

Digital innovation profile - Serbia

Digital innovation ecosystem: Strategies and recommendations for accelerating digital transformation



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accelerating digital transformation**



Acknowledgements

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Foreword

When Ana Brnabic was elected as the Prime Minister of Serbia in 2017, she declared digitalization as the government's top priority, with three key pillars: eGovernment, education, and the digital economy. Turning this bold vision into reality has put Serbia among the top 15 countries globally in eGovernment. The introduction of coding in elementary schools has empowered whole generations with algorithmic thinking and Serbia has had the highest growth of exports of ICT services in Europe since 2017.

Serbia has decisively executed a digital economy strategy and has become globally important for intellectual property creation and R&D activities. The strategy relies on four key pillars:

- 1) Sustainable talent supply: making Serbia one of the most open countries for employment of foreign talents with strong financial incentives.
- 2) Regulatory reforms: underlined by the portfolio of generous tax incentives, regulation in Serbia makes it as easy to do global business as from anywhere else.
- 3) Innovation infrastructure: the state-of-the-art data centre with Nvidia supercomputer and Artificial Intelligence (AI) platform serves as a good example.
- 4) Strong financial support: through multiplication of funds available to the Serbian Innovation Fund, new venture capital investors are also supported.

Going forward, Serbia is further strengthening tech transfer from science to startups and is opening the public sector for cooperation with innovative entrepreneurs. Serbia also recognized two key technologies for its economic future:

- AI, with specific applications in autonomous mobility and healthcare; and
- Biotechnology, driven by synthetic biology and DNA sequencing, and underpinned with AI (to be powered by quantum computing soon).

BIO4 Campus (technology park in Belgrade) initiative is concentrating talent and infrastructure in those key technologies, making Serbia one of the key bioeconomy hubs in Europe.

To conclude, there are plenty of exciting opportunities to engage with the innovation ecosystem in Serbia and our world-renowned hospitality will make you feel warmly welcome.

H.E. Ms. Jelena Begović
Minister of Science, Technological Development and Innovation
Serbia

Foreword

Innovation and entrepreneurship fuel economic growth, stimulate market dynamics, and pave the way for creating competitive industries that improve our lives and connect us to new opportunities. Serbia recognizes the pivotal role that these concepts play in building a sustainable, progressive, and digitally connected society; it has taken significant steps with various ICT investments and its Smart Specialization Strategy and continues to address opportunities toward creating a fully digitalized economy driven by research and development.

This digital innovation profile, developed in collaboration with the Office of the Prime Minister Republic of Serbia, aims to accurately assess the country's digital ecosystem capacity and maturity to help Serbia and its stakeholders navigate the digital innovation landscape. The objective is to help Serbia to continue building new capabilities for a competitive, sustainable, and ICT-enabled economy that accelerates the development of the digital economy toward achieving Serbia's vision.

The creation of this profile entailed an exhaustive process, involving comprehensive research, one-on-one interviews with experts, and collaborative workshops with stakeholders from the public sector, private sector, finance, academia, entrepreneurs, and support networks. I extend my heartfelt appreciation to all the national stakeholders who actively participated in this endeavour. Their contributions and insights have been instrumental in shaping the profile and ensuring its relevance and applicability.

This digital innovation profile will serve as a valuable resource for policymakers, innovators, the private sector, and other stakeholders in Serbia. It offers critical insights into Serbia's digital innovation landscape, identifies areas for improvement, and presents strategic recommendations for collective decision-making processes. I am confident that this profile will guide Serbia's efforts and investments, driving growth and development in areas crucial to the nation's future.

I look forward to seeing the positive impact of this digital innovation profile on Serbia's digital transformation journey. ITU is ready to continue to support Serbia in the next phase of this relationship to see the results of these recommendations.



Dr. Cosmas Luckyson Zavazava
Director, Telecommunication Development Bureau (BDT)
International Telecommunication union (ITU)

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Digital Innovation Capacity



15+ development and tech indicators reviewed

250+ country-specific documents reviewed

Desktop Research



Stakeholder Identification



30 stakeholders directly engaged in activities

Co-Creation Workshops



2,500+ ideas captured through 3 workshops

31 recommendations presented

National Stakeholders' Event



Execution of Recommendations



\$63.07 billion present-day GDP boosted

1 Introduction

Digital innovation profiles are an important element in the ITU series of snapshots of information and communication technology (ICT)-centric innovation ecosystems. Each profile assesses and summarizes the opportunities and challenges in a country's ICT ecosystem. The at-a-glance format of the report enables international comparisons and provides an overview of the digital innovation ecosystem capacity to accelerate digital transformation as well as its capability to integrate digital innovation into its national agenda. The digital innovation profile is an accurate diagnosis of digital innovation ecosystem health that will help to develop strategies, inform national policies and accelerate digital transformation.

Digital innovation profiles offer a rapid and straightforward means of analysing and optimizing an ICT ecosystem. This analysis will help to navigate through the fast-moving ICT/telecommunication landscape to enhance the competitiveness of the ICT sector and unlock the potential for a sustainable digital transformation to support the country's transition into a knowledge economy. Further collaboration with ITU can target specific engagements, including the implementation of appropriate, co-developed, bankable projects of high value in the national context.

All digital innovation profiles are developed by experts specially trained to apply the ITU digital innovation framework. This framework features highly structured workshops and facilitated assessments, designed to build national capacity, enhance on-the-ground skills and powerfully accelerate digital transformation. The framework process equips ITU Member States with the tools to assess and monitor their ICT innovation ecosystems and produce evidence-based assessments and concrete recommendations to change the dynamics and propel them towards digital transformation.

The analysis and the positions expressed in this report reflect the opinions and research of the national expert, working within the ITU digital innovation framework process, and with guidance from the ITU-D digital innovation ecosystems cluster.

2 Background and context

Table 1: Key indicators

Key indicators	
Population (2021): 8 691 841	ITU Global ICT Development Index (2017): Rank 55 / 176 Score: 6.61 / 10
Population density (2021):100 / km ²	Global innovation index (2020): Rank 53 / 131
Gross national income per capita (2020): USD 7 600	Global entrepreneurship index (2018): 74/137
Region: Southern Europe	Global competitiveness index (2019): Rank 72 / 141
	Business sophistication and innovation (2021): 94/132 Ease of doing business (2020): 44/190

The Republic of Serbia is an upper-middle-income country located in Southern Europe. The service sector was the main contributor to the country's gross domestic product (GDP) with 51 per cent of GDP, with 24.8 per cent from industry, and 6.5 per cent from Agriculture. In the decade before the pandemic, economic growth averaged 1.9 per cent annually and increased to an average of 4.4 per cent in 2018 and 2019 (World Bank, 2021). In the last few years, Serbia has enjoyed a period of economic expansion and has attracted investment due to its political stability, low labour costs, and a strong talent pool. However, an ageing population, climate change, and labour shortages are significant challenges. The present political priorities include the transition to a low-carbon economy, and to promotion of education, public service delivery, entrepreneurship, innovation, and digitalization.

A long-term challenge to economic growth is population decline due to migration and a low birth rate, which is impacting the current and future workforce. In 2018, research showed that a third of all students planned to leave the country after graduation (OECD, 2020). If current trends continue, by 2050, the population will decrease to 5.79 million (World Bank, 2020). Students in Serbia scored lower than 2018 OECD averages in reading, mathematics, and science. However, the education system has been undergoing reforms, and the population shows a high literacy rate of 98.8 per cent. Basic ICT competencies, including programming, and computer problem solving, have become an integral part of the curriculum at all levels of education. In addition, the Strategy for the Development of Digital Skills (2020-2024) aims to develop digital skills necessary for everyday life, for a successful career in the sector, and to improve the knowledge and skills of ICT professionals.

The World Intellectual Property Organization (WIPO) ranks Serbia 53rd out of 131 in its Global Innovation Index (2020). A third of government economic investments are in the ICT sector, which now generates about 10 per cent GDP, more than 650 million euros. In 2021, 81.4 per cent of households had a broadband Internet connection, and 94.6 per cent owned a mobile phone (Statistical Office Republic of Serbia, 2021). The Information Society and Information Security Development Strategy (2021-2026) has the overarching objective of developing an information society and citizen and business-oriented electronic government, improving information security for citizens, public administration, and businesses.

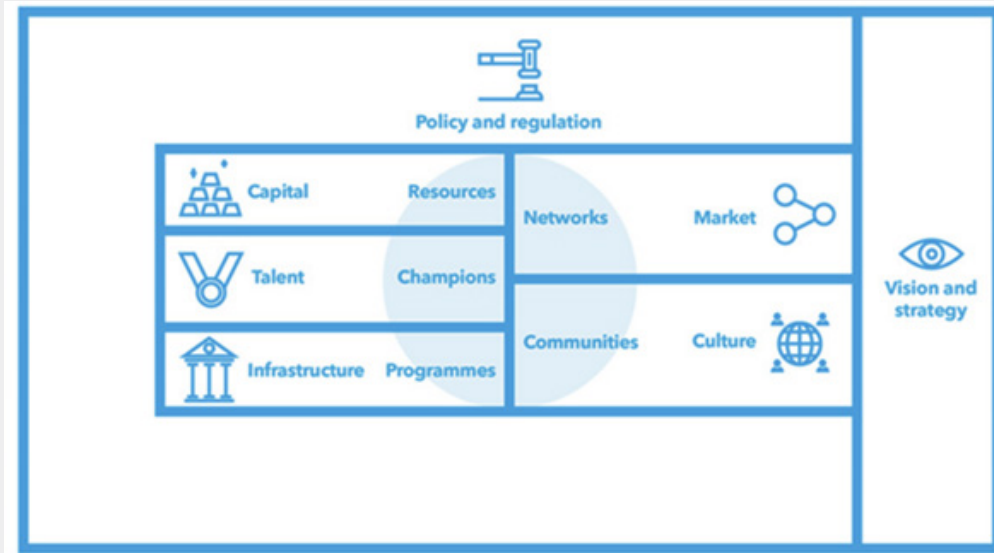
The Government of Serbia has allocated EUR 65 million to develop science and technology centres and has invested EUR 70 million in technical infrastructure to support start-ups. There have been 16 telecommunication companies operating in Serbia since the liberalization of the telecommunication sector in 2013 and considerable network investment has been carried out in recent years, which has boosted Internet usage. Serbia has successfully established itself as a key ICT outsourcing nation that is leveraging its engineering talent. However, present low labour costs cannot offer a sustainable competitive advantage, and local companies will need to create value-added products and services to remain competitive. In addition, the Smart Specialization Strategy aims to establish Serbia as a knowledge-based innovation hub rather than an outsourcing nation.

The private sector is dominated by the energy, automotive, machinery, mining, and agriculture sectors. In 2019, 15.61 per cent of the employees in Serbia worked in agriculture, 27.43 per cent in industry and 56.96 per cent in the service sector (Statistics, 2021). The private sector comprises only 20 per cent of the population and the government has invested in programmes such as "Promoting the private sector in Serbia" and launched the Innovation Fund to support growth and employment. As a result, some small and medium-sized enterprises (SMEs) have improved their competitiveness and innovative capacity. Serbia was ranked 44th in the ease of doing business index, and SMEs still face challenges with labour force availability, access to finance, and trading across borders.

3 Current landscape

Understanding the ecosystem assessment canvas

Figure 1: Ecosystem assessment canvas



The ecosystem assessment canvas offers an overview of the seven components that make up the innovation ecosystem. It helps assess both the challenges and opportunities for the components essential to building a vibrant and innovative digital ecosystem.

Figure 2: Ecosystem assessment canvas and its related issues



Building on the ecosystem assessment canvas, the image above presents the main issues of an enabling environment that, if achieved, can accelerate digital transformation in the economy.

The following section provides insights into the current ecosystem landscape (across seven components: vision and strategy, capital, market, infrastructure, talent, culture, policy) based on interviews and group discussions in the co-creation workshops with local stakeholders and validated by research and review.

3.1 Vision and strategy

- There is a national vision and strategy for digitalization, but more could be done to maximize awareness and impact.
- There is agreement on issues among stakeholders, but the involvement of academia is limited.
- Strong collaboration exists between the Prime Minister's Office and stakeholders, but other parts of government may be lacking the capacity to push reforms.
- Local stakeholders understand their respective roles, but this does not always translate into collaboration.

Stakeholders recognize a clear government vision and strategy for digitalization, and the start-up community is high on the agenda. Digitalization has been a key priority and has been promoted by the Prime Minister, Office for IT & eGovernment and IT sector. The newly formed Council for Development of Digital Economy is focused on the digitalization of the entire economy and aims to increase financing for innovative companies, develop digital infrastructure and invest in research and development.

Several strategies support this aim, including the Information Society and Information Security Development Strategy, and the Smart Specialization Strategy. Most recently, stakeholders have collaborated to develop the Start-up Strategy, the first to be created by the ecosystem itself, with the government playing a supporting role. Many government supported initiatives have started in the private sector and various private sector stakeholders support the preparation of strategic documents and propose amendments to the regulatory framework. As the ecosystem evolves, the private sector should continue to take the lead. This would increase resources within the ecosystem and enable capacity building.

The Prime Minister's Office is connected to ecosystem players through various government stakeholders, such as the Office for IT, the Innovation Fund, and the Science Fund that develop infrastructure, eGovernment, science and technology, and support start-ups.

Stakeholders view the Prime Minister's Office as the glue that holds the ecosystem together. Despite this, some stakeholders indicated that parts of government lack the capacity and resources needed to push digital reform. Stakeholders also recognize issues such as the need to develop entrepreneurial skills, retain talent and get access to finance, however, this does not always translate into collaboration. For example, there are few partnerships between the private sector and academia, which limits applied research and technology transfer. Although strategies have been put in place to alleviate ecosystem issues, some stakeholders feel that implementation has been slow. Not all players fully recognize the benefits of incentives, so follow-up government campaigns would help drive awareness and engagement.

3.2 Infrastructure and programmes

- Access to hard infrastructure includes affordable high-speed Internet but investments are needed to support the rollout of 5G.
- Access to soft infrastructure and services are improving with for example the creation of science and technology parks, however, they should play a more active role in entrepreneurship capacity building.
- Rural areas lack both access and availability of soft and hard infrastructure, which is concentrated in urban areas.
- Serbia is a regional leader in ICT outsourcing services with global potential in key sectors.

Serbia has good air and road transport infrastructure and public transport, as well as benefitting from one of the lowest prices for electricity in Europe. In addition, affordable high-speed Internet access is available in most of Serbia, with the aim of offering broadband Internet to 99 per cent of households by 2025. Although, 5G technology is not available in Serbia, the auction of 5G network frequencies by the Serbian Agency for Electronic Communications and Postal Services (RATEL) will boost investment in 5G infrastructure, improve Serbia's global competitiveness, attract long-term investment, and expand the digital economy.

Some ecosystem players believe that more quality programmes and events are required to support innovators. Soft infrastructure is clustered mainly around science technology parks (STPs), start-up centres, and co-working spaces. Serbia has invested heavily in four state-of-the-art STPs in Niš, Belgrade, Čačak, and Novi Sad. These parks support start-ups and high-tech companies to develop and commercialize innovative products and services. The aim is for STPs to become hubs and play an essential role in developing the innovation ecosystem. Linkages, cross-stakeholder collaboration, and a problem-solving focus will be key to their success.

In rural parts of the country, access and availability to soft and hard infrastructure are limited. Only 69 per cent of households in rural Serbia are connected to fixed broadband, compared to 85 per cent in urban areas. A government digitalization project supported by the European Bank for Reconstruction and Development (EBRD) and bilateral donors under the Western Balkans Investment Framework (WBIF) aims to address this gap. An estimated 90 000 households and 600 schools and public institutions in rural areas will gain access to fast broadband. Startit¹ runs several co-working centres that help to foster entrepreneurship in Serbia.

All ecosystem stakeholders agree that Serbia is a strong competitor in terms of ICT outsourcing service exports in the region, however, they also highlighted the need to focus on IT production, including its competitive strengths, gaming, and blockchain to compete globally. Gaming employs more than 2 000 people, about a third of whom are women, and it generated total revenues of approximately EUR 120 million in 2020 (Startup Genome, 2020). Local start-ups have made Serbia one of the top destinations for R&D blockchain-based product development. In addition, Serbia has a strong AI strategy and has established an AI Institute. To build on these strengths Serbia should continue to dedicate resources to these three sub-sectors to create a globally recognized IT production-based brand.

3.3 Talent and champions

- Excellent technical talent exists but new strategies are needed to increase capacity as the ecosystem grows.
- Innovators have learning opportunities through informal education but lack entrepreneurship training opportunities.
- There are some successful initiatives to attract and engage Serbians living abroad but more can be done.
- Many champions are active in the innovation ecosystem but more start-up success stories are needed to raise aspirations.

Education is a key enabler of digital innovation and compulsory coding is part of elementary school curriculum in Serbia. In the Global Innovation Index (2019), Serbia was ranked highly (22nd) for graduates in engineering and science, with almost 250 000 active science, technology,

¹ A project of SEE ICT, a non-profit organization established in 2010 with the mission to develop the technology and startup space in Serbia.

engineering, and mathematics (STEM) university students. Most stakeholders agree that increasing capacity is a significant challenge for the higher education sector as the ecosystem grows.

The unemployment rate of 15- to 24-year-olds is relatively high at 22.2 per cent (Statistics Office Republic of Serbia, 2021). To address this, the government provides free digital training for citizens including young people not in the job market. In addition, the Microsoft Global Skills initiative supported by the government and educational institutions offers an open digital education programme for ten of the most in-demand occupations. These programmes have shown promising results, but more stakeholder partnerships are needed to up-skill and re-skill the unemployed.

All stakeholders recognize an apparent gap in soft skills, particularly international business development, marketing, and communication. Entrepreneurship is not taught widely at universities and soft skills development is not mandatory. Larger companies train employees in-house, but this is more difficult for start-ups with limited resources. Some innovators are learning through informal education, but experienced mentors are scarce. In the short term, collaborating with international accelerators and venture capital (VC) funding could help fill this gap, but incremental changes to the education system will not provide the speed of change required.

In 2017, almost a third of graduates were leaving the country, contributing to the flight of human capital (brain drain) from Serbia. However, since then, Serbia has been experiencing an influx of talent. The Returning Point programme was established to support repatriates and promote better connections between Serbia and its population living abroad and the government has introduced tax incentives to encourage the repatriation of educated people. Serbia needs to build a society based on exchanging knowledge and experiences, rather than as a one-way outsourcing model. A more dramatic change in business models is necessary to create change for the industry and long-term sustainable value.

Most ecosystem stakeholders perceive Digital Serbia Initiative, the Prime Minister's Office, Serbian Entrepreneurs, and Nordeus as the champions that are supporting innovation development. Some start-ups also expressed a desire and willingness to act as role models. However, Serbia needs more start-up success stories to showcase entrepreneurship as a viable career path. The Government of Serbia is addressing this via their upgraded Entrepreneurship Portal, which provides resources for start-ups in the country.

3.4 Capital and resources

- The government is the primary provider of seed capital for innovation but more private risk capital is needed to support the ecosystem.
- There are attempts to stimulate technology transfer but few faculties have dedicated technology transfer offices.
- The country is a world leader at attracting foreign direct investment (FDI) but it also increases competition to an already scarce talent pool.
- The Science Fund has been established to improve the quality and relevance of research but funding remains a small percentage of GDP.

All stakeholders recognize progress has been made in access to finance for innovation. The Innovation Fund supports early-stage entrepreneurship, including basic research and prototyping. To date, EUR 31.2 million has been approved for 227 innovative projects, which are

popular amongst innovators. Opportunities also exist to raise early-stage and capital investment from South Central Ventures and the Belgrade Venture Forum. Some SMEs are able to access bank loans. In 2018, new bank lending to SMEs increased by 17.2 per cent (OECD, 2018). However, with limited angel investment and venture capital, many start-ups are unsustainable long-term. Labour is relatively cheap, enabling some entrepreneurs to build companies without outside investment, but this is a slow process that can stifle innovation. To fill the funding gap Telecom Serbia has created a EUR 25 million venture capital fund, and the government aimed to have five new venture capital funds by 2022. In addition, the government has created tax incentives to encourage individuals to invest in start-ups and venture capital funds. The country's digital competitiveness remains hampered by a lack of private investment.

The University of Belgrade Centre for Technology transfer supports researchers by guiding and encouraging them to step into the world of industry and business. However, many universities in Serbia are still operating without dedicated technology transfer offices and not adapting fast enough to the changing environment. Technology transfer is not yet adequate to meet the ecosystem needs and is a fundamental challenge to development. Stakeholders state that more communication between universities and the private sector and a structured approach to technology transfer is needed. Besides academia, the Technology Transfer programme (TT programme), part of the Innovation Fund, supports local research and development organizations and other organizations that support innovation to increase their ability and efficiency in commercialising inventions. However, only EUR 580 000 has been spent in technology transfer, with unknown results.

In the last three years, Serbia has been twice ranked first in greenfield FDI and has gained an international reputation as an attractive investment destination (Financial Times, 2019). Blue-chip firms investing in Serbia include Schneider Electric, Continental, Microsoft, Bosch, Michelin, Siemens, and Panasonic, as well as artificial intelligence specialists Wonder Dynamics and Everseen. Although FDI has been positive for the ecosystem, some stakeholders view it as a double-edged sword. Foreign companies bring new knowledge and dynamism into the ecosystem and help raise the bar for local companies. However, domestic companies must compete for scarce technical talent.

Some ecosystem stakeholders believe there is still a gap between scientific research and practical applications. The challenge is that most research is still theoretical rather than applied, so universities need to collaborate with firms to develop these applications. The Government of Serbia established the Science Fund in 2019 to improve the quality and relevance of research. Since the beginning of its operations, the Science Fund has opened five programmes with a budget of EUR 40 million.

3.5 Market and networks

- There is a small domestic consumer market with limited demand for digital consumption but it provides a testbed for pilots.
- Public procurement has undergone digital transformation but remains limited for start-ups in the ICT space.
- Innovation networks are supported but there is no explicit or widely shared mapping of the ecosystem.
- Exports are encouraged and supported but reforms in customs procedures and other regulatory barriers will increase competitiveness.

Serbia has a small domestic market, with almost 20 per cent of the population over 65 years old (Statistica, 2020) and digital literacy is challenging for this age group. Due to market size and structure, there is a lack of local demand for digital services. Unable to expand locally, entrepreneurs must focus their products and services on global markets to be successful. For some start-ups, the domestic market acts as a testbed to pilot innovations. The government and business support networks are addressing this challenge by helping companies to scale-up their activities abroad.

In 2020, the revised Public Procurement Act has enabled the electronic submission of applications via a newly established portal and improved the efficiency, speed, and flexibility of the procurement process. Few start-ups and SMEs bid for public contracts as they still view the process as too demanding and time-consuming. Serbia has introduced an Innovation Partnership procedure to help drive innovation and start-up participation, but this is relatively new and has yet to demonstrate tangible results.

Stakeholders benefit from an abundance of innovation networks and formal business associations, with the Chamber of Commerce being the largest. The Digital Serbia Initiative and the ICT Clusters support the digital economy and represent their members at the national level to ensure that innovators have access to the resources and connections they need. Most ecosystem players are aware of each other, and there exists a mapping of some stakeholder groups, but there is no explicit mapping of the whole ICT ecosystem, thus limiting cooperation between players.

Trade is encouraged and supported by The Development Agency of Serbia, a government organization dedicated to facilitating and implementing direct investments and promoting and increasing exports. Customs challenges exist, and the country is undergoing extensive reforms to consolidate a competitive market-based economy. The aim is to remove regulatory and procedural barriers to trade in goods, which, by inflating transaction costs, have been undermining competitiveness in global markets.

3.6 Culture and communities

- Regular events are taking place across the ecosystem but the ICT ecosystem needs to connect more to other industries through these events.
- Interest in entrepreneurship is increasing but fear of failure is still prevalent.
- Women are recognized as digital industry change-makers but are not yet equally represented.
- Digital expedition has been launched to address the digital divide in rural areas.

Events organized by the public and private sectors connect and inspire start-ups. International conferences bring the ecosystem together to share experiences, invest and collaborate. Online events connecting citizens in Serbia and those living abroad are helping to support ecosystem growth. However, some stakeholders believe there is a lack of quality meetups, mentors, and events to support tangible outcomes in collaboration and business transactions. It appears that the digital sector is active in the event space but needs to connect more to other industries.

According to the ecosystem, interest in entrepreneurship has increased in Serbia. This entrepreneurial culture is spreading most amongst the young, perceived as having more appetite for risk than older generations. University societies and incubators are sparking enthusiasm amongst the youth demographic. However, failure is not considered an opportunity for learning

and is often stigmatized. Due to this, people are reluctant and afraid to start new ventures. Building an entrepreneurial culture for less mature ecosystems requires start-up champions to inspire others to follow in their footsteps.

Serbia has an open, inclusive society, and women are represented in the ICT sector. Female entrepreneurs lead several significant and successful start-ups but are still relatively rare. In government and the corporate sector, women are active in leadership positions. Sixty per cent of recent graduates are women, but they are not all making their way into the digital innovation ecosystem (Statistical Office of the Republic of Serbia, 2021). The ecosystem stakeholders are aware of this issue, and several programmes encourage women entrepreneurs and start-ups in digital media and tech. The UN Women in Serbia supports various initiatives to encourage more girls to use innovation and technology to solve regional and global problems. More programmes, role models, and mentors could help to boost female entrepreneurship.

Some stakeholders fear a digital divide exists in rural communities and that older generations are getting left behind. To help tackle this, the government has launched the Digital Expedition programme, a caravan of digital skills, literacy, and security experts that visited citizens in 15 cities. Similar programmes in rural areas should be encouraged to help all citizens develop skills required in today's society.

3.7 Policies and regulations

- A favourable business environment exists due to regulatory reforms but more dissemination about them is needed within the ecosystem.
- Innovation champions are recognized within the government but some parts are still quite traditional.
- There are some good incentives for R&D but more education is needed to maximize impact.
- Tax incentives create opportunities for foreign direct investment but improved laws for foreign exchange can push for innovation within firms

All stakeholders recognize significant progress in the regulatory environment. Serbia aims to join the EU and its single digital market, aiming to strengthen its technological ecosystem and digital infrastructure in line with the strategic framework of the EU. Supportive policies and regulations, including easy access to work permits, regulatory sandboxes, and IP protection, provide fertile ground for the efforts of entrepreneurs. One of the enablers of Serbia's digital innovation ecosystem and attractive business environment is the new Law on Digital Assets. This law recognizes virtual currency and digital tokens as legal digital assets, making Serbia one of only a few countries in the world with such legislation, although Serbia would benefit from communicating more about its regulations to all stakeholders.

Most players in the ecosystem recognize innovation champions only in some parts of government such as within the Prime Minister's Office. The Government of Serbia is addressing this by investing in the digital transformation of public administration and has implemented online training to help motivate and change employee mindsets. To increase the innovation capacity of the public sector as a whole, it is important to make training available to all government sectors.

A tax incentive strategy is enabling the development of a knowledge-based economy in Serbia. Companies can benefit from research and design (R&D) deductions and lower tax and contributions for salaries in R&D. Some companies are investing in R&D centres such as the Microsoft engineering campus, and in 2018, Continental Automotive, launched a research and development centre in Novi Sad employing 600 engineers. Some start-ups and SMEs are uncertain how this system is implemented and regulated and are reluctant to take advantage of these incentives. Awareness-raising and education of all stakeholders will be needed to maximize the impact of this strategy.

According to Financial Times, Serbia is “punching almost at 12 times above its weight” in attracting foreign direct investments and has created an attractive business environment. The Foreign Investors Council (FIC) safeguards the interests of 120 foreign companies that have invested over EUR 36 billion and employ more than 100 000 employees in the country, but they tend to work with more traditional industries rather than in ICT. However, the law on foreign exchange was viewed by FIC members as a limiting factor in ecosystem development.

4 Ecosystem challenges and opportunities

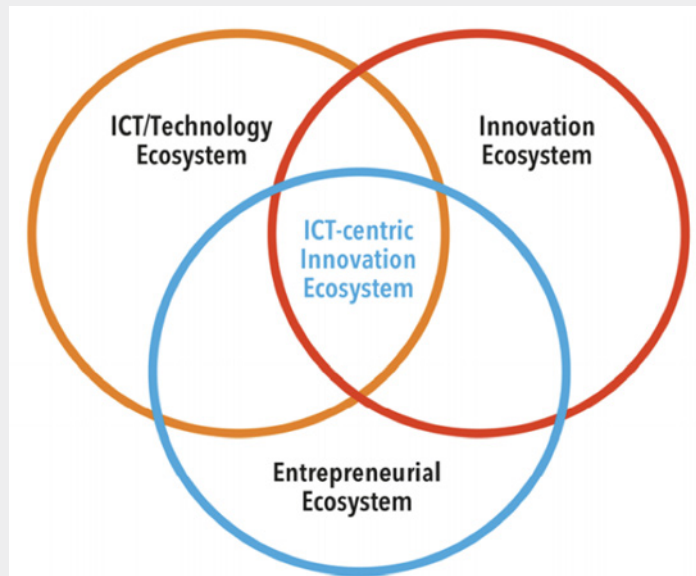
The three main ecosystems essential to Serbia’s digital transformation journey are:

- (i) the innovation ecosystem (universities, research institutes, and the public sector);
- (ii) the entrepreneurial ecosystem (innovators and support organizations); and
- (iii) the technological ecosystem (high-tech, ICTs, technology business-to-business (B2B), and manufacturing companies).

Understanding the ICT-centric (digital) innovation ecosystem

The three ecosystems – Innovation Ecosystem, Entrepreneurial Ecosystem and Technology Ecosystem – are closely linked to developing a country’s digital transformation landscape. At the intersection of the three ecosystems lies the ICT-centric innovation ecosystem, also referred to as the digital innovation ecosystem.

Figure 3: Engines of growth



The following sections contain a brief analysis of each of the three ecosystems and ends with an overview of the challenges and opportunities in each, as gathered through interviews and group discussions during the co-creation workshops with local stakeholders. Detailed analysis of the challenges has been presented in Chapter 3, while detailed recommendations are covered in Chapter 9 and Appendix 1 of this report.

4.1 Innovation ecosystem

The innovation ecosystem, including research institutes, universities and public sector entities such as national innovation agencies and public sector funding, plays an invaluable role in the national innovation journey.

Serbia’s national ecosystem is organized and supported by a clear digital vision and strategy. The government uses three-pronged approach to digitalization of public administration, the

economy, and education. A lack of trust in the digital world still poses a major challenge for the government. In addition, citizens and established businesses do not understand the benefits of ICT. The national development of 21st century skills is a governmental priority, but substantial efforts are needed to increase the use of digital services in Serbia.

To support the economy, the government is investing in R&D, start-ups, and innovative firms. The Innovation Fund plays an invaluable role in the national innovation journey, particularly in kick-starting innovation. National funding for research has increased through the newly established Science Fund but remains low as a percentage of GDP. However, universities are still struggling to fulfil their role and foster innovation, and research institutions are finding it difficult to define their own rules on intellectual property (IP) ownership. The University of Belgrade has regulations in place so that the institution owns all IP created by university staff. This impacts collaboration between academia and industry, reducing the commercialization and application of research. Sharing IP ownership is essential to enable ecosystem evolution.

The quality and relevance of education and training do not fully meet labour market needs. Academia is unable to compete with private-sector salaries and is struggling to attract and retain world-class professors and researchers. Exacerbating this problem, some companies incentivize professors to work with them, which further depletes teaching resources. Universities are beginning to introduce entrepreneurship courses to students, but more are needed. Although digital literacy creates new opportunities for young people, soft skills are vital for ecosystem development. Integrating work placements into degree courses is recommended to expose students to real-world situations and develop these skills.

4.2 Entrepreneur ecosystem

The entrepreneurial ecosystem includes entrepreneurs, their support systems and organizations that initially nurture business creation through the “valley of death” and subsequently their growth into sustainable SMEs.

The entrepreneurial ecosystem includes 200 to 400 start-ups in Belgrade and Novi Sad (DSI, 2019). Although relatively small, the ecosystem is growing at a fast pace. Based mainly in Belgrade and Novi Sad, several prominent organizations and programmes support the start-up ecosystem. Investment in public support programmes and infrastructure has begun to create a fertile ground for innovation. Yet they do not provide the capital and educational resources entrepreneurs require to fully realize their ambitions.

A significant challenge is access to growth funding, with more than 50 per cent of start-ups remaining entirely self-funded (DSI, 2019). Many start-ups follow a bootstrapping strategy to achieve their goals using self-sustaining resources, which slows down innovation and commercialization. At present, there are only a few options to secure external funding, and these are focused mainly on early-stage start-ups. The lack of local investment opportunities pushes some companies to seek international funding. However, the Government of Serbia is trying to attract angel investors and venture capital funding to fill this gap.

Lacking previous start-up experience and entrepreneurial education, start-up founders struggle to traverse the valley of death. Solid marketing and business skills are vital for scaling start-ups. Higher education curricula need to be modernized to build digital expertise, including fintech, blockchain and global digital marketing and business models (DSI, 2019).

4.3 Technology entrepreneur

The technology ecosystem includes high-growth technology companies, equipment manufacturers, systems integrators, companies in the ICT sector and B2B technology platforms supporting SMEs, among others. The development of the technology ecosystem is essential to a country's ability to benefit from technological innovation and create high-growth industries and jobs.

Technology is the newest ecosystem in Serbia and dominated by large foreign multinationals that comprise telecommunication companies, systems integrators, and a few ICT businesses and start-ups. According to the Commission for Protection of Competition, over 2 500 enterprises operating in the ICT sector in 2019 employ more than 28 000 workers. Local tech companies produce products for agriculture, online gaming, and software testing. Initially, firms outsourced their coding services to Serbia due to its large English-speaking cost-effective workforce.

Blue-chip companies such as Microsoft, IBM, Intel, NCR, and Seven Bridges have either established development centres or have outsourced work to local firms. It appears that foreign companies are engaging with what the local tech scene has to offer, and there are opportunities for local firms to collaborate with big players. In this context, this ecosystem is primarily driven by international technology companies with modest local value chain integration. This ecosystem development is critical to Serbia's ability to leverage technological innovation and create high-growth industries and jobs. To achieve a mature technology ecosystem, domestic SMEs need to be more integrated into the ecosystem.

4.4 Macro challenges and opportunities

At a macro level, the three ecosystems face some common challenges.

- Insufficient growth funding is a major challenge for the start-up community in Serbia, directly impacting ecosystem development.
- Access to appropriate human capital is a challenge for all three ecosystems as they compete to recruit the best talent and lack the soft skills necessary to exploit digital technology.
- The lack of a technology transfer is impacting the commercialization rate of innovative digital solutions.
- There is a lack of entrepreneurial culture and there is a need to widen the use and application of digital services to drive the ecosystems.

The digital markets of gaming, blockchain and AI are seen as markets of opportunity. AI and blockchain may have some commercial viability in Serbia today, but the country must become an innovation producer to reap the most benefit from technological diffusion. Serbia's readiness to leverage technology to create solutions is critical to economic growth and high-value job creation.

5 Stakeholders

Understanding the stakeholders

Collaboration between key stakeholders in the innovation ecosystem is the foundation of the assessment process and drives the actions taken to build the ecosystem.

An important part of the country review is thus finding ways of identifying and engaging with these stakeholders.

Table 2 lists the many stakeholders who have contributed to this analysis including entrepreneurs, the finance sector, entrepreneurial support networks, the private sector, academia, and the public sector.

Table 2: Key stakeholders in the ecosystem

	Stakeholders (in alphabetical order)
Entrepreneurs	<ul style="list-style-type: none"> • EDC.rs • HTEC • Seven Bridges Genomics • Strawberry Energy • Vega IT
Entrepreneurial support networks	<ul style="list-style-type: none"> • Chamber of Commerce of Serbia (Centre for digital transformation) • Digital Serbia Initiative • ICT Network Serbia • Science Technology Park
Private sector	<ul style="list-style-type: none"> • Continental • Foreign Investors Council • Microsoft • Philip Morris • Serbian Entrepreneurs
Academia	<ul style="list-style-type: none"> • Artificial Intelligence Institute • Biosense Institute • Faculty of Organisational Sciences • ICEF University of Belgrade • Institute of Molecular Genetics and Genetic Engineering (IMGGE), University of Belgrade
Public sector	<ul style="list-style-type: none"> • Ministry of Health • Office of the Prime Minister • Office for IT and e-Government • Returning Point • UNDP Accelerator Lab

Table 2: Key stakeholders in the ecosystem (continued)

	Stakeholders (in alphabetical order)
Finance	<ul style="list-style-type: none">• Belgrade Venture Forum• Development Agency of Serbia• Innovation Fund• OTP Bank• South Central Ventures

6 Ecosystem maturity map

Understanding the ecosystem maturity map

The ecosystem maturity map, also referred to as the innovation journey map, highlights the work that needs to be done in the ecosystem to harness innovation on a transformative journey from pre-ideation to high growth. It describes stakeholder roles and actions in support of entrepreneurs and innovators at each stage of the start-up lifecycle. The colour coding identifies areas that are well-supported (green), inadequate (yellow) and missing or weak (red).

The heatmap of stakeholders in the ecosystem and the current status of their jobs-to-be-done is based on interviews and group discussions in co-creation workshops with local stakeholders and validated by secondary research and literature reviews.

It must be understood that the innovation lifecycle or entrepreneurial journey is not linear. Instead, it is made up of a series of jobs-to-be-done across different stages of the cycles. In the pre-ideation stage, key stakeholders plant the seeds of support in the innovation ecosystem. In the ideation stage, innovations are developed but have not yet been incorporated as businesses. In the start-up stage, innovations evolve from concepts into businesses. The **valley of death** is a challenging stage of development where entrepreneurs need strong support to survive. In the **SME** stage, the rate of start-up growth increases as they expand rapidly into established businesses, reach steady-state, or exit through buyouts or initial public offerings (IPOs).

There is a need for a comprehensive understanding of how ecosystem stakeholders can work together to implement national development priorities within the maturity ecosystem of digital innovation. Initiatives that are constructed in silos might lead to duplication of efforts and wasted resources.

The ecosystem maturity map in Serbia shows an ecosystem in a **developing** stage. Profiling key stakeholder actions are necessary to accelerate digital transformation.

Table 3: Stakeholders and their roles in the ecosystem

Actors	Cycle stage				
	PRE-IDEA	IDEATION	START-UP	THE "VALLEY OF DEATH"	SME
Entrepreneurs	Entrepreneurial interest	Engage with problems	Develop business models	Build collaboration	Expand
Finance	Research funding	Seed funding	Angel investment	Venture capital	Business finance and loans
Entrepreneurial support	Entrepreneurial events	Hackathons and competitions	Co-working and support	Incubators and accelerators	Business associations
Private sector	Success stories	Research Programmes	Lab Programmes	B2B and support services	Skill training programmes

Table 3: Stakeholders and their roles in the ecosystem (continued)

Actors	Cycle stage				
	PRE-IDEA	IDEATION	START-UP	THE "VALLEY OF DEATH"	SME
Academia	Community of entrepreneurs	Basic research	Spin-offs	Soft skill trainings	Human capital
Public sector	Vision and strategy	IP and R&D support	Tax support	Public procurement	Trade policy

6.1 Entrepreneurs

Interest in entrepreneurship has increased significantly in Serbia, particularly among millennials who are more comfortable with risk-taking. However, many people still prefer a stable job rather than starting their own venture. The stigma of failure remains one of the biggest obstacles. This is changing slowly as more success stories are being shared by ecosystem stakeholders. For example, the high-profile USD 378 million exit of mobile games company Nordeus is inspiring other entrepreneurs.

At the pre-idea stage, entrepreneurs start to explore innovation while support institutions such as the Innovation Fund help to cultivate interest by fostering an entrepreneurial culture. Some start-ups are beginning to engage with local problems and develop solutions they can commercialize. However, academia does not produce enough research to identify these needs and is doing little to encourage researchers to create start-ups. Although Serbia has technical talent on a par with the best markets in the world, the ecosystem lacks soft skills, mainly in international marketing, sales, and communication. Therefore, entrepreneurs do not always have the skills they need to develop strong business models.

Access to venture capital is a considerable challenge and consequently very few start-ups survive the valley of death to gain the status of high-growth SMEs or successfully exit. The public sector is trying to address this and has created a EUR 25 million State fund through Telecom Serbia. However, venture capital-backed exits are not very common. Entrepreneurs must collaborate with academia to accelerate their digital transformation, learn essential business skills, and focus on relevant ecosystem problems.

6.2 Finance

In Serbia, funding for entrepreneurs is available at the pre-idea and ideation stages. The Innovation Fund supports early-stage entrepreneurship in terms of basic research and prototyping. However, the lack of a structured and systematic framework for business angels in Serbia limits funding by them at the start-up phase. This makes it difficult for entrepreneurs to access capital, which means they must either bootstrap or abandon projects. Serbia does not have a strong culture of individuals investing risk capital to support entrepreneurs. Crowdfunding is used but not on a large scale. To make the funding of start-ups more attractive to investors, the government has introduced tax subsidies, however, it will take some time for mindsets to change and the benefits to become apparent.

South Central Ventures and the Belgrade Venture Forum provide opportunities to raise early-stage capital and investment funds. However, the low levels of funding means companies struggle to cross the valley of death. Successful firms generally attract VC funding from abroad

and exit the ecosystem. Valuable business skills and talent are often lost, which hinders ecosystem growth. Initiatives have been created to encourage talent to return to the ecosystem and to make returning to Serbia more attractive for those who have moved away. The ecosystem will be unable to grow unless more venture capitalists and business angels are attracted from the finance sector.

6.3 Entrepreneurial support

Events organized by both the public and private sectors connect and inspire innovators at the pre-idea stage. Several international conferences, including the Western Balkans Digital Summit, Data Science Conference and AI Wonderland Summit, bring entrepreneurs together to share experiences and collaborate. Hackathons and competitions are being organized by the private sector and universities to stimulate ideation.

There has been significant investment in hard infrastructure in Serbia, but more funding is needed in soft infrastructure. Science technology parks, start-up centres, and co-working spaces provide access to soft infrastructure, allowing innovators to access resources and knowledge. However, incubators are mainly independent and not well connected to the whole ecosystem. Support is focused on people already in the ecosystem and appears to be less available to those outside it. The Chamber of Commerce is the largest business network to work on behalf of established SMEs. Accelerators are beginning to emerge, but the entrepreneurial support sector needs more funding to guide entrepreneurs through the valley of death.

6.4 Private sector

At the pre-idea stage successful entrepreneurs help to inspire, mentor and fund new entrepreneurs through international networks such as Serbian Entrepreneurs. There are also personal initiatives by some private sector leaders, but a formal angel network needs to be established to accelerate ideation. The nascent digital innovation ecosystem in Serbia limits the number of success stories, and more initiatives are required to raise the profile of entrepreneurship such as sharing stories of both their success and failure.

Attempts are being made to develop corporate accelerators to help innovators and promising start-ups to access finance. For example, Philip Morris International is currently delivering a three-year programme called StarTech to support the digital transformation of SMEs in cooperation with the Government of Serbia. Due to the success of FDI initiatives, the corporate sector has a high number of foreign firms. Competition for the best technical talent is a challenge for the public sector and start-ups as corporations can offer better remuneration. To help more start-ups cross the valley of death, larger private companies could set up corporate accelerators as part of their corporate social responsibility policy or act as angel investors and help to fill the funding gap.

6.5 Public sector

The public sector has adopted a leadership role in developing the digital ecosystem. There is a clear vision and strategy for digitalization that all stakeholders can embrace. The government has implemented a generous taxation framework that supports entrepreneurship, including attractive research and development exemptions. Despite this, not all companies are taking advantage partly due to a lack of awareness and mistrust of the tax authority treatment of incentives. Educating both accountants and the tax authority is essential to increase uptake and drive innovation.

Reforms have made public procurement more accessible and transparent, and quite a few public sector IT projects are being developed by private vendors. However, stakeholders feel that more can be done to provide opportunities to start-ups. Foreign trade is well supported, and ICT services are Serbia's largest net exporters. The country has free trade agreements with the EU and Russia and preferential agreements with many countries, including Japan, Turkey, and the United States of America.

6.6 Academia

Established in 2017, The Startup Center (SC) at the University of Belgrade Faculty of Economics was one of a few programmes for developing entrepreneurial thinking and behaviour among students in Serbia. However, more programmes have been launched recently, including the University of Belgrade business accelerator "Universe project". In addition, the Faculty of Organizational Sciences in cooperation with the Digital Serbia Initiative and partners (Startit, Nova Iskra, and PwC), and with the support of USAID, has started the "Take the idea" project. Academic Institutions are beginning to understand their role in creating and motivating future innovators.

There appears to be a disconnect between industry and academia, whereby the private sector needs are not fully understood, and apart from a couple of faculties, there seems to be little collaboration. The private sector needs to work in partnership with academia to produce research that identifies real problems. In addition, there does not appear to be a clear research-based framework to support start-ups, so entrepreneurs fail to commercialize research on a large scale. One challenge for universities is a lack of funding for academics, which drives skilled experts to work in the private sector, rather than become professors or teachers. In addition, assistant professors often lack real-world industry experience, which compounds these issues. There are some multidisciplinary studies, however, few graduates are leaving universities with the skills needed by innovative firms. To play its part in the development of the ecosystem, academia needs to develop strategic, long-term partnerships to drive connections between academia and industry through research activities or technology transfer.

7 Relevant practices

During the assessment process, the following practices were identified as noteworthy and potentially positive for the ecosystem. As the next step in this process, an in-depth collaborative analysis could lead to the recognition of champions and good practices throughout the ecosystem.

Belgrade Venture Forum

Belgrade Venture Form has gathered thousands of investors, corporate executives, and start-ups in the last decade. They have created a unique network that spans more than 30 countries and four continents. This carefully curated network invests, exchanges, and showcases the unique spirit of the Balkans. In 2021, the conference moved online for the first time and was truly global: the East met the West, virtually in Belgrade. Serbian Venture Network (SeVeN), an association committed to developing the start-up and entrepreneurship ecosystem in Serbia and South-East Europe, manages the annual event.

Biosense Institute

Founded in 2015, BioSense, a research and development institute for IT in biosystems, is a pioneer in the digital transformation of agriculture in Serbia. Exploring scientific and technological frontiers for the application of IT in agriculture, the Institute strives to deliver state-of-the-art digital solutions to the farming sector to ensure higher yields with smaller investments. There is strong industrial cooperation and a significant track record in innovation acceleration activities, with more than 50 SMEs funded through BioSense programmes. In addition, the Institute has participated in 30 national and 50 international projects, mainly from the European Union Research and Innovation Programme. Biosense is a member of the State University of Novi Sad.

Digital Serbia Initiative

Digital Serbia Initiative is a non-profit, non-governmental organization with the strategic goal of developing a strong, globally competitive digital economy. Founded by leading digital players in Serbia, more than 30 member-organizations from all sectors have combined forces to create a digital ecosystem that includes technology, banking, and finance, telecommunications, consulting, legal, education and research, media, pharmaceutical, and start-up support organizations. They aim to create a business environment that serves the digital economy by investing in strategic programmes in formal and informal education, start-up ecosystem development, legal and regulatory frameworks, digital infrastructure, and public dialogue on digital transformation.

Innovation Fund

The Innovation Fund of the Republic of Serbia is a key State institution that supports innovative activities and manages funding to stimulate innovation. Its mission is to support innovation development through appropriate financial, technical, and advisory support instruments. It aims to empower innovative enterprises and strengthen the link between research and development and the business sector. Since 2011, the Innovation Fund has approved EUR 31.2 million for 227 innovative projects, EUR 3.2 million for 632 innovation vouchers, and EUR 580 000 euros to support technology transfer. More than 3 380 applications for projects were submitted in response to public calls for tender.

Serbian Entrepreneurs

Serbian Entrepreneurs is a non-governmental, non-profit organization that promotes entrepreneurship by empowering the pay-it-forward activities of their 75 referral-based members. Accomplished founders, investors, engineering leaders, and start-up executives have formed a deeply vested network. Monthly meetings provide learnings, operations, networking, and investment platforms in founding city chapters: San Francisco and New York. They are expanding to Los Angeles, California, and Novi Sad, Serbia.

8 Perspective on priorities

The high-priority objectives for the ICT-centric innovation ecosystem, formulated from the workshop with the main stakeholders of the ecosystem, are presented in Table 4.

Table 4: Digital transformation strategies towards the national vision

National vision					
Serbia's vision is to create a fully digitalized economy with a knowledge-based international innovation hub retaining top technical talent and creating globally competitive industries with ICTs as a driver of innovation.					
Strategies					
The implementation of digital strategies that enable the development of advanced value-added services and benefit populations, based on:					
<ul style="list-style-type: none"> • A digital economy driven by research and development. • Creating high-value digital jobs and retaining talent. • Competitiveness for the key economic sectors carrying the economy (energy, automotive, machinery, mining, and agriculture), for the new digital sectors, for the social sectors (education and health) extended to all regions. 					
Economic		Social		Political	
Digital strategies for the competitiveness of key economic sectors supporting the non-ICT economy (energy, automotive, machinery, mining, and agriculture sectors).		Digital strategies for the development of high-value digital jobs to retain top technical talent.		Digital strategies that support and promote collaborative research and development, technology transfer, and provide open access to data.	
Catalysts ^[1]					
Six groups of interdependent catalysts are needed to deliver a new digital vision in Serbia. They help develop and mature the digital ecosystem and align vision with strategies and actions.					
A review of digital policy implementation and incentives to accelerate uptake.	Establishment of 5G infrastructure.	Implementation of flagship projects, development of key sectors and access to markets and networks.	Establishment of a mapping of stakeholders and existing resources.	Setting up support frameworks for effective entrepreneurial education programmes and events and the development of digital communities.	Establishment of a knowledge-based innovation hub equipped to monitor public and private flagship projects.
<i>Project: Review of effectiveness of digital policies and incentives.</i>	<i>Project: Infrastructure for 5G digital innovation.</i>	<i>Project: Initiatives for key sectors.</i>	<i>Project: Digital ecosystem mapping.</i>	<i>Project: Support programme for innovators.</i>	<i>Project: Innovation centre for digital transformation.</i>
^[1] Enablers.					

9 Key performance indicators

The strategic vision and recommended programme must address the systemic challenges that hinder the development of the digital ecosystem and its impact. To this end, the Table 5 demonstrates how the recommendations can lead to a credible, measurable, and inclusive impact.

This table is based on the theory of change. This theory is generally used as a planning tool in the innovation cycle, as a way of showing how actions taken lead to change in the short, medium, and long terms. It is generally used as a strategic tool for the development of social and sustainable projects but also to measure the concrete impact of government actions.

Desired impact

Serbia's vision is to create a fully digitalized economy with a knowledge-based international innovation hub retaining top technical talent and creating globally competitive industries with ICTs as a driver of innovation.

Indicators: Improvement of SDG indices: 1,2,4,5,8,9,10,11,12

Table 5: Strategies for digital transformation

Long-term results	Medium-term results	Short-term results	Recommendations
<p>The general environment is favourable for innovation and entrepreneurship in ICTs.</p> <p>Indicators: <i>Improvement of GII, IDI indices.</i> <i>Improvement of GCI indices.</i> <i>Improvement in Ease of Doing Business ranking.</i></p>	<p>The various regulatory tools, mechanisms and supports are operational and effective.</p> <p>Indicators: <i>Impacts of regulatory tools, mechanisms and operational support.</i></p>	<p>A review of digital policy implementation and incentive utilization to accelerate uptake.</p> <p>Indicators: <i>Increased stakeholder awareness of tax incentives and virtual currency and digital tokens.</i></p>	<p>DI 1,2,3</p>

Table 5: Strategies for digital transformation (continued)

Long-term results	Medium-term results	Short-term results	Recommendations
<p>A fully developed and deployed countrywide 5G infrastructure.</p> <p>Indicators: <i>5G access and subscriptions across the whole country.</i></p>	<p>Recommendations on development and partners of 5G infrastructure are operational.</p> <p>Indicators: <i>Number of recommendations being implemented and number of partners selected.</i></p>	<p>Recommendations on the development of 5G infrastructure are in place.</p> <p>Indicators: <i>Number of recommendations implemented.</i></p>	CI 1,2,3
	<p>Start-ups and SMEs can deploy their full potential and develop beyond their niche in ICTs.</p> <p>Indicators: <i>Number of start-ups and SME solutions active in key sectors.</i></p>	<p>Recommendations on flagship projects, development of key sectors, market and network access are in place.</p> <p>Indicators: <i>Number of initiatives and flagship projects developed for innovation in key sectors.</i></p>	IS 1,2,3,4
<p>The players are mobilized and collaborate on flagship projects and initiatives.</p> <p>Indicators: <i>Improvement of the maturity of the ecosystem.</i></p>	<p>The measures and mechanisms to search for information on the ecosystem are operational.</p> <p>Indicators: <i>All stakeholders are informed of and aware of the activities and resources in the ecosystem.</i></p>	<p>A mapping of stakeholders and existing resources are in place.</p> <p>Indicators: <i>Number of mechanisms put in place for development and information research.</i> <i>Collaborations between public and private sectors.</i></p>	RE 1,2

Table 5: Strategies for digital transformation (continued)

Long-term results	Medium-term results	Short-term results	Recommendations
	<p>The mechanisms and measures allowing the development of digital communities are operational.</p> <p>Indicators: <i>Stakeholders work together to achieve the shared vision.</i></p>	<p>Support frameworks for entrepreneurial education programmes and events and the development of digital communities are in place.</p> <p>Indicators: <i>Number of initiatives for entrepreneurial education, collaboration, networking and information sharing.</i></p>	KE 1
	<p>Mechanisms and measures to promote new models of public and private partnership are operational.</p> <p>Indicators: <i>The necessary resources exist with sound governance of the initiatives.</i></p>	<p>Establishment of a knowledge-based innovation hub equipped to monitor public and private flagship projects.</p> <p>Indicators: <i>Appropriate governance with a structure equipped to support initiatives.</i></p>	PE 1,2,3

Note: See appendix 1 for a detailed presentation of recommendations.

10 Next steps

Decisive intervention can transform an ICT ecosystem, making it more innovative and a true driver of accelerated digital expansion in all aspects of society – with real gains in public, professional and personal lives.

Stakeholder recommendations, based on co-creation and ecosystem priorities, have helped to conceptualize priority projects and are presented in Appendix 1.

The value of this assessment, which identifies the main obstacles and catalysts that already exist in the ecosystem, is to provide the ideal platform for the launch and development of high-impact flagship projects. Each of these projects, designed to be of unique relevance to the country, would help to accelerate the digital transformation of Serbia.

As a next step, further engagement is needed to generate an in-depth assessment to support the creation of a fundable project document. This digital innovation profile provides a valuable first glimpse of both the ecosystem and the existing practices. The profile is designed to raise awareness about the local challenges and opportunities and engage all stakeholders in implementing flagship projects that can foster an enabling environment for the ICT-centric innovation ecosystem to unleash the full potential of Serbia, and ultimately help bridge the innovation gap.

Appendix 1: Detailed recommendations

These recommendations are inspired by the co-creation workshops in which all stakeholders participated.

Table 6: Detailed strategies and actions

Type	Recommendation	Sub-recommendations	Actions	Direct Key Performance Indicator
DI-1	Creation of new sustainable financial support for the digital ecosystem.	<ul style="list-style-type: none"> Incentives for the development of risk capital - specific funds for social impact. Incentives for collaborative academic research and development (R&D). Incentives and support for the development of a formal and structured network of angel investors. 	<ul style="list-style-type: none"> Establish and leverage incentives to stimulate private investment so that large companies can invest in the development of innovative services in sectors that contribute to the development of society. Establish an incentives programme and support for academics to collaborate with industry. Review best practice examples such as the Seed Enterprise Investment Scheme (SEIS) programmes in the United Kingdom. Establish a programme to develop an angel investment network. Work with business associations and stakeholders to promote the scheme. 	<ul style="list-style-type: none"> A number of funds created for key sectors (tourism, agriculture, wood and textile sectors). Number of funds available for university collaborative ICT research as well as recognition of their effective distribution. A loan programme for investments in start-ups in the digital sector. A support programme for the development of angel capital. Number of start-ups and investors registered with the scheme. Number of local investments made.

(continued)

Type	Recommendation	Sub-recommendations	Actions	Direct Key Performance Indicator
DI-2	Revise or strengthen ICT laws.	<ul style="list-style-type: none"> An operational framework for the use of electronic signatures. A review of the effectiveness of National Open data policy. A review of customs policy and procedure in relation to ICT hardware imports and exports. 	<ul style="list-style-type: none"> Operationalize the electronic signature law to accelerate business facilitation in Serbia. Review of data management in public institutions Analysis of administration process and waiting times at borders. 	<ul style="list-style-type: none"> The law is operational, and the government administrations are the first users. Number of open data-driven solutions created Increased awareness of the importance of open data in wider society. Smooth and efficient process with a reduction in border waiting times. Increase in ICT hardware exports in gross value added (GVA).
DI-3	Strengthen support for innovation and intellectual property.	<ul style="list-style-type: none"> Create increased intellectual property support capacity for digital innovation. 	<ul style="list-style-type: none"> Establish a programme to inform and support start-ups in the protection of their innovative solutions. Establish a programme to educate and support accountants and tax offices in R&D tax regulations. 	<ul style="list-style-type: none"> A programme is established at the level of an appropriate local structure. A programme for accounts and tax offices is established.
CI-1	Create high-speed infrastructure to support innovators across the country.	<ul style="list-style-type: none"> Develop a fully operative and countrywide 5G network. 	<ul style="list-style-type: none"> Engage with and support telecommunication providers to develop 5G infrastructure. 	<ul style="list-style-type: none"> Fully operational and countrywide 5G network. Numbers of subscribers to 5G networks.

(continued)

Type	Recommendation	Sub-recommendations	Actions	Direct Key Performance Indicator
CI-2	An education curriculum and programmes that give citizens the soft skills necessary for entrepreneurship.	<ul style="list-style-type: none"> A review of the school curriculum and programmes to materialize the achievements of talents. Promote entrepreneurship in tertiary education. Create programmes for entrepreneurship and the promotion of creativity. 	<ul style="list-style-type: none"> Review the school curriculum and appropriate programmes. Create a framework to support entrepreneurial training and the promotion of entrepreneurial colleges and universities. Promote the curriculum for the education of technology-based entrepreneurship in tertiary structures. 	<ul style="list-style-type: none"> Entrepreneurship programme integrated into the school curriculum starting from elementary level. A framework is established for entrepreneurial training and the establishment of entrepreneurial colleges and universities. A programme is established to make practical tool kits for entrepreneurship available. Introduce a specific module on financing and equity options for start-ups. A course programme is established at the university level for entrepreneurship as a diploma.
		<ul style="list-style-type: none"> Scale ICT competitions and hackathons across all colleges and universities. Introduce an internship programme for all business-based degrees to develop soft skills. 	<ul style="list-style-type: none"> Engage with incubators and support networks to organize and host events. Identify ICT and entrepreneurs experts to support events. Create start-up role models and success stories. Engage with the local business community to provide digital placement opportunities. 	<ul style="list-style-type: none"> Number of events per year. Number of participants and ideas generated. Number of ideas that register as start-ups. Number of student placements and companies engaged.

(continued)

Type	Recommendation	Sub-recommendations	Actions	Direct Key Performance Indicator
		<ul style="list-style-type: none"> Promote a systemic approach to collaboration with businesses. 	<ul style="list-style-type: none"> Create a programme to promote collaboration with the tertiary sector, and public and private companies. 	<ul style="list-style-type: none"> A programme is established with incentives and a framework for collaboration to develop the appropriate human resources for digital.
		<ul style="list-style-type: none"> Promote public sector innovation and intrapreneurship. 	<ul style="list-style-type: none"> Develop a programme to promote public sector intrapreneurship. 	<ul style="list-style-type: none"> A programme is established for government employees to understand digital innovation. Number of intrapreneurship projects are encouraged and supported.
		<ul style="list-style-type: none"> Develop a programme to promote the development of support networks for entrepreneurs. 	<ul style="list-style-type: none"> Establish an umbrella organization for incubators to expand access to spaces and resources that stimulate innovation and develop the capacities of stakeholders in incubation. 	<ul style="list-style-type: none"> An umbrella incubator is established with key initiatives within the science and technology parks.
C1-3	Accelerate access to resources and networks for innovators across the country.	<ul style="list-style-type: none"> Develop a business support programme for innovators in rural communities. Establish co-working spaces in small villages to encourage digital nomads. 	<ul style="list-style-type: none"> Develop a network of mentors responsible for the development of the ecosystem in a specific territory. Develop a start-up programme for over 55-year-olds in rural communities. 	<ul style="list-style-type: none"> A capacity-building programme for local communities has been established. Co-working spaces have been established. Number of digital nomads registered with co-working spaces.

(continued)

Type	Recommendation	Sub-recommendations	Actions	Direct Key Performance Indicator
IS-1	Promote the global brand image of "Serbia creates tech".	<ul style="list-style-type: none"> Attract foreign direct investment in sustainable and green industry sectors. Develop the "Serbia creates tech" brand. 	<ul style="list-style-type: none"> Incentives for key sectors to attract foreign direct investment to establish R&D centres within Serbia. Establish a "Serbia creates tech" label that attributes a value to social contribution for any business based on participation in flagship initiatives in the digital sector. 	<ul style="list-style-type: none"> Number of R&D centres established by foreign investors. Number of high-technology jobs created. A "Serbia creates tech" label is operational and recognized as a programme.
IS-2	Acceleration of the digital transformation of value chains in sectors.	<ul style="list-style-type: none"> Create flagship initiatives to accelerate the digitization of non-ICT sectors. 	<ul style="list-style-type: none"> Create flagship initiatives that can be funded with appropriate governance that bring together a coalition of public and private sectors, start-ups and digital SMEs. 	<ul style="list-style-type: none"> Flagship initiatives allowing the development of business-to-business (B2B) services in key sectors (tourism, agriculture, wood sector and textile sectors) are established.
IS-3	Acceleration of digital transformation within State services.	<ul style="list-style-type: none"> Accelerate the digitalization of State-citizen services. 	<ul style="list-style-type: none"> Develop a strategy for a transparent digital government with access to essential State services. Establishment of key initiatives for the transformation of State services and a framework to operationalize the many State services. 	<ul style="list-style-type: none"> A comprehensive strategy is put in place with essential services to be identified. A programme is established to provide key services.
IS-4	Promote access to the public market for innovators.	<ul style="list-style-type: none"> Develop a programme that facilitates access to public procurement contracts. Raise awareness of the Innovation Partnership procedure. 	<ul style="list-style-type: none"> An action programme to ensure that a minimum percentage of public market contracts are awarded to SMEs and start-ups. Government to become first users of innovative solutions and help start-ups export. 	<ul style="list-style-type: none"> A public access programme is operational. The number of innovative solutions used by public sector entities.

(continued)

Type	Recommendation	Sub-recommendations	Actions	Direct Key Performance Indicator
RE-1	A mapping of the ecosystem and the actions of the stakeholders is to be established.	<ul style="list-style-type: none"> Create a platform that includes a mapping of ecosystem stakeholders, resources, opportunities and activities. 	<ul style="list-style-type: none"> A directory through a digital platform that provides information on ecosystem stakeholders, resources, opportunities and activities. Ecosystem stakeholders have the means to disseminate any useful information relating to the development of entrepreneurship focused on digital innovation. 	<ul style="list-style-type: none"> An established platform serves as a one-stop-shop for access to information, resources, events and communication of ecosystem activities. Concrete actions have been initiated to raise awareness of the consumption of digital innovation.
RE-2	Develop and disseminate accessible knowledge of ecosystem resources.	<ul style="list-style-type: none"> Support programme for ecosystem events. 	<ul style="list-style-type: none"> Establish a programme for systemic support for events that bring together stakeholders or support the development of digital communities. Create international ICT events focused on specific topics to enhance the quality of outcomes and B2B matches. 	<ul style="list-style-type: none"> A programme is established with funding available and distributed for high-quality events. Stakeholders accountable for follow-up and measurable achievement of key measures.
KE-1	Create support frameworks for events and the development of digital communities.	<ul style="list-style-type: none"> Promotion and awareness campaign. 	<ul style="list-style-type: none"> Establish a programme for the promotion of the digital sector in general and start-ups in particular. Create a national TV series to promote entrepreneurship. 	<ul style="list-style-type: none"> A programme is established with specific results regarding promotional goals. A national TV series for entrepreneurship is launched.
PE -1	Strengthening networks and associations	<ul style="list-style-type: none"> Strengthen the capacity of digital start-up ambassadors. 	<ul style="list-style-type: none"> Establish a programme to create mandate-driven digital ambassadors based on criteria and specific products and services they provide to the ecosystem. 	<ul style="list-style-type: none"> A digital ambassador programme is created. Number of active digital ambassadors.

(continued)

Type	Recommendation	Sub-recommendations	Actions	Direct Key Performance Indicator
PE -2	Establishment of an accelerator for digital transformation to strengthen collaboration, trust and the development of flagship projects.	<ul style="list-style-type: none"> Ensure the development and monitoring of flagship projects in order to attract national and international investors. 	<ul style="list-style-type: none"> Efforts to ensure that initiatives can be capitalized and shared. Engage with Serbians living abroad as mentors and investors. 	<ul style="list-style-type: none"> Number of start-ups on the accelerator programme. Number of Serbians living abroad engaged in mentorship and investment.
PE-3	Develop technology transfer partnerships.	<ul style="list-style-type: none"> Create more support for technology transfer with university faculties. Raise awareness of technology transfer within academia and industry. 	<ul style="list-style-type: none"> Review tech transfer activities, resources and outputs from university faculties. Develop a more structured approach to knowledge and technology transfer. 	<ul style="list-style-type: none"> Establish a central hub and spoke model for technology transfer offices at universities. Number of technology transfer offices. Number of collaborative tech transfer projects.

Appendix 2: Methodology

This study was carried out using a global comparative framework developed by the ITU for the diagnosis and development of ecosystems centred on ICTs. The analysis of a country consists of five steps. The aim is to reduce the disparities in digital innovation using a practical kit to strengthen ICT-centric ecosystems that allow defining of common objectives, diagnosing the ecosystem, formulating recommendations, setting up an implementation framework and proposing a monitoring and evaluation method.

The toolkit for strengthening ICT-centric ecosystems is available here: bit.ly/DIPpolicykit

Building on the ITU innovation toolkit series, another toolkit shares more insights on how stakeholders can undertake rapid ecosystem diagnosis, establish key recommendations, and develop flagship projects that effectively nurture ICT-centric innovation within their digital ecosystems.

The toolkit for developing sustainable ICT-centric projects is available here: bit.ly/DIPtoolkit

Appendix 3: Key words and definitions

Table 7: Key words and definitions

Key word	Definition
Vision	The vision defines an ideal to be achieved after a given time. Its objective is to mobilize the stakeholders for its realization while giving the necessary direction to obtain the desired situation.
Strategies	A strategy defines the main axes to be developed in order to obtain the objectives and results towards the vision. The transformation of value chains for each sector with the contribution of digital technology is one of the major research objectives. The strategies should also define the roles and responsibilities of non-digital stakeholders and how their contributions reinforce the defined objectives or sub-objectives. Four pillars of strategies are proposed for sustainable development: political, social, economic, environmental. For each strategy to be developed, it is recommended to develop a theory of change which unites and measures stakeholder contributions.
Catalyst - dynamics of innovation (DI) with digital technology	Measures that allow innovation to exist. They support the general environment for innovation. A dynamic innovation environment needs a coherent regulatory and organizational framework that guides, encourages and fosters a culture of innovation, mind-set, projects and programmes.
Catalyst - capacity for innovation (CI) with digital	Measures that make it possible to have sufficiently developed infrastructures and talents within the ecosystem, which will be conducive to digital transformation. They give innovators the tools, skills, spaces and know-how they need to be successful.
Catalyst - innovation in key sectors (IS) with the contribution of digital	Measures that integrate innovation in key sectors, so that start-ups and SMEs can unleash their full potential and expand beyond their niche, making transformation in other sectors possible.
Catalyst - research in the digital ecosystem (RE)	Measures and mechanisms to search for information on the ecosystem, in particular the mapping of stakeholders and existing resources.
Catalyst - knowledge sharing in the digital ecosystem (KE)	Mechanisms and measures to share knowledge to accelerate the mobilization and collaboration of stakeholders.
Catalyst - Partnership in the digital ecosystem (PE)	Measures and mechanisms allowing access to resources and networks, to develop a public-private partnership model, to focus stakeholders on ecosystem projects.
Theory of change and indicator development	Measures and mechanisms allowing access to resources and networks, to develop a public-private partnership model, to focus stakeholders on ecosystem projects.
Valley of Death	A post-ideation period when innovators need significant investments and a lot of support, and the risk of business failure is high.

Appendix 4: Acronyms and abbreviations

Table 8: Nomenclature of abbreviations

Key Word	Definition
BPO	Business process outsourcing
CSR	Corporate social responsibility
DSI	Digital Serbia Initiative
FDI	Foreign direct investment
FIC	Foreign Investors Council
GDP	Gross domestic product
GVA	Gross value added
ICT	Information and communication technologies
IP	Intellectual property
OECD	The Organization for Economic Co-operation and Development
SDG	Sustainable Development Goals
SEIZ	The Seed Enterprise Investment Scheme
SEZ	Special economic zone
SME	Small and medium-sized enterprises
STP	Science technology park
UNDP	The United Nations Development Programme
UNESCO	The United Nations Educational, Scientific and Cultural Organisation
USF	Universal service fund
VC	Venture capital
WBIF	West Balkans Investment Framework
WIPO	World Intellectual Property Organisation

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