rights (IPR) up to the establishment of university-related venture companies.

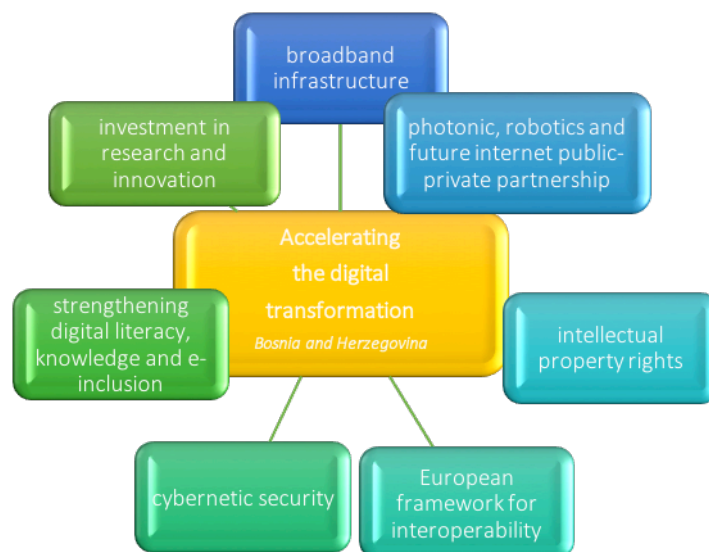
Innovation through competition

- Reduce administrative hurdles in the areas of business start-up
- Reform of the Federal Competition Authority (tasks, powers, resources).
- Implementation of sector-specific analyses (e.g. fuel market, food).
- Review of the competition rules with regard to obstacles to innovation.

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BOSNIA AND HERZEGOVINA



Digital transformation of Industry Guidelines at national level: Bosnia and Herzegovina (BIH)

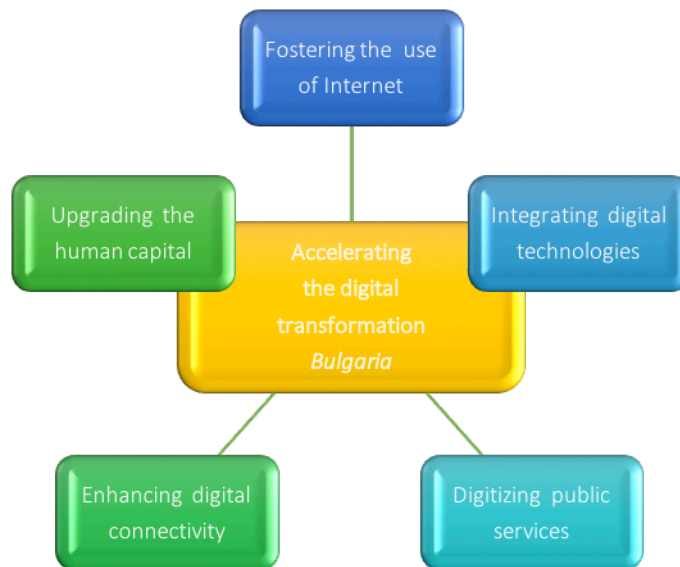
Policy on information society development in BIH	Establishment of the unique digital market
	<ul style="list-style-type: none"> • Simplifying the distribution of creative content; • Improving the protection of intellectual property rights on the Internet; • Adoption of new legislative and by-laws by existing legislation that support the establishment of a unique digital market; • Support and promote a unique digital market in BiH and EU; • Improving the domestic telecommunications market; • Improving copyright protection; • Establish guidelines for the proper implementation of EU rules on consumer requirements for information, download or harmonization with EU legislation in this fields;
	Establishing the framework for interoperability and standards
	<ul style="list-style-type: none"> • Identify, draft, adopt and implement legislation on ICT interoperability; • Provide guidelines for ICT standardization and public procurement; • Approach the European framework for interoperability;
	Stimulating confidence and security
	<ul style="list-style-type: none"> • Enhance the security of private networks and data; • Strengthen the fight against cyberattacks on information systems and critical infrastructure; • Maintain the EU platform to combat cybercrime;

	<ul style="list-style-type: none"> • Develop cybernetic security strategy;
	Establishing fast and ultra-fast Internet access
	<ul style="list-style-type: none"> • Adopt and implement broadband legislation; • Provide means for broadband high-speed access; • Adopt BH policy and spectrum strategy; • Develop an action plan for broadband implementation;
	Encourage investment in research and innovation
	<ul style="list-style-type: none"> • Adopt and implement the BH Cloud Computing Strategy based on the European Framework For Cloud Computing; • Set up more business-friendly environments for beginner entrepreneurs; • Focus on the development of photonic, robotics and future internet public-private Partnership (PPP) - New PPP on High Performance Computing; • Introduce Action Plan for the Development of the Electronic Industry; • Increase Investments in High Performance Computing;
	Strengthening digital literacy, knowledge and e-inclusion
	<ul style="list-style-type: none"> • Provide guidelines for the advancement of digital literacy and ICT competence of citizens of Bosnia and Herzegovina; • Actively implement the digital literacy policy; • Ensure available and efficient eLearning;
	Application of ICT in addressing key challenges of BiH society

References

- Policy on informatics society development in BiH, Ministry of Transport and Communications of BiH.

BULGARIA



“The major problem is the decline of the well qualified human resources in Bulgaria due to the continuing emigration of specialists”.

Prof. Stoyan Markov, Head, National Center for Supercomputing Applications, Bulgarian Academy of Sciences

Digital transformation of Industry Guidelines at national level: Bulgaria

According to the Digital Economy and Society Index (DESI) 2017 Bulgaria occupies 27th place in the ranking of digitalization progress in the EU. The delay in the progress could be overcome by:

National Development Programme: Bulgaria 2020

National Development Programme: Bulgaria 2020

National Reform Programme 2012 - 2020

Public Administration Development Strategy

Digital Bulgaria - 2015 National Programme

Enhancing digital connectivity

- To increase the number of the broadband subscribers;
- To foster the subscriptions for mobile broadband;
- To accelerate the 4G coverage;
- To increase the take-up of fixed broadband;
- To give priority to the deployment of broadband in rural areas;
- To follow the European call for the deployment of 5G networks;
- To make the best of European data.

Upgrading the human capital

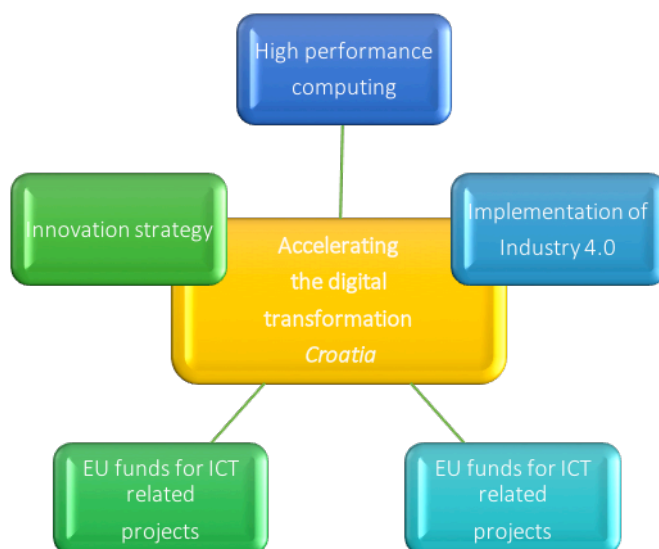
- To make digitalization of economy part of the educational mainstream;
- To raise the share of the STEM (science, technology and mathematics) graduates;
- To legally regulate and recognize the training provided by IT companies for students;
- To support personal and institutional initiatives for acquiring digital skills;
- To make digital trainings obligatory part of the

	professional development.
	Fostering the use of Internet
	<ul style="list-style-type: none"> • To accelerate the development of the infrastructure for Internet banking (used by 7%); • To carry out educational programs on Internet shopping (27th position in the EU); • To intensify the use of music, videos and games via Internet (28th position in the EU).
	Integrating digital technologies
	<ul style="list-style-type: none"> • To support the Small and Medium Enterprises (SMEs) selling via Internet (currently only 17% of the SMEs); • To promote the use of cloud computing by the enterprises (currently 13% use it); • To provide incentives for increasing the e-commerce turnover.
	Digitalizing public services
	<ul style="list-style-type: none"> • To strictly follow the Roadmap for implementation of the Strategy for the Development of e-Government for the period 2016-2020 (2016); • To continue the homogenization of the legislation and the policies in the field of electronic governance; • To consequently combine the development of Open Data policies with the policies for data protection and cyber security.

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- National Reform Programme - 2012 - 2020 <https://www.minfin.bg/en/page/867>
- Public Administration Development Strategy - 2014-2020;
- Basic model of full-range administrative services;
- Digital Bulgaria - 2015 National Programme
- National Strategy on Cyber-security https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Documents/Events/2016/Cybersecurity%20Forum%20Bulgaria/Bulgaria_sharkov_todorov.pdf
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CROATIA



Digital transformation of Industry Guidelines at national level: Croatia

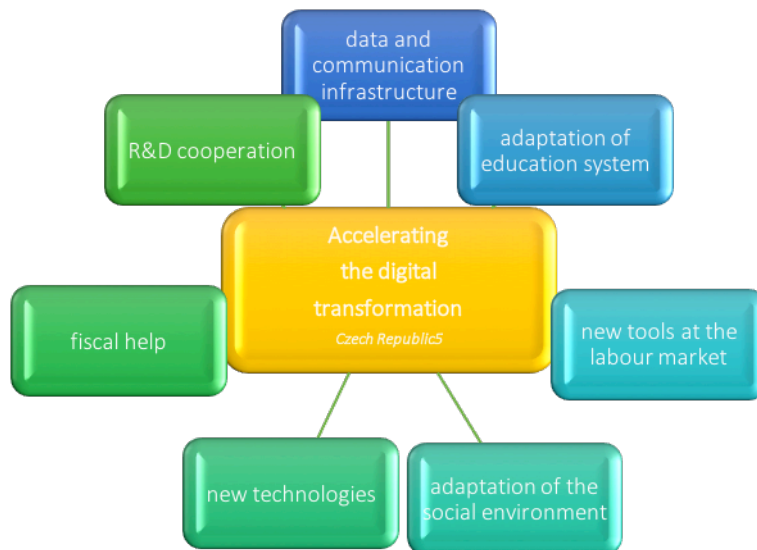
Digital transformation of economy 2016 - 2020	High performance computing <ul style="list-style-type: none"> • Encourage the use and development of open source software • Increase the number of skilled staff through university and other educational programs • Accelerate innovation and research
Protect your digital enterprise: Hewlett Packard Enterprise Transformation Workshop	Implementation of Industry 4.0 <ul style="list-style-type: none"> • Implement related technologies such as IoT, big data, security, communication and cloud computing in order to increase business agility and to introduce new business scenarios • Increasing presence of IoT in healthcare, retail and manufacturing • Development of new services which will lower the environmental pollution • Adapt to new trends i.e. consumers that use social networks for decision making • Maintain high level of digital security • IoT, cloud computing, big data, social networks i smartphone platforms are vulnerable to cyber attacks • Defending from cyber-attacks require adaptive, predictive and dynamic security systems, processes and technologies • Use above mentioned technologies for development of Smart City platforms • Cover as many SMEs as possible
ICT research and innovation	EU funds for ICT related projects The ICT sector represents 4.8% of the European economy and generates 25% of total business expenditures in research and development

	<ul style="list-style-type: none"> • Use of both EU and national funds for financing research and development activities
Smart specialization	Improve education in ICT
Draft Of Croatia's Smart Specialization Strategy	<ul style="list-style-type: none"> • Promote HPC and related fields such as parallel programming, computational chemistry, deep learning etc. • Introduce ICT technologies at earlier stage of education in order to better prepare students for using the digital technologies within Industry 4.0 • Lifelong learning programs in ICT
Innovation and Digitalization of Croatia	Innovation strategy
	<ul style="list-style-type: none"> • Incorporate 'smart specialization' approach • Provide an efficient framework to strengthen the competitiveness of Croatian R&D • Development of innovation system, including regulatory and fiscal framework of Strengthening the innovation potential • Promotion of cooperation and knowledge transfer between business, public and research sectors o Creation of attractive environment for world-class researchers • Aim economy towards higher value-added industries • Therefore, increase The Global Innovation Index rank for Croatia and improve the competitiveness rank from World Economic Forum

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- Draft of Croatia's Smart Specialization Strategy:
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CZECH REPUBLIC



For the Czech Republic, with its high dependence on the manufacturing industry, it is probably nothing more important than jumping on the train of Industry 4.0. We need to develop this comparative advantage as much as we can ... In fact, we don't lack money for the development, but we have to invest in the strategic areas, where we have knowledge and, and we have to give them only to those who could produce results.
 Miroslav Zámečník, Euro 47/2015⁶

Digital transformation of Industry Guidelines at national level: Czech Republic

Industry 4.0	Reskilling of workforce: new skills for Industry 4.0
	<ul style="list-style-type: none"> To increase flexibility of labour market To promote and support entrepreneurship, start-ups and spin-offs To create system of complex monitoring of new jobs To enhance educational and retraining system
	Stimulate applied research in new areas
	<ul style="list-style-type: none"> To strengthen support of applied research by concentrating support for larger projects Create new models for finance support of applied research with higher involvement of private funds Create new evaluation system of research outputs suitable for applied research
	Accelerating of uptake of new technologies
	<ul style="list-style-type: none"> To promote interdisciplinary theoretical R&D To promote creation and operation of infrastructures for fast prototyping (FabLab, TestBed) To promote joint ventures of companies and research organisations To promote transfer of technologies from R&D institutes and companies To promote R&D at companies
	Changes in educational system
	<ul style="list-style-type: none"> Implement new trends and technologies (e-skills, IoT, IoS, IoM, robotics) into educational system on all levels Intensive use of modern technologies (multimedia, interactive mobile applications, augmented and virtual reality, serious games) Creation of new study cross disciplinary programs at universities (combination of engineering, IT and elector engineering subjects)

- Creation and implementation of new financial model to increase private funding of educational activities

Standardisation of technical norms

- To be more involved in international bodies CEN, CENELEC, ETSI
- Create advisory board at Czech Office for Standards, Metrology and Testing for Industry 4.0
- Involve experts from industry into standard preparation process
- Increase availability of the standards for companies

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- [Czech Republic: "Průmysl 4.0" - European Commission - Europa EU](#)
- [Industry 4.0 Initiative \(in Czech\)](#)

GERMANY



*“We should look at the benefits digital can bring, without running too far in the hype or danger direction. Digital can help people do their job better, be more efficient, have access to more data, improve planning, etc. Companies in Germany can do a lot of move the digital topic forward. They need to ensure a mix of executives from inside and some hired from outside to stir things up. Help bring in younger talent to Executive Boards and Supervisory Boards. In addition, it is critical that everyone in the company understands and supports the changes. In particular, every employee needs to feel that their concerns and fears are being heard.” Erik S. Meyers, Twitter
Published on March 20, 2016*

There is a huge opportunity if the country and its industry can just get it right.

Digital transformation of Industry Guidelines at national level: Germany

Digitalisation “made in Europe”	Creating a gigabit network for Germany
	<ul style="list-style-type: none"> • To have globally competitive telecommunications networks in Germany (by 20125) which offer gigabit/s transmission speeds both upstream and downstream, and which guarantee adequate capacity at all network levels, reliable real-time capability and the highest service quality. • To ensure in the short term that trade and industry in particular (Industrie 4.0, Smart networking, Smart services) have nationwide access to first-class networks and that rapid progress is made on rolling out gigabit networks
	Steering in a new age of entrepreneurship
	<ul style="list-style-type: none"> • To support Entrepreneur’s fresh ideas and rethinking of commerce • To support their innovative skills with established companies and the networking which offers key opportunity for industry in Germany • To support start-ups, improve funding conditions, and promote cooperation between new and established companies
	Creating a regulatory framework for more investment and innovation
	<ul style="list-style-type: none"> • To evaluate legal framework with a view to digitalisation (and to see a modernisation of the European legal framework which provides a

stimulus for a strong, growing Digital Single Market)

- To take support and take account of some laws of special features of online markets, and merger control needs to be adapted both in the national and in the European context
- To think about setting up regulatory “experimental spaces” for new technologies and business models

Pushing forward with smart networking in the core areas within our economy

- To construct comprehensive and systematic use of the digitalisation potential in the fields of energy, transport, health, education and public administration
- To generate considerable efficiency gains and to stimulate macroeconomic growth (The Smart Networking Strategy was adopted by the cabinet in September 2017. Since then, a lot of information policies have been rolled out. For example, a “Smart Networking Initiative Germany” centre of excellence has been set up, and roadshows set in motion)

Strengthening data security and data protection

- To ensure data security and data protection safeguard basic rights
- To promote public acceptance, and also stimulate growth, because they require the development of new technologies and business models
- To create our own security ecosystems (for hardware and software)

Enabling new business models for SMEs, the skilled craft sector and services

- To help SMEs to succeed and grow in the rapidly changing conditions of a global data economy. In some sectors, such as the services sector, this initially involves measures to raise awareness of scope for digital development and resulting new value chains

Utilising Industry 4.0 to modernise Germany as a manufacturing base

- To offer potential for more efficient, customer-oriented and resource-conserving production and for the creation of additional value added by means of new business models
- To increase a goal to make Germany the leading supplier and user of Industry 4.0 - and as a result, it will be the most modern industrial location in the world
- To achieve the leading supplier, is needed to enable SMEs to come to terms with Industry 4.0.

Bringing research, development and innovation in digital technology to a competitive level

- To significantly boost funding for research and development in the area of digitisation of the economy. In most areas of trade and industry, this funding is only one-tenth the amount of that provided for energy or aerospace
- To enforce in promotion of research and development projects at the precompetitive stage, address forward-looking topics in ICT early on
- To expedite the transfer of scientific results, including market-oriented cutting-edge technologies with substantial application potential

Offering digital training to people at every stage of life

- To support digital education and training and provided it at all levels of the education system in the interest of innovative commerce, decent work and better participation in working life through better digital evaluation skills
- To take responsibility for people's own data

Creating a digital agency as the central unit for implementing the Digital Strategy till 2025

- To overcome the fragmentation of tasks at federal level regarding digital economy issues, and to effectively support the implementation of German Digital Strategy
- To bring together the responsibilities along the entire digital value chain, to provide institutional backing for the implementation of the Digital Strategy (duty of the new "Federal Digital Agency" of the Economic Affairs)
- To strengthen the digitalisation expertise for the provision of neutral policy advice (in the short term, the capacities in the Bundesnetzagentur (Federal Network Agency) which focus on issues like Industry 4.0, smart networking, standardisation, etc. will be increased;
- To expand market monitoring, so that we can better understand digitalisation processes and, if necessary integrate them into the regulatory system.

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- The [new](#) High-Tech Strategy Innovations for Germany (2014), Bundesministerium für Bildung und Forschung/Federal Ministry of Education and Research (BMBF)
- [White paper – digital platforms, Digital regulatory policy for growth, innovation, competition and participation \(2017\). Federal Ministry for Economic Affairs and Energy \(BMWi\)](#)

HUNGARY



"Hungary's success cannot be achieved without improving competitiveness, and competitiveness cannot be achieved without successful digitalization."

Tamás Deutsch
 Prime Ministerial
 Commissioner
 for the Digital Welfare
 Program

Digital transformation of Industry Guidelines at national level: Hungary

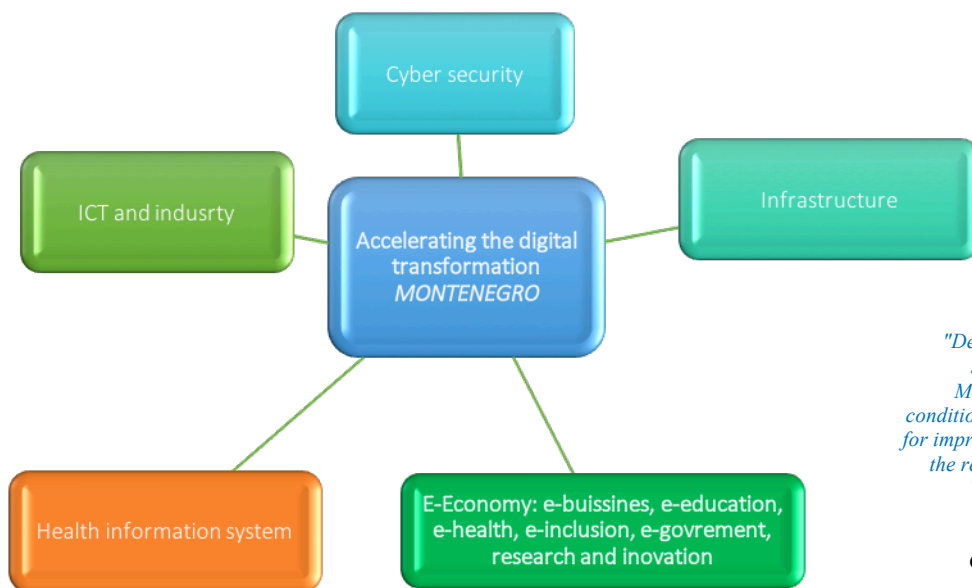
National Info-communication Strategy 2014-2020	Digital infrastructure <ul style="list-style-type: none"> Eliminating the potential bottlenecks in the segments of electronic telecommunications networks
	Digital competences <ul style="list-style-type: none"> Increasing the spread of digital competences among the population and SMEs
	Digital economy <ul style="list-style-type: none"> Reducing the shortage of ICT experts both in quantity and quality Increasing the rate of IT use in domestic SMEs and their participation in the digital economy Encouraging and supporting cooperation between educational institutions and ICT enterprises
	Digital state <ul style="list-style-type: none"> Establishing and operating a stable and secure government IT background Putting in place a legislative framework for the transferability of info-communication technologies in order to achieve interoperability
	R+D+I <ul style="list-style-type: none"> Supporting the innovation activities of knowledge and technology intensive ICT companies to develop marketable products Strengthening the co-operation culture and supporting its forms

	<p>in R+D+I</p> <ul style="list-style-type: none"> • Supporting any closer co-operation between ICT companies and universities and research institutes, with special regard to increasing the efficiency of participation in tenders • Supporting ICT cluster development • Making the adequate super-computing (HPC) capacities available for the R+D+I sector
National Research and Development and Innovation Strategy 2013-2020	Developing globally competitive knowledge bases
	<ul style="list-style-type: none"> • Training researchers and creative professionals • Strengthening globally competitive research centres
	Strengthening intensive flow of knowledge
	<ul style="list-style-type: none"> • Facilitating R+D and technology-based dynamism of medium-sized companies • Integrating large enterprises based on R+D • Establishing an integrated, client-oriented, IT-based national innovation service system • Supporting open, pre-competitive and social innovation co-operations
	Improving efficient knowledge utilisation
	<ul style="list-style-type: none"> • Boosting innovative small firms • Making more dynamic collaborations and networks
Iriyni Plan 2016	Application of new and digital technologies
	<ul style="list-style-type: none"> • Increasing industry competitiveness • Accessing and exploiting market gaps
	Energy and material efficient instruments and production methods
	<ul style="list-style-type: none"> • Reducing dependency on raw materials and energy • Increasing the marketability of Hungarian products • Using the most state-of-the-art technologies in production
	Easing territorial disparities
	<ul style="list-style-type: none"> • Employment creation in less industrialised regions • Increasing networks
	Expanding employment opportunities
	<ul style="list-style-type: none"> • Extending dual education
	More efficient use of resources
	<ul style="list-style-type: none"> • Producing higher value-added products • Providing high value-added services • Streamlining the composition of energy use
	Industry 4.0
	<ul style="list-style-type: none"> • Use of digital technologies during production • Producing “smart” products • Supporting related R&D&I activities

References

- Hungarian Government - Digital Success Program
- National Infocommunication Strategy 2014-2020
- National Research and Development and Innovation Strategy 2013-2020
- Irinyi Plan 2016

MONTENEGRO



"Development of informational society and digitalization in Montenegro is one of the pre-conditions for its economic growth, for improving its competitiveness in the region and in broader area."

Vujica Lazovic, Minister of Informational Society and Telecommunications in Government of Montenegro

Digital transformation of Industry Guidelines at national level: Montenegro

Strategy for information society development 2020

Infrastructure

- Increase broad band access availability
 - The basic broad band access – coverage 100% of the population by 2018
 - The fast broad band access (>30mb/s) – coverage 100% of the population by 2020

Cyber Security

- Develop strong organizational infrastructure for prevention and combat against internet incidents
 - The capacities of the national CIRT for protection, prevention and combat against internet incidents strengthen with the total number of team experts to increase to 20 by 2020.
 - The improvement of structure of local CIRTs
- Enhance protection of critical information structures in Montenegro
- Strengthen capacities of state law enforcement authorities
- Raising public awareness and protection on the Internet
- Incident Response

E-Economy: e-buissines, e-education, e-health, e-inclusion, e-govrement, as well as research, inovation and development in the field of ICT

- Growth of the basic and advanced digital skills

- The percentage of the ICT graduates in total number of the graduates should amount to 10% by 2020.
- The number of ECDL certificates issued should reach 15000 by 2020.
- Field of digital business: reach 6% of the share of the ICT in GDP, which will be reflected in economic growth and job creation in other sectors of the economy.
- E-education: enreach the proportion of available computers per students in schools as well as skills of the teaching staff
- E-health: make massive use of e-prescriptions, e-referrals and online appointments
- E-inclusion: overcome the gap between urban and rural areas, income based digital divide, and divide based on social and demographic characteristics
- Further development of e-government: increase the number of legal entities using e-services as well as number of the users who choose to communicate electronically with the public administration
- ICT research and innovations: encourage new scientific and research institutions in the field of ICT, which will have positive effects on the increase in financing the research in this field in relation to the overall budget for research and innovation.

Strategy for Health Care Development of Montenegro by 2020

Health information system

- Provide support to further development of the health care information system by:
 - Establishing standards with regard to data structure and the manner of transfer throughout Montenegro;
 - Establishing an electronic citizen's health card as a central element for medical documentation;
 - Forming communication infrastructure necessary for data exchange;
 - Enabling access to data by different participants in the health system according to the defined levels of access.

Industrial policy of Montenegro till 2020

ICT and industry

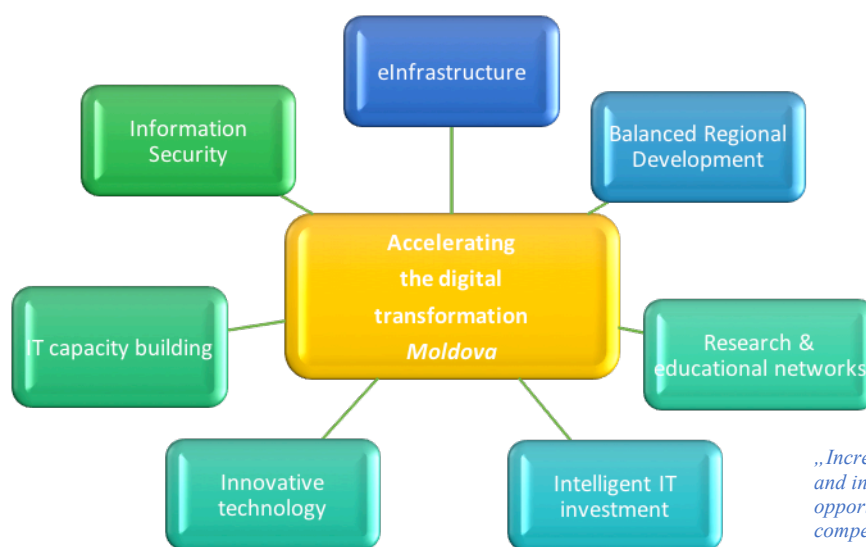
- The ICT sector has significant potential for growth, through implementation of projects relating to information-based society, electronic communications and broadband infrastructure, which would consequently have a further impact on the development of other sectors of strategic importance for the development of Montenegro;
- Development of education of human resources within the ICT sector is at a high level whilst there is still significant space for improvement in formal and non-formal ICT education

References:

- Strategy for information society development of Montenegro by 2020: <http://www.gov.me/files/1255505965.pdf>

- CYBER SECURITY STRATEGY FOR MONTENEGRO 2013-2017:
<https://www.enisa.europa.eu/topics/national-cyber-security-strategies/ncss-map/strategies/cyber-security-strategy-for-montenegro/view>
- Strategy for Health Care Development of Montenegro by 2020:
https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwi-5d_3qIfWAhWrK5oKHfojBj0QFggvMAA&url=http%3A%2F%2Fwww.mzdravlja.gov.me%2Ffiles%2F1077189400.doc&usg=AFQjCNHcp48tyAZRHPJTQ00833_lTaBazA
- Industrial policy of Montenegro till 2020:
<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjTxJ-Bq4fWAhXjHJoKHQ3ABFcQFggnMAA&url=http%3A%2F%2Fwww.mek.gov.me%2FResourceManager%2FFileDownload.aspx%3Frid%3D244853%26rType%3D2&usg=AFQjCNENw1TYNcHZ5mDfIJ0yiR81zkSaqw>

MOLDOVA



„Increased cooperation in research and innovation will create new opportunities for growth, competitiveness and jobs in all our economies.“

Máire Geoghegan-Quinn,
 European Commissioner for
 Research, Innovation and Science,
 Western Balkans countries,
 Moldova sign up to Horizon 2020

Digital transformation of Industry Guidelines at national level: Moldova

Strategy for the development of research and innovation 2020: Moldova

Efficient management of research processes

- Create education able to generate ideas, absorb new knowledge
- The higher education system develops individual completeness for graduates, so that the latter can recover investments in education after graduation relatively quickly through employment

Favourable society for the innovative and firm inclusion

- Facilitate the social, economic and political inclusion in order to combat poverty, to consolidate human rights, to provide for the digital inclusion, equality, solidarity and intercultural dynamics by supporting interdisciplinary researches, indicator of the technological progress, organizational solutions and new forms of cooperation and co-creation
- The research, among other activities, supports implementation of the Europe 2020 strategy, as well as of other external policies of the EU.
- At the national level, in order to synchronize the national research documents with the international ones, the scientific community identify in a transparent manner, by consulting the opinion of the relevant central bodies of the public administration, the new strategic directions until 2020, which will be included in the future partnership agreements, submitted for approval to the Government and Parliament.

	<p>Strategic vision on research and innovation</p> <ul style="list-style-type: none"> • Capable system of creating an efficient scientific knowledge in the view of increasing the competitiveness of the national economy and the degree of the welfare of the population • Orientation of research priorities to academic community to keep up the effort, since programs cover a wide range and provide additional resources valuable. • Commercializing of research results, first, in the absence of adequate public funding countries turn increasingly to alternative sources of finance and second, research institutes, universities and other entities ties are becoming increasingly aware of the value of intellectual property they generate. • Evaluation of the research and innovation activities, growing importance of research management and, in particular, efforts to evaluate the effectiveness and quality of thereof <p>Implementation of innovative technologies</p> <ul style="list-style-type: none"> • Public research infrastructure to be open to businesses (especially large companies) and small businesses and have access to research through research programs for the benefit of SMEs. • Better management of intellectual property that will ensure recovery of patents, and adequate protection of intellectual property • Good integration with the business of national and international research environment • Knowledges transformed into technologies and products
<p>National Strategy for the development of information society „Digital Moldova 2020”</p>	<p>Enlarging access and connectivity - wide optimized ICT infrastructure</p> <ul style="list-style-type: none"> • Improvement of connectivity and network access. • Management and shared use of electronic communication networks including associated infrastructure through the development/adjustment of the legal and regulatory framework. • The electronic communications legal framework is mainly harmonized with the European Union's legal framework <p>Digital content and affordable electronic public services</p> <ul style="list-style-type: none"> • Setting favourable conditions for the development and use of national digital content and digitization of the existing national one, as well as for implementation and use of electronic services • The Government will undertake strong action in order to exploit the opportunities of creating and promoting the digital content and services generated in the Republic of Moldova, including the positioning services based on GIS. <p>Enforcing ITC usage</p> <ul style="list-style-type: none"> • Educational institutions graduates possess digital skills to activate in the information society • Public sector employees own digital skills required for an efficient governance • Appropriate conditions created for social inclusion based on electronic services

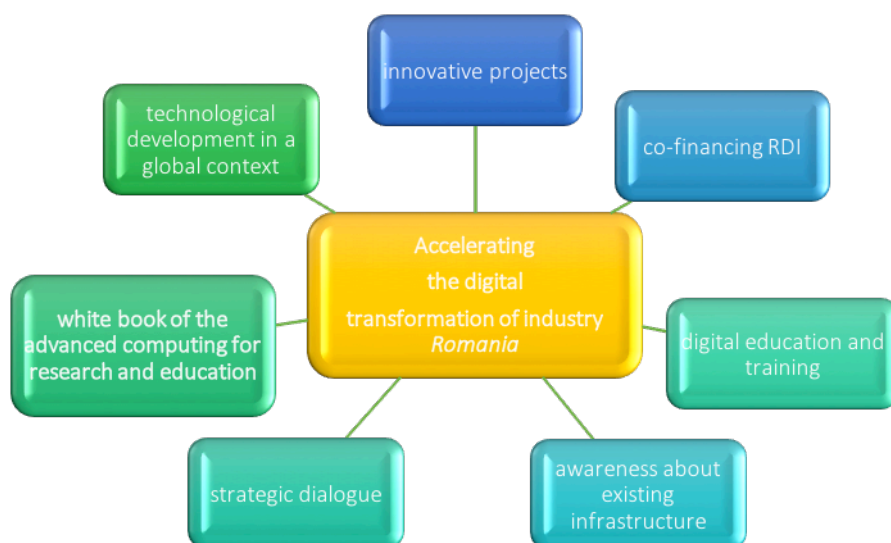
	<ul style="list-style-type: none"> • Developing digital literacy educational standards compatible with the European practices
Roadmap for increasing the Competitiveness of the Republic of Moldova	Secured and defended digital environment
	<ul style="list-style-type: none"> • Establish conditions for increasing security and trust of the digital space • Improve cyber security of the national critical infrastructure (public authorities/institutions, electronic communications networks, water pipes, energy grids, transportation networks, etc.) • Raise awareness of the risks in the digital space and measures that are necessary to ensure its cyber security • Promote and develop international cooperation in cyber security
	Research, Technologies and Innovations
	<ul style="list-style-type: none"> • Applying science and by implementation of scientific achievements, learning of advanced technologies, knowledge and information • Focus on Digital Transactions between Citizens and Government • Promote Access to Information on the Internet and Ensure Adequate Security and Privacy Measures in place • Secure document workflow between EU and national institutions • E-Government to cut bureaucracy, administrative costs, inefficiency and low level of productivity • Insufficient development of human and institutional skills within the system of research, development and innovations • Lack of an open model of governance in the field of research, technologies and innovations • Existence of some barriers in implementing the academic and professional mobility determined by a large number of formalities for access in the teaching and scientific activity
The infrastructure of quality	
<ul style="list-style-type: none"> • The Republic of Moldova exhibits a considerable need of improvement in the quality and efficiency of the infrastructure, in particular: trade infrastructure; information technologies; environmental infrastructure; transport and logistics • Harmonize the regulatory system and afferent infrastructure, so as to promote production and trade at the global level. • Supporting innovative activities of SMEs and their activities of implementation of innovations by means of applying special programs to attract long-term credit lines from international financial institutions 	
Information society	
<ul style="list-style-type: none"> • Low position of the Republic of Moldova in the international ratings on Information Society (69 and lower), although in some ratings in the field of ICT Moldova is positioned among the first 50 • Poor quality of information in the basic registries of the country (e.g.: State Registry of Population, etc.) and outdated technologies • Available digital content and electronic services insufficient for the business 	

	<ul style="list-style-type: none"> • Implementation of the European legislation and gradual liberalization of the mail sector • Low productivity per employee in the IT sector
	<p>Human Resources</p> <ul style="list-style-type: none"> • Equipping the labour force with knowledge and skills to assimilated new technologies and to produce new goods and services to be competitive on international markets • Participate at the international level in creating values is largely determined by the quality of education, attention for the development of science education and access to research services and professional training

References

- European Commission- Press release, Western Balkans countries, Moldova sign up to Horizon 2020 (<https://goo.gl/WCcssje>).
- Strategy for the development of research and innovation 2020: Knowledge Moldova (<https://goo.gl/Zr1B42>).
- National Strategy for the development of information society „Digital Moldova 2020” (<https://goo.gl/niqTZ9>).
- Roadmap for increasing the Competitiveness of the Republic of Moldova (<https://goo.gl/XmJRm5>)

ROMANIA



„A digital future means that Romania should surpass the technological level of EU and, in time, to become a regional leader and an important actor in the digital future of the EU”

Manifesto for a Digital Romania, 2016

Digital transformation of Industry Guidelines at national level: Romania

National Strategy for Research, Development and Innovation 2014-2020	Co-financing research and innovation (R&I) <ul style="list-style-type: none"> Supporting projects initiated by economic operators by funding thematic projects through a set of instruments focused on priority areas (ICT including HPC is one of Romanian national smart specialization) – on short/ long term, on phases from idea to market. Supporting projects initiated by economic operators by funding RDI projects conducted by enterprises, individual or in partnership with research institutes and universities for process and product innovation (goods and services) in economic sectors with growth potential (ICT including HPC is one of Romanian national smart specialization).
	Infrastructure <ul style="list-style-type: none"> Co-financing research and development infrastructures for enterprises Financing projects for research and development infrastructures in the public sector – developing the existing ones and creating new infrastructures. Creating a unique point (National Register of Research and Development Infrastructures) to provide increased access to infrastructure for both public and private environments, to create a market for scientific and technical services, to increase the international visibility of research results in Romania and their economic sustainability.
National Strategy for	Support factors and services <ul style="list-style-type: none"> Human resources and education: Improving the quality of the

Competitiveness 2014-2020	<p>educational system to be correlated with the workforce market (ex. educational offer based on ICT to be at least 30% of compulsory educational programmes)</p> <ul style="list-style-type: none"> • RDI: Supporting SMEs to launch new innovative products or services through venture capital, grants, collaborative projects • Digital infrastructure: Improving digital broadband infrastructure (ex. basic broadband for 100% of citizens until 2020)
Smart Everything Everywhere, Digital Romania International Forum II, 2017	<p>Catalysing the digitization of Romanian industry</p> <ul style="list-style-type: none"> • To offers an environment for strategic dialogue and decision for the digitization of industry • To bring start-ups at the forefront of the conversation on digitalization <p>Addressing industry verticals where digitization projects can have significant impact</p> <ul style="list-style-type: none"> • Stimulating projects in industry verticals where digitization projects can have significant impact (e.g. smart/autonomous us <p>Establishment of Digital Innovation Hubs (DIH)</p> <ul style="list-style-type: none"> • To establish Digital Innovation Hubs (DIH) to offer companies a chance to identify and attract talent, technology, and solutions; to improve their competitiveness; and to position themselves at the forefront of the fourth industrial revolution
National Strategy on the Digital Agenda for Romania 2020	<p>Promoting innovative groups and competitive poles</p> <ul style="list-style-type: none"> • Promoting competitive groups (clusters) and the specialization of employees in the field, with focus on those within the clusters of excellence in Bucharest, Cluj, Iasi and Timisoara. <p>Supporting research for regional infrastructure development</p> <ul style="list-style-type: none"> • Developing research and ICT infrastructure at global level based on the existing regional scientific research • Promoting knowledge transfer between partners and supporting a comprehensive legislative framework for intellectual property rights. <p>Financing ICT innovative initiatives in Romania</p> <ul style="list-style-type: none"> • To support investments in three categories: <ul style="list-style-type: none"> - Type 1: Small investments in new ICT instruments with market potential, but small contribution - Type 2: Medium investment in ICT initiatives with proved market potential and the possibility of returning investment - Type 3: Big investments in ICT, in confirmed models which received finance from multiple sources
Manifesto for a Digital Romania	<p>Technological development in a global context</p> <ul style="list-style-type: none"> • Supporting innovative projects aligned with the most performant European and international standards • Supporting early adoption of disruptive technological solutions • Supporting applied research and industry digitalisation • Supporting entrepreneurship and the development of national technological solution competitive at global level. <p>Technological development orientated towards future</p> <ul style="list-style-type: none"> • Supporting last-hour technology and permanent innovation in

	high-tech by offering a constant framework for digital education and training for all citizens.
ARCAS, 2014	<ul style="list-style-type: none"> • Necessity of a white book of the advanced computing for research and education in Romania, and of its use as an argument for further funding requests • Design and implementation of a national cloud for research and education
Consultation with InnoHPC stakeholders	<p>Awareness about existing HPC facilities</p> <ul style="list-style-type: none"> • Increasing the visibility of the existing HPC infrastructure and competencies • Supporting the access of all interested actors to HPC infrastructure financed by public funds <p>Realization of a common integrated HPC infrastructure in Romania</p> <ul style="list-style-type: none"> • Prioritizing the development of the existing HPC infrastructure instead of financing new ones • Allocating funds to support exploitation of the existing HPC infrastructure (e.g. for human resource) • Developing top-down policies to capitalise on the spill over around the existing HPC infrastructure

References

- ARCAS, 2014, <http://host.hpc.uvt.ro/wp-content/uploads/2014/03/WP6-ARCAS.pdf>.
- Manifesto for a Digital Romania, 2016, <http://ithub.gov.ro/wp-content/uploads/ManifestRomaniaDigitala.pdf>.
- National Strategy for Competitiveness 2015-2020, http://www.minind.ro/strategie_competitivitate/SNC%20aprobata%20prin%20HG-1.pdf
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- National Strategy on the Digital Agenda for Romania 2020, <https://ec.europa.eu/epale/sites/epale/files/strategia-nationala-agenda-digitala-pentru-romania-2020c-20-feb.2015.pdf>
- Smart Everything Everywhere, Digital Romania International Forum II, 2017, <http://see40.org/2017forum/>

SERBIA



Digital transformation of Industry Guidelines at national level: Serbia

National level strategic documents

University level transformation

- Innovation of study programs and their alignment with trends in scientific, technological, economic, social and cultural development so that the final outcome of education is fully synchronized with market demands.
- Support for HEIs in modernization, procurement and implementation of software and hardware.
- Increase of the capacity of faculties that educate ICT experts and respective budget quotas

Research, innovation and entrepreneurship

- Direct research within the HEIs towards priority areas for Serbia's development.
- Support for the concept of "entrepreneurial university" - the creation of a new knowledge-based industry nucleus.
- Joint applied and developmental research of the academy and industry in the framework of the projects implemented at the HEI level
- Establishing a strong scientific and research base at universities and research institutes.
- Development of technological and business infrastructure, in support of the creation of innovative enterprises.
- Improving conditions for easier foreign technology transfer; Digitalization of telecommunication infrastructure, Internet access, encouraging the development of the web economy, ensuring efficient access to information and knowledge
- Building an information society - applying ICT in different areas
- New legal solutions in the field of electronic document, electronic

identification (signature, timestamp, electronic seal, reliable delivery and storage), electronic accounting

Industry development strategy and policy

- Measures and activities of the development of a knowledge-based society and lifelong learning, application of innovations, development and use of ICT
- Expansion in existing frameworks through technological modernization of the Medium-Low-Tech sector and the introduction of high-tech content;
- Changing the technological profile of the industry, through the migration of the focus of industrial production from the dominantly low-tech sector to high technology.
- Development of new business models of the Serbian industry based on the wide use of ICT technologies at all levels.
- Incentives for investing in start-up projects, exploiting the capacity of technological parks and local technology centers development

EU and Danube region strategic documents

Improvement of framework conditions for SMEs

- Improving the use of EU funds for ICT
- Promotion of the internationalisation of SMEs and facilitation of interdisciplinary cooperation
- Support for investments in competitive infrastructure for SMEs, especially in rural and border regions
- Support for openness to new research and market developments in a public and people oriented approach
- Support for initiatives to stimulate the creation of new markets and diffusion of new technologies

Cooperation between universities and industry

- Fostering the environment for technology transfer and dissemination of accumulated knowledge at the university level
- Establish labs through which industry and academia jointly develop new products by involving customers from very early stages
- Establishment of a national high performance computing center

Organizational aspects of digital transformation

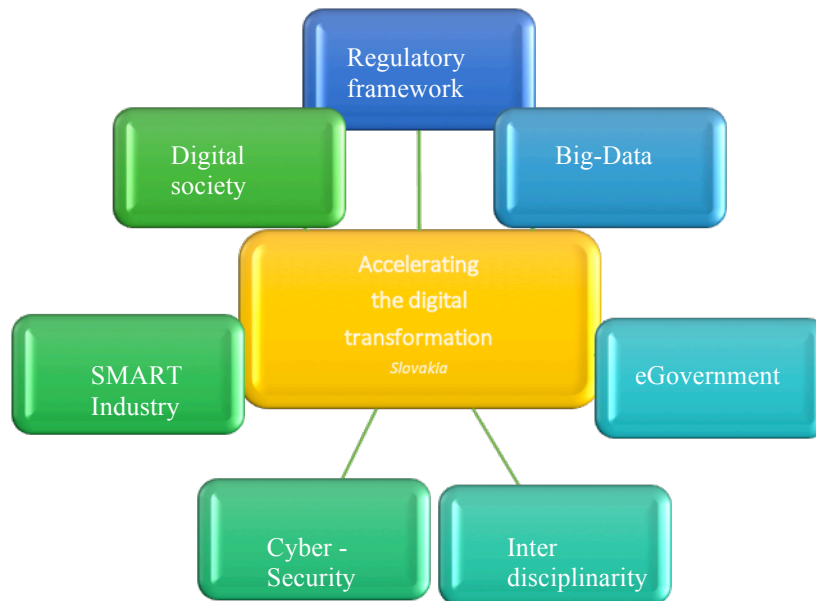
- Establishment of new centres of digital transformation and their integration with pan-European network of such centres
- Better support for digital transformation through funds and programmes
- Education of experts with highly specialized skills
- Digital training for all decision-makers involved in designing, consulting and supporting policies and regulations
- Promotion of entrepreneurship as an opportunity for acquiring digital skills

References:

- Strategy for the development of education in Serbia until 2020
- Strategy and policy of development of industry of the Republic of Serbia 2011 to 2020

- Strategy for support of development of small and medium sized enterprises, entrepreneurship and competitiveness 2015 to 2020
- Strategy of Information Society Development
- Strategy for increasing the domestic industry in the development of telecommunications (The strategy is from 2009)
- Strategy for the development of the information technology industry for the period 2017-2020

SLOVAKIA



"The priority is to ensure the cross-border portability of on-line content-providing services on the Single Market. We want to give citizens and entrepreneurs the freedom to move in the digital space and to ensure the freedom for data movement as a fifth freedom throughout the EU internal market"

Peter Pellegrini, Deputy Prime Minister for Investment and Informatisation, SR

Digital transformation of Industry Guidelines at national level: Slovakia

Smart Industry for Slovakia (Industry 4.0)	Intelligent manufacture <ul style="list-style-type: none"> • Setting up a network of interconnected factories able to cooperate (production plants and enterprises) within the supply chain. • Ensuring a high-speed, secure and reliable Internet connection that will be governed by defined standards in communication. • Promoting more flexible manufacturing and delivery processes that will benefit from Big Data • Implementation of an integrated security and security architecture and unique identifiers, along with relevant enhancements in the field of training and other content of career development.
	Intelligent research <ul style="list-style-type: none"> • Reorganizing the research and innovation system - wider application of R & D results in business practice that will lead to a change in the ratio of applied and fundamental research to: 70% for applied research and 30% for basic research. • support of key technologies in industrial manufacturing, especially through cloud solutions, high-speed networks (5G), add-on processing (3D printing), robotics, mobile sensory systems, automation, nanotechnology and artificial intelligence • Creating international cooperation with R & D institutions such as VTT (FI) and Fraunhofer (DE) to help Slovakia make progress in its national research, support Slovakia's research and development capacities and potential, and develop similar models of cooperation

	<p>with universities in Slovakia. Collaboration should also involve start-ups and innovative small and medium-sized businesses to find creative and non-standard solutions in research and development projects</p>
	<p>Digital society</p>
	<ul style="list-style-type: none"> • Systematic development of the necessary skills in the public sector (boot camp), building the trust in a new IoT economy (including computer security) • To create innovative state education programs for study and learning departments at all levels of education. All of the study and teaching departments should be involved in computer science as applied computer science. • The use of open IT technologies in education and the use of public licenses for educational resources should become a standard. • Intelligent industry should create exchange programs that bring together Slovak professionals in industry and trade with relevant study classes and study programs, and should also invite representatives of international industry and trade to share expertise, professional skills and creativity.
	<p>• For the future prepared Regulations and Government</p>
	<ul style="list-style-type: none"> • The Intelligent Industry Concept for Slovakia has the ambition to create favourable framework conditions for the development of the Slovak ecosystem IoT. Therefore, specific areas of public sector support and incentives for the adoption of the Intelligent Industry need to be specified for which regulatory barriers (Future-prepared regulation) should be removed, administrative burdens reduced and international cooperation should be promoted. • A future-based regulation to remove regulatory barriers, ensure the introduction of common standards and foster growth and international cooperation (RIA, DIA, IIA) • More emphasis should be put on public dialogue (with businesses, relevant actors and regulators) in the preparatory phase of new regulatory proposals. Preparing the proposed regulation for the future should be an essential part of regulatory processes that will result in the determination of standards and standards. • Build trust by creating a single service infrastructure and intelligent state administration (data-use, personal data management) • Propose a transparent and effective public sector digitization plan (new types of digital services, public sector interfaces for innovative use of public data and mobile eGovernment) • Ensure active participation by state authorities in the promotion and implementation of the Intelligent Industry • Continue to develop the necessary skills in the public sector (boot camp), build trust in a new IoT economy (including computer security) • Ensure the acquisition, flow and commercial use of data (Open Data and Big Data), IP rights and data protection and adopt open standards for interoperability and security
<p>OP Integrated</p>	<p>Informatization of society</p>

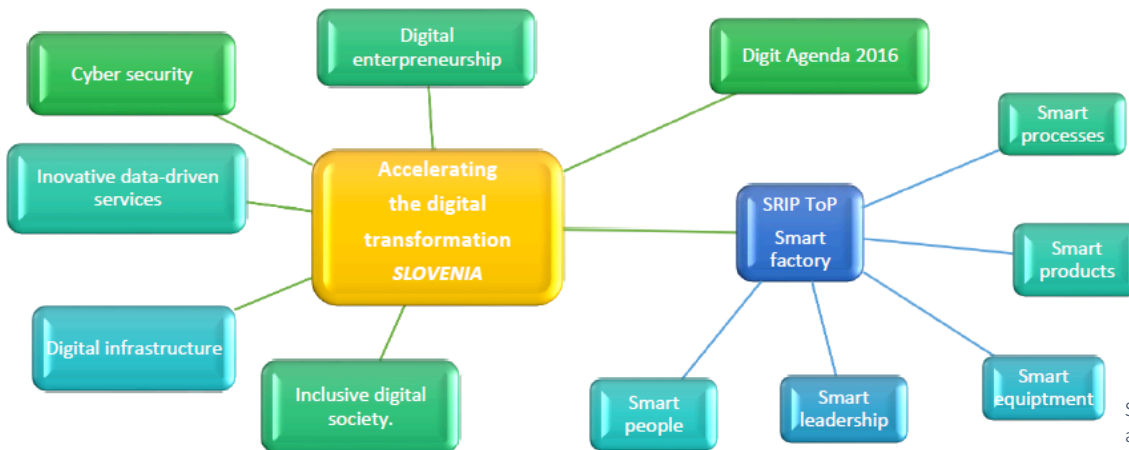
Infrastructure	<ul style="list-style-type: none"> • Increase of broadband Internet / NGN coverage • Increasing the innovation capacity of, in particular, small and medium-sized entrepreneurs in the digital economy • Improving the quality, standard and availability of eGovernment services for entrepreneurs • Improving the quality, standard and availability of eGovernment services for citizens • Improving the overall availability of public administration data in the form of open data • Improving digital skills and inclusion of disadvantaged individuals in the digital market • Facilitate the modernization and rationalization of ICT governance by ICT tools • Rationalization of the operation of information systems through cloud eGovernment • Increasing cyber security in society
Strategy for R&D for smart specialization of SR	<p>Big data</p> <ul style="list-style-type: none"> • New approaches to processing large data (Big Data), in particular processing of fast-growing data and data streams (Fast Data); • Data storage, storage and accessibility, Open Data and Linked Open Data; • Methods and tools for intelligent data processing, including usage of semantics, which is a prerequisite for efficient work with large data in large distributed digital environments (such as the web environment); • Machine learning and Optimization; • Effective data processing algorithms; • Methods and tools for a social collaborative digital space taking into account the individual's individuality in the digital space; • Methods and tools for privacy protection (identification, authentication) and data security.
	<p>Information security</p> <ul style="list-style-type: none"> • Security systems models, identification methods and security requirements for systems, methods of developing reliable and secure systems, assessing compliance with the specification, assessing the strength of security mechanisms, detecting vulnerabilities and hidden channels in software systems. • Study of IB management methods in the context of new ICT and threats; • Development of IB level assessment, economic aspects of IB; • Recognizing the symptoms of attacks / emerging security incidents; • Effective methods of addressing and recovering security incidents; • Computer crime (taxonomy, development, legislation, methods of detection, provision of evidence); • Identification and authentication, combination of technical and non-technical means (biometrics, etc.) • Research on the security aspects of e-Government, e-Health, e-commerce, social networks; • Research focused on the impact of ICT on youth development, social

	<p>relationships, way of life;</p> <ul style="list-style-type: none"> • The possibilities and methods of collecting, processing personal data, their use, abuse to influence the behaviour of individuals and groups of people; • Effective methods for creating user security awareness
	<p>Cyber space</p> <ul style="list-style-type: none"> • Devices capable of recording information and then sharing it, as well as receiving information remotely and effectively using it (for example sensors, robotics, intelligent systems and services - autonomous systems and artificial intelligence, additive technologies - 3D printing, and intelligent devices for household and day-to-day use); • Services and solutions in the field of large data processing, fast data processing (Big Data); • Preservation and disclosure of information (Open Data); • Interoperability of inputs and outputs, anticipation of production, distribution, consumption and market behaviour of subjects (for example, interactive interfaces to work with data via enhanced reality and virtual reality, application of web and mobile technologies, expert systems, cloud systems and services); • Support for new business models (eg. data processing and storage, generation of outputs) and streamlining of public institutions • Intelligent transport systems (creation of navigation systems, collaborative economy systems and improvement of intermodal transport); • Robotic workstations and automated systems for industrial manufacturing applications; • Control systems for the accumulation and redistribution of energy in energy, industrial and transport applications
	<p>Interdisciplinary application of ICT</p> <ul style="list-style-type: none"> • Development and use of methods for computer modelling, simulation and testing of materials • management of technological processes of preparation of new materials using ICT • ICT applications in medicine, biotechnology, agriculture and the environment • ICT in industry and services • ICT in public administration, health, education, culture and defence

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SLOVENIA



Slovenia's vision is to use, through the accelerated development of a digital society, the development opportunities of ICT and the internet and thus become an advanced digital society and a reference environment for introducing innovative approaches in the use of digital technologies.

Development Strategy for the Information Society until 2020

Digital transformation of Industry Guidelines at national level: SLOVENIA

<i>Digital Slovenia 2020</i> <i>[1]</i>	Digital entrepreneurship
	<ul style="list-style-type: none"> • Enhanced competitiveness of the Slovenian ICT industry. • Digitisation of entrepreneurship and the private sector (industry 4.0). • Development of the internet of things, smart cities and smart homes. • ICT as enabling technology for the improved competitiveness of other sectors. • Increase of the share of ICT in Slovenia's GDP to at least 7 % and the share of investments in ICT to more than 1 % by the end of 2010. • Transition from the provision of computer infrastructure and applications to a service-based digital economy. • Release of knowledge and innovations for the provision of digital jobs and welfare and application of achievements for efficient marketing. • Quicker adoption of standards of e-business and their implementation in practice. • Ensuring conditions for a quicker and faster penetration of Slovenian ICT enterprises on global markets.
	Cyber security
	<ul style="list-style-type: none"> • Establishing a comprehensive cyber security system as an important integral factor of national security will contribute to ensuring an

open, safe and secure cyberspace, which will make the basis for smooth functioning of infrastructure, important for state bodies' operations as well as for the life of each individual. By 2020, Slovenia will establish an effective cyber security assurance system, which will prevent and also eliminate the consequences of security incidents.

Innovative data driven services

- Increased competitiveness of the economy and better conditions for digital business.
- Improved quality of life of citizens, including by improved communication and harmonisation with public administration with the help of digital channels.
- Digitisation and optimisation of internal operations for a flexible, rational, efficient, transparent and open public administration.
- Provision of high-quality supply and efficient demand as well as the highest possible re-use of the open data of the public sector.
- Further development of the national computer cloud, the Arnes computer cloud, high-capacity computer group SLING and establishment of the computer cloud for research and innovation.
- Definition of the open data of the public sector as a national treasure and strategic resource of the digital society.
- Establishment of the national infrastructure for spatial information as a part of the European infrastructure in accordance with the INSPIRE directive.
- Provision of long-term preservation of digital content.
- Increasing the level of interoperability.
- Consolidation of e-identity management in state administration.
- Development of new e-services and increased use of e-services of public administration and cross-border e-services.
- Further development of the eHealth information system.
- Improved quality of the education system with open learning environments, rational use of ICT in learning processes and efficient digital learning content.
- Optimisation of steering and management of educational institutions by digitisation of operation.
- Provision of suitable network and service digital infrastructure for the needs of education, research and culture.

Digital infrastructure

- Provision of stable and predictable legislation - regulatory framework for the work of electronic communications operators.
- Provision of broadband internet access at a minimum speed of 100 Mb/s to as many households in Slovenia as possible, and at a minimum speed of 30 Mb/s to other households by 2020.
- Provision of mobile communication network coverage to 98 % households; the network will serve as complementary supplement to the fixed broadband internet access.
- Provision and allocation of additional radio spectrum for mobile communications.
- Ensuring internet access at a minimum speed of 1 Gb/s to all public

	<p>educational and research establishments.</p> <ul style="list-style-type: none"> • Encouraging development of television terrestrial digital broadcasting (DVB-T2). • Introducing advanced services by integrating the capacities of digital broadcasting, IP TV and the internet. • Promoting introduction of radio terrestrial digital broadcasting (DAB+). • Promoting the use of LTE in the 700 MHz frequency band also for the needs of public security and services for protection and relief. <p>Inclusive digital society</p> <ul style="list-style-type: none"> • Improved digital literacy of population. • Improved e-competencies and e-skills of the population. • Opening and adaptation of the education system to new generations and needs of the digital society. • More digital content and better digital literacy at all levels of the education system. • Better e-inclusion and enabling the access to e-services to all groups of population, especially less educated, elderly, disabled and inactive. • Improved online accessibility in accordance with international guidelines. • Improved e-skills for the use of ICT for new digital jobs
<p>SRIP Top</p>	<p>Smart factory</p> <p>Goal of the strategic research and innovation partnership Factories of the future is to establish open and innovation friendly environment for development of perspective, breakthrough innovations that will internationally recognized and appreciated. Part of the strategic innovation partnership Factories of the future is a focus area and vertical value chain Smart factory.</p> <p>Strategic guidelines on the field of Digitalization, Industry 4.0, smart factories etc. for Slovenian export companies are:</p> <ul style="list-style-type: none"> • Uniformly designed cover processes with exactly defined control points that will allow digitalization of the most important processes of the company and their connection with supporting processes and processes of the business partners. • Use of modern and optimal technologies at performing analyses and setting up processes and concepts of smart factory as at implementation of processes. • High increase of added value of these processes. • Concept of leading smart factory should be based on simultaneous development of all components needed for building a smart factory: • Smart products, that know how to communicate with equipment, people and enables information's for guidance. • Smart equipment that knows how to communicate with products, people and enables information's for guidance. • Smart people that are qualified for manage smart equipment and products and know how to use information's for guiding processes.

	<ul style="list-style-type: none"> • Smart planned processes that enables rational work and use of technologies with clearly defined inputs/outputs and characteristics so that digitalization is possible. • Smart leadership that is based on minimal amount of data needed for maximal output. <p>Primary goal of vertical value chain Smart factory is to build supporting environment that will enable joining of companies depending on their digital and technological matureness. Key building blocks of supporting environment:</p> <ul style="list-style-type: none"> • Upgrade of support to already existing value chains to establish offer of 4 level comprehensive service of ‘turnkey smart factory’ • Establishing unified network of knowledge and information’s about factories of the future • Establishing three level demo infrastructures with Open innovation process • • Establishing internal market of realistic industrial scenarios of collected data to verify the power and real added values of the AI method
<p><i>DigitAgenda 2016</i></p>	<p>Recommendations Of The Digitalization Of Industry Working Group</p> <p>Virtualisation of operations – virtual factory</p> <p>In order to control all processes and eventuality, companies should model their operations through virtualisation.</p> <p>Objective: To optimise operational management and increase Slovenia’s overall corporate operating profit (EBITDA margin) by one percentage point by 2020.</p> <p>Establishment of value added chains via a digital platform</p> <p>The digital modelling of value added chains shall also enable automatic ordering, scheduling and supply. Objective: Optimisation of operational management in industry and increase EBITDA margin by one percentage point by 2020.</p> <p>Connecting with Germany’s Industry 4.0</p> <p>With the objective of following the standards implemented by Germany within its Industrie 4.0 project, which aims to achieve connectivity between different IT systems in manufacturing, it is reasonable that the CCIS acts as an intermediary in the provision of information to Slovene enterprises wishing to develop commercial relations with German firms and customers.</p> <p>Objective: More rapid integration of Slovenian companies into international value chains.</p> <p>Establishment of the patent box</p>

The establishment of a patent box would provide tax relief in intellectual property revenues deriving from digital innovation. Deadline: 2018, i.e. within the next package of tax legislation.

Objective: to increase private sector investment in ICT R&D from the current 0.2% of GDP to 0.38% of GDP (the OECD average).

Digital single-entry point

The establishment of a digital single-entry point through the provision of uniform interfaces (data entry format). In addition to facilitating the one-stop submission of information required by the state, this shall also allow automatic data processing. Deadline: by the end of 2017.

Objective: A 10% reduction in the time companies spends reporting, by 2020.

Digital training in industry

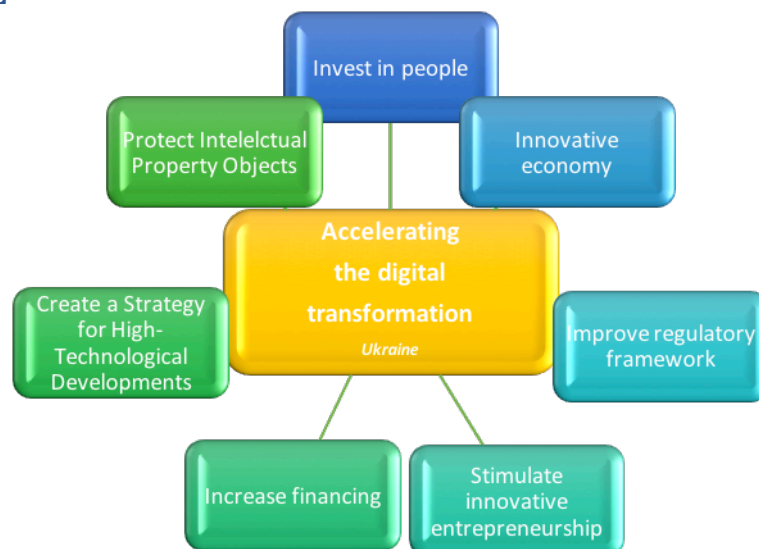
All employees need to be additionally trained or retrained in order to prepare them for the challenges of the digital future. This will reduce potential layoffs due to lack of competence and consequently lessen the social issues consequent to unemployment.

Objective: To increase the percentage of ICT professionals in the Slovenian economy from 4.7% of total today, to 6% by 2018.

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UKRAINE



Digital transformation of Industry Guidelines at national level: Ukraine

Digitalisation “made in Europe”	To create a Strategy of High-Technological Developments before 2025
	<ul style="list-style-type: none"> • To focus on the OECD classification of the high-tech industries • To focus on the opportunities and competitive advantages of Ukraine (human capital, land resources, geographical location, raw material resources, etc.) • To focus on key competencies • To focus on factors of long-term demand in the domestic and foreign markets • To form a more relevant classification of high-tech industries • To transform the raw material economy into an innovation based on knowledge and intellectual work • To focus on raising the intellectualization of the key industries through the intensive introduction of innovations and information and communication technologies
	To steer entrepreneurship
	<ul style="list-style-type: none"> • To encourage the world's leading manufacturers of high technology products and services to move as manufacturing and research facilities in Ukraine • To create a full-fledged market business conditions • To deregulate the business activity in high-tech areas • To create a full-fledged market business conditions • To reduce the regulatory burden • To simplify the maintenance activities • To direct market participants to innovation • To support digital start-ups • To share expertise between corporate and start-ups

- To increase the digitalization of the business market
- To increase collaboration between industry and academia

To provide of financial support for innovation, research and development of high technology

- To create favourable conditions for the development of high technologies through the influence on macroeconomic factors, which are the necessary conditions for development
- To optimize existing means of production needs financing
- To enhance the availability of financial resources for enterprises, scientific institutions and organizations
- To promote the creation of an efficient venture financing ecosystem
- To develop an innovative economy
- To improve special export support programs
- To allocate grants within the framework of a variety of international programs that can be obtained on a competitive basis and used to finance research and development trials in early stages characterized by a high level of risk. Grants should also be allocated within the framework of various international programs that can be obtained on a competitive basis and used to finance research
- To ensure an adequate level of financing is possible through budget and international assistance
- To invest in "intelligent" infrastructure
- To attract financial assistance in the form of loans and investment fund

To preserve and support of intellectual capital

- To strengthen the domestic higher technical education
- To actively popularize science and technology
- To create a network of scientific, technical and creative centres (co-working centres)
- To deepen and strengthen scientific and technical network
- To continuously improve the skills and retraining of employees

To create a modern information and communication infrastructure

- To create of an effective system of protection of intellectual property objects

To introduce effective institutional mechanisms for the development of high-tech industries

- To synthesize the perspective directions of intensive introduction of innovations, knowledge and results of intellectual work using modern technologies
- To create the office of high technologies
- To bring the legislation to European standards in the field of high technologies

To increase the exports of high-tech products and services

- To protect and support exporters of high-tech products and services
- To improve the currency regulation
- To improve information support
- To improve the network of technology transfer
- To strengthen the image of Ukraine as a high-tech state

To stimulate the development of advanced technologies

- To introduce new technologies, processes and innovations
- To create, develop and implement the innovative solutions for these industries through extensive use of modern it technologies
- To support innovations through stimulation of entrepreneurship
- To modernize the outdated industrial infrastructure

To reduce the import dependence of the domestic high-tech sector

- To improve the investment attractiveness
- To carry out analysis and forecasting of the development of promising technologies
- To correct the direction of research
- To effectively transform the structure of production
- To ensure the creation of conditions for the development of promising and advanced technologies
- To create a dynamic adaptive system that can respond adequately to global changes
- To increase the demand for products in the domestic market

References

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