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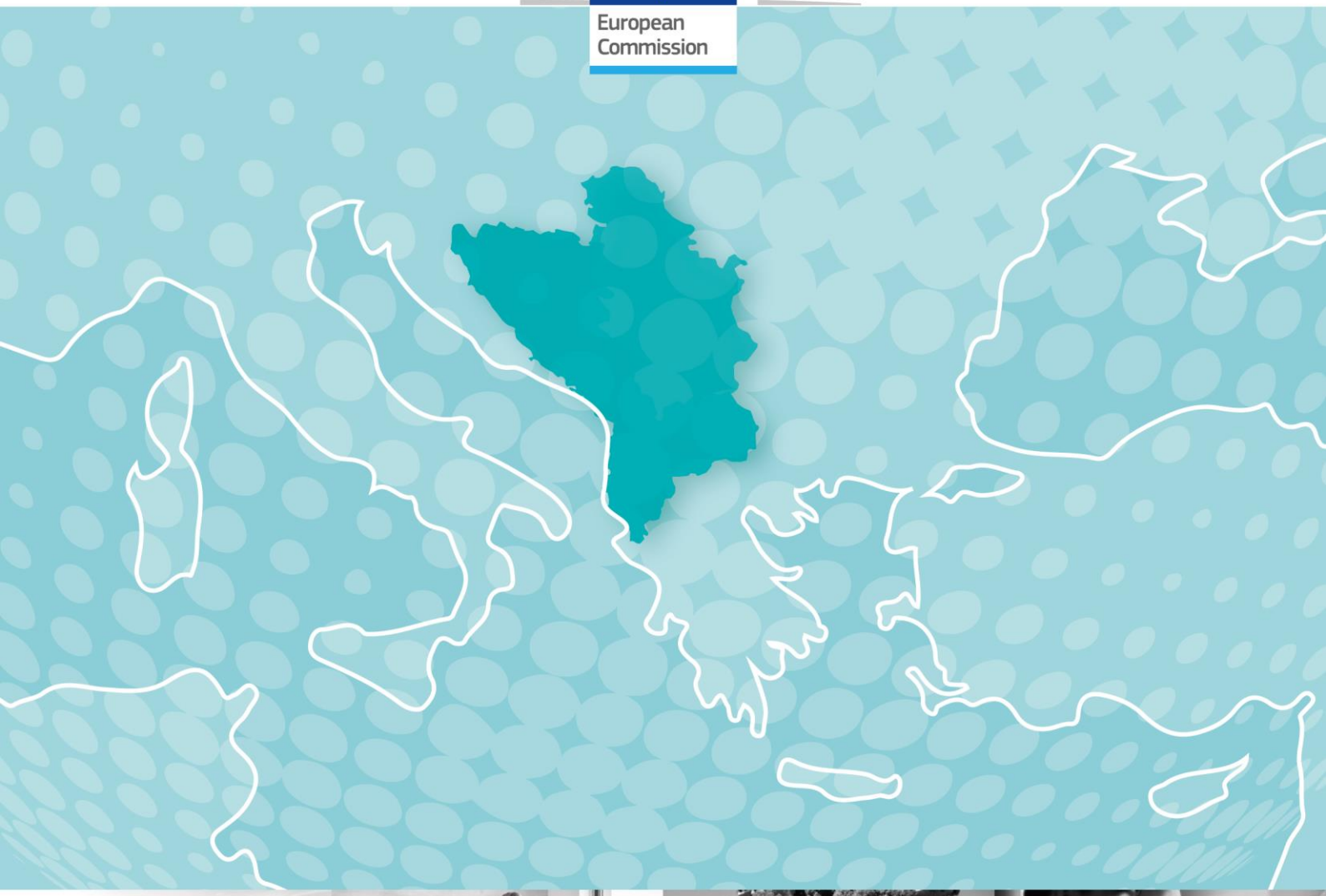

SMART SPECIALISATION IN THE EU ENLARGEMENT REGION

# Regional potential for ICT collaboration in the context of Smart Specialisation in the Western Balkans

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## Contents

## Abstract

This report, aligned with the JRC's efforts under the Global Gateway strategy as EU flagship investment plan underpinning the external dimension of EU policy across the world, provides insights into Information and Communication Technologies (ICT) collaboration in the Western Balkans, crucial for advancing regional development agendas. It addresses urgent questions on leveraging ICT for digitalisation and green transformation, recognizing high stakes for economic growth and sustainability. Through a mixed-methods approach, it identifies a strong commitment to ICT cooperation among Western Balkan economies, emphasizing the need for targeted interventions to overcome financial constraints and limited awareness. Key possible policy implications include establishing regional cooperation platforms, creating regional support financial instruments for Smart Specialisation Strategies (S3) implementation, and harmonising legal frameworks to foster cross-border cooperation, all essential for enhancing regional competitiveness and innovation capacity. The report underscores the importance of regional partnerships, digital skill enhancement, and strategic alignment to unlock the full potential of the ICT sector in driving economic resilience and growth in the Western Balkans. This study sheds light on the main challenges ahead and opportunities in the region, to be possibly tackled also in the context of the Growth Plan for the Western Balkans.

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## Executive summary

This report is part of the ongoing efforts of the Joint Research Centre (JRC) aligned with the Global Gateway strategy as EU flagship investment plan underpinning the external dimension of EU policy across the world, to support Smart Specialisation Strategies in EU Enlargement and Neighbourhood Region. The JRC, in cooperation with DG NEAR, has provided technical advice, methodological support and capacity building for Smart Specialisation in the EU enlargement and neighbourhood countries. This report responds to the specific needs identified in the context of the Smart Specialisation Strategies for the Western Balkan economies, particularly in improving competitiveness and innovation capacity, with a focus on information and communication technologies (ICT). It complements the broader objectives of the JRC INNO NEAR project, which aims to improve the business environment for innovation, build capacity in public sector innovation strategies and harmonise national policy frameworks in line with the principles of Smart Specialisation.

The report's findings and recommendations contribute to advancing regional development, fostering cross-border collaboration, and aligning policy frameworks with strategic innovation priorities. It provides actionable insights to support evidence-informed and participatory innovation strategies, thereby promoting economic growth and resilience in the Western Balkans. It is relevant to ongoing efforts to enhance regional cooperation, support economic development, and advance digitalisation in the Western Balkans.

The report addresses the urgent question of how ICT cooperation can be used to drive digitalisation and green transformation in the Western Balkan region. It makes clear that the stakes are high when it comes to realising the potential of the ICT sector for economic growth and sustainability. The report adds value by providing actionable recommendations that are tailored to the regional context and based on extensive research and stakeholder insights. The report contributes to ongoing debates and initiatives aimed at fostering ICT co-operation and supporting the regional development agenda. While the report's conclusions focus primarily on ICT policy, they also have broader implications for regional co-operation, innovation strategies and economic resilience in various policy areas.

Key policy implications of the findings include the need to establish a regional cooperation platform to facilitate ICT cooperation, to create a regional fund for the implementation of S3 and to harmonise the legal framework for cross-border cooperation. The report proposes policy options such as promoting ICT education, supporting cross-border innovation hubs and initiating a regional tech incubator programme. The analysis confirms the importance of ICT cooperation for regional development and at the same time identifies new challenges and opportunities. It emphasises the need to adapt problems, reassess costs and benefits and close knowledge gaps to enable effective policy making. The report highlights potential innovations in regional cooperation and digital transformation, but also recognises the risks associated with inaction. Significant uncertainties remain regarding the scalability and sustainability of the proposed initiatives, necessitating further research and evaluation.

The analysis reveals a strong commitment to ICT cooperation among Western Balkan economies, driven by shared priorities in digitalisation and green transformation. Key findings include the growing importance of ICT in the regional economies, labour development challenges and opportunities for cross-border cooperation. Despite positive trends, financial constraints and limited awareness hinder ICT collaboration, emphasising the need for targeted interventions and policy support. The report also emphasises the importance of fostering regional partnerships, enhancing digital capabilities and aligning strategies to unlock the full potential of the ICT sector in the Western Balkans.

In future, the context of the Growth Plan for the Western Balkans could provide additional opportunities to further develop the regional potential for ICT cooperation.

The Western Balkans Growth Plan emphasizes digital transformation as a central priority for regional integration and ICT is a cornerstone of the Reform Agendas (2024-2027) approved under this framework.

In the national reform agendas, ICT is identified as a key area for reforms and investments, enhancing digital infrastructure and services to boost economic growth and competitiveness. The digital priorities identified in the respective national Reform Agendas are integrated to align with the EU's digital transformation goals and this alignment is crucial for the Western Balkans' path to EU accession.

# 1 Introduction

The economies of the Western Balkan region showcase a variety of economic and innovation capabilities when it comes to integrating into transnational innovation ecosystems and value chains. Despite this diversity, Smart Specialisation processes in the Western Balkans have identified ICT as a common priority for all economies in the region. Acknowledging the transformative power of ICT in stimulating innovation, economic advancement, and societal development, the region underscores the significance of strategic alignment and cooperation in this dynamic field. This shared emphasis holds promise for fostering collective involvement in the Western Balkans and facilitating the uptake and execution of numerous ongoing EU endeavours.

This report delves into the complexities of ICT collaboration within the Western Balkans and explores the intersecting linkages, challenges, and opportunities at the nexus of Smart Specialisation and regional cooperation. By examining multiple dimensions of ICT collaboration, the analysis aims to provide insights to unlock the region's collective potential and cultivate a collaborative ecosystem conducive to technological innovation.

The central policy problem addressed in the report is the need to assess and enhance regional cooperation potential within the ICT sector in the Western Balkans. This is significant due to the region's identification of ICT as a common priority and its potential to drive innovation, economic growth, and societal progress. Understanding the barriers, opportunities, and strategies for ICT collaboration is crucial for leveraging the region's collective strengths and addressing shared challenges.

The main objectives of the report are:

- To unravel the complexity of ICT collaboration within the Western Balkans.
- To explore the linkages, challenges, and opportunities where Smart Specialisation and regional collaboration intersect.
- To provide insights that enable the region to realise its collective potential and foster a collaborative ecosystem.
- To inform policymakers and stakeholders about strategies for enhancing ICT cooperation to drive regional economic development and competitiveness.

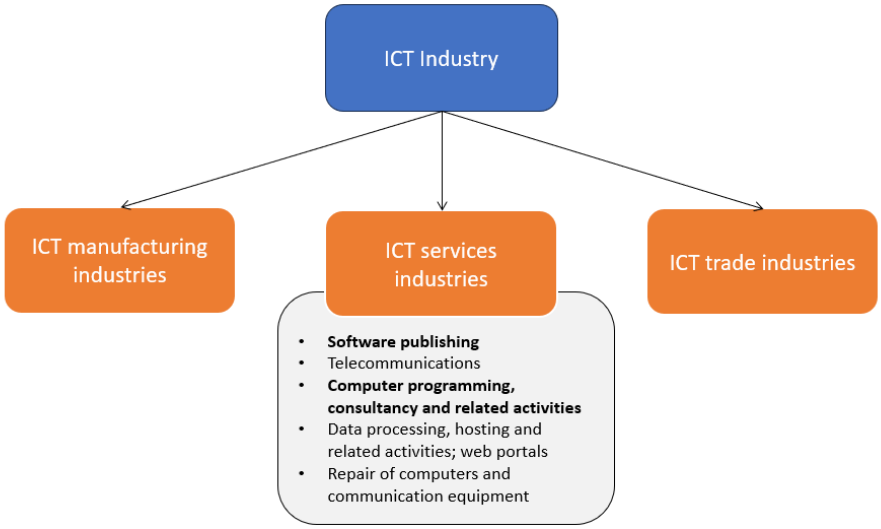
These objectives aim to address the policy problem by providing actionable insights and recommendations for promoting ICT collaboration and leveraging the region's ICT potential to advance Smart Specialisation objectives and foster economic growth in the Western Balkans.

## 1.1 ICT sector classification and Western Balkans specialisations

The ICT sector encompasses a wide spectrum of product and service technologies, spanning computer hardware, software, services, and telecommunications functions. In reviewing the available reports in the region, it was concluded that the ICT industry is often misinterpreted, i.e. there is a misunderstanding of the basic classifications and sub-sectors that ICT as an industry includes. It is therefore necessary to make a clearer classification in this report and to precisely define where the focus of the report lies in accordance with the strengths of the region.

This report follows the OECD classification (OECD, 2007)) which is also used by Eurostat (https://ec.europa.eu/eurostat/cache/metadata/en/isoc_se_esms.htm). According to the OECD, the ICT industry is traditionally divided into three sectors: ICT manufacturing industries, ICT services industries and ICT trade industries (Figure 1). This specific categorisation was chosen for its simplicity and clarity and provides a straightforward overview of the individual sub-sectors.

**Figure 1.** ICT Sector Definition




*Source: authors based on OECD (2007)*

The ICT manufacturing industry comprises the production of physical computing devices and components that are essential for various technological applications. The ICT trade industry includes the wholesale of physical devices and software such as computers, computer peripherals and software, electronic devices and telecommunication equipment. The ICT services industry includes various activities such as software publishing, telecommunications, computer programming, consulting, but also the repair of computers and devices.

When discussing the ICT prospects of the Western Balkan region, it is essential to recognize that the primary opportunity within the region lies within the ICT services sector. Therefore, the region has mainly specialised in ICT services, especially software development and related IT services and consulting. Software development involves the creation of applications and systems that are tailored to specific needs and drive digital solutions. ICT services and consulting, on the other hand, focus on providing expertise, advice and technical support to companies and organisations seeking effective technology implementation. This specialisation is in line with the results of previous studies (Matusiak et al., 2022; Solaja & Matijevic, 2022) and is confirmed by the interviews conducted for this report.

The export-oriented segment of the IT industry in the Western Balkans is experiencing growth due to high demand on foreign markets. This growth is fuelled by the outsourcing model, in which local IT companies collaborate with larger companies in the Western market to take on certain tasks, projects or services. The attractiveness of the outsourcing model lies in its flexibility, cost efficiency and access to specialised skills. In Serbia for instance, a prevailing form of outsourcing is custom software development, an "advanced" model that creates significant added value by specialising in specific technologies, markets or customers. This close customer relationship often leads to the development of new software, either as a product of the company or as a joint project with the customer. While some companies aim for in-house solutions and develop software for sale on the national or global market, the outsourcing model remains more attractive in the Western Balkans as it is more quickly

profitable without large initial investments. Conversely, developing in-house solutions requires investment and a willingness to take risks in the face of fierce global competition. Although some regional companies are exploring hardware solutions, the complexity of hardware development, which requires a highly skilled team of experts, is a major challenge.

# 2 Methodology

The research methodology applied in this report was designed to provide a multifaceted understanding of the ICT collaboration in the context of Smart Specialisation in the Western Balkans. Recognizing the nature of this topic, a combination of research methods was employed to ensure a holistic analysis. In line with the specific objectives of the research, three research methods were implemented: desk research, online survey questionnaire and online interviews conducted in 2023.

- Desk research served as an initial exploration, delving into existing literature, reports, policy documents, and recent academic publications. The literature review established the foundational knowledge base and contextual framework for the subsequent stages of the research.
- To gather quantitative insights, a structured survey questionnaire was designed. The questionnaire covered various dimensions related to survey respondent information, attitudes towards types of collaboration, familiarity with the EU funds, digitalisation, and green transformation in the region (The survey questionnaire is provided in Annex 1).
- To gain qualitative insights and explore diverse perspectives, semi-structured interviews were conducted with key stakeholders in the Western Balkan region. A total of 10 interviews were conducted, focussing on people with a broader perspective on ICT cooperation in the region (The list of experts interviewed can be found in Annex 2). The interviews allowed for a deeper exploration of the challenges, opportunities and future prospects of ICT cooperation in the region.

Numerous dissemination channels were used to reach a broad and relevant stakeholders. These wide-ranging dissemination efforts were important to ensure that 110 valid responses were received, providing valuable insights into the attitudes of the Western Balkan ICT community. However, while valuable, the sample size of 110 may not represent the full spectrum of stakeholders in the ICT sector in the Western Balkans. The online survey may have been prone to response bias, where certain perspectives were over or under-represented due to self-selection by participants. Despite these limitations, the results provide valuable insights into the regional potential of ICT cooperation in the Western Balkans. It is important that readers interpret the results with these limitations in mind and emphasise the need for further research and exploration in this important area.

## 2.1 Survey sample overview

A total of 110 stakeholders from 6 economies in the Western Balkans took part in the survey. Serbia, the largest economy in the region, led the participation with 36 responses, representing a total share of 32.73%. The share of responses from Bosnia and Herzegovina, Albania, North Macedonia and Montenegro varies between 13.64% and 15.45%. Finally, the proportion of responses from Kosovo[1] was slightly lower at 8.18%.

In terms of sectors, the responses were diverse. Most research participants are from the business sector (63.64%). The research and education sector contributed with 15.45%, while there was also a significant number of supporting organisations (10.91%) such as science and technology parks,

[1] * This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence. This applies to the whole document and each time Kosovo is mentioned.

incubators, hubs, associations, and clusters, which play an important role in promoting the ICT sector in the region, especially for the ICT startup ecosystem.

In line with the predominant business model in the Western Balkans described in the introduction of the report, a remarkable 95% of respondents from the business sector are mostly active in software development (63.77%) or ICT services and consulting (31.88%). The remaining 4.35% of respondents are from companies specialising in the manufacture of hardware or the telecommunications sector.

**Table 1.** Sample information

| ***Share of responses by WB economies*** | | |
|---|---|---|
| ***WB economy*** | **Total number** | **Percent** |
| *Albania* | 15 | 13.64% |
| *Bosnia and Herzegovina* | 16 | 14.55% |
| *Kosovo* | 9 | 8.18% |
| *Montenegro* | 17 | 15.45% |
| *North Macedonia* | 17 | 15.45% |
| *Serbia* | 36 | 32.73% |
| ***Share of responses by sectors*** | | |
| ***Sector*** | **Total number** | **Percent** |
| *Business sector* | 70 | 63.64% |
| *Research and education sector* | 17 | 15.45% |
| *Government sector* | 7 | 6.36% |
| *Civil society* | 4 | 3.64% |
| *Supporting organisations (science and technology parks, incubators, hubs, associations, and clusters)* | 12 | 10.91% |
| ***Share of responses by ICT sub-sectors within the business sector*** | | |
| ***ICT business sub-sector*** | **Total number** | **Percent** |
| *Software development* | 44 | 63.77% |
| *ICT services and consulting* | 2 | 31.88% |
| *Hardware manufacturing* | 22 | 2.90% |
| *Telecommunications* | 1 | 1.45% |

# 3 ICT in the current Western Balkan's strategic framework

## 3.1 Policy context

Due to their strategic orientation, all Western Balkan economies have set themselves the common goal of accelerating the digitalisation of their economies. The ICT is one of the most frequently prioritised areas in the strategic frameworks of the Western Balkan economies. Recognising its potential, governments across the region have consistently prioritised investments and policies to promote ICT infrastructure, digital skills development and technology-driven industries. This emphasis on ICT as a common focus area reflects the region's shared commitment to harnessing the benefits of digitalisation for a better future.

In Albania's Economic Reform Programme 2023-2025, there is a strong emphasis on the green transition and digital transformation for EU integration and socio-economic development. Green transition measures focus on reducing pollution and decarbonizing industries, including F-gas regulation and electronic registration. In terms of digital transformation, efforts include developing broadband infrastructure, 5G networks, and promoting a Green Agenda in the digital sector. In the National Plan for the Sustainable Development of Digital Infrastructure, Broadband 2020-2025, the development of ICT infrastructure is highlighted as one of the priorities of the Albanian government and as part of the national strategic goals for development and integration.

Bosnia and Herzegovina operates under a highly decentralized system comprising two semi-autonomous entities, the Federation of Bosnia and Herzegovina and Republika Srpska, each with its government and president. Additionally, the Brčko District functions as a self-governing administrative unit. This intricate arrangement makes policymaking and coordination between different levels of government in BiH a challenging endeavour. In the Federation of Bosnia and Herzegovina, the Development Strategy (2021-2027) places a strong emphasis on enhancing the digitalisation of the economy. Key policy measures outlined include establishing a robust public digital infrastructure, driving the digital transformation SMEs, bolstering the digital skills of citizens to align with labour market demands, fostering the development and application of artificial intelligence, and supporting the growth of innovative digital solutions and software companies. In Republika Srpska, the Industrial Strategy (2021-2027) takes a multi-faceted approach to boost the region's industrial capabilities. This strategy centres on advancing production across multiple stages of processing, emphasizing knowledge and innovation integration with digital technology. Additionally, it encourages a gradual transition toward a more environmentally sustainable and circular economy, recognizing the pivotal role of ICT in this transformative journey.

The ICT sector also plays an important role in the strategic framework for Kosovo's economic development. The Kosovo IT Strategy 2016 recognizes the importance of ICT for economic development and outlines specific measures and actions to improve the competitiveness of Kosovo's IT sector. It focuses on enhancing the competitiveness of the IT industry through measures like creating a conducive digital ecosystem, offering tax incentives for software developers, improving public IT procurement, and attracting foreign investment. The National Strategy for Innovation and Entrepreneurship (2019-2023) recognised ICT as a priority due to its innovation potential, emphasising the challenge of the mismatch between ICT graduates and industry demand.

In Montenegro's Strategic Framework, ICT holds a prominent role as both a priority sector and a horizontal enabler. Identified within Montenegro's S3, ICT is deemed essential for economic development, trade, and national competitiveness. Digitalisation is a core aspect of Montenegro's S3 strategy, aiming for a "Digital Montenegro" where advanced ICT solutions pervade all sectors of the

economy, fostering dynamic access to innovative technologies. Policy measures within this framework include R&D tax incentives, support for digital transformation in companies, and programs for energy efficiency and renewable energy sources. Montenegro's Industrial Strategy (2019-2023) underscored ICT's crucial role in advancing the nation's industry, economy, and competitiveness. It stressed improving national broadband infrastructure, streamlining access to high-speed electronic communication networks, and enhancing the open data portal for businesses and citizens. The Industrial Strategy also strives to promote digital transformation in companies, focusing on industrial sector entities. Montenegro's Digital Transformation Strategy (2022-2026) reaffirms the importance of digital transformation in all sectors, public administration and society. It emphasises the need to expand electronic identification and trusted electronic services, while strengthening digital awareness and the competitiveness of the ICT sector.

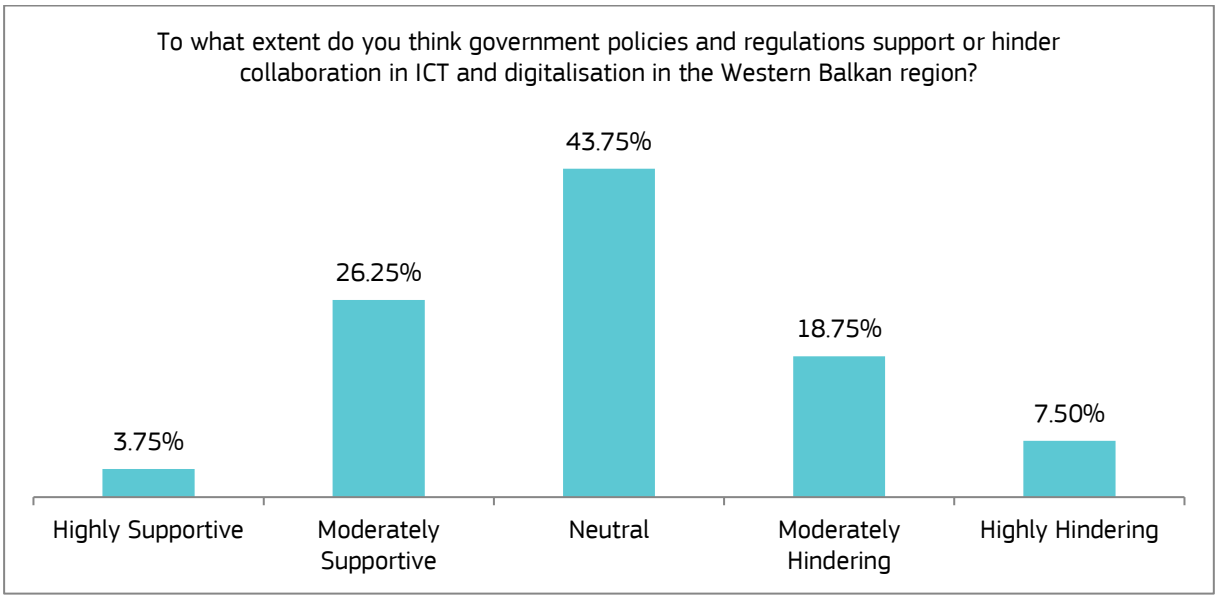
In North Macedonia, the National SME Strategy (2018-2023) recognised ICT as a tool for SME growth, with a focus on supporting green SMEs. The strategy includes reforms, incentives, and support for SMEs in the ICT and green economy sectors, promoting their competitiveness and sustainable practices. Additionally, the Education Strategy for 2018-2025 prioritizes digital literacy and ICT integration in education, aiming to use technology in the learning process and establish electronic teaching platforms.

In Serbia, various strategic documents underline the important role of ICT, digitalisation and green transformation. The Scientific and Technological Development Strategy (2021-2025) prioritizes ICT and artificial intelligence (AI) for research and innovation, while the Smart Specialisation Strategy (2020-2027) identifies ICT as a priority area and a crucial area for economic growth, with a focus on software development. The Industrial Policy Strategy (2021-2030) emphasizes ICT's role in industrial development, while the Startup Ecosystem Development Strategy (2021-2025) highlights ICT's significance in high-tech innovation. Furthermore, the Strategy for the Development of Artificial Intelligence (2020-2025) recognizes AI's potential for economic growth, digitalisation, and education. The Digital Skills Development Strategy (2020-2024) targets digital competency enhancement, while Strategy of Development of the Information Society and Information Security (2021-2026) prioritizes digital infrastructure development. The Education Development Strategy (2021-2030) integrates digital education objectives, while the Economic Reform Programme (2023-2025) stresses green transition and digital transformation, with a focus on circular economy implementation and ICT infrastructure development. These strategies collectively propel Serbia's digital and green transformation agenda.

Despite clearly defined strategic goals, the Western Balkans face the challenge of translating these goals into tangible results. Inadequate monitoring and evaluation practices contribute to inefficiencies and create a gap between objectives and results. This observation, which emerges from expert interviews, emphasises the frequent distrust of the business community towards government.

The need for investment in administrative capacity is emphasised by survey respondents and reflects the prevailing atmosphere that requires a strengthening of trust and collaboration. Only 30% of respondents expressed confidence in supportive government policies (Figure 2). Interestingly, over 43% of respondents remain neutral on this question. This assessment was also confirmed by interviewees who claimed that private ICT companies focus on their tasks regardless of public policy. Furthermore, they emphasised that it is crucial for the government to recognise its dependence on the IT sector rather than expecting the IT sector to prioritise the government's interests. The role of the government is to create an environment that motivates the IT sector to participate in the region's digitalisation and green transformation.

**Figure 2.** The ICT community's general opinion of the government's policies




*Source: authors based on survey results*

## 3.2 The role of ICT in priority setting for Western Balkans' Smart Specialisation Strategies

This section examines the role of ICTs in the formulation of S3 in the Western Balkans. The investigation begins with a focus on the mapping analyses conducted in the Western Balkan economies during the S3 design phase, which served as the basis for our investigation.

In the context of S3 development, ICT has emerged as a shared priority across the Western Balkan economies. While some economies have adopted S3 strategies in which ICT occupy a central place, others are actively developing their strategies, with ICT playing a prominent role.

The mapping exercise in Albania, aimed to identify priority areas for the Smart Specialisation Strategy highlighted the significance of the ICT sector. Quantitative analysis pinpointed key subsectors, including radio broadcasting, television programming, wired telecommunications, and satellite telecommunications, showcasing their current and potential economic and innovation importance. Qualitative analysis further emphasized the role of the ICT industry in digitalizing public administration and e-services, driven by strengths like robust distribution networks, economies of scale, and cost efficiency. Moreover, the qualitative assessment revealed possible opportunities in digital transition, leveraging technologies like AI, internet of things (IoT), data analytics, and robotics, as well as ecological transition, focusing on sustainable business models and renewable energy sources aligned with international standards of sustainability (Fabbri et al., 2022).

In the S3 mapping exercise of Bosnia y Herzegovina, ICT is being investigated as a sector with potential for growth. The sector has harnessed changes in technological investment, infrastructure development, and strategic planning as an opportunity for growth. The ICT industry has been growing rapidly, with a focus on software development, ICT products and services, and from the analyses currently being finalised the sector is primarily focussed in coding and product design. ICT sector presents diverse typologies of firms, each with unique characteristics and a certain innovation

potential. These firms fall into three broad categories: those focused solely on coding, those tailoring solutions to clients' specifications, and those developing their ICT products or services.

ICT in BIH has the potential to act as driver for cross-sectorial collaboration. This sector is positioned to influence and support innovation, digitalization and digital transformation of various industries, providing smart manufacturing solutions, integrating IoT and data analytics to optimize production processes, reduce downtime, and enhance quality control. Collaboration can also focus on supply chain management, using digital platforms for tracking and managing inventory, production, and distribution and the adoption of Industry 4.0 technologies, as well as of digital marketing solutions.

According to the Quantitative mapping for Smart Specialisation in Kosovo, the ICT sector shows emerging economic potential. Specifically, industries such as software publishing, wired telecommunications activities, and other telecommunications activities stand out, demonstrating relatively high performance on multiple selection criteria. Furthermore, the report mentions that the ICT sector plays a significant role in economic transformation and growth. It highlights the importance of industries like: manufacture of consumer electronics and wireless telecommunications activities as emerging activities within the ICT sector. These findings suggest that the ICT sector in Kosovo has the potential to drive economic development and should be considered a priority area for investment and development initiatives.

Quantitative and qualitative analysis of economic, innovation and scientific potential carried out in Montenegro for the first round of S3 assessed the ICT sector as developing and competitive at the regional level, with a focus on the advancement of information technology in various sectors such as public administration, education, industry, agriculture, and health. The report highlights some deficiencies within the ICT sector, including the dominance of the communication subsector in terms of revenue and the lack of domestic companies in this subsector. The IT sector is mainly composed of micro and small enterprises. However, software engineering is identified as a sector that is reaching global markets. Regarding digitalisation, the report emphasizes the main strategic direction of the ICT sector in Montenegro, which is aimed at the development and promotion of the digital economy. The goal is to stimulate knowledge-based entrepreneurship and enable greater access to global markets. The development of human resources is also considered crucial for creating a globally competitive ICT system and implementing smart solutions in various sectors. As for the green transformation, the report does not explicitly mention it in relation to the ICT sector. However, it highlights the synergistic effects of ICT in various sectors, including energy, agriculture (BIO-ICT), medicine (e-health services), education (e-education), industry (Industry 4.0), tourism, and culture (e-tourism, creative industries). These synergistic effects suggest that ICT can also contribute to the green transformation in Montenegro by enabling optimization, smart networks, and sustainable technologies in different sectors.

In North Macedonia, ICT is identified as a top priority within the Smart Specialisation process. A quantitative analysis, conducted in 2019, highlighted key ICT industry groups, including publishing, sound recording, radio broadcasting, wireless and other telecommunications, and information technology services. Notably, the past decade witnessed significant growth in the ICT sector, with a concentration of companies in software and IT services, primarily following the outsourcing model. However, qualitative analysis reinforced the belief that the future lies in advancing custom software development and collaborating with ICT support organizations. Custom software development was recognized as holding substantial development potential, along with emerging trends like Big Data, Business Analytics, IoT, and Cloud Computing, categorized under "advanced ICT services". Moreover, ICT is acknowledged not only as a vertical priority but also as a critical horizontal area, offering

extensive opportunities for digital transformation across industries and society (Radovanovic et al., 2022).

The S3 mapping report for Serbia, published in 2017, has also identified ICT as a potential priority domain of Smart Specialisation. The mapping methodology included determining the comparative advantages of the regions of Serbia in relation to the national level using the following indicators: economic potential (employment, exports); innovation potential (innovative companies, patents) and scientific potential (published papers on the ISI list). Based on extensive exploration of economic, scientific and innovation potential at the subnational level, the following ICT industry groups have emerged as priority domains: Computer programming, consultancy and related activities in Belgrade region and the fields of Computer science and Telecommunications are described as "potentially emerging innovative" in Vojvodina region (Radovanovic et al., 2021). The relevance of the ICT sector was confirmed in additional quantitative analysis conducted on a national level.

**Table 2.** ICT fields and focus areas from the analyses of economic, research and innovation potential in the context of S3 development in the Western Balkans

| *WB economy* | **Economic Subsectors** | **Potential emerging opportunities** |
|---|---|---|
| ***Albania*** | • radio broadcasting<br>• television programming<br>• wired telecommunications<br>• satellite telecommunications | • digitalizing public administration and e-services<br>• AI, IoT, data analytics, and robotics<br>• Green transition focusing on sustainable business models and renewable energy sources |
| ***Bosnia y Herzegovina*** | • Coding and product design | • Business services<br>• Custom software development<br>• Collaboration with ICT support organizations |
| ***Kosovo*** | • Software publishing<br>• Wired telecommunications activities<br>• Other telecommunications activities | • Digitalisation |
| ***Montenegro*** | • Television programming and broadcasting activities<br>• Wired telecommunication activities<br>• Other telecommunication activities<br>• Computer programming, consultancy and related activities | • Business services<br>• Creative Industries |
| ***North Macedonia*** | • publishing,<br>• sound recording,<br>• radio broadcasting,<br>• wireless and other telecommunications, information technology services. | • custom software development<br>• collaboration with ICT support organizations<br>• emerging trends: Big Data, Business Analytics, IoT, and Cloud Computing, categorized under "advanced ICT services" |

| | | |
|---|---|---|
| | | • ICT as acritical horizontal area, offering extensive opportunities for digital transformation across industries and society |
| ***Serbia*** | • Computer programming, consultancy and related activities | • Custom software development<br>• Own solutions development<br>• Blockchain<br>• Artificial Intelligence |

*Source: authors based on S3 mapping analyses*

## 3.3 Regional strategies and priorities

In parallel to the national strategic framework, several regional strategies and priorities focus on the ICT sector. The EU Strategy for the Western Balkans, adopted in 2018, outlines the priorities and domains of enhanced collaborative efforts, tackling the distinct challenges that the Western Balkans encounter, with a focus on the imperative for essential reforms and fostering positive relations with neighbouring countries. One of the flagship initiatives of this strategy is the Digital Agenda, in which the WB partners commit to the following actions: Investing in broadband connectivity, increasing cybersecurity, trust and digitalisation of industry, strengthening the digital economy and society, and supporting research and development (European Commission, 2018).

The Green Agenda for the Western Balkans, approved in 2020, encompasses five pillars: climate, energy, and mobility; circular economy; biodiversity; depollution; and sustainable agriculture and food production. Digitalisation will be a key enabler for the above five pillars, aligning with the concept of a dual transition that integrates both green and digital elements (European Commission, 2020). The Western Balkans Agenda on Innovation, Research, Education, Culture, Youth & Sport, places particular emphasis on aiding digital transformation and advocating for the integration of the EU Green Deal in the region (European Commission 2021).

# 4 Exploring ICT's role in Western Balkans' economic, innovation, and research potential

## 4.1 Economic potential

From the expansion of internet connectivity to the growing startup ecosystems and e-government initiatives, the Western Balkans is experiencing a profound shift in its ICT landscape. As the global economy becomes increasingly digital, the Western Balkan economies are actively working to position themselves within this ecosystem and seize the opportunities offered by the digital sector.

In a recent study on value chains in the Western Balkans, the ICT sector was identified as one of the most relevant, based on criteria such as regional potential, current initiatives at the economic level, social/environmental aspects and prospects for EU integration. The ICT sector is considered an industry with a strong business community in the region, important links to global players and significant potential for increasing employment and competitiveness (Matusiak et al., 2022). According to this report, the ICT industry's share of value added shows an increasing trend in all economies of the WB.

### 4.1.1 ICT exports

Data from the World Bank database show that ICT sector in commercial service exports is growing making the sector a significant driver of economic development in the region (Table 3). However, the region exhibits varying levels of participation of the ICT sector in the service exports (Table 4). Whiles some economies experienced significant growth, which may be linked to global trends in digitization and the demand for online services, others still have not fully utilized their potential. This points to a need for a more sustained investment in the ICT sector to ensure long-term economic sustainability. In addition, it shows a need for further education and skills development to sustain current and enhance future region's competitiveness.

The data shows the resilience of the region's ICT sectors and their ability to adapt to global challenges. This characteristic stands out as the region's most important advantage, as it was emphasised several times in the interviews with regional stakeholders that the region's ability to adapt and be resilient is one of its fundamental competitive advantages.

**Table 3.** Computer, communications, and other services (% of commercial service exports)

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***ALB*** | 26.42 | 22.44 | 22.27 | 23.85 | 27.04 | 30.51 | 29.85 | 30.00 | 45.02 | 33.74 | 28.95 |
| ***BIH*** | 41.53 | 36.77 | 37.02 | 34.20 | 33.32 | 31.79 | 30.48 | 29.56 | 43.04 | 34.47 | 28.07 |
| ***XKX*** | 18.93 | 15.27 | 20.03 | 15.82 | 12.59 | 11.47 | 13.61 | 13.38 | 23.85 | 15.58 | 18.60 |
| ***MNE*** | 14.57 | 15.37 | 16.14 | 15.00 | 14.24 | 13.83 | 15.31 | 14.17 | 37.24 | 23.12 | 20.31 |
| ***MKD*** | 58.52 | 58.33 | 58.64 | 59.14 | 58.34 | 55.13 | 54.28 | 52.65 | 60.14 | 56.43 | 55.41 |
| ***SRB*** | 51.54 | 51.67 | 52.47 | 52.42 | 53.43 | 53.64 | 57.35 | 59.06 | 64.45 | 61.77 | 58.77 |

*Source: World Bank dataset, https://databank.worldbank.org/source/world-development-indicators#*

While certain economies like Serbia and North Macedonia demonstrated rapid expansion, others have taken a more gradual trajectory of development (such as Bosnia and Herzegovina, Kosovo, and Montenegro). Conversely, in Albania, the significance of the ICT sector in the export of services is diminishing. Bosnia and Herzegovina displayed a slow and stable growth in ICT service exports, with

a significant increase in 2020, possibly driven by the global shift towards digital services during the pandemic. Kosovo's ICT service exports showed a fluctuating pattern, with a noticeable increase in 2020 as in the case of Bosnia and Herzegovina. Additionally, Kosovo experienced growth in 2022, suggesting a focus on ICT infrastructure in recent times. Export of ICT services from Montenegro have made progress, particularly in the last few years, indicating a positive trend in the digital economy. North Macedonia shows consistent trend in ICT service exports, demonstrating economy competitiveness and strength in the ICT industry. Serbia, as the most advanced economy has strong position in the ICT sector with steady organic growth in ICT service exports, with a highest increase over the years (Table 4).

**Table 4.** ICT service exports (% of service exports, balance of payments)

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***ALB*** | 6.42 | 8.02 | 6.60 | 4.98 | 4.75 | 3.04 | 2.23 | 2.84 | 3.24 | 2.78 | 3.26 |
| ***BIH*** | 8.32 | 7.78 | 7.72 | 7.23 | 7.61 | 8.01 | 8.78 | 9.68 | 16.49 | 13.52 | 12.51 |
| ***XKX*** | 7.95 | 6.84 | 8.30 | 5.76 | 4.26 | 3.40 | 3.58 | 4.02 | 7.16 | 5.17 | 8.45 |
| ***MNE*** | 3.55 | 3.62 | 3.49 | 4.90 | 4.35 | 3.87 | 4.43 | 3.31 | 9.04 | 6.43 | 7.97 |
| ***MKD*** | 9.95 | 10.35 | 9.36 | 9.43 | 10.79 | 10.22 | 11.63 | 13.42 | 16.74 | 18.95 | 20.24 |
| ***SRB*** | 12.13 | 12.76 | 12.79 | 14.29 | 16.17 | 17.13 | 18.73 | 20.52 | 23.22 | 23.80 | 24.30 |

*Source: World Bank dataset, https://databank.worldbank.org/source/world-development-indicators#*

### 4.1.2 Employment

Data from the International Labour Organisation (ILO) on employment trends in the Western Balkans indicate a general growth in employment in the ICT sector. There is a clear indication that the ICT sector in the region is growing and making an increasingly important contribution to the region's labour market. Serbia leads the region in terms of the absolute number of people employed in the ICT sector. Serbia has experienced remarkable employment growth in this sector, which indicates the economy's ability to attract technology-related businesses and investments. In recent years, unlike other industries, there have been upward trends in employment as the sector has managed to position itself, increase flexibility, adaptability and output. The notable increase in both employment and the number of unemployed in Serbia in 2022 can be attributed to the conflict in Ukraine, which led to an increased influx of IT professionals from Russia to Serbia (Table 5).

**Table 5.** Employment in Information and communication sector (thousands)

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***ALB*** | n/a | n/a | 13.26 | 8.24 | 14.86 | 10.82 | 12.54 | 13.68 | n/a | n/a | n/a |
| ***BIH*** | 12.96 | 16.14 | 15.12 | 12.13 | 15.88 | 13.52 | 13.59 | 16.85 | 19.17 | 23.02 | 30.53 |
| ***XKX*** | 7.17 | 9.96 | 9.57 | 9.64 | 7.32 | 9.49 | 11.95 | 13.98 | 13.75 | 12.42 | n/a |
| ***MNE*** | 11.23 | 11.04 | 13.88 | 14.48 | 13.60 | 13.59 | 13.00 | 15.35 | 18.48 | 20.66 | 21.19 |
| ***MKD*** | 4.95 | 4.97 | 5.11 | 5.01 | 4.55 | 5.39 | 4.95 | 5.33 | 5.45 | 5.49 | n/a |
| ***SRB*** | 33.64 | 47.70 | 60.68 | 59.82 | 61.68 | 66.43 | 72.55 | 78.42 | 90.52 | 50.72 | 105.54 |

*Source: ILO dataset, https://www.ilo.org/shinyapps/bulkexplorer4/?lang=en&id=EMP_TEMP_SEX_AGE_ECO_NB_A*

The data on unemployment among previously employed individuals in the ICT sector also provides insights into regional labour market dynamics. The data suggests that the level of unemployment is almost non-existent and that the local companies are absorbing all labour potential (Table 6).

**Table 6.** Unemployment of previously employed persons by former economic activity (thousands)

| | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ***ALB*** | n/a | n/a | 0.803 | 1.388 | 0.66 | 0.543 | 1.619 | 0.796 | n/a | n/a | n/a |
| ***BIH*** | 1.152 | 1.31 | 0.888 | 1.969 | 1.531 | 0.762 | n/a | 1.14 | 0.922 | 1.153 | 0.87 |
| ***XKX*** | 0.47 | 0.28 | 0.537 | 0.123 | 0.193 | 0.359 | n/a | 0.187 | n/a | n/a | n/a |
| ***MNE*** | 2.013 | 2.166 | 1.954 | 2.068 | 1.28 | 1.745 | 1.302 | 1.157 | 1.936 | 1.074 | 0.777 |
| ***MKD*** | 0.169 | 0.13 | 0.142 | 0.276 | 0.351 | 0.267 | 0.223 | n/a | 0.336 | n/a | n/a |
| ***SRB*** | 5.822 | 4.652 | 6.356 | 6.19 | 5.817 | 5.747 | 4.841 | 4.746 | 1.603 | 1.52 | 3.683 |

*Source: ILO database, https://www.ilo.org/shinyapps/bulkexplorer4/?lang=en&id=UNE_TUNE_SEX_OCU_NB_A*
*Note: Data relate to sector J. Information and communication: (ISIC-Rev.4))*

During the interviews with relevant stakeholders, the lack of qualified employees was identified as one of the biggest obstacles in the region. As it can be seen from the data presented, the interviews showed that Serbian companies absorb a large part of the ICT workforce in the region.

### 4.1.3 Education

In parallel with the growth of the ICT industry in the Western Balkans, the educational system in this area is also growing and developing. ICT education has increasingly become a part of the national curriculum. Students are introduced to computer science and related subjects at various educational stages. Depending on the economy, primary and secondary schools offer courses in basic computer skills. Some economies have integrated coding and programming into their secondary school curriculum, while other offer vocational schools that focus on ICT-related fields (IT support, network administration, programming). Universities offer a range of ICT-related programs, including computer science, software engineering, information technology, data science and other.

Government initiatives are essential to develop digital innovation culture in the Western Balkans. Such initiatives are closing skills gap in ICT sector, promoting entrepreneurship, and positioning the region as a competitive player in the global ICT market. While individual projects and their effects may differ throughout Western Balkans, taken as a whole, they are advancing the digital transformation of the area. Some of the initiatives include:

— Digital School Initiative in Serbia[2] aimed at modernizing education by introducing technology into the classroom. E-School project[3] focuses on the development of e-learning content for students and teachers.

[2] https://www.dsi.rs/en/, accessed 13 November 2023.

[3] https://eskola.rs, accessed 13 November 2023.

— E-Learning Macedonia[4], an online learning platform that offers digital content and courses for students and teachers. STEM education programs are promoted, including coding and robotics in schools.

— Kosovo Basic Education Program[5] aimed to improve the quality of basic education in Kosovo, including the integration of technology in classrooms.

— Bosnia and Herzegovina Framework Education Program that includes the development of a national curriculum and standards for education to ensure that ICT and digital skills are integrated into the educational framework.[6]

The data shows that the interest of university students from the Western Balkans in ICT education is growing and the region is keen to capitalise on the opportunities offered by the ICT industry. While the available data shows that the number of ICT students in Albania and North Macedonia is only slowly increasing, the proportion of graduates from ICT degree programmes in Bosnia and Herzegovina and Serbia has risen significantly. No data is available for Montenegro and Kosovo.

**Table 7.** Percentage of graduates from tertiary education graduating ICT programmes

| | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 |
|---|---|---|---|---|---|---|
| ***ALB*** | 6.01 | 6.76 | 5.35 | 5.43 | 5.60 | 6.08 |
| ***BIH*** | 3.67 | 4.11 | 4.88 | 4.63 | 5.06 | 6.29 |
| ***MNE*** | n/a | n/a | 4.54 | n/a | n/a | n/a |
| ***XKX*** | n/a | n/a | n/a | n/a | n/a | n/a |
| ***MKD*** | 6.56 | 6.32 | n/a | 5.88 | 6.42 | n/a |
| ***SRB*** | 5.39 | 5.65 | 6.22 | 7.44 | 7.67 | 7.18 |

*Source: UNESCO Institute for Statistics (2023), Science Technology and Innovation Database, http://data.uis.unesco.org*

Despite progress, the Western Balkans face challenges in their education systems. These challenges include outdated curricula, limited resources, and the need for teacher training. However, the biggest problem that the economies might face in the future is the declining quality of education in ICT. According to interviewees, the critical problem of declining education quality and its consequences for the labour market is the migration of university employees to companies as a result of much higher salaries in commercial enterprises. The resulting lower educational standards could pose challenges for companies in the region, as new employees will have a much lower level of knowledge.

## 4.2 Research and innovation potential

In most Western Balkan economies, the majority of researchers come from the higher education sector, followed by state-funded research institutes (Figure 3). About 10% of researchers are

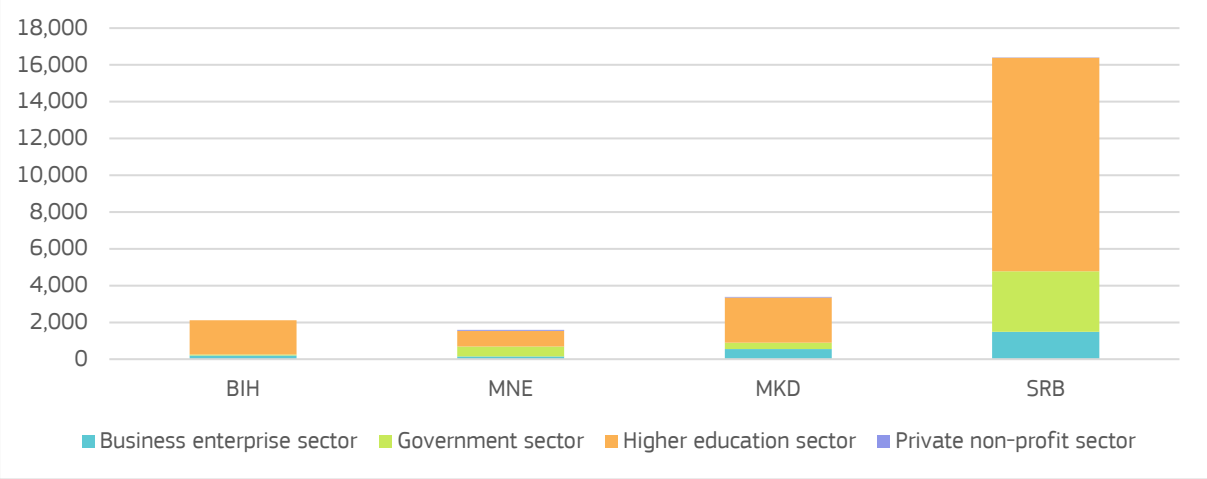
[4] https://www.eduino.gov.mk/nastava/zanimalna/, accessed 13 November 2023.

[5] http://www.kec-ks.org/projects/basic-education-programme-bep-2/?lang=en, accessed 13 November 2023.

[6] Priorities in Integrating Entrepreneurial and Digital Competence into Education Systems in Bosnia and Herzegovina 2019–2030, available at: http://www.mcp.gov.ba/attachments/sr_Мигрирани_документи/Сектори/Образовање/Образовање-стратешки/Prioriteti_u_integraciji_poduzetnicke_kompetencije_FINAL_srpski_jezik.pdf#, accessed 13 November 2023.

employed in the business and private non-profit sectors, which indicates that cooperation between the private sector and academic institutions is present but weak. With these figures, the Western Balkans region lags far behind the EU27 average, which records 48% of researchers in the business enterprise sector.

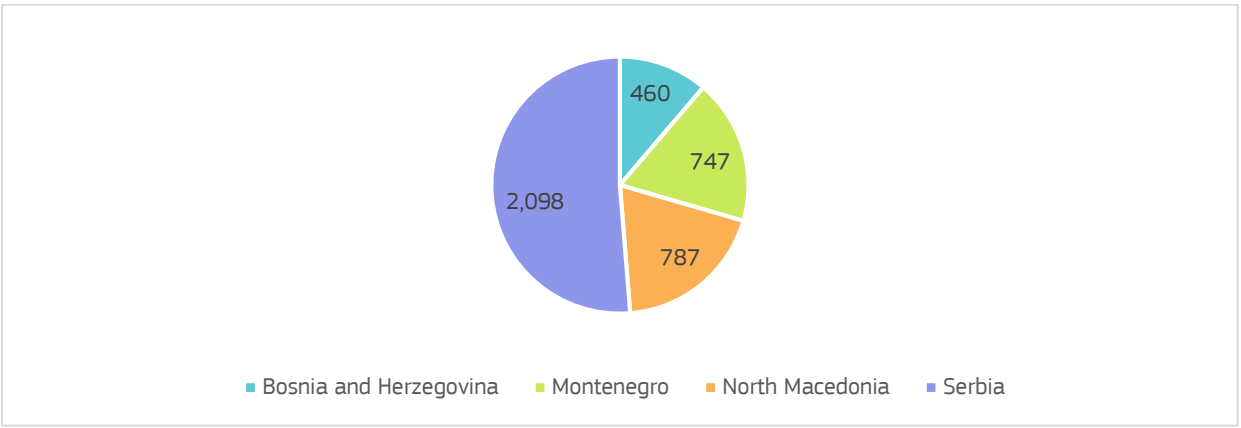
**Figure 3.** Number of researchers by sector of performance, 2019




*Source: Eurostat, dataset,*
*https://ec.europa.eu/eurostat/databrowser/view/rd_p_persage__custom_8189549/default/table?lang=en*
*Note: The data shown relates to 2019, as more recent data is not available for some economies. For the economies for which more recent data is available, it does not differ by more than 5% from the 2019 data, so the authors have chosen to present the data for 2019.*

With around 2,098 researchers per million inhabitants, Serbia has the highest density of researchers (Figure 4).

**Figure 4.** Researchers per million inhabitants (2019)

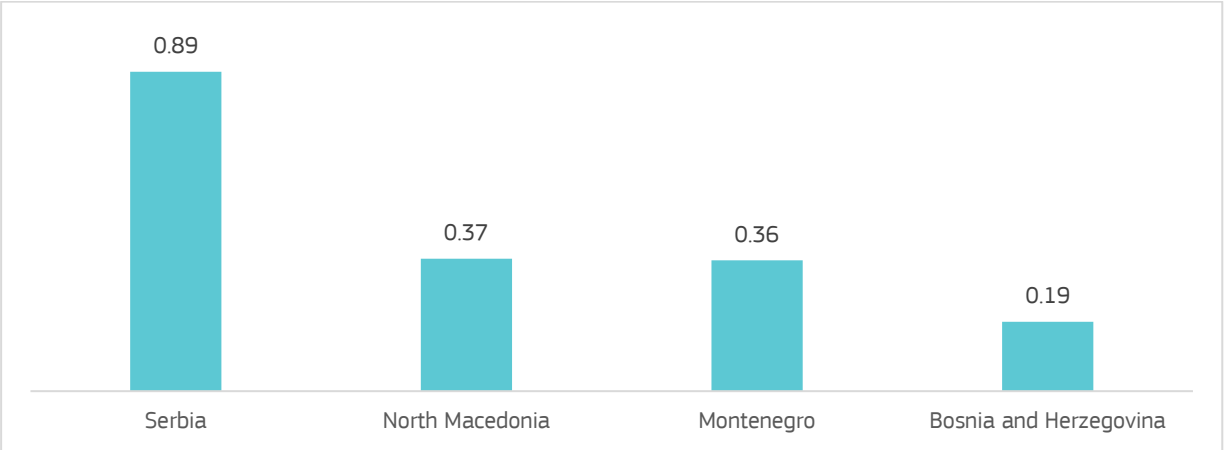



*Source: UNESCO Institute for Statistics (2020), Science Technology and Innovation Database, http://data.uis.unesco.org*
*Note: The data shown relates to 2019, as more recent data is not available for some economies. For the economies for which more recent data is available, it does not differ by more than 5% from the 2019 data, so the authors have chosen to present the data for 2019.*

Another area of weaker performance was the region's limited spending on research and development (R&D). Serbia, the economy that invests the most in R&D and whose investments amounted to 0.9

per cent of GDP in 2019, has a share of around 43% of the EU share, which was 2.2 per cent of GDP in 2019. The other economies of the Western Balkans invest only very modestly in R&D (Figure 5).

**Figure 5.** GERD as a percentage of GDP (percentage, 2019)



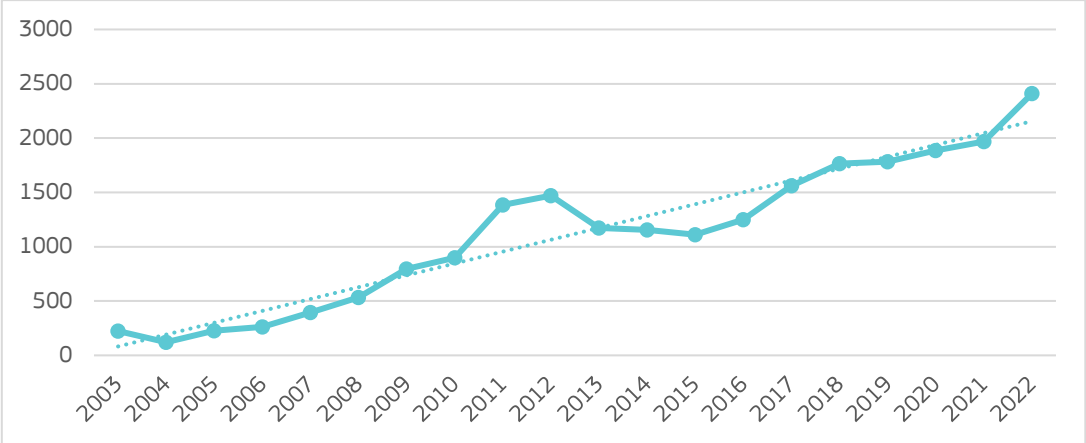

*Source: UNESCO Institute for Statistics (2020), Science Technology and Innovation Database, http://data.uis.unesco.org*

*Note: The data shown relates to 2019, as more recent data is not available for some economies. For the economies for which more recent data is available, it does not differ by more than 5% from the 2019 data, so the authors have chosen to present the data for 2019.*

### 4.2.1 Scientific productivity

The Western Balkan region has demonstrated significant publication productivity over the last two decades, as evidenced by the data extracted from the Scopus database (2003-2022). A total of 22,372 papers within the subject area "Computer Science" have been published by authors from this region during this period. Serbia stands out as the leading contributor with 14,973 published papers, showcasing a robust research output. Bosnia and Herzegovina, North Macedonia, Montenegro, and Albania have also made notable contributions, with 3,516, 2,561, 1,252, and 1,009 published papers, respectively. Data for Kosovo are not available. Furthermore, analysis of the publication trend (Figure 6) reveals a consistent rise in the number of papers published, indicating a linear upward trajectory. These data underscore the active engagement of the Western Balkans' academic and research community, highlighting their increasing contributions to the global scholarly landscape.

**Figure 6**. Number of published papers by authors coming from Western Balkans in the subject area "Computer Science".




*Source: author's calculation based on Scopus (data extracted 2 September 2023)*

The international collaboration network of Western Balkan economies in the computer science area spans across more than 130 countries globally. In the context of co-publishing with international partners, Serbia stands out with robust ties to leading nations. Notably, Serbia has established significant research collaborations with the United States, boasting 788 co-papers. Strong affiliations are evident with the United Kingdom (616 co-publications), Germany (607 co-publications), and Italy (513 co-publications).

In Bosnia and Herzegovina, research collaborations have been prominent with neighbouring Serbia, with 489 joint publications, Croatia (296 co-publications), and Slovenia (97 co-publications).

In North Macedonia, research partnerships have been wide-ranging, involving both regional and international collaborations. Particularly noteworthy are the joint publications with Serbia, which total 160, and the significant cooperation with Slovenia (129 co-publications), the United Kingdom (119 co-publications) and the United States (116 co-publications).

Montenegro focuses on partnerships with Serbia, which have resulted in 131 joint publications. In addition, Montenegro has actively participated in global research networks, in particular with the United States (76 joint publications) and France (62 joint publications).

In Albania, research collaborations have shown strong links with Japan, reflected in 240 joint publications. In addition, Albanian researchers have actively participated in research networks with Spain (102 joint publications) and Italy (89 joint publications).

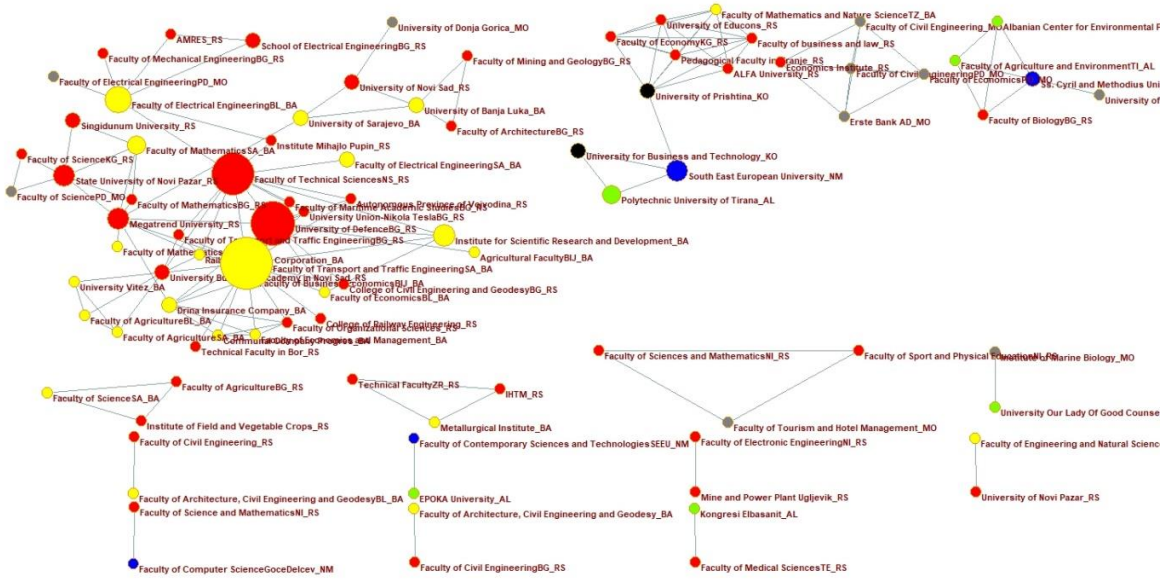
Analysing networks of collaboration between research institutions reveals characteristics of academic communities that help to understand the specificities of scientific collaboration and to identify the notable research institutions in the Western Balkans. Figure 7 shows a co-publication network of Western Balkan research institutions in the field of computer science. The publication data is taken from the Scopus dataset for the period 2015-2022. The 1,000 most frequently cited publications were selected, representing about 7.2% of the total publications in this field.

In this network, the set of nodes consists of the authors' institutions and a link between two institutions exists if they have co-authored one or more papers. The size of the node indicates the number of published papers from that institution. Lines connecting nodes show the number of papers

written in co- authorship between authors from different institutions. The thickness of the line determines the intensity of cooperation between the institutions.

The most influential knowledge providers in the Western Balkans in the field of computer science are the Faculty of Transport and Traffic Engineering, University of East Sarajevo (Bosnia and Herzegovina), Faculty of Technical Sciences, University of Novi Sad (Serbia) and University of Defence (Serbia). As shown in Figure 7, scientific cooperation in the region is mainly based on strong institutional links between Serbia and Bosnia and Herzegovina. Institutional cooperation on scientific projects between other economies in the Western Balkans is scarce.

**Figure 7.** Co-publication Network of Western Balkan Institutions in the Area of Computer Science - Based on Scopus




*Source: Author's visualisation based on data retrieved from Scopus*

*Legend: red node - Serbia, yellow node - Bosnia and Herzegovina, blue node - North Macedonia, green node - Albania, grey node - Montenegro, black node - Kosovo.*

Based on an analysis of the most frequently used keywords in the influential scientific papers published by authors from the Western Balkans, the most prevalent themes include machine learning, internet of things, artificial intelligence, learning systems and optimisation.

### 4.2.2 Participation in ICT-related projects within the EU Framework Programmes

The inclusion of the Western Balkans in the EU Framework Programmes has proved crucial for systematic change in the region. It has enabled Western Balkans to align their national strategies and policies with EU priorities and focus on creating a green, digitalised and socially cohesive Europe. It is particularly noteworthy that the Western Balkans have made steady progress in their participation in Horizon 2020, with success rates reaching or even exceeding the EU average. It is also worth noting that the initial results in the first two years of Horizon Europe have significantly exceeded the achievements of its predecessor, indicating a solid path of progress.

According to the CORDIS database[7], Western Balkan economies have made progress in ICT-related projects and shown strong participation in various initiatives. Serbia has been particularly active, achieving 599 participations, of which 211, or 35%, were ICT-related. Similarly, North Macedonia has achieved 122 participations, with 42 of these dedicated to ICT, constituting 34% of their engagements. Albania, with 52 total participations, has been actively involved in 15 ICT-related, amounting to 29% of their engagements. Montenegro, with 65 participations, has directed its efforts toward 22 ICT-related participations, comprising 34% of their overall involvement. Kosovo and Bosnia and Herzegovina have placed relatively low emphasis on ICT-related projects compared to other Western Balkan economies. Kosovo has actively contributed to 6 ICT-related participations with 22 participations, representing 27% of their engagement. Bosnia and Herzegovina, despite a total of 118 participations in various projects, has focused on a limited number of ICT-related initiatives. Only 10 participations, representing 8% of the total engagement, were ICT-related. This indicates a relatively low emphasis on ICT-related efforts compared to other sectors.

When it comes to identifying key research and innovation players in ICT, Serbian institutions are leading the way, while other Western Balkan economies are making steady progress (Table 8). The Biosense Institute, Nissatech and the Institute Mihajlo Pupin are the frontrunners, each involved in 13 projects. On the other hand, institutions from other Western Balkan economies are at different stages of cooperation. The North Macedonian Ss. Cyril and Methodius University in Skopje has shown a remarkable commitment and is involved in 11 ICT-related projects. Montenegrin institutions such as the University of Montenegro and the Maritime Safety and Port Management Administration are actively involved, albeit with slightly less intensity, in 7 and 5 projects respectively. In Albania, the Albanian Academic Network is involved in 6 ICT-related projects, reflecting the growing interest in e-infrastructure projects.

**Table 8**. Organizations from the Western Balkans with most active participation in H2020 ICT-related projects

| ***Institution*** | **WB Economy** | **Number of implemented H2020 ICT-related projects** |
|---|---|---|
| ***Biosense Institute*** | Serbia | 13 |
| ***Nissatech*** | Serbia | 13 |
| ***Institute Mihajlo Pupin*** | Serbia | 13 |
| ***Ss. Cyril and Methodius University in Skopje*** | North Macedonia | 11 |
| ***Inosens Novi Sad*** | Serbia | 10 |
| ***University of Belgrade*** | Serbia | 9 |
| ***Faculty of Technical Sciences in Novi Sad*** | Serbia | 7 |
| ***Faculty of Transport and Traffic Engineering*** | Serbia | 7 |
| ***University of Montenegro*** | Montenegro | 7 |
| ***Dunavnet*** | Serbia | 7 |
| ***Albanian Academic Network*** | Albania | 6 |
| ***Belit*** | Serbia | 6 |
| ***Faculty of Sciences in Novi Sad*** | Serbia | 6 |

[7] Community Research and Development Information Service (CORDIS) is the European Commission's primary source of results from the projects funded by the EU's framework programmes for research and innovation, from FP1 to Horizon Europe.

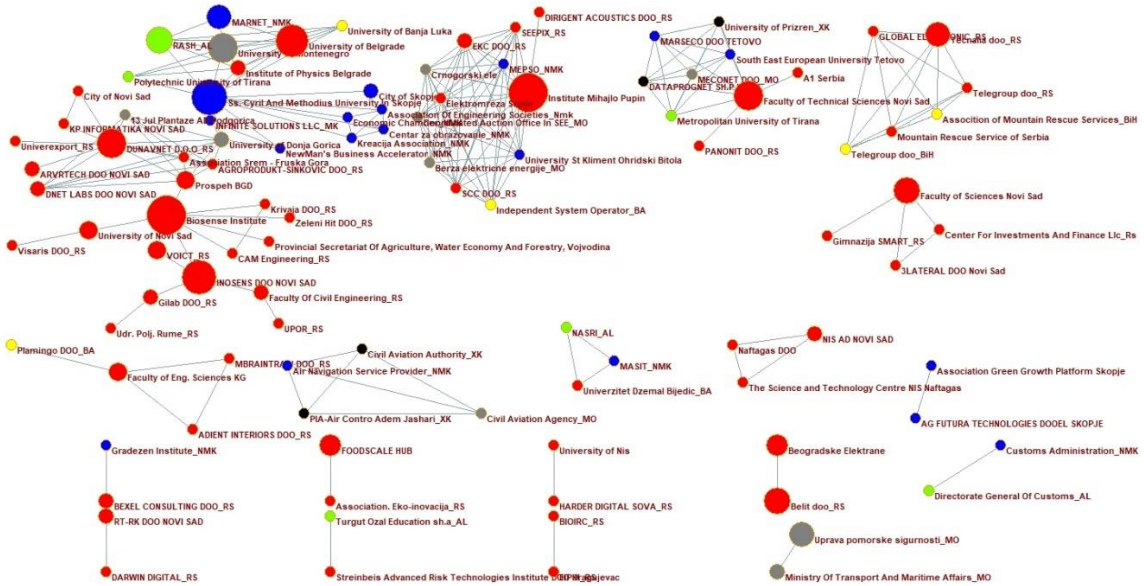
| | | |
|---|---|---|
| ***Administration for Maritime Safety and Port Management Montenegro*** | Montenegro | 5 |
| ***Macedonian Academic Research Network*** | North Macedonia | 5 |
| ***Tecnalia*** | Serbia | 5 |
| ***Belgrade Power Plants*** | Serbia | 4 |
| ***Tajfun Hil*** | Serbia | 4 |
| ***Foodscale Hub*** | Serbia | 4 |
| ***Vojvodina ICT Cluster*** | Serbia | 3 |
| ***Vizlore labs*** | Serbia | 3 |
| ***Prospeh BGD*** | Serbia | 3 |
| ***University of Novi Sad*** | Serbia | 3 |
| ***Faculty of Engineering Sciences in Kragujevac*** | Serbia | 3 |

*Source: Author's calculation based on CORDIS database (data extracted 4 September 2023)*

Figure 8 shows a collaboration network of ICT-related Horizon 2020 projects carried out by institutions from the Western Balkans. As was to be expected, institutions from Serbia dominate this cooperation network in terms of the participation of institutions in the network, but also the number of projects implemented by individual institutions, as can be seen from the size of the nodes. Several cooperation networks are identified in the cooperation network, which indicates a decentralised network structure.

The Faculty of Technical Sciences in Novi Sad, the University of Belgrade, the Institute Mihajlo Pupin and the Ss. Cyril and Methodius University in Skopje have the greatest significance for regional ICT-related projects network cooperation. Their connections to other actors and their influence on the creation of the cooperation network are the greatest.

**Figure 8.** Western Balkans Horizon 2020 Collaboration Network of ICT-related Projects




*Source: authors visualisation based on data retrieved from Scopus*

*Legend: red node - Serbia, yellow node - Bosnia and Herzegovina, blue node - North Macedonia, green node - Albania, grey node - Montenegro, black node - Kosovo.*

### 4.2.3 E-Infrastructures in the Western Balkans

E-infrastructure refers to a combination of various IT resources, tools and services such as computer networks, systems and scientific databases. It offers a completely new concept for collaborative research and the use of different resources, regardless of the point of access, with the intention of creating a global virtual research community to serve the socio-economic progress of Europe. The development of e-infrastructure has reached a level that was unimaginable 15 years ago. National research and education networks have been interconnected with 10 Gbit/s optical links, – creating the pan-European GEANT network (consisting of more than 10,000 research and education institutions and 50 million users).

Over the course of 15 years, several key initiatives have played an important role in facilitating high-quality research. These initiatives have been critical in South-Eastern Europe, including the Western Balkan economies, providing key e-infrastructure resources, application support and training. They played a crucial role in reducing the digital divide in Europe by ensuring that the Western Balkan economies had access to regional e-infrastructures. These efforts were aimed to create an environment that would enable the Western Balkans to participate on an equal footing in advances in European network and grid computing technology. According to the Western Balkans Research and Innovation Infrastructure Roadmap (2022), this was achieved through the provision of e-infrastructure resources, application support and training. The successful realisation of this objective depended heavily on the close cooperation between national research and education networks and business-level Grid initiatives in the Western Balkans. In terms of participation in Horizon 2020 projects under the e-Infrastructures thematic priority, Serbia and North Macedonia participated in 9 and 8 projects respectively, while Montenegro and Albania participated in 6 projects each. It is noteworthy that Serbia received the highest contribution from the European Commission with € 2.7 million, followed by North Macedonia with €1.2 million.

Regional infrastructures created under the above-mentioned initiatives have supported the regional IT sector and significantly improved research in a number of scientific fields, contributing to the technological development of the region. The region's researchers have had the opportunity to collaborate with partners from all over Europe and the world.

The adoption of high-performance computing (HPC) in the Western Balkans is lagging behind the EU. HPC infrastructure is essential for the ICT sector as it drives research, development and the delivery of advanced technologies and services. It accelerates innovation, improves performance and enables the ICT industry to meet the growing demands of a digitally connected world. However, there are differences between the economies of WB in terms of development and awareness of HPC technologies. According to the Western Balkans Research and Innovation Infrastructure Roadmap (2022), the current status of HPC in the region WB is as follows:

- Serbia and North Macedonia have established HPC infrastructures and renowned research institutions involved in European HPC projects. In Serbia, the Institute of Physics leads HPC development for the entire region WB. In North Macedonia, the Faculty of Computer Science and Engineering at the University of Ss. Cyril and Methodius is part of the EuroCC project, which aims to create national centres of excellence (NCCs) for HPC across Europe.
- In Bosnia and Herzegovina, there are no HPC centres and awareness of HPC technologies in the business community is limited.

— Albania lacks HPC centres and infrastructure for local researchers and innovators working on Big Data analytics. However, there are plans to implement a regional HPC infrastructure project in Albania.

— Montenegro currently has no HPC infrastructure, but the University of Donja Gorica is establishing a National Centre of Excellence (NCC) for HPC as part of the EuroCC project.

— Kosovo has limited resources for HPC infrastructure development.

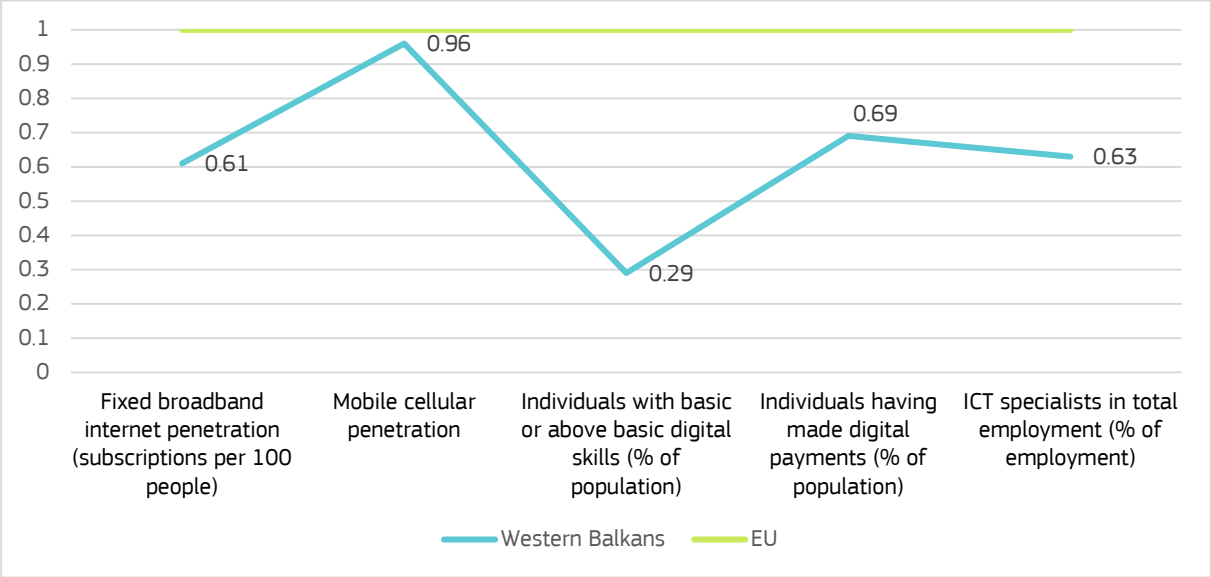
Even if not all the Western Balkan economies are part of the European High-Performance Computing Joint Undertaking (EuroHPC JU), there is potential for collaboration and resource sharing with EuroHPC to deploy state-of-the-art exascale supercomputers. Regardless of the current stage of development, the Western Balkans Research and Innovation Infrastructure Roadmap (2022) emphasises that more efforts are needed to promote HPC, familiarise decision-makers with the importance of HPC and increase the use of HPC services by industry. In addition, significant efforts need to be made to create a high-speed grid infrastructure communication network.

## 4.3 Digitalisation in the Western Balkans

According to the OECD report (OECD, 2023), performance in the Western Balkans digitalisation cluster has been largely positive, as the region has slowly started to converge with EU and OECD levels. The only exception to the otherwise positive development is the very low share of people with basic or higher digital skills. This confirms the previous findings, in particular the need for increased policy attention to address skills gaps. As for the green cluster, the same report shows that the regional performance of the Western Balkan economies shows a relative deterioration over time in the green transition compared to the EU and the OECD. Results in waste generation and renewable energy have deteriorated, while areas such as CO2 emissions and energy productivity show signs of stagnation.

Despite the differences, most Western Balkan economies show strong performance in mobile penetration, consistently reaching around 96% of the EU level and steadily narrowing the gap (Figure 9). In addition, the region has seen a significant increase in fixed broadband internet penetration, which more than quadrupled between 2008 and 2021, but still lags far behind the EU average. The share of ICT professionals in total employment has increased slightly, but with performance at 63% relative to the EU average. The lowest performance can be observed in digital skills, where there is a significant gap. While around 27% of EU citizens have at least basic digital skills, only 8% of people in the Western Balkans have the same skills, which is only 29% of the EU average.

**Figure 9.** Performance of the Western Balkans in digitalisation relative to the EU (2018-2022)




*Source: Authors calculations based on OECD (2023)*

# 5 The perspective of cooperation in the field of ICT in the Western Balkan region

This section presents the results of a survey questionnaire and interviews. The survey, conducted in 2023, engaged 110 stakeholders across six Western Balkan economies, with specific sample details outlined in Section 2.1. At the same time, ten in-depth interviews were conducted with relevant stakeholders.

The questionnaire encompassed various dimensions, ranging from respondent information and organizational affiliations to attitudes towards collaboration, familiarity with EU funds, perceptions about the impact of ICT collaboration on the digital and green economy, and considerations for future collaboration plans. It aimed to capture the diverse perspectives within the region's ICT sector, providing valuable data to shape a nuanced understanding of collaboration dynamics and identify potential areas for enhancement. The questionnaire's scope involved stakeholders from different sectors, such as business, research, non-governmental organizations, government, and others, fostering a holistic examination of the collaborative landscape in the Western Balkans.

The interviews, structured around a series of broad questions, aimed to obtain information from prominent stakeholders actively involved in promoting ICT and digitalisation at national and regional level. Interviewees provided valuable insights into the barriers to collaboration, successful projects in the region and the role of government policy. The interviews also discussed future perspectives and presented important steps and initiatives to unlock the full potential of cooperation in the ICT sector in the Western Balkans, especially in the areas of digitalisation and green transformation.

## 5.1 Current status of cooperation: past and future prospects

A substantial 67.8% of respondents reported engaging in collaborations with various entities in the ICT sector, including companies, research institutions, civil organisations and supporting organisations. However, it is also important to mention the 32.2% of respondents who stated that they did not collaborate in the past or currently. This indicates that there is still a significant proportion of stakeholders in the ICT sector that operate without collaborations with other organisations in the region. Of those that have collaborated, 28.57% have only collaborated within their economy, while more than 70% have collaborated with organisations from the region or both within the country or region (Table 9).

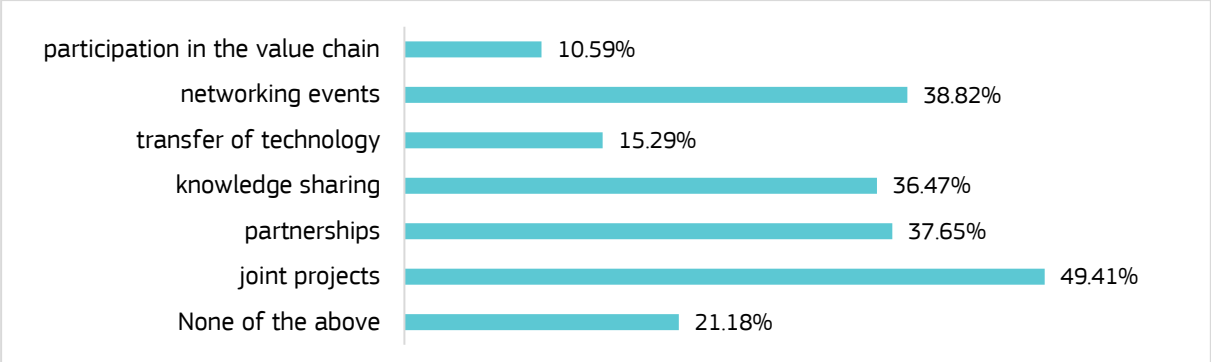
**Table 9.** The level of cooperation in the ICT industry

| ***Have you collaborated with other entities from the ICT sector in the Western Balkan region either in the past or currently?*** | |
|---|---|
| *Yes* | 72.94% |
| *No* | 27.06% |
| ***Have you collaborated with other entities from the ICT sector in the Western Balkan region either in the past or currently?*** | |
| *Within the same country* | 33.33% |
| *Across Western Balkan economies* | 28.57% |
| *Both, within the same country and across Western Balkan economies* | 38.10% |

*Source: authors based on survey results*

While industrial collaborative projects with the organisation in the region are very rare, joint research and innovation projects are the dominant form of collaboration, with 49.41% of respondents actively involved in such initiatives (Figure 10). Several examples of inter-regional project-based cooperation funded through EU programs were reported by interviewees. One such example is the collaboration between the University of Niš and the Faculty of Electrical Engineering and Information Technologies, Ss. Cyril and Methodius University in Skopje, resulting in the development of the IoT solar track. This innovation represents a mobile photovoltaic module capable of adjusting to solar conditions throughout the day. Joint projects are closely followed by networking events, as 38.82% of participants have used these platforms to promote connections and cooperation. Partnerships and knowledge also play an important role with 37.65% and 36.47% respectively.

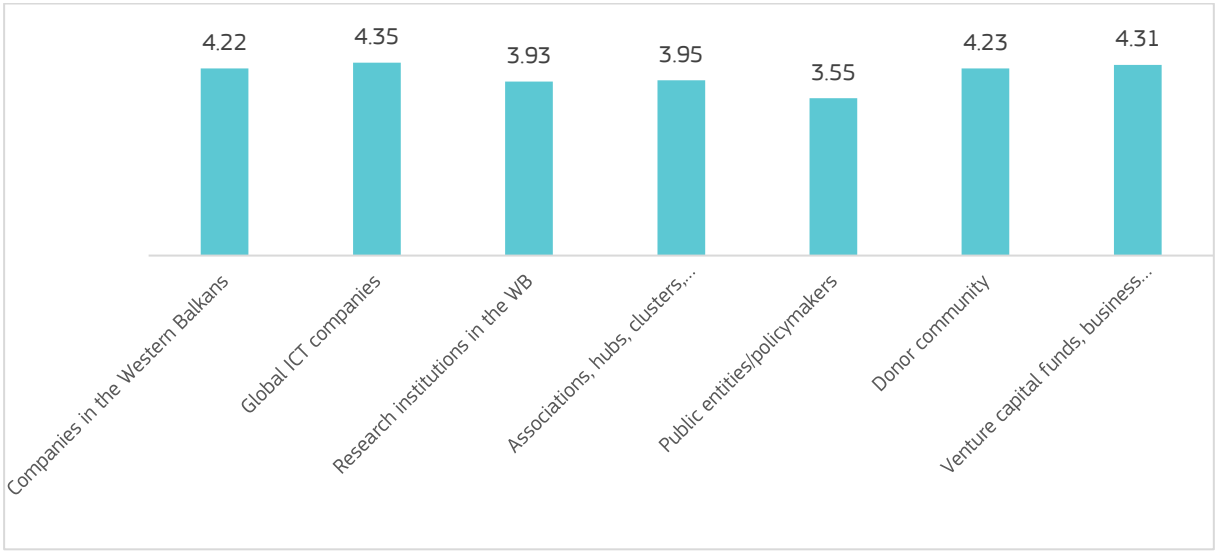
**Figure 10.** Most common types of cooperation




*Source: authors based on survey results*

The predominant interest of the ICT community in the Western Balkans lies in collaboration with global ICT companies, especially within the business sector (Figure 11). These results are in line with our expectations, considering the prevailing business model of most IT companies in the region, which are primarily export-focussed and a significant portion of them cater to large companies in Western markets. The survey highlights a significant interest in working with donor organisations, venture capital funds and business angels, although venture capital is underdeveloped in the region. Conversely, collaboration with policy makers received the lowest score, indicating a general sentiment within the IT community to act independently of government intervention and emphasise an independent approach to business ventures.

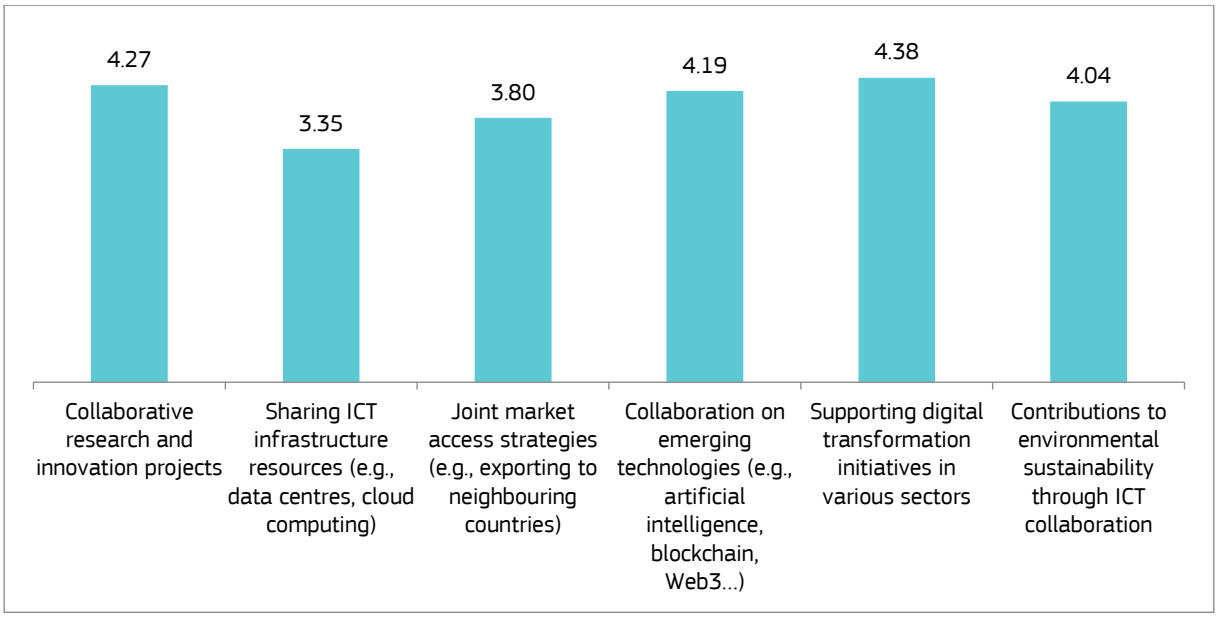
**Figure 11.** Interest in collaboration with different types of stakeholders (weighted average on a scale of 1-5)




*Source: authors based on survey results*

In terms of potential types of collaboration with partners from other Western Balkan economies, participation in digital transformation initiatives in traditional sectors attracted the most interest from respondents (Figure 12). These results show that the IT community in the region has recognised the importance of the digitalisation of companies and is willing to contribute to support these processes in the domestic markets. The findings also suggest a willingness to shift from the current export-oriented business model and engage more with local markets. Furthermore, collaborative research and innovation projects are proving to be promising areas for future cooperation. However, the potential for collaboration in the shared use of ICT infrastructure resources is less recognised.

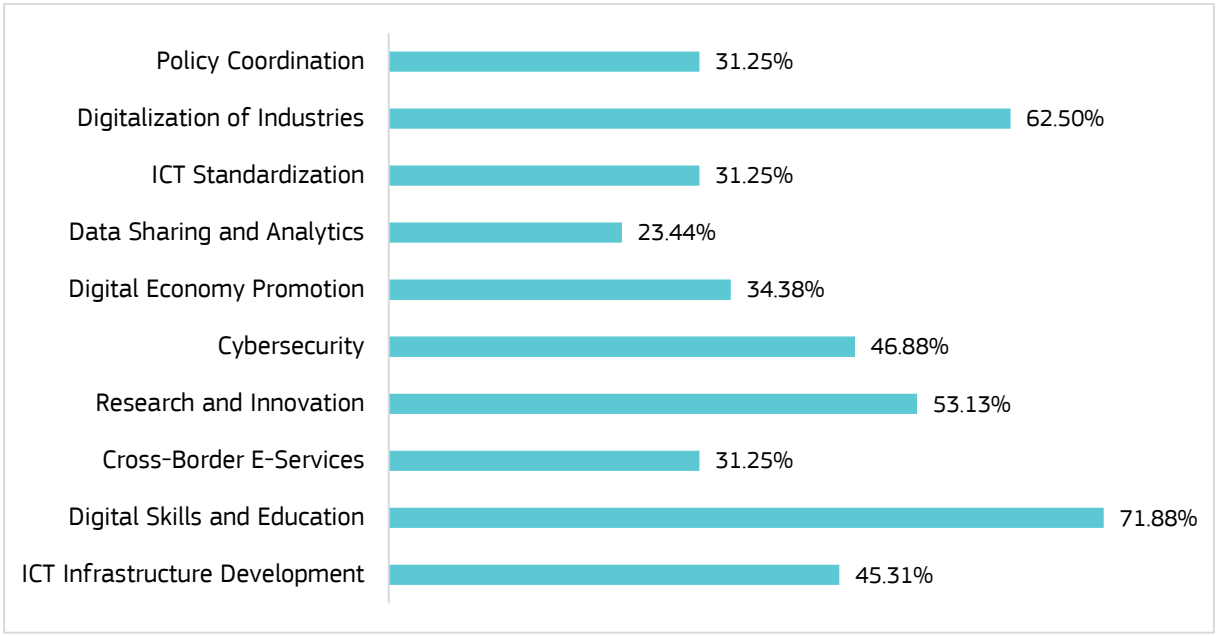
**Figure 12.** Interest in collaboration in selected types of collaboration with partners from other Western Balkan economies in the ICT sector (weighted average on a scale of 1-5)




*Source: authors based on survey results*

More than 71% of respondents believe that cooperation in improving digital skills through informal education is important. In addition, the cooperation of the ICT sector in the process of digitalisation of industry is considered very important and is an important prerequisite for cooperation in the coming period (Figure 13).

**Figure 13.** Areas that have the most potential for collaboration in the Western Balkans




*Source: authors based on survey results*

When assessing the potential for cooperation in the ICT sector in the Western Balkans, it becomes clear that certain sub-sectors offer the greatest potential for such efforts. Based on their experiences and future expectations, the interviewees identified several ICT areas that are suitable for cooperation. The consensus is that blockchain, Web3 and, to a certain extent, artificial intelligence are the most promising sub-sectors. Demand and employment opportunities have increased in these areas, especially in the wake of the disruption caused by the Covid-19 pandemic. The regional collaboration has also important potential in custom software development covering cross-sectoral areas such as e-health, FinTech, agri-food, energy management, intelligent transport, etc. Given the competitive advantages in the gaming industry, this sub-sector could also represent an interesting driver for collaborative efforts across the Western Balkans.

Although most respondents expressed significant interest in collaboration with partners in the Western Balkans, especially in the field of digitalisation, only 30% reported having specific plans or initiatives related to collaboration within the next 5 years in the Western Balkan ICT and digitalisation sector (Figure 14). Nearly half of the respondents indicated a lack of awareness about such plans. These findings align with the understanding that digitalisation efforts in various sectors involve not only the IT community but also require active engagement of other stakeholders.

**Figure 14**. Specific plans for collaboration in the Western Balkan ICT and digitalisation sector within the next 5 years


*Source: authors based on survey results*

In terms of specific actions, survey respondents highlighted the following:

- Focus on initiatives related to digital workforce, freelancers, skills development and entrepreneurship.
- Exploring opportunities under programmes such as the Digital Europe Programme, the European Innovation Council (EIC) and similar.
- Collaboration within initiatives such as the GÉANT network and various Horizon 2020 projects to utilise international research networks.
- Collaboration with companies in the ICT sector to improve the skill level of graduates.
- Participation in several regional projects within the Western Balkans Startup Alliance.
- Participation in lobbying campaigns to convince regional administrations to bring their digitalisation plans in line with EU directives to promote the international.

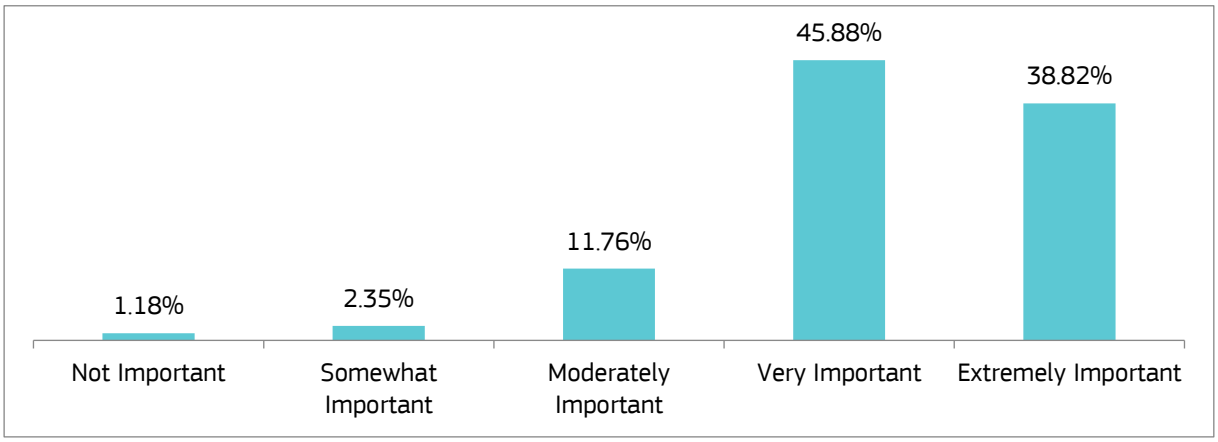
## 5.2 ICT collaboration as a driver for digitalisation and green transformation of the region

Given the increasing importance of technological advancement for environmental sustainability globally, this section explores if collaboration within the ICT sector can act as a catalyst to advance both the digital and green agendas in the Western Balkans. It explores the interconnected dynamics between ICT collaboration, digitalisation and the pursuit of environmentally conscious practises and highlights the transformative potential inherent in strategic partnerships and collaborative initiatives.

While there is a clear need to improve digital capabilities and invest in telecommunications infrastructure projects, it is equally important for the Western Balkans to overcome the existing challenges through joint efforts and thus align with EU standards. In this context, respondents' views

on the level of importance of cross-sectoral collaboration, where ICT companies work in partnership with companies from other industries, best illustrate the significance of digitalisation for the Western Balkan region (Figure 15). Namely, almost 85% of respondents believe that this type of cooperation is important or very important for the future of the region. Nevertheless, it is crucial to highlight that companies outside the ICT sector generally lack awareness regarding the significance of digitalisation. As an illustrative instance, in North Macedonia, the Swiss Embassy extended grants for digital maturity assessments to companies, but non-ICT businesses exhibited limited interest, with only ICT companies actively participating in the promotion of the call. This underscores the need for targeted initiatives and awareness campaigns specifically tailored to non-ICT sectors to foster a broader understanding of the benefits and importance of digitalisation.

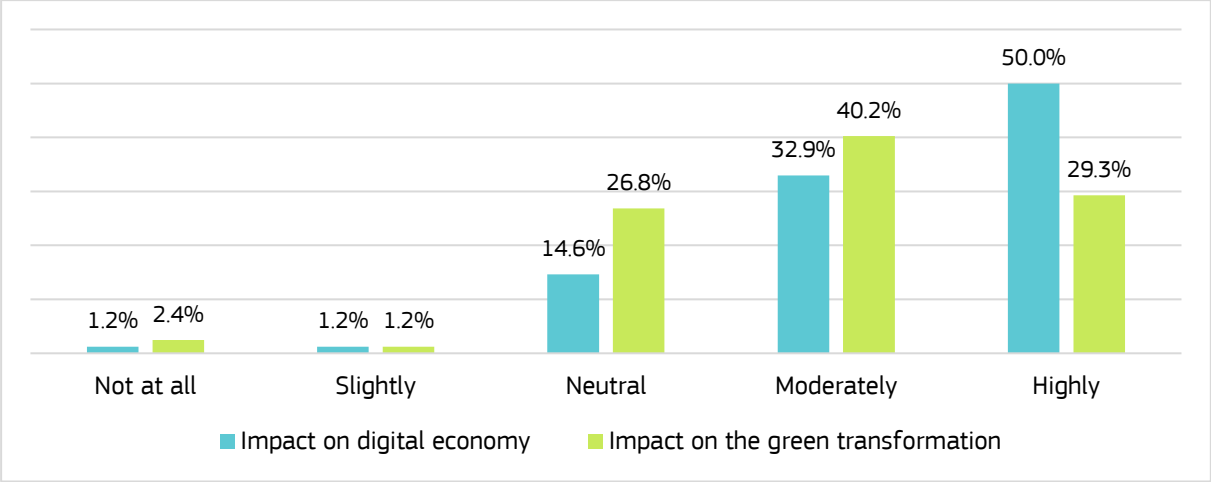
**Figure 15.** The level of importance of cross-sectoral collaboration, where ICT companies work in partnership with companies from other industries in promoting digitalisation and innovation within the Western Balkans




*Source: authors based on survey results*

The research results also underline the significant impact of ICT collaboration on the digitalisation and green transformation of the Western Balkans, as shown in Figure 16. While a larger percentage of respondents attribute greater importance to ICT in the digitalisation process than to its role in the green transformation, it is noteworthy that a significant proportion (69.5%) still acknowledges the potential of ICT to have a moderate to significant impact on the green transformation process in the region.

**Figure 16.** Extent to which collaboration in ICT can impact the digital economy and green transformation of the Western Balkans




*Source: authors based on survey results*

However, as one interviewee noted, the Western Balkans are only in the early stages of integrating the concept of green transformation in various sectors. Many sectors in the region are just beginning to engage with the idea of green transformation. To effectively integrate ICT into these processes, there is an urgent need to actively promote the introduction of green initiatives in these sectors.

A significant number of survey respondents agreed that cooperation on ICT and digitalisation can boost the region's digital economy, improve infrastructure, foster innovation and entrepreneurship, enhance digital skills, promote e-government services, support regional cooperation, attract foreign investment and strengthen cybersecurity. There are a number of ways in which ICT cooperation and digitalisation can influence the digital economy and innovation in the Western Balkans region. The following actions were suggested by survey respondents:

- Increased awareness-raising and promotional activities to highlight the importance of ICT and digitalisation cooperation.
- Actively engage companies at the forefront of the fourth industrial revolution to initiate change and support government agencies in their digital transformation.
- Facilitate the piloting of newly developed digital solutions in Western Balkan companies that are aligned with the real needs of industry.
- Promote cooperation in the creation of a larger, unified digital market that attracts foreign investors and fosters healthy competition and innovation. Promote synergies between large companies, research institutes, start-ups and SMEs to strengthen the overall ICT and digitalisation ecosystem and create a more active and vibrant innovation environment.
- Pooling capacities through specific intergovernmental and cross-sectoral clusters to accelerate the adoption and diffusion of IT innovations.
- Support the development of start-up ecosystems through initiatives such as accelerators that serve as intermediaries between digital solutions and industry needs.
- Collaboration between research and innovation actors, including clusters and hubs, to create training programmes and skills development initiatives to foster entrepreneurship and innovation.

— Greater influence on local policy decisions when regional clusters, ICT associations and other stakeholders join forces and advocate for policies that promote innovation, digitalisation, infrastructure development and incentives.

— Develop strong, collaborative ICT clusters in the Western Balkans region to build a positive reputation and attract global partners, talent and investors.

Most respondents agreed that ICT has the potential to be a key driver for green transformation and sustainability in the Western Balkans region through collaboration and digitalisation. Harmonised policies and regulatory frameworks across economies can further promote the adoption of green technologies and sustainable practises. By integrating digital technologies with green initiatives, the Western Balkan region can make significant progress towards a green and sustainable economy, which requires a joint effort from governments, the private sector and civil society. Below are some ways in which digitalisation and ICT collaboration can influence regional sustainability, as suggested by survey respondents:

— Collaborate on ICT and digitalisation to drive a comprehensive green transformation that includes efforts such as smarter environmental monitoring, integrating renewable energy, optimising resource management, promoting green transport, smart infrastructures and cities, facilitating remote working, improving environmental education, supporting policy development and progressing towards a circular economy.

— Work together to develop and implement systems to monitor and manage environmental resources. Use sensors, data analytics, and remote sensing technologies for waste management, climate change, and air and water quality monitoring, with a focus on developing accurate and effective environmental monitoring systems.

— Promote collaboration to facilitate the seamless integration of renewable energy sources such as wind and solar power into the electricity grid. Utilise digital solutions and smart grid technologies to improve energy production and consumption to reduce carbon emissions and dependence on fossil fuels.

— Collaborate to improve resource efficiency in manufacturing, agriculture and other industries through the use of ICT. Use digital supply chain management, 3D printing and precision agriculture to minimise waste and resource consumption.

— Promote the digitalisation of government services and platforms for interaction with citizens. Learn from successful examples such as the improved e-government services in Serbia to promote better resource allocation, transparency and public participation in environmental policy formulation.

— Facilitate collaboration and data sharing among stakeholders, including government organisations, academic institutions and commercial enterprises. Improve collaborative data sharing to promote sustainability research and contribute to informed decision-making.

— Utilise ICT collaboration to support educational initiatives that raise awareness of sustainability and environmental issues. Use online platforms, e-learning and digital campaigns to achieve a wider reach and promote environmentally friendly behaviours and practises.

— Promote cross-border cooperation and financial opportunities related to sustainability and green transformation. Organisations such as the Vojvodina ICT Cluster from Serbia can play an important role in these efforts by bringing together different stakeholders to address issues such as resource management, climate change mitigation and environmental protection.

## 5.3 Funding opportunities for collaborative projects

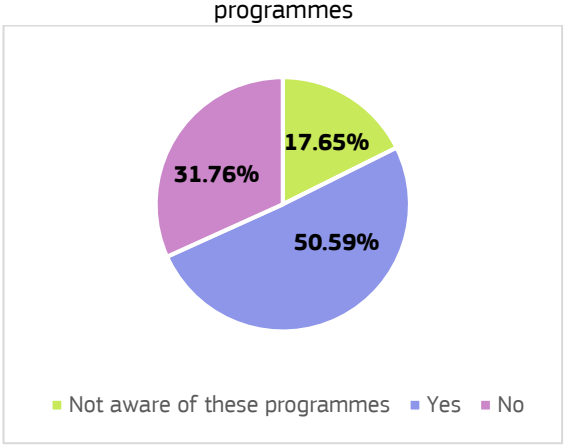
### 5.3.1 EU Funds

The results of the desk research show that, in their quest for modernisation and digital transformation, the economies of the Western Balkans are increasingly turning to external sources of funding to support their projects. One of the most important ways to finance these projects is through financial support from EU funds. The EU has recognised the potential of the Western Balkans and is providing financial resources to drive the development of advanced technologies and digital infrastructures in the region. In this context, EU funds have become an important lifeline, enabling governments, companies, and research organisations to embark on ambitious and promising ICT projects.

Through the Horizon Europe Programme, the EU and European Commission provide substantial support for collaborative ICT projects in the Western Balkans. There is a growing demand, both from the EU and civil society, for sustainable investments that consider their impacts on the local environment and ecosystem. Climate change, air pollution, and resource management significantly affect all economic sectors in Western Balkan economies. Consequently, Horizon Europe projects contribute to transformative reforms aimed at climate mitigation and the transition toward a green economy. Notably, projects in areas such as ICT for agri-food, circular economy, renewable energies, wastewater/recycling industries, and related fields are prioritized. These projects are well-positioned to adapt to market challenges and harness emerging market opportunities. They serve as key catalysts for enhancing collaboration opportunities across the region.

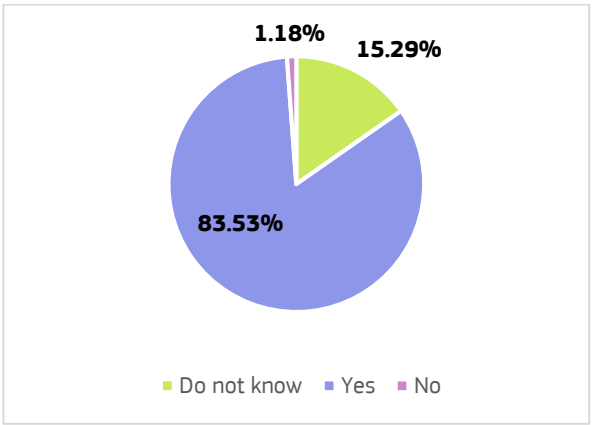
Our research has shown that more than 49% of respondents have applied or considered applying, and more than 80% of them would be interested to participate in projects under the EU programmes or other international donor organisation programmes in the future (Figures 17 and 18). These figures show high interest for European projects by regional ICT stakeholders.

**Figure 17.** Share of respondents who applied or considered applying in the EU Programmes or other international donor organisation programmes




*Source: authors based on survey results*

**Figure 18.** Share of respondents who are interested to participate in the EU Programmes or other international donor organisation programmes in the future

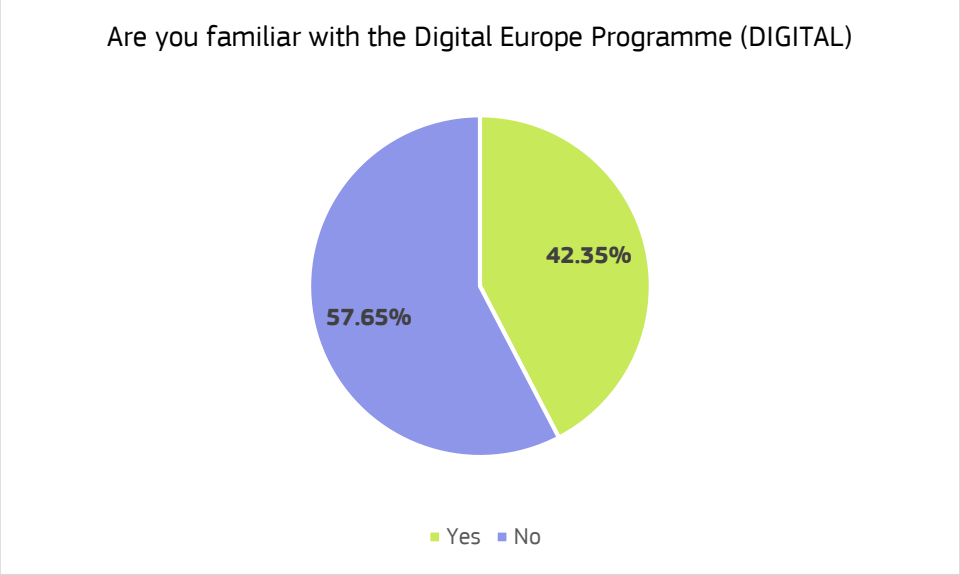



*Source: authors based on survey results*

In June 2023, in the margins of the regulatory dialogue with the Western Balkan economies, the European Commission signed association agreements for the Digital Europe Programme with Montenegro, North Macedonia, Albania and Serbia. Businesses, public administrations and other eligible organisations in these economies now have access to calls under the Digital Europe Programme, which has a total budget of €7.5 billion for the period 2021-2027. Participants from these four economies will be able to take part in projects that deploy digital technologies across the EU in specific areas such as supercomputing, artificial intelligence, cybersecurity, advanced digital skills, and ensuring a wide use of digital technologies across the economy and society, including through Digital Innovation Hubs.

Despite identifying a few instances of stakeholders who are aware of the opportunities provided by the Digital Europe Programme, our research results reveal that more than 57% of respondents in the surveyed ICT community in the Western Balkans lack awareness of this Programme (Figure 19). This suggests that efforts to disseminate information about this new Programme need to be strengthened to ensure that stakeholders in the region are well informed and can actively contribute to improving regional cooperation, digitalisation and development in the ICT sector.

**Figure 19.** Familiarity with the Digital Europe Programme




*Source: authors based on survey results*

### 5.3.2 The Western Balkans Investment Framework

The Western Balkans Investment Framework (WBIF) is a joint effort of the EU, financial institutions, bilateral donors and regional beneficiaries. Its main objective is to promote synchronisation and cooperation in investments, to support the socio-economic progress of the region and to foster the European integration aspirations of the Western Balkans. The WBIF plays a central role in the implementation of the EU's Economic and Investment Plan for the Western Balkans, reflecting its collaborative approach. Economic and Investment Plan aims to spur the long- term economic recovery of the region and foster regional economic integration. It identifies 10 flagship investments to support a green and digital transition in the Western Balkans and bring the region closer to the EU Single Market. The Digital Agenda paves the way focusing on digital skills, secure and sustainable digital

infrastructures, business and governments, and digital transformation. One of the funds under this plan is Western Balkans Enterprise Development & Innovation Facility (WB EDIF).

WB EDIF is the first regional initiative focusing on SMEs which is channelled through the WBIF. WB EDIF has been designed to offer complementary financial engineering instruments addressing the entire range of SME financing needs in the Western Balkans. The Facility consists of four different pillars: (1) SME Equity Financing, (2) SME Loan Guarantee, (3) SME Lending and (4) Support Services.

The Enterprise Innovation Fund (ENIF) is a venture capital fund active since 2016, focusing on an investment portfolio consisting of innovative SMEs at various stages of business development, from the seed to expansion phase, in the Western Balkans. ENIF aims at reinforcing the financial structure of innovative SMEs resulting in a strong and bankable balance sheet.

South Central Ventures (SCV) operates from offices in Ljubljana, Zagreb, Belgrade, and Skopje, focusing on tech startups across South-East Europe through the ENIF. SCV primarily targets early-stage and growth investments in technology companies, aiming to fuel international business expansion and support promising startups demonstrating potential for substantial growth. They invest in seed and early growth startups, offering up to €500,000 for seed investments and up to €5 million for early to growth-stage investments per company. The main geographic focus lies in Belgrade and Skopje within the Western Balkans region.

Managed and advised by the European Bank for Reconstruction and Development (EBRD) and investing since 2016, the Enterprise Expansion Fund (ENEF) finances established SMEs with high growth potential to support the development and expansion of their businesses. In particular, ENEF aims to identify local and regional champions – market leaders with good growth prospects – and provide them with the financing they need to take them to the next level.

### 5.3.3 National Funding opportunities

As desk research showed, prioritising innovation and technological progress has emerged as a central focus in the pursuit of economic expansion, improved competitiveness, and sustainable development in the Western Balkans. In line with this strategic approach, many economies in the region have taken initiatives to establish funding mechanisms to support these goals. At the time of the analysis, Serbia and North Macedonia had established their National Innovation Funds, which play a central role in supporting research and innovation projects within their national borders. Montenegro had established its own Innovation Fund based in the capital Podgorica. The national innovation funds are of particular importance given the integral role that ICT technology plays in innovative projects and startups and that a significant proportion of project proposals usually come from companies in the ICT sector.

The Innovation Fund in Serbia is the main state institution supporting innovative activities and managing financial resources for the promotion of innovation. The Innovation Fund has been active since 2011 and was a pioneer in the region when it comes to this type of support. By 2023, the fund has supported the implementation of 656 innovative projects and provided funding of almost 80 million euros. More than half of the supported projects are in the field of ICT.

The Science Fund of the Republic of Serbia is a public organisation that supports scientific and research activities. The programme for the development of projects in the field of artificial intelligence aims to improve the excellence and relevance of scientific research in the field of artificial intelligence in the Republic of Serbia, as well as to support the promotion of human resources development and the improvement of international development in this field.

Fund for Innovation and Technology Development (FITD) of North Macedonia is the leading state institution supporting startups and innovative companies in North Macedonia. Currently, the Fund co-finances 686 projects through its financial instruments with a total investment of 86 million euros. A Total of 51% of the FITD portfolio, i.e. 326 supported enterprises, are startups in the area of IT, mostly founded by young people. With almost 1.5 million euros, the Fund also supports the development of three accelerators in the country: X Factor, Seavus Accelerator and Business-Technology Accelerator UKIM.

The Innovation Fund of Montenegro is a national umbrella institution whose mission is to implement measures and innovation policies tailored to micro-enterprises and SMEs, while facilitating the transfer of technologies from research and development institutions. It is worth noting that this organisation, established in 2021, is a relatively new addition to the Montenegrin innovation landscape. As a nascent institution, it has set out to initiate and develop its programmes, reflecting the country's commitment to promoting innovation and technology transfer in the coming years. In addition, it is expected that support for projects in the ICT sector will gradually increase over time to further promote innovation in this dynamic sector.

The National Agency for Scientific Research and Innovation (NASRI) plays a central role in promoting science, technology and innovation (STI) programmes in Albania. Its focus is mainly on the support to research activities. With regards to digitalisation, at the time of the analysis a series of initiatives were promoted and being launched, such as the Digital Agenda of Albania and seed funding instruments, directly contributing to a conducive digital ecosystem and to support innovative start-ups. Along with these initiatives, supporting organisations are actively contributing to the start-ups ecosystem and to ICT companies. An important player in this regard is the Protik Innovation Centre, a collaboration between the Albanian American Development Foundation, the Albanian government, USAID, Microsoft, Albtelecom and CISCO. Protik is an independent, non-profit ICT centre that aims to stimulate the demand and use of ICT, promote market growth, improve human and institutional capacity and foster collaboration between the private sector, educational institutions and the government.

In Kosovo, the landscape for supporting innovation and technology transfer is evolving through collaborative efforts. The Innovation Centre Kosovo (ICK) is playing a significant role in fostering innovation growth within the economy. In partnership with the GIZ project Creating Employment through Export Promotion – CETEP and with the support of the Ministry of Innovation and Entrepreneurship, ICK provides financial support to small and SMEs through the Innovation Fund grant scheme.

In Bosnia and Herzegovina, at the time of the analysis there was no institutional framework at the state level to support the development of SMEs and consequently a lack of financial instruments to support innovation in SMEs, including the ICT sector. Various agencies, innovation centres and hubs at entity level provide different types of support, especially for the ICT startup community, but as the interviewee pointed out, new venture capital funds targeting innovation-based ICT start-ups are needed. The Association Agreement signed in 2024 for joining the EU Digital Europe Programme constitutes anyway an important step towards the improvement of development conditions of enterprises in the field of digitalisation.

### 5.3.4 Private Sector Investments

While commercial credits are accessible, the scarcity of risk capital, which is crucial for the early development phase, poses a challenge. In the Western Balkan region, there are difficulties with individual venture capital funds, but positive changes are underway. An illustrative example is the establishment of the first Serbian corporate venture capital fund, TS Ventures Fund, in 2021 by Telekom Serbia. This Fund is the first of its kind in the Western Balkans and focuses on investing in startups and innovative entrepreneurs in their early stages of development. This pioneering initiative by Telekom Serbia, with plans to invest 25 million euros in the period 2021-2026, is a remarkable step forward and points to potential improvements in the region's venture capital landscape.

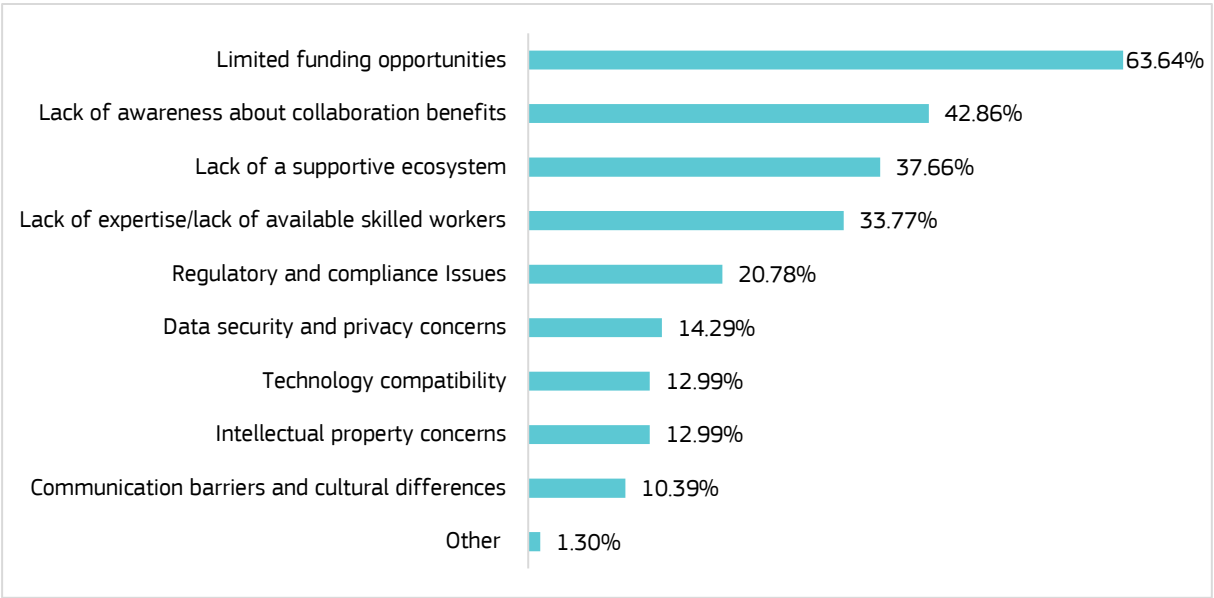
Another good example also comes from Serbia. ICT Hub Ventures is a private investment fund founded in 2017 that invests in startups in the pre-seed and seed phases. It provides initial support for startups, including an investment of up to 50,000 euros in exchange for a 5-15% stake in the company. It has a portfolio of 10 companies supported so far.

There are also other venture capital funds that invest in regional ICT companies but are based outside the region, such as Earlybird, Eleven Ventures and others.

## 5.4 Key challenges in regional ICT cooperation

A major obstacle to increased ICT cooperation in the Western Balkans is limited financial resources. More than 63% of the survey participants consider the scarcity of funds to promote cooperation in the region as one of the main obstacles (Figure 20). In addition, factors such as limited awareness of the potential benefits of cooperation, the lack of a supportive ecosystem and a shortage of skilled human resources were also identified as important barriers.

**Figure 20.** Main challenges or obstacles in collaborations within the ICT sector




*Source: authors based on survey results*

The lack of qualified people and the brain drain are particularly emphasised in the interviews. The region is experiencing an exodus of its most talented employees abroad, which is contributing to an overall shortage of qualified engineers. A shortage of a skilled workforce is also a notable challenge for daily operations in the ICT sector across the Western Balkans. Recognising this deficit, some Serbian companies have addressed the issue by expanding their presence into other economies, establishing affiliations within the Western Balkans - a trend that has been ongoing for the past decade. Considering this, it is important to note that over 75% of respondents believe that future cooperation initiatives should focus on skills development and education to increase the ICT workforce in the region.

In addition to the challenges mentioned above, it is also important to point out the interviewee's opinion that the barriers for more efficient cooperation in the region may lie in the fact that most of the ICT industry in the region works as subcontractors for large foreign ICT companies. A smaller proportion of companies develop their own solutions, which can represent a significant competitive advantage on the global market and a real solution for the regional market. To ensure the long-term competitiveness of the ICT sector, a possible reorientation towards the development of own products is necessary. If this path is not taken, the sector's competitive advantage may diminish over time.

Although not dominant, it is important to acknowledge the existence of several regulatory and compliance barriers that significantly impact collaborative efforts within the ICT sector across the Western Balkans. These obstacles revolve around key issues such as limited data availability, divergent regulatory frameworks, and a noticeable absence of standardization. The region can benefit from investing in capacity building, fostering public-private dialogues, and leveraging the ongoing EU integration process to align regulatory practices with international standards.

When it comes to the impact of ICT collaboration on the green transformation of the region, respondents see a critical problem in the insufficient awareness of the environmental challenges and the lack of motivation to participate in the green transformation and sustainability efforts through personal sacrifice. The biggest challenge is the lack of education, which hinders understanding of the long-term consequences. Without government intervention to address these pressing issues, the potential of ICT and digitalisation to bring about change remains limited.

# 6 Conclusions and recommendations

## 6.1 Key findings and conclusions

The conclusions presented in this section are based on the results of the survey and interviews in all Western Balkan economies in 2023. The final conclusions reflect the opinion of stakeholders from all Western Balkan economies. However, it is worth noting that most of the results come from Serbia, as it is the largest and most developed economy in the region, especially in the ICT sector.

Despite the independent nature of the ICT industry in the Western Balkans, which operates autonomously and drives its success through the direct export of services rather than through a complementary component to other sectors, this report reveals a latent potential for collaboration. This untapped potential for cooperation underlines the need for concrete measures to create conditions conducive to such cooperation.

The strategic orientation of all Western Balkan economies towards the acceleration of digitalisation implies a shared commitment to the use of technology for social and economic progress. The prioritisation of the ICT sector in the regional strategic frameworks underlines the recognition of its transformative potential. Governments in the region have consistently focused investments and policies on improving ICT infrastructure, promoting digital skills and fostering technology-driven industries. However, despite this strategic focus, the implementation, monitoring and evaluation of policies have often proven to be ineffective, as the results of this report show. The joint commitment to digitalisation needs to be complemented by more effective governance mechanisms to ensure that these strategic objectives are translated into tangible benefits for the Western Balkans.

The analysis of economic, research, and innovation potential in the context of Smart Specialisation Strategies across the Western Balkans shows clear patterns and promising areas for cooperation. Albania shows a strong focus on the digitalisation of public administration, artificial intelligence, the internet of things and the green transition. North Macedonia is characterised by the development of customised software in line with broader cooperation in ICT support and emerging trends. Serbia is characterised by customised software development, proprietary solutions and new technologies such as blockchain and artificial intelligence. Kosovo focuses on digitalisation, while Montenegro shows its strength in business services and its potential in the creative industries. Commonalities include a strong emphasis on advanced ICT services, digital transformation and specific thematic interests such as customised software development and the green transition. These identified patterns not only reflect the unique strengths of each economy, but also indicate a shared commitment to technological innovation and sustainability. The close alignment with the Smart Specialisation Strategies positions these patterns as integral guides for joint efforts that promote progress in the ICT sector across the Western Balkans.

The research has shown that the ICT sector in the Western Balkans is becoming a significant driver of economic development, characterised by a remarkable increase in exports of commercial services. However, while some economies in the region have experienced significant growth, others have yet to realise their full potential. Employment trends underline the growing importance of the sector in the labour market. At the same time, the education system has developed in step with the growth of the ICT industry. However, persistent challenges such as outdated curricula, limited resources and the need to train teachers pose obstacles to the region's educational progress. Overcoming these challenges is crucial to ensure a harmonious and sustainable synergy between the burgeoning ICT sector and the evolving education landscape in the Western Balkans.

The international scientific collaboration network in the field of computer sciences domain for Western Balkan economies extends worldwide and includes over 130 countries. However, the focus of scientific cooperation within the region is predominantly concentrated on the institutional links between Serbia and Bosnia and Herzegovina. Despite the expansive nature of cooperation projects under international programmes such as Horizon Europe, cooperation in the ICT sector within the region is relatively limited. In particular, cooperation with companies is less common, with institutions from Serbia playing a leading role in both network participation and project implementation. As the Western Balkans continues to expand its scientific cooperation, fostering more partnerships and diversified collaborations within the region remains a possible way to improve the overall scientific ecosystem in the ICT sector.

The predominant interest within the regional ICT community is focused on global partnerships, especially in the business sector, and shows a significant inclination to collaborate with donor organisations, venture capital funds and business angels. Although the importance of business digitalisation in the region is recognised, a significant proportion of respondents have no concrete plans for collaboration in the ICT and digitalisation sector in the Western Balkans in the next five years. The report emphasises the crucial role of cross-sector collaboration and respondents agree that it is of great importance for the future of the region. The results highlight the remarkable impact of ICT collaboration on both digitalisation and the green transformation of the Western Balkans, with a stronger emphasis on the role of ICT in the digitalisation process. The research also shows that respondents may not be sufficiently informed about the Digital Europe programme, underlining the need for increased information dissemination.

Financial constraints prove to be a major obstacle to increased ICT cooperation. This is compounded by challenges such as limited awareness, a lack of a supportive ecosystem and a shortage of skilled human resources.

## 6.2 Implications for future collaboration

The implications presented in this section result from the findings and feedback obtained from the responses of the survey participants and interviewees. While the authors have analysed and summarised this information, it is important to emphasise that these conclusions are largely based on the perspectives, experiences and recommendations shared by the engaged stakeholders in the Western Balkans region.

Despite the obvious challenges, it is clear that fostering cooperation in the ICT sector is essential for the region's continued progress in this industry. A wide range of stakeholders, including governments, companies, business associations, civil organisations and research institutions, play a central role in promoting and developing this cooperation.

Given the important role that ICT associations play in promoting cooperation in the ICT sector, there is an obvious need to strengthen these associations throughout the Western Balkans. It is evident that such organisations play a key role in representing and uniting ICT companies. To improve cooperation, ICT associations and chambers of commerce should actively promote a more robust dialogue between ICT companies and traditional industries. By acting as intermediaries, these organisations can bridge the existing divide and help develop meaningful collaboration that benefits all actors.

As many interviewees emphasised, it is essential for the Western Balkans to prioritise the improvement of skills, especially the digital skills of their workforce. Future cooperation efforts should focus on initiatives aimed at developing skills and educational programmes to increase the ICT

workforce in the region. Key stakeholders in the region recognise the critical importance of a skilled workforce in the evolving digital landscape and should proactively invest in education initiatives to foster a robust talent pool that can effectively contribute to growth and innovation in the ICT sector.

The effective implementation of government policies and regulations is crucial to unlocking the full potential of the sector and realising the economic and societal benefits it can offer. Throughout the research process, it became evident that certain economies, such as for instance Kosovo and Albania, face challenges related to data availability. The weaknesses of statistical systems contribute to the absence of timely and reliable data essential for effective planning. Addressing these shortcomings is crucial to enable informed decision-making and promote progress. Policy makers need to actively engage with industry stakeholders, keep pace with technological advances and adapt their policies to the evolving needs of the ICT sector.

Good examples, such as the Serbian Innovation Fund and the Fund for Innovation and Technological Development in North Macedonia, may serve as regional blueprints. Following these experiences, other economies could set up funds endowed with financial resources to promote innovative IT solutions and the development of locally created products. These initiatives that support innovative projects play an important role in fostering start-ups and innovation, steering the IT industry away from the prevailing "outsourcing" model towards an environment where more companies develop and commercialise their own products. The transformation of the IT sector from a mainly outsourcing-orientated industry to one that actively produces its own products is crucial for the future of the regional ICT industry.

To enhance collaboration in the Western Balkans' ICT sector, efficient systems for knowledge transfer are essential. Serbia plays a relevant role in the region and could contribute in sharing experience and knowledge in the ICT sector. Additionally, the possible establishment of regional branches of existing companies could further facilitate collaboration in the region.

In order to strengthen cooperation in the region, it is essential to intensify bilateral agreements among economies, especially the neighbouring ones. For example, promoting the institutional dialogue between the ministries of science and education can significantly improve mutual understanding and cooperation. In addition, initiatives such as mobility scholarships, targeted networking events and other bilateral cooperation mechanisms could also be supported.

Facilitating cross-sectoral collaboration is imperative for the region's overall progress, especially in domains like intelligent transport and energy efficiency that transcend geographical boundaries. The highly competitive wages in the ICT sector often hinder collaboration with non-ICT stakeholders, as ICT companies demand remuneration beyond the means of local enterprises. To bridge this gap and drive digitalisation in diverse sectors, facilitators should be engaged to support the process. Instead of relying solely on EU funding, the region should establish a steady flow of funds and articulate strategic priorities for sustained development. Incentives for ICT companies, while beneficial, need careful implementation to prevent misuse.

Considering the untapped potential of knowledge sharing for the digitalisation of traditional industries in the Western Balkans, policy makers should consider adopting successful models such as, for instance, the Centre for Digital Transformation in Serbia. This national project dedicated to the digital transformation of the business sector may serve as example of effective practice. Policy makers across the region may consider implementing similar initiatives tailored to the specific needs of their economies. Furthermore, fostering cooperation between such initiatives within the Western Balkans could increase impact and contribute to a more coordinated and region-wide approach to digitalisation.

An additional example for other economies in the Western Balkans is also the Centre for the Fourth Industrial Revolution in Serbia. Functioning as a platform, it facilitates collaboration among diverse societal actors, aiming to enhance the application of fourth industrial revolution technologies. Additionally, the Regional Roaming Agreement serves as a noteworthy example of collaboration between governments in the region.

As a result of the interviews conducted with relevant stakeholders, concrete measures were proposed to improve cooperation in the field of ICT in the Western Balkan region. The following recommendations for decision-makers emerge from the contributions of the research participants:

- Create a regional cooperation platform that brings together academic institutions, government officials, business leaders and ICT clusters in the Western Balkans. Utilise existing resources and integrate them with regional platforms such as the Chamber Investment Forum Western Balkan 6 (WB6 CIF), the Western Balkans Startup Alliance and similar initiatives to foster collaboration and knowledge sharing. Such platform could serve as a coordinating body to ensure a harmonised approach, sharing of best practises and monitoring of progress in digital transformation across the Western Balkan economies at a higher level. This would allow the laggards to learn from the leaders and would generally ensure a good momentum of change at regional level.
- Establish regional funds for S3 implementation. Recognising the financial constraints that hinder the effective implementation of the S3 in the region, these instruments could act as catalysts for innovation, close funding gaps and foster collaboration. The main objective should be to support and finance research and innovation projects that are aligned with the S3 priority areas and promote regional economic growth and competitiveness. In this scenario, any support from the European Union would be crucial to guarantee the success and sustainability of such instruments. The active involvement of regional governments would be fundamental for effective implementation.
- Organise regional conferences, summits and knowledge sharing events to showcase achievements, innovations and teamwork in the ICT and digitalisation sector in the Western Balkans. Encourage the sharing of successful results and experiences to promote collective learning and awareness. Select and build on the previous year's successful initiatives, highlighting those that have significant impact and potential for wider application. The Regional Cooperation Council (RCC) could serve as a good support for such activities.
- Positioning the entire region as an attractive IT destination. This can be achieved by promoting cooperation via networks or similar organisations. It is crucial to communicate the region's distinctive strengths, including high quality, language proficiency, speed, innovation, and resilience, in an effective manner to capture international interest.
- Develop a regional ICT education programme that offers online courses and certificates in cooperation with local universities and institutes. Emphasise the skills needed in the digital age and work with industry professionals to plan workshops and boot camps for workers on the latest tools and technologies.
- Work towards harmonisation of the legal framework for ICT and digitalisation in the Western Balkans. Harmonising policies on data protection, cybersecurity and e-commerce can reduce barriers to cross-border cooperation.
- Support the establishment of cross-border innovation centres to foster collaboration on creative projects between academics, tech companies and start-ups in the Western Balkans.

— Initiate regional tech incubator programmes to support early-stage companies with tools, funding and mentoring. Encourage stronger links between the creative industries and the ICT sector.

— Establish cross-border cybersecurity alliances to jointly combat cyber threats and share best practice.

— Strengthen international cooperation with European ICT clusters, associations and funding bodies to maximise funding and resources for local ICT initiatives.

It is opinion of the authors that the above policy opportunities might be further developed and investigated also in light of the future investments linked to the Western Balkans Growth Plan (2024-2027).

The Western Balkans Growth Plan emphasizes digital transformation as one of the priority for regional integration and ICT as a cornerstone of the Reform Agendas adopted by the economies in the region.

Digital infrastructures and services are crucial to boost economic growth and competitiveness and the alignment with the cybersecurity directives and EU digital frameworks, such as the Digital Services Act and Digital Markets Act, ensure safer digital environments, fair competition and resilience against cyber threats.

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## List of abbreviations and definitions

| Abbreviations | Definitions |
|---|---|
| ALB | Albania |
| BIH | Bosnia and Herzegovina |
| EU | European Union |
| GERD | Gross domestic expenditure on R&D |
| ICT | Information and communication technologies |
| IoT | Internet of things |
| MKD | North Macedonia |
| MNE | Montenegro |
| OECD | Organisation for Economic Cooperation and Development |
| R&D | Research and development |
| SMEs | Small and medium-sized enterprises |
| SRB | Serbia |
| WB | Western Balkans |
| XKX | Kosovo |

## List of figures

## List of tables

# Annexes

## Annex 1. Survey Questionnaire

I SURVEY RESPONDENT INFORMATION

— Name of your organization: _____
— Number of employees:
— 1-10
— 11-50
— 51-250
— More than 250

Which sector best represents your current professional affiliation?

— Business
— Research
— NGO
— Government
— Other:

In which sub-sector of the ICT industry does your organisation primarily operate? Please select the most relevant option:

— Software Development
— Hardware Manufacturing
— ICT Services and Consulting
— Telecommunications
— Other (Please Specify: _____)

Your position in the organisation: _____

WB economy:

— Albania
— Bosnia and Herzegovina
— Kosovo
— Montenegro
— North Macedonia
— Serbia

II ATTITUDES TOWARDS TYPES OF COLLABORATION

On a scale from 1 to 5, please rate your organization's interest in collaboration with:

| | 1<br>Not Interested at All | 2<br>Slightly Interested | 3<br>Neutral | 4<br>Moderately Interested | 5<br>Very Interested |
|---|---|---|---|---|---|
| Private sector companies in the Western Balkans | | | | | |
| Global ICT companies | | | | | |
| Research institutions in the Western Balkans | | | | | |
| Support infrastructure (associations, hubs, clusters, accelerators…) | | | | | |
| Public entities/policymakers | | | | | |
| Donor community (EU financial support scheme, | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| international funding agencies) | | | | | |
| Investment companies (venture capital, business angels and other investors) | | | | | |

In your view, how important is cross-sectoral collaboration, where ICT companies work in partnership with companies from other industries (e.g., healthcare, finance, manufacturing) in promoting digitalisation and innovation within the Western Balkan region?

- 1-Not Important
- 2-Somewhat Important
- 3-Moderately Important
- 4-Very Important
- 5-Extremely Important

On a scale from 1 to 5, please rate your organization's interest in the following types of collaboration with partners from other Western Balkan economies in the ICT sector:

| | 1 Not Interested at All | 2 Slightly Interested | 3 Neutral | 4 Moderately Interested | 5 Very Interested |
|---|---|---|---|---|---|
| a) Collaborative research and innovation projects | | | | | |
| b) Sharing ICT infrastructure resources (e.g., data centres, cloud computing) | | | | | |
| c) Joint market access strategies (e.g., exporting to neighbouring countries) | | | | | |
| d) Collaboration on emerging technologies (e.g., artificial intelligence, blockchain, Web3...) | | | | | |
| e) Supporting digital transformation initiatives in various sectors | | | | | |
| f) Contributions to environmental sustainability through ICT collaboration | | | | | |

Which of the following areas do you think have the most potential for collaboration in the Western Balkan region? (Select all that apply)

- ICT Infrastructure Development
- Digital Skills and Education
- Cross-Border E-Services
- Research and Innovation
- Cybersecurity
- Digital Economy Promotion
- Data Sharing and Analytics

— ICT Standardization
— Digitalisation of Industries
— Policy Coordination
— Other_____

Have you collaborated with other entities from the ICT sector (companies, research institutions, civil organizations, etc.) in the Western Balkan region either in the past or currently?
— Yes
— No
if Yes:
5a. Are the collaborations primarily within your own country, or do they involve stakeholders from other Western Balkan countries?
— Within the same country
— Across Western Balkan economies
— Both within the same country and across Western Balkan economies
5b. Please describe the nature and scope of your current or past collaborations in the Western Balkan region.
— joint projects
— partnerships
— knowledge sharing
— transfer of technology
— networking events
— participated in the value chain
— other, please specify _____

Please describe main challenges or obstacles in collaborations within the ICT sector
— Limited funding opportunities
— Lack of awareness about collaboration benefits
— Lack of a supportive ecosystem
— Intellectual property concerns
— Communication barriers and cultural differences
— Regulatory and compliance Issues
— Technology compatibility
— Data security and privacy concerns
— Lack of expertise/lack of available skilled workers
— Other, please specify _____

III FAMILIARITY WITH THE EU FUNDS

Have your organization applied or considered applying to participate in projects under the EU Programmes such as Horizon Europe or other international donor organisation programmes?
— Yes
— No
— I am not aware of these programmes

Would you be interested to participate in projects funded by the Horizon Europe or other international donor organisation programmes in the future?
— Yes
— No
— I do not know

Are you familiar with the Digital Europe Programme (DIGITAL) introduced by the European Commission?

— Yes
— No

IV DIGITAL AND GREEN ECONOMY

How much do you believe that collaboration in ICT and digitalisation can impact the digital economy and innovation within the Western Balkan region?
— 1-Not Impactful
— 2-Slightly Impactful
— 3-Neutral
— 4-Moderately Impactful
— 5-Highly Impactful

Please explain your perspective on how collaboration in ICT and digitalisation can influence the digital economy and innovation within the Western Balkan region

_____
_____

How much do you believe that collaboration in ICT and digitalisation can impact green transformation and sustainability within the Western Balkan region?
— Not Impactful
— Slightly Impactful
— Neutral
— Moderately Impactful
— Highly Impactful

Please explain your perspective on how collaboration in ICT and digitalisation can influence green transformation and sustainability within the Western Balkan region.

_____
_____

V AVAILABILITY OF SKILLED WORKFORCE

Do you believe that collaborative initiatives should include a focus on skills development and education to enhance the ICT workforce in the region?
— Yes
— No
— I do not know

If yes, please provide insights into the types of initiatives or strategies you think would be most effective in enhancing the ICT workforce.

_____
_____

VI GOVERNMENT AND POLICY

To what extent do you think government policies and regulations support or hinder collaboration in ICT and digitalisation in the Western Balkan region?
— Highly Supportive
— Moderately Supportive
— Neutral
— Moderately Hindering
— Highly Hindering

What steps or initiatives (national or international) do you believe are essential to promote effective collaboration in ICT and digitalisation among Western Balkan countries?

_____
_____

VII FUTURE COLLABORATION PLANS

Looking ahead, does your organization have specific plans or initiatives related to collaboration in the Western Balkan ICT and digitalisation sector within the next 5 years?

— Yes
— No
— I do not know

If the answer is "Yes," please briefly describe the nature or focus of these planned collaborations.

_____
_____

## Annex 2. Interviews

**The list of experts interviewed:**

— Milan Šolaja, Vojvodina ICT Cluster, CEO - Serbia

— Bojan Stanić, Chamber of Commerce of Serbia, Deputy Director - Serbia

— Đorđe Ćelić, Business Incubator Novi Sad, Director - Serbia

— Marina Blagojević, ICT Hub – Serbia

— Nemanja Petrović, CEO at Moonstruck and Manager of Supercluster Web3 and Blockchain Technologies – Serbia

— Kosta Andrić, ICT Hub, CEO – Serbia

— Vladimir Atanasovski, Faculty of Electrical Engineering and Information Technologies, Dean – North Macedonia

— Bojan Ćudić, ONEX Digital Innovation Hub, CEO – Bosnia and Herzegovina

— Agim Kukaj, Ministry of Economic Development, Department of Post, Telecommunications and Information, Director – Kosovo

— Radivoje Drobnjak, Science and Technology Park Montenegro, Program Activities Manager – Montenegro

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