UNIVERSITY OF LJUBLJANA
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MASTER'S THESIS

# AN ANALYSIS OF THE INNOVATION POLICY IN THE CONTEXT OF THE SOFTWARE INDUSTRY IN THE FEDERATION OF BOSNIA AND HERZEGOVINA

Ljubljana, November 2023 AMAR NUMANOVIĆ

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| | |
|---|---|
| **AI** | Artificial Intelligence |
| **BAM** | Bosnia and Herzegovina convertible mark, international code |
| **BiH** | Bosnia and Herzegovina |
| **B2B** | Business-to-business |
| **B2C** | Business-to-customer |
| **EBRD** | European Bank for Reconstruction and Development |
| **EU** | European Union |
| **EUR** | Euro, international code |
| **FBiH** | Federation of Bosnia and Herzegovina |
| **FMDEC** | Federal Ministry of Development, Entrepreneurship and Crafts |
| **GDP** | Gross domestic product |
| **GIZ** | German Agency for International Cooperation |
| **GVC** | Global value chain |
| **ICT** | Information and communication technologies |
| **IT** | Information technology |
| **ITES** | IT-enabled services |
| **ITO** | Information technology outsourcing |
| **MSME** | Micro, small and medium-sized enterprise |
| **OECD** | Organisation for Economic Co-operation and Development |
| **PPI** | Public procurement of innovative solutions |
| **R&D** | Research and development |
| **SaaS** | Software-as-a-service |
| **SDG** | Sustainable development goal |
| **SME** | Small and medium-sized enterprise |
| **STEM** | Science, technology, engineering and mathematics |
| **S&T** | Science and technology |
| **UN** | United Nations |
| **UNCTAD** | United Nations Conference on Trade and Development |

# 1 INTRODUCTION

The notable growth of the software industry[1] in Bosnia and Herzegovina (hereinafter: BiH) has drawn attention in both the public and policy discourses. There is a growing consensus among economic scholars, researchers and interested parties that the Information-Technology (hereinafter: IT) industry – especially in the domain of software development – could be considered as an industry with high potential for growth in BiH or, particularly, in the Federation of Bosnia and Herzegovina[2] (hereinafter: FBiH), which is in the focus of the thesis (Imamović, 2017; Fijuljanin & Fijuljanin, 2017; Strik Consulting, 2017; Hakemulder & Wilson, 2016).

The immense potential for creating decent jobs, which was observed over the last decade (see Chapter 3.2), has subjected the industry to a vibrant and dynamic policy debate. The debate is mainly focused on addressing the key impediments of growth, such as human capital underdevelopment, labour shortages, high costs of doing business and unfavourable business climate (e.g. high tax burdens), among others. This has been followed by the growing public support for the IT/software industry coming from both entity and cantonal governments. Yet, the majority of recent policy initiatives tailored to support the industry have been implicitly supportive of the further growth of the predominant 'outsourcing' model in which software companies from the FBiH export low-to-medium value-added tailor-made services to overseas clients. A little has been done to support the upgrading of the industry toward innovation-intensive product-based development models. In other words, the current policy response maintains the status quo rather than promoting moving up the value chain.

Considering vast opportunities within the outsourcing niche, there are no substantive imminent incentives for the industry to experiment with product-based modalities. Outsourcing allows companies in developing countries to experience fast growth, usually competing in the international market by low costs, foreign language capabilities of the workforce and decent quality of services/outputs. However, although job-rich, this development path comes with notable downsides, such as limited returns, lower technological spillovers to other domestic industries and potential long-term lock-in in lower-end segments of the software value chain (see Chapter 2.2.4).

[1] The term industry is used as a synonym for the term sector.

[2] Bosnia and Herzegovina is administratively comprised of two entities – the Federation of BiH and Republika Srpska – and the Brčko District of Bosnia and Herzegovina. The Federation of BiH has 10 cantons. This means that the economy of each canton is governed by three levels of policies, i.e. state-level policies, entity-level policies and cantonal policies, depending on the jurisdiction of each of the administrative levels in specific policy areas. The focus of this thesis is on entity-level policies/governance, and relevant state-level strategies and framework laws but cantonal initiatives in relevant domains have been also taken into consideration.

The purpose of the thesis is to assess the potential of government support to the software industry in the FBiH in terms of functional upgrading toward higher-end activities (moving up the value chain) by enhancing the industry's innovation capabilities to produce competitive software products. The thesis considers the rationale, viability and purposefulness of introducing a policy mix that would address systemic constraints and disincentives that prevent the industry to shift from the lower value-adding service model to higher value-adding product-based models. In doing that, the thesis relies on the analysis of a theoretical body of knowledge, empirical evidence, policy experience of other countries and exploration of the current setup of the FBiH software industry.

Specific research questions of the thesis are:

1. What are the structure, development path and position within the value chain of the software industry in the FBiH?
2. What are the current capabilities, needs and constraints faced by the FBiH software industry regarding the creation of software products?
3. What is the room for addressing systemic and capability constraints and gaps through public policy response, i.e. innovation/industrial policy?
4. Relatedly, what is the preferred policy approach considering the existing body of knowledge and characteristics of domestic industry and institutional setups?

The research was intended to have policy relevance. It means that research findings should inform and shape ongoing academic, professional and policy debates on creating a favourable policy environment that would reduce barriers and stimulate the FBiH software industry to sustain growth and evolve by putting more focus on innovation-enhancing policy approaches and measures. As a by-product, it is expected from this thesis to inform a wider discourse on IT/software outsourcing as a model for IT/software industry development, which is usually praised for job-creation potential but whose disadvantages are often underestimated or insufficiently recognised.

The ultimate goal of the thesis is to provide sound evidence and rationale for government support to the FBiH software industry in the area of functional upgrading toward higher-end activities, which takes into account the long-term development and sustained growth of the industry. In order to achieve that, the thesis has the following specific objectives:

1. to provide an understanding of the innovation policy in a wider sense, as a multiple-domain policy mix that improve conditions for functional upgrading, structural transformation and innovation-led development;
2. to systematize relevant and scarce evidence on the software value chain, thus providing a better understanding of the position of a particular software industry within the value chain;
3. to identify and outline disadvantages and long-term risks associated with the IT/software outsourcing model on the 'service supply' end;

4. to qualitatively examine the current state of play regarding product innovation in the FBiH software industry;
5. to identify the main capability gaps and systemic obstacles that prevent the FBiH software industry to shift/diversify toward the higher-end segments (i.e. moving from the service-based to product-based models);
6. to outline the rationale and analyse the viability and purposefulness of policy response aimed at functional upgrading and enhancement of product innovations in the FBiH software industry, by analysing the existing policy course and identifying key policy challenges in selected relevant areas.

The thesis applies a qualitative approach to data collection and analysis. To understand the current setup of the software industry in the FBiH, systemic constraints or disincentives that keep the industry away from the product-based model(s), and potential policy response, both secondary and primary data collection and analysis have been performed.

Secondary research included an extensive literature review to establish theoretical foundations for the analysis, obtain insights into public policy trends in relevant areas and extract key insights into different (economic) policy instruments applied to promote innovativeness across the economy or within the IT/software industry, and desk research focused on the analysis of available data relevant for the topic, including governmental sources, independent research, development projects and other knowledge-holders involved with the software industry.

Primary research included the following:

- Analysis of innovation policy framework and institutional setup in the FBiH, from the lens of the digitalisation/software industry, including (i) key policy documents in the areas of innovation policy, digital economy/information society and the software industry, (ii) existing fiscal incentives and other policy measures oriented toward stimulating the more innovative and entrepreneurial economy. Policies at the cantonal level have not been analysed systematically due to the formal limitations of the thesis but special attention has been put on Sarajevo Canton considering that more than half of the software industry is concentrated in this administrative unit (see Chapter 3.2).
- Semi-structured interviews with representatives of the software companies, Bit Alliance[3] and experts/knowledge-holders. The key informant technique was applied to obtain insights into the relevant topics. This technique relies on qualitative in-depth interviews with people who

[3] Bit Alliance is a (representative) association established in 2014 that gathers the largest IT companies in the country. The Association promotes the interests of the industry by advocating for better policy solutions and by providing support to members and the industry in various areas, e.g. joint human capital development initiatives, joint projects, collaboration with external stakeholders, etc. (Bit Alliance, 2023). In that sense, Bit Alliance can be considered a key industry system player in BiH and, thus, in the FBiH.

have a good understanding of the specific industry, market, ecosystem or community. The aim of the interviews was to obtain an understanding of the industry, its setup and growth potential, R&D capabilities and the main structural obstacles that companies face regarding the creation of innovative software products. Research interviews were conducted with 8 key informants, considering that some of the existing studies indicate that no more than 10 key informants have to be interviewed when applying this technique (Muellmann et al., 2021). Key questions and a list of participants are available in Appendix 2 and Appendix 3.

The thesis is divided into four main parts/chapters. (1) The first part briefly explains and defines innovation policy for the purpose of this thesis, thus perceiving innovation policy primarily from the lens of functional upgrading/moving up the value chain. Considering a relatively low amount of theoretical and empirical research that specifically tackles the topic of innovation policy for the software industry, this section tends to provide a high-level framework that is further complemented by additional consideration in other chapters of the thesis. This chapter also provides a conceptual overview of the software industry, defines software product and software service, and systematises key knowledge on the software value chain. Special attention has been put to understanding the IT/software outsourcing industry, its position in the global value chains, and the disadvantages, challenges and risks associated with outsourcing as a development model for the industry. (2) The second part analyses the current setup and development path of the FBiH software industry, key policy-related constraints/gaps preventing the shift toward product-based models and the policy course outlined by strategic documents from the lenses of opportunities and constraints for shifting/diversifying toward the product-based models. (3) Finally, the third part discusses the policy implications of findings, the rationale and the high-level design of the potential public policy response promoting functional upgrading of the software industry. The thesis does not provide an in-depth analysis of the policy design but rather tends to introduce the topic and provide initial, high-level, recommendations. These inputs/recommendations should be used as a starting point for opening a wider policy debate and conducting more exhaustive research in the future.

Research has been marked by two major crises/disruptions that heavily affected the global tech industry, including the software industry. The first was the COVID-19 pandemic that led to massive digitalisation in many areas of socio-economic life during 2020-2021, thus stimulating demand for software solutions and positioning tech industry as the centrepiece of the response to a ‘new normal’. The second is a crisis that specifically hit the global tech industry in the second half of 2022 (sometimes labelled as tech industry’s recession), resulting in mass layoffs and downsizing of operations/investments among the industry’s leaders, such as Google, Meta, Twitter, Amazon, Salesforce, to mention a few. The latter crisis is especially relevant in the context of the thesis, considering it may have consequences on global tech value chains. However, scale and intensity of the crisis are still not fully clear, whilst its effect on service-oriented vs. product-

based software companies in developing countries is yet to observed. Therefore, it has to be acknowledged that the ongoing developments, which started occurring at the moment of finalising this thesis, could shed a new light and have a profound impact on understanding particular aspects tackled by the thesis.

# 2 INNOVATION POLICY IN THE CONTEXT OF THE SOFTWARE INDUSTRY'S CAPABILITY DEVELOPMENT

## 2.1 Innovation policy for functional upgrading

Innovation policy can be defined as a "public intervention to support the generation and diffusion of innovation" (Edler et al., 2016, p. 3) or "the set of public interventions on behalf of the public interest that are directed towards influencing the context in which firms and other innovators operate" (Borrás & Edquist, 2016, p. 8). In the EU's Fact Sheet on the European Union, innovation policy is considered as "the interface between research and technological development policy and industrial policy", which "aims to create a conductive framework for bringing ideas to market" (Gouardères, 2021). As pointed out by Fagerberg (2017), innovation policy can be understood in a narrow sense, as the set of policies and interventions intentionally designed and applied to affect innovation, or in a broader sense, as all policies that impact innovation. The latter understanding means that policies tailored for other purposes can also make an impact on innovation activity (Edler & Fagerberg, 2017).

Innovation policy is often considered as (i) a broader, modern-day, form of former industrial policy (Soete, 2007), i.e. a policy framework that evolved from industrial policy, or (ii) a set of policies linked to, complementary or intertwined with industrial policy (World Trade Organization, 2020). Thus, innovation policy is considered to be a constituent part of 'new industrial policies' (World Trade Organization, 2020). In that sense, innovation policy plays a crucial role in the 'productive transformation' of an economy or industry, such as transitioning toward new products or higher value-added activities (Nübler, 2014). Some of the voices within the ongoing debates on industrial policy emphasise that contemporary industrial policies (should) expand the focus beyond the manufacturing industries and include service industries as well (Rodrik, 2022). Therefore, innovation policy in this thesis is considered as a form of industrial policy aimed at increasing innovativeness within the industry or a specific niche within the industry (vertical approach) or economy as a whole (horizontal approach), regardless of the type of industry.

Although knowledge creation and learning are considered fundamental roles of innovation policy (Bengt-Åke, 2003), contemporary literature and policy debates go beyond the 'knowledge generation function' and understand that innovation is influenced by a broader and more complex

set of factors, i.e. socioeconomic context in which ideation is positioned (Borrás & Edquist, 2016; Raee et al., 2017). It includes entrepreneurship and competition in the market, availability of talents/skillsets and education policy, among others (World Trade Organization, 2020). Therefore, as already briefly mentioned above, innovation policy often tends to affect various constituents in innovation systems and address obstacles to innovation beyond knowledge production and diffusion.

Innovation policy is seen as an important instrument for stimulating productivity, competitiveness and growth, whose relevancy is recognized by policymakers and experts in both high-income and low-income economies (World Trade Organization, 2020).

Historically, the development of the IT/software industry was, and still is, heavily and distinctively influenced by policy actions and government support. As observed by Lippoldt and Stryszowski (2009), policy support – with a strong emphasis on innovation/R&D policy – has played a significant role in the development of software industries in well-known software destinations, Ireland, Israel, Spain and India, regardless of different setups of these national industries. Similarly, Tessler et al. (2003, pp. 4-9) have documented that government support to software/tech industries in Ireland, Israel and India transformed and advanced their national software capacities, making these countries some of the leading global software exporters. Along with the overall, yet context-specific, government-led promotion of the development of software capabilities, innovation-oriented public policies and targeted budgetary spending had a determinantal role in yielding ICT innovations. For instance, Mazzucato (2015) has extensively documented and demonstrated that many of the ICT products/technologies originate from the US state-led (primarily defence-related) R&D programmes. Governments also use innovation policies to promote product-oriented software niches when the industry is predominantly concentrated around software services (see Chapter 2.2.1 for more on the distinction between software services and software products), thus promoting moving up the value chain. For instance, India has started promoting an innovative, product-oriented, software industry to complement the existing advantages in the field of IT-enabled services (ITES). In that sense, the National Policy on Software Products – 2019 defines a range of innovation-promoting measures oriented toward stimulating software products (Government of India - Ministry of Electronics and Information Technology, 2021). The impact of software on other industries in terms of productivity enhancement and changing ways of doing business is one of the main reasons for the government to take an active part in promoting IT/software innovations (Lippoldt & Stryszowski, 2009).

In the specific context of this thesis, as it was briefly elaborated in Introduction, innovation policy is primarily analysed in the context of 'functional upgrading', i.e. as an instrument to support moving up the value chain in the software industry. Namely, as it will be further elaborated in Chapter 2.2.5, participation of the software industry in the global value chains (hereinafter: GVCs)

is not a sufficient precondition for developing capabilities to move toward high value-added segments of the software value chain; moreover, as mentioned by some key informants (see Chapter 3.2), the current participation in GVCs disincentives companies to invest into innovation capability upgrade. OECD (2007) has recognised innovation and entrepreneurship policy, in a broader sense, as one of the key pillars for moving up the value chain.

Considering the reason mentioned above, the thesis applies the broader understanding of innovation policy design (mix) when analysing innovation policy in the context of the software industry. Innovation policy mix is "the set of specific public interventions aiming at addressing concrete problems in the innovation system" (Borrás & Edquist, 2016, p. 3). In that sense, Borrás and Edquist (2016), World Trade Organization (2020), and Cirera et al. (2020) provide comprehensive systematisations of innovation policy mixes (policy issues that need to be addressed and policy instruments that can be used, among others). The innovation policy mix focuses on policy responses in multiple areas, which can be considered as (i) supply-side constraints (e.g. low investment in knowledge generation/R&D or acquisition, inadequate skill supply, technology adoption issues, knowledge gaps in innovation management, etc.), (ii) demand-side constraints (lack of demand for innovative outputs), (iii) under-developed entrepreneurship (poor business climate, lack of startup/business support ecosystem, etc.), (iv) lack of collaboration among the key constituents in the innovation system (absence of clustering, insufficient collaboration between universities/R&D institutes and industry, etc.), and (v) regulatory constraints or gaps (e.g. inadequate intellectual property rights protection, poor trade policies, etc.).

Considering the limitations of the format, this thesis focuses analysis on the three main areas: supply-side (R&D, talents and internal capabilities to manage innovation activities), demand-side (a market for software) and entrepreneurship as means of stimulating product innovations. Considering that knowledge (cognitive capital) is, as explained in Chapter 3.3, one of the key prerequisites and drivers of software innovations, the supply-side constraints/obstacles and policy solutions will be thoroughly explored within the thesis. On the other side, innovation-led development of the software industry requires a market that can 'pull' software products, i.e. create a sustainable demand for software solutions. Thus, supply and demand measures could be understood as key areas for consideration. However, entrepreneurship in tech industries is also an important source of innovations: innovative product-based tech startups have shaped the global economy in recent decades and given vitality to the software industry (Zhang, 2003; Schwab, 2016). On the other hand, agglomeration policies tending to create vibrant high-tech clusters have not been explored in this thesis, considering it would require extensive analysis of market players, the economic potential of clustering and innovation networks, which notably exceed the formal limits and scope of this thesis. Similarly, in-depth analysis of regulatory gaps (e.g. data protection and intellectual property rights policies) have not been covered by the thesis and should be a subject of future research.

The next chapter explores the difference between service export and product-based models through the prism of horizontally integrated (global) software value chains, whereby the aim is to outline the disadvantages of the service export model and opportunities for functional upgrade.

## 2.2 Understanding the software industry in terms of its position in the global software value chains

### 2.2.1 Defining the software industry

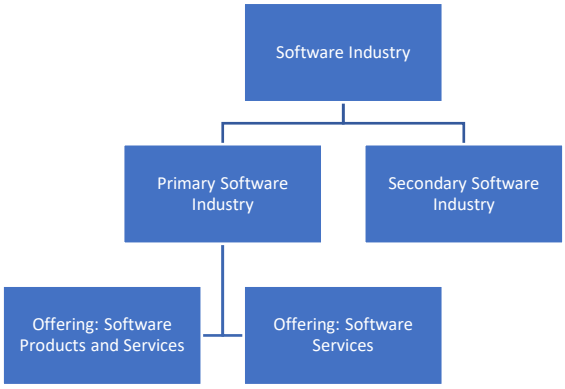
Since the beginning of the third industrial revolution in the 1950s, software has been an increasingly important factor in technological and business development. The occurrence of the modern computer and Internet in the middle and the second half of the 20th century created a wide range of new economic opportunities and very soon profoundly transformed the global economy and societies. The transformation relied not only on improving hardware – e.g. processing power, the efficiency of design, etc. – but also on improving software, i.e. logical and mathematical commands (codes) that run and command the machines (Campbell-Kelly, 2003; Saxena et al., 2017). The industry is often described as the engine of growth in advanced economies: it transforms other industries, while its contribution to employment, competitiveness and innovation is immense (Schleife et al., 2017).

Software industry can be defined "as the sum of all enterprises whose core business is closely related to the development of software products in its broadest sense and complimentary services" (Schief, 2013, p. 14; Pussep et al., 2011). However, a notable portion of software products/solutions has been produced by companies whose primary business activities are not related to software development but rather perform software-intensive activities. In other words, many organisations belonging to other industries have internal units for software development and/or service, although not performing it as their core business. This is usually classified as the 'secondary software industry' (Saxena et al., 2017). Furthermore, boundaries between the software industry and other industries are fading out. Software plays an important role in agritech, fintech, biotech and other niches that combine traditional sectors and high-tech solutions. The convergence of the software industry with other industries makes sectoral boundaries hard for defining.

The main division of companies within the (primary) software industry is between those that are focused on product development and those oriented toward the provision of services (Figure 1). Product companies develop and sell software products (operating systems, applications, etc.) that

tend to respond to the identified market needs[4] (Saxena et al., 2017). On the other side, software services companies mainly deliver services "such as system integration, custom applications and IT consulting" to other businesses or the public sector in line with their specific needs and requirements (tailor-made software solutions) (Saraswati, 2012, p. 10; Saxena et al., 2017). In other words, software services imply a wide spectrum of activities and include all individual segments of software development, ranging from research and design, via coding to maintenance (Rocheska et al., 2015). However, the software service industry is less observed and less understood: sometimes, it is referred to this industry as 'the hidden industry', despite the fact it is approximately of equal size to the software product industry (Saraswati, 2012). This division indicates the double nature of software: it can be both product and service.

*Figure 1: Typologization of the software industry*




*Source: Saxena et al. (2017, p. 80).*

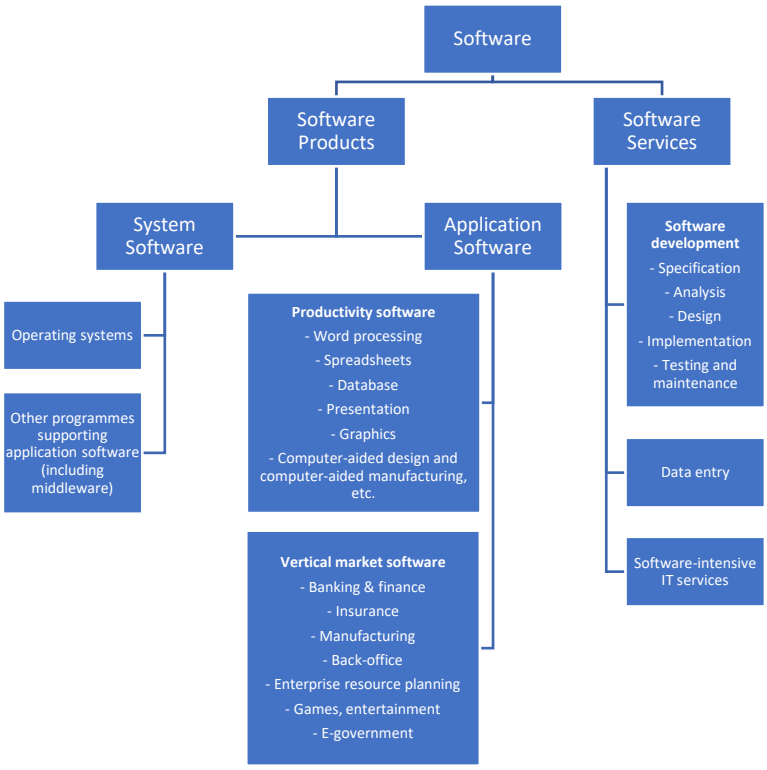
### 2.2.2 Defining software product

Software represents different types of structured and codified commands and instructions that operate machines (e.g. Engelhardt, 2008). In that sense, the software comprises a wide spectrum of different products, ranging from complex operating systems that run hardware (e.g. computers, smartphones, etc.) to software applications that execute various specific tasks and differ in the purpose, complexity and functionalities provided to end-users (Lippoldt & Stryszowski, 2009). Software-as-a-service (hereinafter: SaaS) can also be understood as a product: SaaS represents centrally hosted, cloud-based, software solutions that are provided to end users on a subscription basis (e.g. Dropbox, Zoom, Slack, etc.). However, along with software products, software services

[4] Predominantly, companies sell licences or subscription packages for products they developed. Along with that, product companies usually ensure product maintenance (e.g. in form of regular updates or upgrades) and in-house or outsourced customer support.

are often considered as part of software's definition (Figure 2). It encompasses "all services related to the traditional software development lifecycle", data entry and various software-intensive IT services (UNCTAD, 2012, p. 7).

*Figure 2: Categories of software*




*Source: UNCTAD (2012, p. 6).*

Software products belong to the sphere of higher value-added compared to software services (Figure 3). Products and services for export are adding more value than those traded in the domestic market. In other words, "the scope for value creation depends on the nature and market orientation of production" (UNCTAD, 2012, p. 7), as presented in Figure 3. This conceptualisation can be used to present a diachronic evolution of the software industry as well. Developing countries usually start with activities with lower entry barriers such as data entry and software services provided on the domestic market. Maturation of the industry moves companies towards production and export of their own products, if the context is favourable (i.e. availability of skilled workforce, sufficiently large domestic market or ability to export, etc.) (UNCTAD's 2012, pp. 7-9). Therefore, companies need to develop capabilities to innovate in the product sphere in order to enter the most lucrative domains of the industry.

*Figure 3: UNCTAD's conceptualisation of the software value chain*


*Source: Adapted from UNCTAD (2012).*

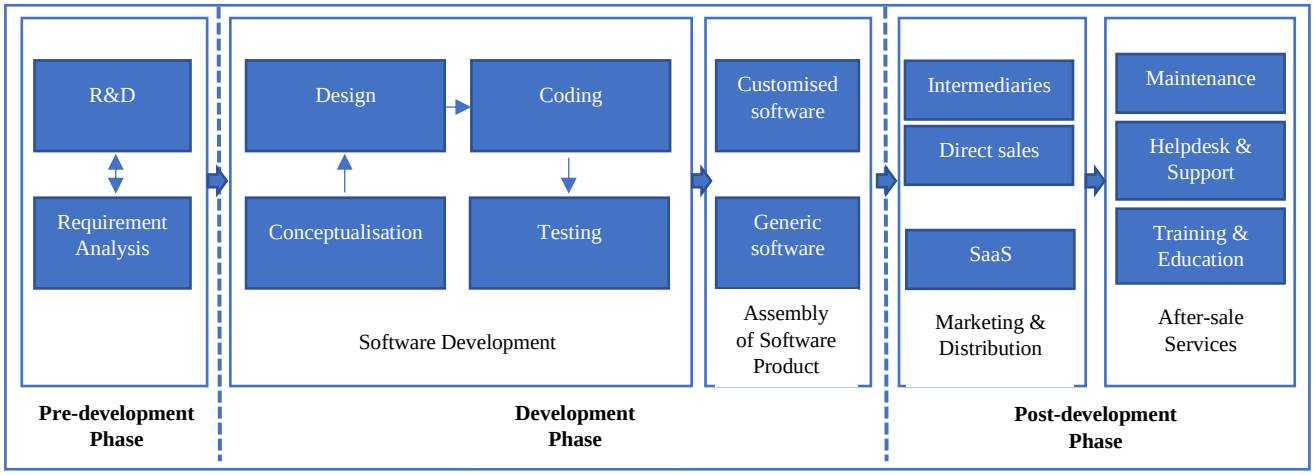
Software innovation can be understood as a process that results in a (novel) 'software artefact', which can be either a programme, software application, algorithm or code (Rose, 2010, p. 15). More specifically, according to Lippoldt and Stryszowski (2009, p. 51), software innovation can be understood as the "development of a novel aspect, feature or application of an existing software product or process", or "introduction of a new software product or process or an improvement in the previous generation of the software product or process", which leads to "entry to an existing market or the creation of a new market". This thesis focuses on (commercial) product innovations, which require companies to develop capabilities in the software pre-development phase and are followed by post-development, downstream, activities, as elaborated in the next section.

### 2.2.3 Software value chain

Despite the growing body of academic knowledge on the software industry, little attention has been paid to understanding the software value chain. Only a few research papers have been published on this topic in recent years (the following were identified and reviewed: Arora et al., 2001; Sharpe, 2009; Pussep et al., 2011; Pussep et al., 2012; Rocheska et al., 2015; Huang et al., 2021). The representation offered by Sharpe (2009, according to Huang et al., 2021) recognises the following elements of the value chain: architecture (consulting, analysis, concepts); developing code; testing; implementation, marketing and distribution; maintenance; helpdesk and training and education. Other representations provide a similar understanding of the value chain. The most comprehensive one, yet simple, was offered by Huang et al. (2021). It divides the software value chain into the pre-development, development and post-development phase. A pre-development segment of the value chain is comprised of R&D (e.g. on software or hardware prerequisites and tools, research of fundamental algorithms and selection of major technologies and subsystems; some of these elements were recognized by Pussep et al., 2012) and user needs /requirements analysis (Huang et al., 2021) or, in other words, market research. Pre-development segment is a key part of the chain in the context of product innovation. The development stage encompasses software development (conceptualization, design, coding and testing of software components) and assembly of an executable software product that can be customized or generic. Finally, post-

development value-adding activities in the software value chain are comprised of (i) marketing and distribution of software products, which can be done directly by a company that produced software or through intermediaries (shops, sales companies, etc.) but can also be sold as a subscription to a cloud-based platform/service (software-as-a-service); (ii) after-sale services, such as continuous maintenance of a software product (e.g. bug-fixing, software upgrades, migration to new operating systems, etc.), customer support provision and training/education on how to use the software. Figure 4 visually presents this conceptualization of the software value chain.

*Figure 4: (Generic) software value chain*

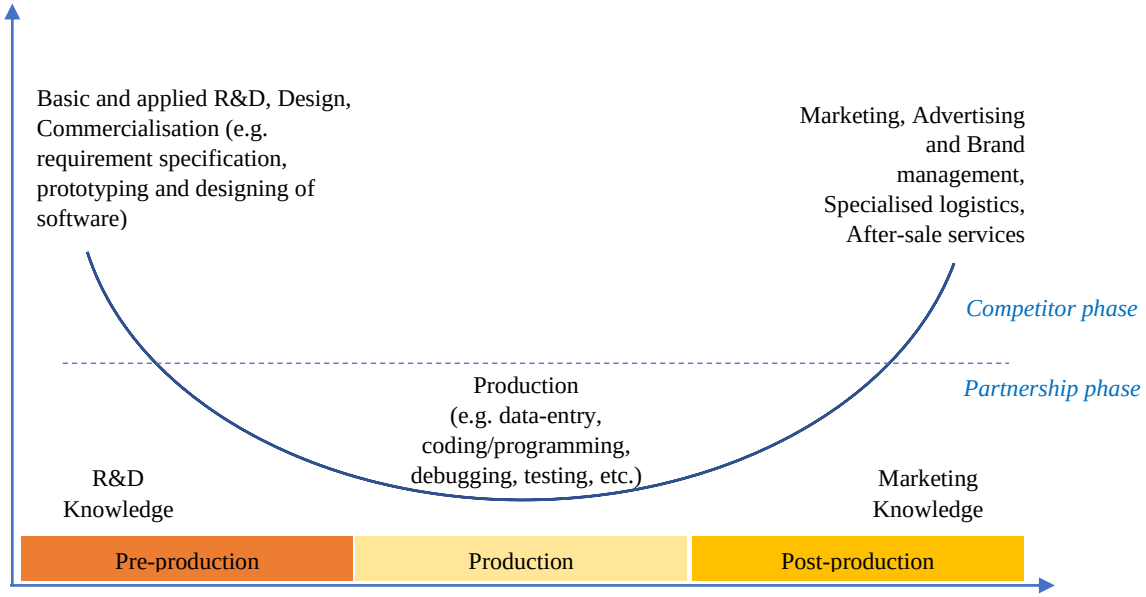



*Source: Adapted from Huang et al. (2021).*

Although there is no comprehensive research that analyses how the value is added within the software value chain, the existing partial and scattered evidence can be used to distinguish higher value-added from low value-added segments of the value chain. Thus, software development, especially in the domains of coding and testing (Figure 4) can be considered as a low-end part of the value chain. In other words, low-end segments of the software value chain are comprised of activities such as data-entry tasks, low-level design, coding and programming, debugging and testing, conversions, maintenance and alike (D'Costa, 2004; Sridharan, 2004). On the other side, requirement specification, high-level design and prototyping require highly skilled labour and belong to higher value-added software development activities (D'Costa, 2004; Sridharan, 2004). Therefore, instead of providing a precise analysis of software value chains from the perspective of the distribution of value-adding potential, this thesis uses a general smiling curve[5] to depict the value-adding dimension of different software development activities (Figure 5).

[5] The smiling curve as a concept was developed by Stan Shih, the founder of Acer Inc (multinational hardware company), in the early 1990s to explain how different parts of the hardware/personal computer industry are adding value to the end product. The concept gained popularity in explaining how the value has been created in the value chains of other industries as well. Although the distribution of value-adding potential is mainly U-shaped – whereby

*Figure 5: The smiling curve in the context of the software industry*




*Source: Own work based on Mudambi (2008); Yan & Islam (2011); D'Costa (2004); Sridharan, (2004); Huang et al. (2021).*

The whole value chain can be performed by one company (so-called vertical integration), by a cluster of companies or in a way that some particular activities, i.e. elements of the value chain, are outsourced by one to another company (horizontal integration). However, most of today's software companies outsource some nodes of the chain, while the full vertical integration is more often the case among start-ups and companies at the early stage of their development (Schief, 2013). Thus, the latter case is becoming increasingly evident in practice, considering that "the high modularity of the software development process allows fragmentation in multiple sub-components" (Rocheska et al., 2015, p. 91). Companies often offshore part of the software development process to other countries for various reasons, but primarily to deflate costs of production (cost-reduction strategy that usually relies on lowering labour costs and costs associated with management of human resources), improve the efficiency of delivery (e.g. different time-zones, which enable a company to provide constant support or reduce time losses within the production process), access pool of talents that a company's country is lacking due to under-supply of IT professionals or to bridge the gap in internal expertise, thus outsourcing particular activities to companies specialised in relevant domains (Rocheska et al., 2015;

R&D/design and marketing/branding are high ends of the chain, while production belong to lower value-added activities – its curvature differs from industry to industry.

Pankowska, 2019). In that sense, software outsourcing/offshoring is at the very core of today's global IT/software industry.

### 2.2.4 Horizontally integrated software value chains: the software outsourcing industry

Outsourcing has been increasingly popular and used in many industries in recent decades, including the IT/software industry. Most simply, outsourcing can be defined "as the practice of subcontracting service and manufacturing works to external business units" (Pankowska, 2019, p. 2). IT outsourcing (hereinafter: ITO) has been introduced as a practice in the second half of the 1980s (Pankowska, 2019; see the same article for different modalities of outsourcing) and since then, it has been in constant expansion. This thesis analyses outsourcing in terms of offshoring/nearshoring, i.e. as the phenomenon of companies in one (developing) country joining global value chains and providing software development services, or performing other activities within the value chain, to/for companies in developed countries.

Software industries in developing countries mainly grow and develop through outsourcing. Despite low entry barriers, at least in terms of capital, it appeared that only „a few low-income countries have emerged as relatively successful players in the global market for ICTs" (Vijayabaskar & Babu, 2014, p. 239). They mainly succeed in the sphere of ITO, rather than in product-based models (UNCTAD, 2012; D'Costa, 2004; Gereffi & Fernandez-Stark, 2010). India is considered the global leader in the software outsourcing industry. Along with India and China, some European countries (e.g. Poland, Romania, and Ukraine before the war) are also important global players in this domain (Gunn, 2021). The development of software industries in the Western Balkan countries is also mainly based on outsourcing models (Shllaku et al., 2020).

Rapid digitalisation and the need for ICT solutions combined with a low supply of IT professionals globally (Korte et al., 2017; McGrath, 2019) create opportunities for talent-rich and low-labour-costs countries to capitalise on the context, i.e. to take advantage of stable and diversified demand that cannot be met within markets of developed countries. The outsourcing niche of the IT industry enables companies from developing countries to enter global value chains without substantial capital investment (more on capital-intensity vs. skill-intensity of the software industry in Rocheska et al., 2015), considering that IT/software outsourcing industry predominantly relies on low-cost labour availability. In turn, it offers relatively attractive margins and a profitable market (D'Costa, 2004), i.e. easy-to-achieve returns on investment. Finally, when observed at the level of the economy, the IT outsourcing industry provides a relatively stable source of employment and income for developing countries as long as they manage to keep low/competitive labour costs (Gereffi & Fernandez-Stark, 2010). For instance, the ITO industry in India has created incomparably more well-paid jobs than any other industry over the past few decades (Nano & Stolzenburg, 2021).

However, offshoring is not necessarily concentrated on outsourcing low-end tasks to other companies. It can also include R&D and other higher-end activities, such as software architecture, IT consulting, project management, etc. (Rocheska et al., 2015; Aspray et al., 2006; Gereffi & Fernandez-Stark, 2010). Yet, it requires a high degree of specialisation (strong domain expertise, highly skilled workforce, etc.) and sophistication of services provided by suppliers in this kind of relationship. Contrary to a standard transactional relationship between the client and supplier in 'lower-end' outsourcing, where a client provides a blueprint and the supplier executes specific tasks (i.e. deliver specific outputs), the outsourcing of higher-end activities usually relies on a two-way, transformative and collaborative partnership. In the latter case, the purpose of outsourcing is not just to minimise costs of production, but rather to add value, bring innovative solutions and ensure delivery of outputs for which a client does not possess in-house expertise to produce. Table 1 provides a brief overview of the main distinctive characteristics between transactional partnerships focused on delivering low-end tasks/outputs and transformative partnerships concentrated around collaborating at high-end activities in outsourcing relationships. However, although upgrading toward the higher-end activities within the value chain, a supplier within this kind of relationship still misses to capture the largest part of the value (return) generated by the end-product sales. This can only happen by having control over the value chain, i.e. by exiting the partnership phase (service provision) and entering the competition sphere (software product creation) as it has been shown in Figure 5.

*Table 1: An overview of some of the key differences between outsourcing arrangements in the lower end of the value chain and the higher end of the value chain*

| **Indicator** | **Lower value-added end** | **Higher value-added end** |
|---|---|---|
| Type of relationship | Transactional relationship with clients (e.g. simple delivery of outputs per defined tasks) | Transformative relationship with clients (collaborative innovation) |
| Level of involvement | Third-party hands-off contractual relationship | Mutually beneficial, two-way, partnership; trust is crucial for the relationship |
| Type of task delivered to clients | Non-core, routine / repetitive and non-strategic tasks | More substantive, creative, more knowledge-intensive and innovation-driven tasks |
| Purpose of outsourcing | Minimising client risks and costs | Adding value (value is co-created by client and supplier) |
| Growth strategy | Reducing production costs | Expertise-building and investing in innovation |

*Source: Based on Abbott et al. (2012).*

As a model of the software industry development, outsourcing has non-negligible downsides. The literature has identified the following disadvantages of the model:

- Lock-in effect: It undermines or slows down the future transformation of the industry toward the higher-end profile. Companies fail to develop internal capabilities for producing their own products or performing sophisticated activities within the value chain. ITO companies are at risk of not adequately developing domain expertise (especially if they are project-driven). The outsourcing software industry fails to articulate a long-term innovation approach (D'Costa, 2004, p. 51). Considering that access to end-markets/end-users and high-profile know-how or technology are managed and controlled by the client (Nano & Stolzenburg, 2021), it reduces the ability of the service export companies at the lower end of the value chain to upgrade capabilities and develop market knowledge.
- Limited returns: Software products "provide the largest margins as they entail concept building and marketing" (D'Costa, 2004, p. 67), while ITO companies usually experience lower returns and are unable to achieve the economies of scale, considering that IT/software service provision to overseas clients is a labour-intensive model.
- Limited spill-over to other industries in the domestic market: The industry also loses the link with the domestic market (e.g. too expensive services for the local companies due to price inflated by the demand in the developed countries), which "truncates the immense technological spin-offs possible with finding software (IT) solutions to local problems" (D'Costa, 2004, p. 51).
- Negative impact on the IT workforce development: If the IT/software industry is dominated by lower-end jobs, opportunities for IT professionals to upgrade and diversify skills will be limited, thus negatively affecting the medium-to-long-term development of human capital. Many ITO destinations are characterized by the domination of lower-end and routine tasks/jobs, considering that their position within GVC is mainly concentrated in coding, testing, data entry, etc. (Nano & Stolzenburg, 2021). It also influences the education policy choices and outcomes of both formal and non-formal education. As observed in India's case, outsourcing countries tend to produce coders/programmers instead of software engineers and architects (V & Sharma, 2011). Also, lower-end or repetitive projects do not fulfil the long-term ambitions of employees (V & Sharma, 2011), which can push professionals toward other industries or countries.
- Vulnerability to automatization: Relatedly, the increasing opportunities to automatise lower-end tasks, including code writing and reviewing, testing, debugging, etc. due to the rapidly growing capabilities of tools based on Artificial Intelligence threaten to replace business operations concentrated around low-end, routine, tasks in the software value chain (Nano & Stolzenburg, 2021; Chapter 3.2).

### 2.2.5 Moving up the Value Chain

Moving up the value chain represents a process of a company's or industry's shift toward the production of higher value-added goods or services by enhancing its capabilities. More specifically, in the context of the service outsourcing industries it "refers to service providers being able to develop their capabilities to the extent that they can provide more value-added services to clients" (Abbott et al., 2012, p. 2). By moving up the value chain, service providers can start producing their own products as well, instead of developing part of the client's product or providing low-end services to market leaders.

Existential or profitability threats to the company associated with the technological advancements (e.g. automatization of low-end tasks), increased competition due to low entry barriers and weak differentiation between competitors and/or diminishing margins are some of the reasons why companies have to move up in the value chains. This process is sometimes described as 'upgrading', which could be defined as "the event of firms moving up in the chain to perform more profitable activities" in order to be able to „appropriate a larger portion of the value added in the chains" (Armando et al., 2016, p. 40).

*Table 2: Types of upgrading in the (global) value chains*

| **Type of upgrading** | **Definition (description)** |
|---|---|
| Process upgrading | Transforming inputs into products more efficiently through reorganizing production or using superior technology. |
| Product upgrading | More sophisticated products, which can be defined by obtaining higher prices in the market. |
| Functional upgrading | Performing new functions in the chain, as, for example, design or marketing. |
| Inter-industry upgrading | Firms can use the competency learned in a new industry. |

*Sources: Armando et al. (2016); Humphrey & Schmitz (2002).*[6]

However, there is evidence that functional upgrading is not something that happens often in the context of companies from developing countries being involved in the global value chains (Armando et al., 2016, p. 40-41; Humphrey & Schmitz, 2002). Innovation and high value-added activities are usually in the hands of companies in developed countries (buyers or clients), which

[6] Definitions of all four types of upgrading have been literally cited from Armando et al. (2016, p. 40) but put in the tabular form.

do not have the incentive to support functional upgrading of suppliers – they benefit from process and product upgrading, while functional upgrading usually means that suppliers move to the competitors' area. Therefore, companies from developing countries that entered global value chains can end up being locked in the low value-added position, thus narrowly specialising in delivering specific products/services to clients in the developed world (Armando et al., 2016, p. 41). This is the case with the Indian software industry, which was growing in the past decades, generating more jobs and wealth, but missing to evolve, i.e. progress on the value chain (V & Sharma, 2011).

Convergence between suppliers and clients (buyers) in the global value chains, in terms of the ability to produce the same product, usually happens to some degree, but it is not very likely that supplier will reach the point of being able to produce and successfully place the same product independently. In other words, although 'learning by supplying' can enable companies to absorb new knowledge, practices and technologies or, simply said, know-how, the conversion of the absorbed to successful commercial products/solutions is a complex process with a not-so-often positive outcome. It requires strong knowledge and experience on both high ends of the value chain – design (R&D) and marketing and sales. This is especially less likely to happen in the cases of suppliers working with global market leaders, which have well-developed mechanisms and tactics for protecting their ideas, design, and expertise, i.e. intellectual properties. Suppliers are at risk of being locked in their current position in the value chain. These are the findings that have been empirically documented by Alcacer and Oxley (2013) observing the case of the mobile telecommunications handset industry, but the essential findings can be applied to other industries as well.

Therefore, having in mind this limitation in 'vertical spillovers' within global value chains, software companies from developing countries cannot solely rely on knowledge transfers occurring through buyer-supplier relationships, if tend to move up the value chain: the bottom-up development of capabilities is needed and this process can be supported through the public industrial/innovation policy as mentioned in Chapter 2.1.

The next chapter will analyse the software industry in the FBiH to understand its setup, specific gaps and constraints that prevent the industry from producing its own software products and the policy framework that influences overall and specific obstacles in either positive or negative ways.

# 3 ANALYSIS OF SOFTWARE PRODUCT INNOVATION GAPS IN THE FBiH IN RELATION TO PUBLIC POLICIES

## 3.1 Research design and methodology

Findings and conclusions outlined in chapters 3 and 4 are based on a comprehensive and in-depth qualitative data collection and analysis, which encompassed both secondary and primary research. In that sense, analytical insights, which are grouped and presented thematically in these two chapters, represent a product of the critical analysis of information and data obtained from multiple sources.

Secondary research included the following:

- Extensive literature review to establish theoretical foundations for the analysis, obtain insights into public policy trends in relevant areas and extract key insights into different (economic) policy instruments applied to promote innovativeness across the economy or within the IT/software industry. During the analysis of the theoretical and empirical body of knowledge, special attention has been paid to identifying findings applicable to the observed industry (software industry) and the context of local socio-economic and industry setups. Yet, relatively limited literature that specifically explores the software industry from the lens of gaps and constraints preventing the service-export industry from shifting to higher value-added product-based models, viable policy measures to support this type of transition or diversification, etc., resulted in some parts of analysis being more reliant on more general or broad findings from previous research. The literature review was further constrained by the fact that similar research was not conducted in BiH earlier.
- Desk research that was focused on the analysis of available data relevant to the topic, including governmental sources, independent research, development projects and other actors involved with the software industry. Among others, this includes descriptive statistical data on trends in the software industry that have been obtained from official sources, reputable non-official sources (e.g. specialised sites for salary monitoring) and academic and non-academic research/analytical reports.

Primary research included the following:

- Analysis of innovation policy framework and institutional setup in the FBiH, from the lens of the digitalisation/software industry, including (i) key policy documents in the areas of innovation policy, digital economy/information society and the software industry, (ii) existing fiscal incentives and other policy measures oriented toward stimulating the more innovative and entrepreneurial economy. The analysis encompassed relevant strategic state-level and entity-level policies. The funnel approach has been applied, meaning that the author first screened a wide range of policy documents and then analysed thoroughly those that appeared

to be relevant from the perspective of the thesis topic. Policies at the cantonal level have not been analysed systematically due to the formal limitations of the thesis but special attention has been put on Sarajevo Canton considering that more than half of the software industry is concentrated in this administrative unit (see Chapter 3.2).

- Semi-structured interviews with key informants. The key informant technique was applied to obtain insights into the relevant topics. This technique relies on qualitative in-depth interviews with people who have a good understanding of the specific industry, market, ecosystem or community. The aim of the interviews was to obtain an understanding of the industry, its setup and growth potential, R&D capabilities and the main structural obstacles that companies face regarding the creation of innovative software products. Research interviews were conducted with 8 key informants, considering that some of the existing studies indicate that no more than 10 key informants have to be interviewed when applying this technique (Muellmann et al., 2021). The convenience sampling approach was used for selecting interviewees (key informants), whereby the author approached representatives of companies and knowledge-holders who were identified as potentially insightful during the desk research and preparatory consultations. Key informants included representatives of prominent software companies and software startup owners/managers (including both service export and product-based companies), a representative of Bit Alliance and individuals with expertise/experience in conducting industry-level development and policy advocacy activities (knowledge-holders), thus ensuring diversity of viewpoints. Formal requests for research interviews have been sent to all key informants explaining the research topic, purpose and approach (including information on the treatment of obtained information/data). Some of the approached potential key informants refused to participate in the research due to busy business schedules. Key questions and a list of participants are available in Appendix 2 and Appendix 3.

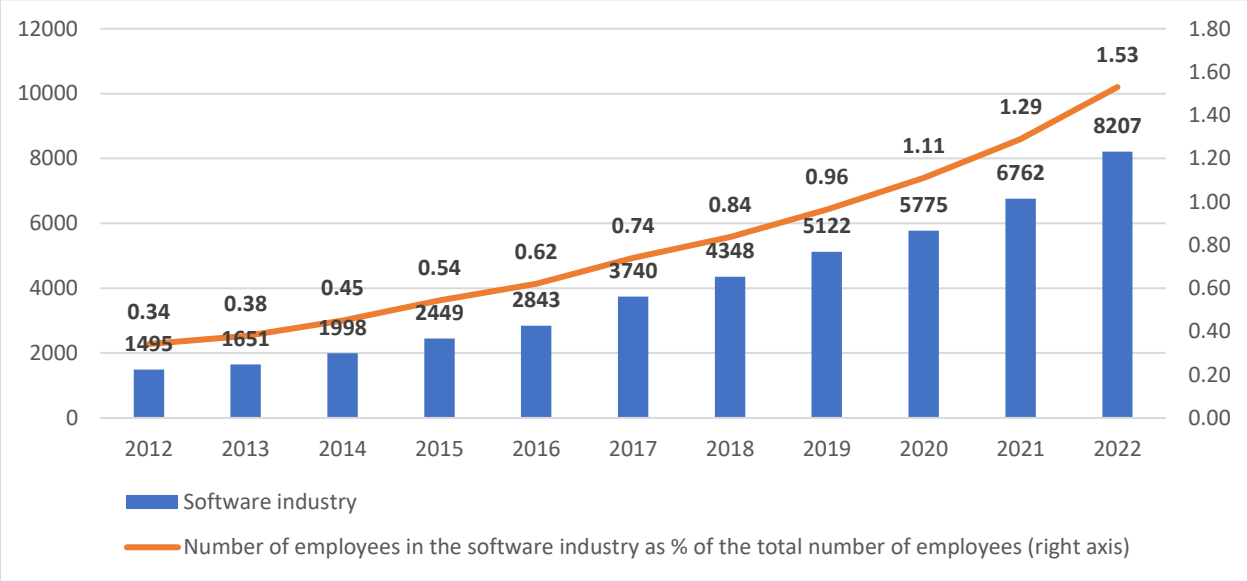
Based on the critical analysis of insights obtained through literature review, desk research and primary analysis of policy documents, information provided by key informants and available statistical data presented throughout Chapter 3, high-level policy recommendations have been formulated and proposed in Chapter 4.

## 3.2 A brief overview of the FBiH software industry

In terms of job creation (employment), the software industry has a record of continuous and stable growth in recent years. During the period of 10 years, between 2012 to 2022, the total number of employees in the software industry in the FBiH has increased by approx. 449% (Figure 6). In other words, the official data shows that the software industry in this entity has been growing, on average, at around 18.7% annually. The growth varied between 10.4% and 31.6% in the year-over-year perspective (Figure 6). The software industry accounted for approx. 1.5% of total formal employment in the entity in 2022, which represents a notable increase in share compared to 2012

(Figure 6) (author's calculation based on Institute for Statistics of FBiH, 2023). Finally, it is worth mentioning that the employment multiplier (type II, i.e. multiplier that includes both indirect and induced effects) for the software industry in BiH is 2.57, meaning that 100 jobs in the software industry support or lead to the creation of additional 157 jobs across the economy (Economic Institute Sarajevo, 2019).

*Figure 6: Job-creation trends in the FBiH software industry (J.62) from 2012 to 2022*



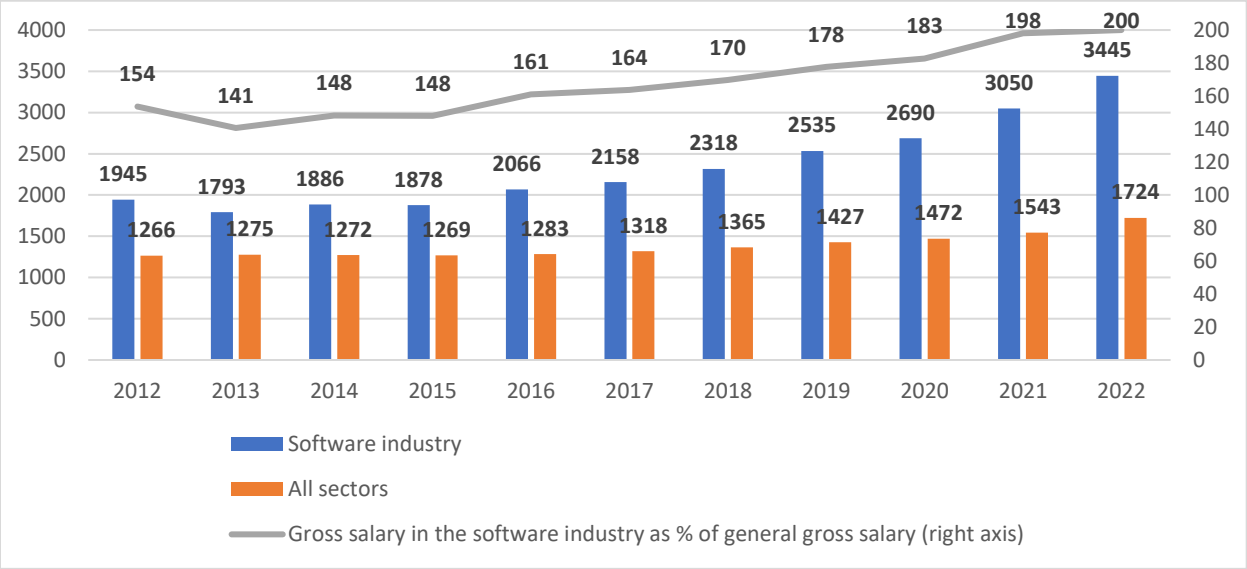

*Source: Institute for Statistics of FBiH (2023).*

The software industry is recognised not only as a prosperous generator of new jobs but also as an industry that creates decent employment opportunities for the domestic workforce. The average gross salary in the software industry in the Federation of BiH was twice as high as the general average gross salary in this entity in 2022 (Figure 7)[7]. In that sense, 8,207 jobs in the software industry – as recorded in 2022 – are equivalent to approx. 16,414 jobs in the general economy in terms of earnings as well as tax and contributions that are paid on salaries. Thus, the software industry belongs to the (sub)sectors with the highest average salaries – only the financial sector/sub-sectors have higher averages (Figure 8). The average wage in the software industry was increasing at a higher pace than the general average salary in the Federation of BiH in recent years: the nominal growth was 77.1% in the former and 36.2% in the latter case over the 10-year period from 2012 to 2022 (Figure 7). Finally, having in mind the under-supply of talent (see more in Chapter 3.3.1), software companies compete for workers by constantly improving working conditions for employees, thus offering flexible hours, remote work, attractive annual leave

[7] This does not include potential informal/undeclared parts of salaries (envelope wage).

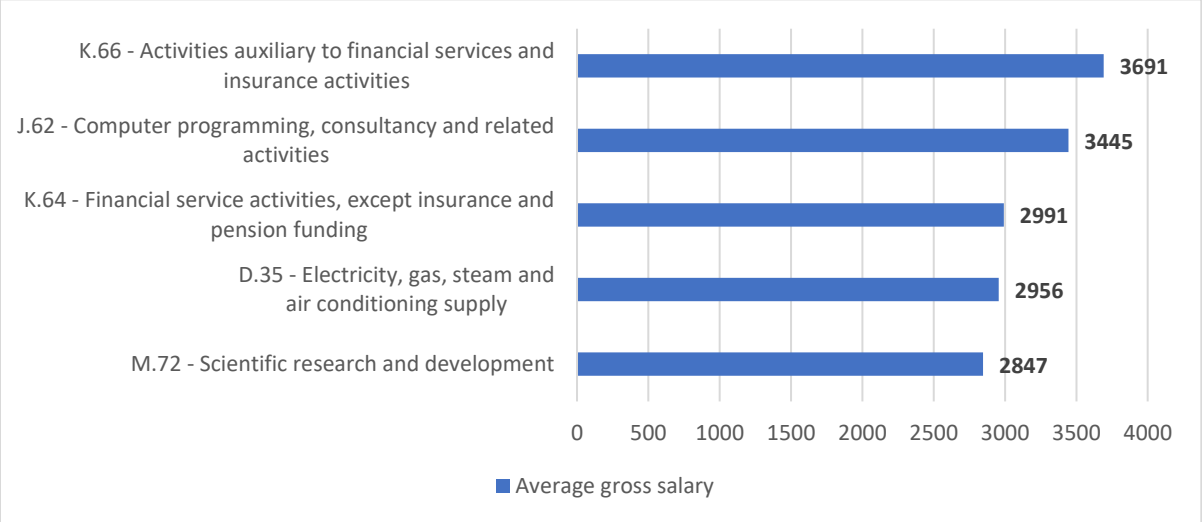
schemes, entertainment within facilities, wellness vouchers, etc. (Fijuljanin & Fijuljanin, 2017; Economic Institute Sarajevo, 2019).

*Figure 7: Average gross salaries in the software industry (J.62) and within the general economy in the FBiH, BAM, 2012-2022*




*Source: Institute for Statistics of FBiH (2023).*

*Figure 8: Industries having an average gross salary higher than 150% (BAM 2,586) of the general average gross salary in the FBiH in 2022*




*Source: Institute for Statistics of FBiH (2023).*

The FBiH software industry is still in the infant development stage and mainly concentrated in Sarajevo Canton. According to the 2020 data, there were 503 active software companies (i.e. companies that reported income) registered under J.62 (Nace Rev 2), out of which 56.5% were located in Sarajevo Canton, 13.3% in Herzegovina-Neretva Canton and 12.3% in Tuzla Canton, while the rest 18% were registered in other 7 cantons (own work based on BISNODE, n.d.). Therefore, more than 4/5 of software companies are concentrated in 3 cantons and more than half of all software companies registered in the FBiH are located in Sarajevo Canton.

The FBiH software industry is dominated by small-sized and micro enterprises and the majority of companies are relatively young. According to the aforementioned 2020 data 74.8% of software companies are micro enterprises, 21.1% are small-sized enterprises and only 4.2% are medium-sized enterprises, without any enterprise counting 250+ employees (large enterprise). On the other side, only 35.8% of companies exist for more than 10 years, whilst 44.5% of software companies have been established in the period 1-5 years prior to 2020 (own work based on BISNODE, n.d.). The low number of medium-sized companies and lack of big ones, together with the predominance of young companies, suggest that the industry is in its infant stage of development.

Despite its rapid growth, the software industry in the Federation of BiH is not known for innovations, at least not for software product innovations. This can be attributed to the fact that the industry is predominantly rooted in the 'outsourcing model' (Strik Consulting, 2017), meaning that local companies provide software development services to clients rather than developing their own software products. A similar is pointed out in some of the recent relevant strategic documents in BiH (see Chapter 3.4). However, although research and strategic documents consistently recognise that the software industry in (F)BiH is primarily an IT outsourcing industry, a comprehensive data-based understanding of the industry's structure in line with UNCTAD's conceptualisation elaborated in Chapter 2.2.2 is lacking. Previous research has found that 21% of the software companies, i.e. companies formally registered under J.62 (NACE Rev. 2), in BiH have their own commercial software product (PricewaterhouseCoopers, 2018), but it is unclear what are the market niches of these products and what is their primary market – domestic market, specific foreign market or international/global market.

In a general sense, the previous findings have been (re)confirmed by the primary research. Key informants have relatively consistently described the industry as predominantly an outsourcing industry, thus mainly estimating that between 70% and 80% of the industry is concentrated around software/IT service export. Very few interviewees have provided estimates below 70% but agreed that software service export (outsourcing) accounts for the major part of the industry. According to key respondents, software service export is followed by software services provided in the local market (approx. 10-15%), while the product-based model is estimated to account for 15-20% of the industry. Data entry is, reportedly, a relatively marginal model within the industry and key informants were not able to mention any software company primarily focused on data entry.

Therefore, it could be said that, following UNCTAD's conceptualisation, the software industry in the Federation of BiH is mainly positioned in moderate value-added segments (Figure 9).

*Figure 9: The illustrative representation of the FBiH software industry composition according to UNCTAD's conceptualisation of the software value chain*


Legend: Size represents the roughly estimated share of the specific activity/model within the FBiH software industry

*Source: Adapted from UNCTAD (2012).*

Software products developed by FBiH companies are, according to key informants, mainly business-to-business (hereinafter: B2B) products, primarily for the financial industry and accounting. Software products for export are usually, as stated by some key informants, developed on an opportunity-driven basis for foreign companies or market niches discovered/identified throughout regular activities. In that sense, product portfolio and expertise lack diversity and business-to-customer (hereinafter: B2C) focus.

Despite the predominance and attractiveness of the 'outsourcing' model, it is not without substantial disadvantages, as recognised by key informants. The following disadvantages have been relatively consistently identified within the primary research:

(i) Inability to achieve economies of scale: Although is known for relatively low entry barriers, low risk and high growth potential driven by insatiable demand for software services in the global market, the outsourcing model prevents software companies from achieving economies of scale. Considering that the outsourcing model is labour-intensive, the increase in output can be achieved only by a relatively proportional increase in the workforce hired by a company. On the other hand, the product-centred model, if successful, increases revenues without a substantial increase in costs: once the product has been developed, it only requires maintenance and upgrades on the technical side, and marketing and sales investments on the placement side. This disadvantage has been identified by literature, as presented above in Chapter 2.2.4.

(ii) Short-term human resource planning and high level of fluctuations: Software service exporters tend to hire and dismiss workers on the basis of the short-term needs of overseas clients. When opportunities for new projects arise, a software company has to onboard new IT professionals (engineers, developers), sometimes dozens of them, to be able to land a new

project. In a highly competitive market on a demand side, with massive labour shortages, it poses a challenge and drives salaries (labour costs) up. On the other hand, loss of the project or reduction in the volume of the project portfolio results in layoffs, considering that some workers become 'projectless'. Although a company can decide to keep good performers on salary even in the absence of projects as a strategy of talent retention, it is a short-lived approach that can, usually, last only for a few months. Although this dynamic is common for all businesses, some key informants indicated that the service export (outsourcing) model is more prone to fluctuations than product-based models. In the cases of the latter, longer-term and more precise human resource planning and investment is possible, which means more stability for both employers and workers. Relatedly, it can be assumed that transaction costs associated with talent recruitment are higher in project-based service export (outsourcing) companies.

Along with the general disadvantages of the model, key informants have identified several vulnerabilities and risks associated with the currently predominant model of software service export (outsourcing). These vulnerabilities/risks have been identified by the literature reviewed for this thesis (Chapter 2.2.4) and affirmed (validated) through the primary research, but also further contextualised and better understood:

(i) Diminishing price competitiveness: High demand for labour – primarily software developers and engineers – combined with an under-supply of the desired profiles in the local market create wage pressures. The continuous rise in salaries recorded in recent year (Figure 7) reduce the margins charged by companies. This means that companies can either start gradually reducing their profit without changing the price of labour/service for clients or can start increasing the price of services. The former choice threatens business viability and sustainability in the medium-to-long run, while the latter option leads to a decrease in competitiveness against other outsourcing destinations. As claimed by some key informants, the labour cost level started getting closer to some EU countries, such as Austria. According to Paylab, the monthly gross salary level for the middle 80% of software programmes in Austria varies between EUR 2,649 and 7,421 (Paylab, 2022), while this range for the same profession and cohort in the FBiH is between EUR 1,096 and 3,061 (Paylab, 2022a). When the margin, charged on top of the gross salary by the FBiH companies, is calculated in, it is clear that the price difference is narrowing. Yet, the global shortage of software developers/engineers makes this price increase tolerable to foreign clients. As consistently reported by several key informants, the FBiH software industry has entered a stage by competing with the quality of service rather than the low price of labour. However, the diminishing price competitiveness has triggered concerns within the industry, which is increasingly requesting lowering taxation or tax exemptions (Haskić-Suša, 2022).

(ii) Vulnerability to new/emerging software service export destinations: The emergence of new price-competitive and quality software service export destinations poses a risk to the already established destinations, if the former ones can offer comparative advantages to the latter ones. These advantages can include lower costs of labour, language skills, business culture, and geographical proximity/time zones, among others. Some of the key informants believe that the FBiH, as a destination, is currently at risk of suffering from competitive pressures, having in mind increased costs/diminishing price competitiveness described in the point above. In that sense, some of the key informants recognised Africa as the new outsourcing destination that is increasingly attracting the attention of the global tech business community. This is in line with numerous reports suggesting that Africa is becoming the next global IT outsourcing hub. An overall young population, a sizable population fluent in English, decent talent pools and time zone alignment with the EU countries and cost-saving opportunities for companies from developed countries (up to 50%) are some of the factors that position South and East Africa as attractive destinations for tech offshoring (Deloitte, 2015; Violette, 2022; Alfonso, 2022).

(iii) Vulnerability to AI-driven automatization: As mentioned in Chapter 2.2.4, automatization of software development tasks (code-writing, testing, etc.) is one of the notable threats to lower-end service export/outsourcing operations. The AI-supported software development or manipulation – e.g. low-code/no-code platforms for software application development, AI 'pair programmers' that use natural language to write code, AI-based software testing, debugging and code review – is on the rise and is expected to reduce the need for human labour to a great degree in the upcoming years; however, this process is gradual and the existing AI-based solutions are still relatively far from being a sufficient replacement of human workforce (McKinsey & Company, 2022, pp. 71-80). Yet, this development especially affects lower-end, i.e. low-to-medium complexity, tasks that are usually subjected to outsourcing. Although the FBiH software industry, as was shown earlier in this chapter, is not concentrated around the lowest-end tasks, it still heavily relies on routine software development tasks. Therefore, some of the key informants expressed their belief that the existing model will be challenged by the increase in the development and usage of AI-driven automatization of software development in the near future.

However, multiple structural and policy-related factors keep the industry on the current development path. Although the attractiveness of the software service export model (low entry barriers, high demand and, therefore, relatively certain and quick returns) is recognised by key informants as the key reason for the dominance of the service-based model over the product-oriented models, multiple firm-level gaps and broader systemic constraints undermine or disincentivise the industry's potential shift toward the software production, as summarised in Table 3.

*Table 3: Overview of key factors preventing or disincentivising shift to product-based models*

| Group of factors | A brief description of factors (as per qualitative insights) |
|---|---|
| **Supply-side factors** | Lack of investments in research and development: As consistently assessed by key informants, software companies in the Federation of BiH do not lack financial resources to invest in the R&D of software products. However, strong pull forces of the service export (outsourcing) model and risk aversion make top management reluctant to invest in highly uncertain product development over the well-established and safe return-generating software service export. Thus, although it is believed that financial resources are in place, their use for innovation activities aimed at the creation of software products is not likely. Therefore, some of the respondents claimed that the actual barrier is the lack of incentive that would nudge in-company decision-makers to allocate financial and other resources or absorb opportunity costs associated with the reallocation of a part of resources from service export to product innovations.<br><br>Under-developed capabilities to manage software product value chain: Considering heavy orientation toward software service, the industry failed to develop and accumulate managerial knowledge on product value chain management. As mentioned by some key informants, examples of unsuccessful or insufficiently successful attempts to develop commercially viable software products for the international market were marked by poor management of processes, such as insufficiently recognised importance of market research and market intelligence or inadequate experience in properly managing this part of the value chain.<br><br>Human capital/skills gaps: Key informants have consistently assessed the ability of the workforce to produce high-quality technical outputs as satisfactory or exceptional. The quality of skills in the domain of software development is perceived as comparable to peers from developed countries. |

*(Table continues)*

*(Continued)*

*Table 3: Overview of key factors preventing or disincentivising shift to product-based models*

| | |
|---|---|
| | However, as stated by several key informants, the industry faces skills gaps in higher value-added segments of both upstream and downstream segments of the value chain, i.e. research and, in particular, market research, product development management and product placement and sales capabilities. Considering the current sectoral setup as well as the wider educational ecosystem, these skillsets have not been systematically developed and nurtured, especially not with the sectoral angle. Some key informants also mentioned, referencing recent examples, that the quantity of the supplied workforce represents a constraint for software service export (outsourcing) companies to experiment with product development: considering large quantities of the workforce needed to be fed into outsourcing projects, software companies do not have the luxury of allocating employees to long-term product design projects with uncertain return. |
| **Demand-side factors** | Under-developed local market (lack of demand) for software products: Almost all key informants have recognised the lack of demand in the domestic market as an important stumbling stone in the context of stimulating the industry to invest in the development of software products. There is a lack of demand on both the private sector and public sector sides. This has been attributed to the overall low level of digitalisation across the economy and the lack of an ambitious strategic policy approach to digitalisation. As a result, there is a low demand for software solutions that would incentivise software companies to orient more toward the creation of software products. However, some of the key informants do not see the domestic market as an ultimate destination for product development. To achieve the necessary scale, the regional or global market is needed. Yet, as some key respondents stated, the domestic market is an important precondition for testing/experimenting with solutions, learning and ultimately achieving the initial commercial success needed for scaling products. |

*(Table continues)*

*(Continued)*

*Table 3: Overview of key factors preventing or disincentivising shift to product-based models*

| | |
|---|---|
| **Entrepreneurship** | Under-developed tech start-up ecosystem: Key respondents did not recognise either excessive competition or insufficient competition in the local market as reasons for the lack of product innovations[8]. On the other hand, there is a consensus that new entrants in the market can be a driver of change. Namely, the vast majority of respondents have recognised the development of sound start-up ecosystems and culture as an opportunity for promoting and stimulating product innovations. Compared to larger software companies with a well-established service export business, start-ups are small and agile and, thus, can afford to experiment and fail. However, the current start-up support system is assessed as inadequate by key informants considering it channels support inefficiently to a wide variety of micro-businesses instead of promoting innovative, product-based, entrepreneurial ideas. |

*Source: Own work.*

In line with Chapter 2.1, and based on qualitative findings presented in Table 3, policy-related systemic constraints are going to be explored in the following chapter, which is followed by the overview of the strategic framework relevant in the context of product-based, innovation-led, development of the software industry in the Federation. This analysis provides foundations for reflecting on policy implications of findings and high-level policy recommendations provided in Chapter 4.

## 3.3 Systemic gaps and constraints regarding software product innovation in the FBiH

### 3.3.1 Supply side policy-related gaps and barriers

#### *3.3.1.1 Policies encouraging private investments in R&D*

[8] Although the recent growth of the software industry in the Federation of BiH led to increased competitive pressures, the global demand is, reportedly, still sufficiently high to keep active all businesses able to deliver quality service; in fact, as indicated by key informants, inter-country competition is more relevant than the intra-country competition in the context of outsourcing. There is a space for new companies to enter the market as long as the Federation of BiH as a whole is a competitive destination and the model is globally viable. Furthermore, companies have developed some degree of specialisation for different types of services, technologies, markets, industries and/or product niches, which further amortise competitive pressures. The majority of competitive pressures occur in the field of human resources, i.e. talent attraction and retention, considering tremendous labour shortages.

Governments apply a wider range of policy instruments to tackle the lack of ability or willingness of businesses to invest in R&D: reasons for under-investment in R&D can be various, from the well-known market failure associated with the public good nature of knowledge (Edler & Fagerberg, 2017) to awareness-related gaps. Instruments applied by governments can be classified as (i) government / public sector performed research, (ii) direct government funding of private R&D, (iii) R&D tax incentives, and (iv) patent protection (Westmore, 2014). Empirical research on government-performed research suggests that "non-defence related public research tends to have a neutral effect on business R&D; not encouraging nor substituting for private research" (Westmore, 2014, pp. 128-129), although governments' R&D is often the main source of revolutionary innovations (Westmore, 2014, Mazzucato, 2015). Direct government funding of private R&D can be designed and administered in many ways but is usually realised in the form of grants, loans and loan guarantee schemes (Westmore, 2014). However, direct schemes are prone to result in a displacement of private investments and have low additionality, meaning that companies use public funds to finance projects they would finance anyhow, even in absence of the public support (Westmore, 2014). Also, it is difficult for government officials and public servants to assess which projects could result in the best social outcomes, while programmatic approach could distort companies' decision in which technologies or areas to invest (choosing those for which public support have been offered instead of those they find the most promising) (Westmore, 2014). Therefore, practical and empirical insights on the negative sides of direct measures, as well as inconclusive evidence on their effectiveness, fuelled a tendency among governments to reduce or move away from direct support and focus more on more agnostic and neutral measures, i.e. R&D tax incentives (Westmore, 2014).

R&D tax incentives have been increasingly used as an indirect instrument for encouraging innovations since the 1990s (Carvalho, 2011). Today, this instrument is widely adopted in high- and middle-income countries (Cirera et al., 2020, pp. 141-152); the majority of EU and OECD countries implement some form of R&D tax incentives (Straathof et al., 2014; OECD, 2019). The main objective of R&D tax incentives is to reduce the costs of doing R&D by reducing tax burdens and thus stimulate private companies to invest (more) in R&D.

R&D tax incentives can be seen as a market-oriented policy response to identified market failures (primarily so-called 'incomplete appropriability'; Cirera et al., 2020, p. 142) that avoids direct interference of government in R&D projects and lower the chance of 'government failure' (Hall & Van Reenen, 2000). Thus, there are several advantages of tax incentives over the government's direct support recognized by the literature: first of all, the granting process is non-discrete and more transparent, offering equal participation and benefits for all businesses aligned with set terms and criteria; second, tax incentives do not alter or distort the choice of the company regarding the aims and design of R&D activity as it could be the case with project-based granting or procurement approach; finally, tax incentives offer ex-post financing for R&D projects, meaning that tax

discounts are claimed once the project is already implemented or in the process of implementation (first-do-then-claim approach) (Sterlacchini & Venturini, 2019; Straathof et al., 2014; Hall & Van Reenen, 2000).

The existing empirical evidence coming from evaluation studies largely confirms that R&D tax incentives increase private R&D expenditures (Cirera et al., 2020; Straathof et al., 2014, pp. 27-42). The instrument works better for large firms, but some evidence indicates that young innovative companies can benefit as well (Cirera et al., 2020). Considering that the majority of evaluations were conducted in OECD countries, it limits insights into the effectiveness of the instrument in developing countries (Cirera et al., 2020). Furthermore, the design of R&D tax incentives determines its success and impact: Cirera et al. (2020, p. 144) and Straathof et al. (2014, pp. 73-81) provide an overview of elements of good design that will not be extensively elaborated in this thesis due to formal limitations.

Beyond R&D tax incentives, innovation vouchers are increasingly used direct measure to incentivise the initiation of collaboration of SMEs with knowledge providers to develop innovative projects (Cirera et al., 2020). The instrument is usually designed as an entitlement-based (i.e. criteria-based) non-competitive small grant provision that can be used by companies (primarily non-innovators) to procure services from external knowledge providers (e.g. consultancy, applied research, market research, management training, etc.) in line with their needs (Cirera et al., 2020). Therefore, this instrument is easily administered, ensures transparency, avoids value assessments/evaluations and, similarly to tax incentives, is non-prescriptive, thus avoiding 'government failure' risks associated with theme setting. However, "some voucher schemes target particular sectors, such as digital, creative industries, and other knowledge-intensive services" (Cirera et al., 2020, p. 113). Although comprehensive and multi-contextual empirical evidence on the effectiveness is lacking, the instrument is expected to instigate proactive learning and collaboration between SMEs and knowledge providers if properly designed and implemented, thus addressing firm-level capability failures and information asymmetries (Cirera et al., 2020, pp. 113-116 for details on good design, strengths and drawbacks/risks associated with the instrument). The instrument is also recognised for its potential to "stimulate innovation in service sectors where formal R&D activities are less common" (Cirera et al., p. 112).

The level of investments in innovative product R&D is reportedly very low in the FBiH software industry. Although official or non-official exact data is lacking, qualitative insights obtained from key informants indicate that R&D aimed at product innovations is a heavily neglected part of the software business in the FBiH. This is in line with the general (non-sectoral picture): the total private sector's R&D gross expenditure in this entity was BAM 16,038,000 in 2019 (Institute for Statistics of FBiH, 2020) and BAM 14,263,000 in 2021 (Institute for Statistics of FBiH, 2022), i.e.

0.07% of GDP and 0.06% of GDP, respectively[9]. This is extremely below the EU-27 average figure of 1.5% of GDP in 2021 (EUROSTAT, 2022). Whilst in the EU-27 R&D investments of the business enterprise sector comprise 57.9% of the total R&D expenditure, the share is notably lower in the FBiH, amounting to around 29.2% (Institute for Statistics of FBiH, 2020 and 2022). Therefore, it could be said that the software industry mirrors the overall lack of innovation-led private sector development in (F)BiH (Aridi & Lopez, 2019).

Key informants mainly agreed that well-established software companies do not face financial barriers to investment in R&D, considering the relatively stable, prosperous and surplus-rich growth of the industry. The reasons for under-performance in this domain can be found, according to key informants, in risk-aversion, reluctance to step out of the comfort zone associated with the predominant service export (outsourcing) model and insufficiently recognised long-term benefits of investments in innovative product R&D by top managements of software companies. Therefore, some of the key informants see financial support to product-oriented R&D as a potent motivator for investing more in high-risk product development projects and an instrument for middle management to convince top management to invest more in costly product innovations. As mentioned by a key informant, high costs of product development projects paired with uncertain and non-immediate returns on investment discourage top management to start or maintain investments in this field; it is rather perceived as a waste of resources compared to service export that leads to an influx of revenues and decent margins that fuel growth and ensure the sustainability of the business.

However, the portfolio of policy instruments used for stimulating innovative activities within the business sector and mobilising private investments in R&D is heavily under-developed in the FBiH. Public support for R&D is mainly performed in the form of grants (Aridi & Lopez, 2019). According to Aridi and Lopez (2019, see p. 33), there were only four innovation-through-R&D measures at the entity level in the Federation of BiH over the 2015-2018 period, which consumed around 26% of the total entity's innovation and entrepreneurship budget that amounted to BAM 54,861,834. All measures[10] were implemented in the form of grants and none of them targeted the private sector, but academic and research organisations and individuals (Aridi & Lopez, 2019, see p. 47). The portfolio has not been significantly improved over the period 2019-2021 either volume-wise or in terms of scope: (i) the cumulative budget allocation (entity level and cantons) was BAM 46,783,843.00 in 2021, out of which only 10.8% was allocated for financing R&D in the private

[9] The Gross Domestic Product in the Federation of BiH was BAM 23,179,128,000 in 2019 and BAM 25,194,000,000 in 2021 (Agency for Statistics of Bosnia and Herzegovina, 2022).

[10] The Federal Ministry of Education and Science has implemented three measures (Support to the development of institutions of science and encouragement of scientific work of relevance for FBiH, Support to institutions of science and culture of importance for BiH, Support to the field of science of relevance to FBiH), while the Federal Ministry of Development, Entrepreneurship and Crafts has implemented one measure targeting individual innovators and students (Incentives for innovators individuals) (Aridi & Lopez, 2019).

sector and the majority (85%) went to higher education (Institute for Statistics of FBiH, 2022), (ii) new measures aimed at supporting innovation through R&D in the private sector have not been effectively introduced in the period 2019-2021 by the entity-level government (ministries).

Action Plan for Innovations in Small and Medium-sized Enterprises in the Federation of BiH for the period 2021-2023, which was adopted by the FBiH government in June 2021, envisages the introduction of a pilot voucher scheme for SMEs. As explained above in this chapter based on literature, such a measure would have the potential to instigate collaboration between software companies (especially smaller ones) and knowledge providers, thus addressing some of the capability gaps related to market research, sales strategies, managerial knowledge, etc., identified by key informants (Chapter 3.2). However, the measure has not been operationalised and implemented yet. Similarly, R&D tax incentives have not been introduced despite being mentioned in several strategic documents (see Chapter 3.4).

The software industry has not been vocal in advocating for R&D tax incentives or other R&D-support instruments. Although IT Manifesto published by Bit Alliance calls for "incentives, reliefs or income tax exemptions to all IT companies, and particularly to those that invest in research and development, support the projects in the field of education and science, invest in start-up project, develops personal products and alike" (Bit Alliance, 2019, p. 23), concrete policy proposals that entered a public policy debate are concentrated exclusively around granting purpose-agnostic tax exemptions to the IT industry. Namely, following the labour taxation reform package proposed by the FBiH government, which was nominally aimed at lowering the tax wedge by introducing progressive personal income taxation (instead of the current flat rate) and decreasing the aggregate contribution rate (Numanović & Obradović, 2020), Bit Alliance issued a set of the proposed amendments to the draft laws in September 2019. These amendments proposed the introduction of the special tax treatment of the industry's employees[11], which would, according to an estimate calculated by Bit Alliance, save employers BAM 10.4 million in the first year and BAM 14.7 million in the second year of the law's implementation compared to the scenario of adopting new laws without these amendments (KLIX, 2019). Despite being dismissed, the request for granting general-purpose labour taxation exemptions has remained in the policy discourse concerning IT/software industry development.

This stance is a reaction of the industry to growing wage pressures (arising from workforce under-supply) that increase total labour costs and threaten to diminish the price-rooted competitiveness of the industry in the global market. However, the amendments proposed by Bit Alliance had

[11] The proposed amendments envisaged using 90% of the average industry's salary paid within the last 6 months of the previous year as a basis for calculating contributions in the current year, whereby the annual increase should not exceed 20%. In the case that there were no increases in the salary, the same basis as in the previous years should be applied (KLIX, 2019).

several weak points: (i) it is not in line with the state-level Law on State Aid System (Official Gazette of Bosnia and Herzegovina 10/12, 39/20), which constrains vertical industrial policy and prohibits any kind of government support, including grants, subsidies, tax exemptions, etc. (article 2) to particular industries that could harm competitive behaviour (article 5), except for agriculture and fishing, military industry, and infrastructure, (ii) it could have a harmful effect on the secondary software industry (see Chapter 2.2.1) by creating or further exacerbating unequal working conditions provided by companies in primary and secondary software industries, (iii) it could create a ground for informalities and other types of misuses of the policy due to the somewhat abstract nature of software and software services, thus incentivising non-software companies to falsely register as software companies only to claim benefits – this is suggested by the case of introducing similar measures in Romania (Dragan, 2018). Except for these risks, as mentioned by some key informants, this policy would likely keep the status quo in terms of the industry's structure, i.e. further stimulate 'outsourcing' niche of the industry without encouraging experimentation with innovation-led product-based models. In other words, this policy would incentivise the existing and new software companies to enter or remain in the service export (outsourcing) niche.

#### *3.3.1.2 Policies promoting human capital development*

Skilled human capital is one of the key prerequisites for innovation. In its 2010 Innovation Strategy, the OECD stated that "human capital is fundamental to growth and innovation" (OECD, 2010, p. 55). It means that the workforce has to be capable of properly adopting (absorbing) new technologies, knowledge and business processes to be able to adapt, invent and implement improvements in products, services or organisational practices (Toner, 2011; OECD, 2010). Such capabilities rely on nurturing wide-ranging skills, which could be acquired throughout the formal education system or informal training/upskilling schemes (OECD, 2010). In that sense, higher overall skill levels – usually measured and expressed as education attainments among the labour force – and more diversified skills create better preconditions for innovation, especially incremental ones. Along with education, learning-by-doing is an important source of capability for creating incremental innovations (Toner, 2011). However, innovations closer to the technological frontiers require advanced and more sophisticated technical and managerial skills (Toner, 2011). Yet, there is no unified 'skills profile' that could foster innovation regardless of the country, industry or firm-level context (OECD, 2010). In other words, different economic setups or business environments require different skill sets to optimise innovation potential. Finally, human capital is a fundamental pillar of any endeavour related to knowledge generation: as some researchers suggest, policy measures aimed at increasing R&D activities will end in increased costs but not in increased volume if the proper supply of talents/R&D workers is not ensured

(Reenen, 2021)[12]. It means that a lack of IT professionals who understand high-end software development activities will make any public R&D measure futile (see Chapter 3.3.1.1 for more details on R&D support measures).

There is a wide consensus that skilled human capital is a crucial factor for software innovation (Lippoldt & Stryszowski, 2009; Rocheska et al., 2015; Rose & Furneaux, 2016). Considering that the software industry is a skills/knowledge-intensive industry, that software is "knowledge in codified form" (Hoch et al., 2000, p. 6), the wide basis of the skilled and knowledgeable workforce is one of the key preconditions for the generation of software innovations. In that sense, „software, perhaps more than any other high-tech industry, relies more intensively upon human capital" (Arora & Bagde, 2010, p. 31). Many studies found and documented that the level of human capital development influences the performance of ICT industries, such as growth and export (e.g. Lippoldt & Stryszowski, 2009; Arora & Bagde, 2010; Murphy & Traistaru-Siedschlag, 2007; Murphy & Siedschlag, 2011). As the software industry moves up the value chain, the availability of highly skilled professionals of various profiles becomes more and more important compared to the simple availability of a sufficient quantity of software programmers (Pillai, 2006).

Human capital development policies are often neglected in the innovation policy discourse and under-utilised as innovation policy measures (Borrás & Edquist, 2016; Reenen, 2021), partially because they "tend to work better in the long run, which makes them harder to empirically evaluate" (Reenen, 2021, p. 23). However, to address underlying issues regarding the skills supply that affect the potential of an economy or industry to innovate or simply grow, governments introduce various measures aimed at enhancing the availability of talent/quality workforce. The systematised evidence indicates that some of the key measures contained in innovation policy mixes are: (i) measures aimed at increasing the number of professionals in science, technology, engineering and mathematics (hereinafter: STEM), which can be realised in a form of PhD and post-doctoral scholarships or subsidies or as support for training in these fields[13], (ii) measures aimed at expanding universities, considering that science-based faculties, R&D institutes and programmes within the universities provide not only R&D outputs but also contribute to the overall increase in the supply of quality experts in this regard, especially those who were exposed to R&D tasks/projects, (iii) immigration policies, considering that non-negligible evidence suggest that immigration of highly skilled workers positively influence innovation outcomes, and (iv) measures

[12] However, the relationship between (technology) innovation and human development is bi-directional. As Qureshi, et al. (2020, p. 24) found by observing 15 developed countries, "technology innovation plays a significant role in enhancing human development in all selected technologically advanced countries", meaning that innovation-intensive economy improves human capital, including the capabilities of the workforce.

[13] Although the increase of the general level of STEM skills among the population leads to better absorption and diffusion of technologies, some evidence suggests that postgraduate education plays an important role in the creation of innovations that are new to the economy (not only to a company) and closer to technological frontiers (Reenen, 2021).

aimed at addressing the 'lost Einsteins' issue, considering that studies found that children with wealthier family background are extremely more likely to become inventors than those born in poorer families: these measures can be classes mixing high achievers and pupils from disadvantaged backgrounds, innovation-oriented mentorship programmes tailored for disadvantaged students/pupils, innovation exposure programmes (e.g. science competitions), but also general welfare schemes promotion inclusion and equal participation in education for children from poor and minority/disadvantaged families (Reenen, 2021).

The software industry in the Federation of BiH – as well as in the rest of the country – is heavily affected by multi-layered issues related to human capital. Therefore, the majority of development initiatives aimed at the IT/software industry in the last decade were in this domain. However, in terms of the ability of the industry to yield software product innovations, key informants relatively consistently assessed that the quality of the workforce is not a constraint: according to them, the industry has engineers and software developers capable of constructing and executing/programming complex software solutions at the quality level comparable to their peers in developed countries known for tech/software innovations[14]. The key respondents have identified gaps and constraints that can be, broadly, classified in two groups: (i) under-supply of software engineers and developers limit software service export companies to allocate staff on experimental product innovation projects without harming core business, (ii) the industry lacks skills concerning the initial software product development stage (e.g. product development management, market research) and post-production activities (marketing and sales). Both identified constraints/gaps will be briefly analysed in this chapter.

Workforce under-supply is cited as the most pressing issue and an obstacle to the development of the (F)BiH software industry. This prevents companies from onboarding new clients or projects, i.e. fully responding to the global demand for services, which limits their growth but also creates wage pressures: intense competition over a small pool of workforce drives salaries up, increases total labour costs and diminishes price competitiveness in the global market. According to the Economic Institute Sarajevo (2019), the estimated horizontal mismatch in the sphere of the software industry is 41.9%, meaning that 42 of 100 vacancies in the sector cannot be filled due to a lack of skilled workforce. More precisely, in the current circumstances, this mismatch results in an estimated annual loss of 388 jobs in the software industry that would be created if there was an available skilled workforce (Economic Institute Sarajevo, 2019). Bit Alliance provided an even higher estimate in 2019, suggesting that the industry will face a shortage of 6 thousand IT

[14] This assessment should be taken with caution, considering that it can be argued that the relatively undeveloped product-based software industry prevents informants from properly assessing if there is a skill quality gap in this domain; insights are primarily obtained based on the experience of the software export niche. However, due to the lack of quantitative data, this should be further explored by future research concerning the software industry.

professionals in the five-year perspective (Bit Alliance, 2019a), but the method behind the estimate is not clear.

This issue can be primarily attributed to poor enrolment policy and insufficient capacities of existing IT-related faculties to absorb more students, but also the lack of vocational schools for IT and under-developed (re)training options (Economic Institute Sarajevo, 2019; Strik Consulting, 2017). The issue is further exacerbated by emigration trends, which particularly affect the IT industry: according to some evidence, there is a pronounced trend of high-skilled IT professionals migrating from BiH to Austria, Croatia, Germany, Serbia and the United States in recent years (International Organization for Migration, 2022). According to the European Commission (2020), brain drain in Bosnia and Herzegovina is most present in the medical, health and IT sectors, which, according to the Commission, impacts innovation outcomes within the economy. The intensity/incidence of emigration among IT professionals has not been empirically observed yet. On the other side, the complex and costly procedures of "importing workers", i.e. granting permission for foreign workers to work in the (F)BiH, represent an obstacle for substituting the missing workforce (Association of Employers of the Federation of BiH, 2022); this issue has gained prominence within the policy discourse in the FBiH at the time of writing this thesis.

The IT/software industry in (F)BiH has recognised the issue of insufficient talent supply as the key strategic priority for the development of the industry and started tackling the issue at both policy and industry level. The IT Manifesto, a document produced by Bit Alliance to articulate strategic goals and actions needed to address the most pressuring issues and obstacles that the industry face, put special attention to education and the increase of talent supplied within the economy. In that sense, 9 out of 21 strategic goals have been devoted to this field, proposing high-level strategic actions related to all levels of education, capacity-building within formal education, life-long learning, and non-formal training (Bit Alliance, 2019).

However, although the policy reaction was missing for years, the industry has organised itself to boost talent supply, thus investing its own resources in reskilling and upskilling schemes and on-the-job training. With the support of international donor initiatives, the industry has developed a vibrant and diversified internal skills development ecosystem, thus addressing the quantity and quality-related labour supply gaps (Nippard, 2022). The common feature of these programmes is that they have been designed to relatively quickly produce or improve a workforce that would be capacitated to do basic programming tasks (e.g. front-end programming for websites and mobile apps) or deliver other complementary tasks/services within the value chain (e.g. UX/UI design, software testing, etc.). Relatedly, 94% of IT companies provide continuous training/upskilling support to their employees. It is mainly realised in the form of in-company training and mentorship, while 27% of these companies engage external organisations – private education centres or informal training providers – mainly when lacking internal capacities or need specific certification

(Economic Institute Sarajevo, 2019, p. 46). This intra-industry ecosystem of skills development has been further supported by the Ministry of Economy in Sarajevo Canton, which introduced a business support measure in the training-for-employment form in 2020 with the aim to enhance in-company skills development for future IT professionals.

Furthermore, there have been some recent policy reactions addressing the issue of under-supply at the level of tertiary (university) education in Sarajevo Canton. Namely, as a result of Bit Alliance's policy advocacy endeavours, two brand-new study programmes in software development have been launched at the University of Sarajevo in 2018. These two-year non-degree study programmes Software Development at the Faculty of Electrical Engineering, University of Sarajevo and Information Technologies at the Faculty of Natural Sciences and Mathematics, University of Sarajevo – equip students with practical coding skills demanded by the industry, while more complex and more theoretical subjects are excluded from the curricula. The idea behind the programme is to produce the needed workforce in a shorter period of time, focusing primarily on coding and software development skills. Furthermore, the Government of Sarajevo Canton introduced several policy measures in this realm in June 2022, including the increase of enrolment quotas (to 150 for the Computer Science and Informatics at the Faculty of Electrical Engineering and to 100 for the Theoretical Computer Science at the Faculty of Natural Sciences and Mathematics, University of Sarajevo) and the introduction of free-of-charge education for all students enrolled in these first-cycle study programmes for the first time (Government of Sarajevo Canton, 2022). Currently, Bit Alliance advocates for the establishment of a brand-new faculty for information technology within the University of Sarajevo, as well as in other parts of the country, as a way to notably improve both the quantity and quality of the supply of IT professionals (Hadžibegić, 2023; interviews with key informants).

However, as critically pointed out by some of the key informants, initiatives to produce additional workforce fuel the existing service export/outsourcing model rather than pushing the industry toward innovation-intensive product-based models. The assumption behind this critical remark is that an additional supply of workforce will only encourage companies to keep the status quo, onboard new clients/projects and deflate labour costs (due to the increased competition on the labour supply side). Yet, the availability of a workforce is both a precondition for the software industry growth and a precondition for experimenting with software products, considering that, as pointed out by some key informants, software companies do not have the luxury of allocating employees to long-term product design projects due to insufficient workforce base for outsourcing projects.

As pointed out by several key informants, the industry faces knowledge and skills gaps in the higher value-added domains, i.e. in the pre-development and post-development segments of the value chain (Figure 4). Whilst the latter is primarily a matter of the organisational setup of service

export (outsourcing) software companies, which do not invest intensively in the development of in-house sales and marketing capabilities, the former can be partially explained by the under-supply of specific skills. Key informants mentioned a lack of quality market research skills/professionals, under-developed entrepreneurial skills/mindset among the IT professionals (for initiating and leading innovative projects) and a lack of managerial skills for full-cycle product development (Software Product Management).

This has been further confirmed by primary desk research. As shown in Appendix 5, an analysis of curricula conducted on the sample of six faculties/universities offering study programmes in software development indicates that the aforementioned non-core technical skills are not sufficiently covered by the current study programmes. None of the programmes belonging to the sample contains a course devoted to Software Product Management (Appendix 5). Faculties rather offer Software Project Management courses, which correspond to the predominantly project-driven software industry in the country. Yet, only 30% of higher education IT programmes in the Federation of BiH offer mandatory Software Project Management courses, 22% of programmes offer elective courses on Software Project Management, while the rest do not offer formal training in this field (author's estimates based on Economic Institute Sarajevo, 2019, pp. 24-30). The early software product design stage (analysis) is partially covered by business intelligence courses offered as elective or core courses within some of the programmes (see Appendix 5), but other relevant dimensions – such as market research – are not part of the curricula.

Entrepreneurship is not extensively taught within software development study programmes. There is a variety of instruments for enhancing the entrepreneurial knowledge and mindset of students in non-business study programmes recognised by the literature, such as (i) introduction of mandatory courses dealing with economics and entrepreneurship, adapted to the main discipline of the study programme, (ii) introduction or expansion of the 'portfolio' of elective courses dealing with the entrepreneurship and other relevant economic topics, and (iii) introduction of hubs, projects and other non-obligatory complementary activities focused on promoting and stimulating entrepreneurship through interactive and hands-on activities/simulations (Kaloudis et al., 2019, p. 132). However, as presented in Appendix 5, entrepreneurial and business skills are predominantly taught on an elective basis, while the portfolios of courses are narrow and usually focused on specific (thematical) areas such as e-commerce or high-level introductory courses on management. The multidisciplinary second-cycle study programme Management and Information Systems launched by the School of Economics and Business, University of Sarajevo, in 2017 represents an intersection between management and IT, i.e. focuses on the management of software development, implementation and application for the business purposes, thus providing knowledge and skills in managerial and entrepreneurial dimensions of the IT industry. However, as stated above, regular IT study programmes notably lack this component.

### 3.3.2 Demand side policy-related gaps and barriers

The development of the domestic market (demand) for software is a strong driver of the software industry's growth and innovation spurring. According to Tessler et al. (2003, p. 10), "the domestic use of software technology is perhaps the most important driver of software industry growth for emerging economies". The authors found out that even strong software exporters, such as Israel, Ireland, or India, can attribute the development of software capabilities to (early) domestic market opportunities; moreover, the lack of a broad internal market for software in India has been recognised as a possible explanation for the country's position in the low-value segments of software export (Tessler et al., 2003).

Domestic market demand for software is comprised of demand coming from (i) the private sector, which integrates software solutions in its business operations, using them to enhance productivity and competitiveness, and (ii) the public sector which uses ICT solutions for governance and service delivery. However, in the contexts where demand for technologies/software is weak within the private sector, the public sector (government) can strategically employ its position (policies) and resources (purchasing power) to instigate demand by promoting usage, creation and/or diffusion of innovative technological solutions. This approach belongs to so-called demand-side innovation policy measures.

Demand-side innovation policy measures are being increasingly used by both developed and developing countries to boost innovation in the domestic markets and these measures belong to the most important policy instruments for promoting innovation (Czarnitzki et al., 2018). They have been used in recent years by policy-makers in the majority of OECD and EU countries (European Commission, 2018; OECD, 2011; OECD, 2017). The increased interest in demand-side measures could be seen through the lens of the conceptual shift from a linear model of innovation to "a more broad-based approach that considers the full scope of the innovation cycle" (OECD, 2011, p. 9). In other words, policy-makers understood that public investment in R&D is not a sufficient measure to induce a desired level of innovation in the economy.

There are two main ways for the public sector to boost demand for software products (and services). The first is the digitalisation of the public sector (e-governance, software-supported service delivery). The second one is through public measures aimed at inducing or supporting the digitalisation of private businesses. The government can use IT innovations/software solutions as an important criterion or a basis within support schemes to other sectors (e.g. agriculture-related support programmes) or in solving specific societal issues (e.g. social policy, ecological concerns and issues, etc.) (Tessler et al., 2003).

Digitalisation of the public sector and, generally, procurement of software solutions by the public sector, have been recognised as a highly effective way to boost demand for innovations, including those in the software domain. Thus, recognising weak domestic demand on the market as one of the key barriers to the development of the software industry in developing countries, the UNCTAD has recommended better utilisation of public procurement to boost the demand for software (UNCTAD, 2012). The public sector is described as "a major potential client for software companies in developing countries" (UNCTAD, 2012, p. 95). For instance, proactive policies for e-governance played a non-negligible role in boosting the software industry in India, attracting IT companies to the state and creating an IT cluster (Kumar, 2009; Ramachandran & Ray, 2005). Although the measure had a limited impact, considering that IT companies were primarily export-oriented, it contributed to the overall development of this industry (Kumar, 2009). Similarly, South Korea and Sri Lanka used e-governance "as a tool to spur local software growth" (UNCTAD, 2012, p. 95).

Although the demand for software solutions generated by the public sector boosts the development of the IT/software industry in general, it has a distinctive role in promoting software product innovations. In particular, there is a growing consensus that public procurement represents a potentially effective policy instrument to boost innovation in the domestic market. The utilisation of public procurement to achieve innovation goals is a policy approach that gained prominence in the EU countries (Uyarra & Flanagan, 2009; Georghiou et al., 2014) and become part of the EU-level competitiveness and innovation policies since the second half of the 2000s, when public procurement was officially recognised and adopted as a means of promoting innovation[15]. Public procurement of innovative solutions (hereinafter: PPI) is promoted within the EU for two main reasons: (i) it helps public services to be improved by purchasing and adopting innovative and efficient solutions and (ii) it creates a new market for innovative technologies/solutions by helping businesses to get first buyers, i.e. deploy and commercialise their products (pre-commercial procurement) or achieve economies of scale (European Commission, 2018).

The second approach the public sector can apply to boost domestic demand for software solutions is, as mentioned above, to implement policy measures aimed at supporting businesses to digitalise. The main purpose of such measures is to reduce the digital gap, but they indirectly boost the private

[15] It is especially important to mention the European Parliament resolution on pre-commercial procurement: driving innovation to ensure sustainable high-quality public services in Europe that was adopted in February 2009, taking into account the European Commission's communication of December 2007: Pre-commercial Procurement: driving innovation to ensure sustainable high quality public services in Europe (COM(2007)0860). Council of the European Union recognised the potential of pre-commercial procurement in this respect by its 2871st Competitiveness Council Conclusions and invited member states and the European Commission "to encourage public authorities at all levels to implement pre-commercial procurement when innovative solutions are needed to address the mid-to-long term challenges of the public sector" (Council of the European Union, 2008, S. 2.3, p. 9). For the full overview of the relevant EU policies and initiatives related to the public procurement of innovative solutions, please see: https://bit.ly/2KALZqa.

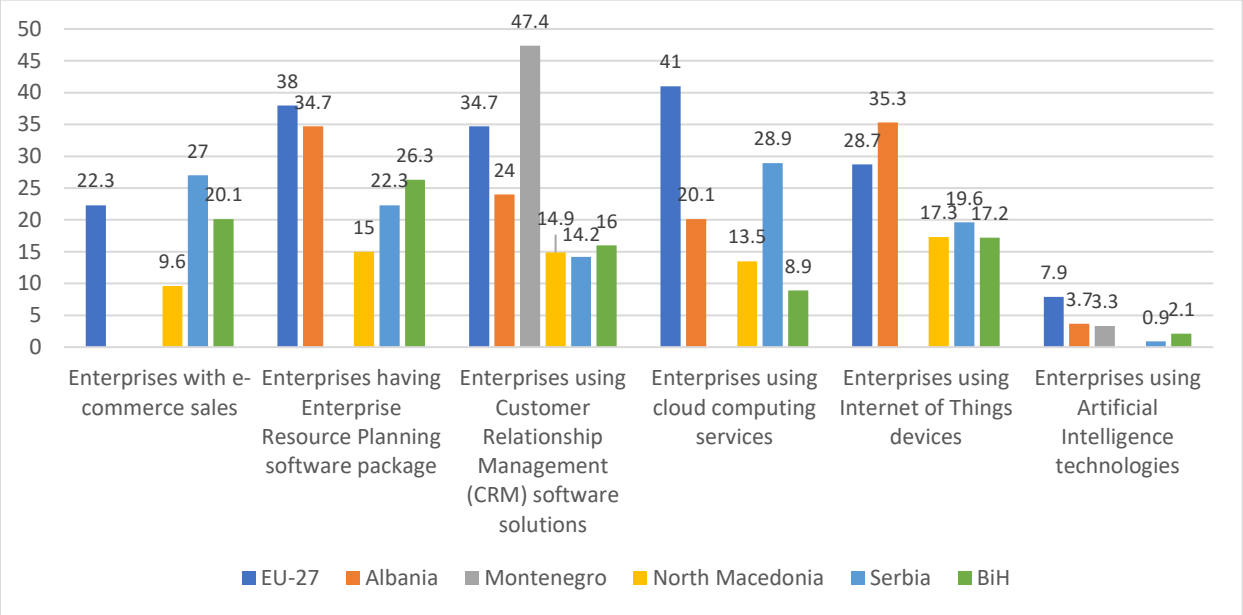
sector's demand for software solutions. Namely, SMEs often lag in digitalisation, i.e. adoption of digital technologies in production, marketing and sales, supply-chain management, HR management, etc., despite the productivity and profitability benefits that digital transformation brings. Their inability to digitalise is due to lack of internal capabilities to implement software-based solutions, i.e. three main gaps: (i) a skills gap, meaning that managers and employees lack skills to identify and adopt necessary software solutions and adapt business model accordingly, (ii) a financing gap, referring to lack of internal financial resources to invest in digitalisation or lack of access to external financing options (e.g. loans), and (iii) an infrastructure gap (e.g. poor internet access) (OECD, 2021). This creates a notable digital gap between those who managed to adopt new technologies (software-based solutions) and those who rely on old technologies, which is expectedly translated into lower competitiveness and higher fragility of the latter ones (OECD, 2021). Yet, governments can support businesses to digitalize – substantially or partially – via targeted policy measures, thus improving overall productivity and international competitiveness of domestic industries.

Almost all key informants have recognised the lack of demand in the domestic market as an important stumbling stone in the context of stimulating the FBiH software industry to invest in the development of software products. There is a lack of demand on both the private sector and public sector sides, which can be attributed to the overall low level of digitalisation across the economy and the lack of an ambitious strategic policy approach to digitalisation.

The low level of digitalisation of enterprises can be illustrated by several proxy indicators. As presented in Figure 10, based on the EUROSTAT's 2021 data, BiH lags behind the EU-27 in using digital technologies by enterprises, especially when it comes to cloud computing services and Artificial Intelligence technologies. In the e-commerce sphere, BiH has been improving well in recent years and exceeded slightly the EU-27 average in 2022 (EUROSTAT, 2023). The Global Competitiveness Report positioned the BiH economy among the worst performers regarding the growth of innovative companies (127$^{th}$ place out of 141) (Schwab, 2019). According to the latest available data, the share of high-technology exports in total manufactured exports was only 5.3% in 2021, notably below the EU average of 14.9% in the same year (World Bank, 2023). Furthermore, as mentioned by several key informants, the business collaboration between IT/software companies and companies coming from other industries, in terms of trade (i.e. selling-buying software) is underdeveloped. This can be confirmed by secondary data: according to Ćatić et al. (2020, p. 56), 74% of the (interviewed) domestic IT companies do not have developed software solutions – products or services – for local SMEs. Even in the case that IT companies are more likely to target the domestic market, estimates show that almost 3/4 of the market still would be international or regional (Ćatić et al., 2020, p. 56). According to partial evidence obtained through interviews with key informants, this can be largely attributed to low awareness of benefits and low willingness of the local companies to buy software and digitalise operations and/or sales.

On the other side, low awareness of digitalisation benefits within the local private sector, as indicated by some key informants, as well as limited purchasing power or market size locally, have directed the focus of IT/software companies to overseas markets.

*Figure 10: Enterprises (10+ employees) using specific digital solutions as a percentage of all enterprises (10+ employees) in Bosnia and Herzegovina, Western Balkans economies and the EU-27, 2021*




*Source: EUROSTAT (2023).*

On the other hand, little support is provided for the digitalisation of enterprises through public measures. At the entity level, the Federal Ministry of Development, Entrepreneurship and Crafts (hereinafter: FMDEC) implements the Strengthening Competitiveness of SMEs measure that, among others, supports technological upgrade and digitalisation of business processes and production. However, the measure is of limited scope and intensity due to budgetary constraints (Federal Ministry of Development, Entrepreneurship and Crafts, 2022a): in 2022, BAM 2,709,336.37 has been allocated to 95 enterprises (up to BAM 40,000.00 per enterprise) within this measure (Federal Ministry of Development, Entrepreneurship and Crafts, 2022b). Furthermore, the design of the measure is general and, therefore, implies a large focus on purchasing or upgrading machines. Except for this measure, there are no other, tailor-made, measures that specifically support software-intensive digitalisation of the business sector – such as measures helping businesses to introduce e-commerce – within the regular FMDEC portfolio. It is similar in Sarajevo Canton, where none of the regular measures is tailored to provide support to the digitalisation of enterprises, despite the presence of a vibrant IT industry in this administrative unit. However, a pilot loan and subsidy scheme for digitalisation has been

introduced by the FMDEC in partnership with international development stakeholders, as elaborated in the next paragraph. Furthermore, the FMDEC 2022-2024 work plan envisages the introduction of a measure for supporting the digitalisation of SMEs, but the annual funds planned for the measure are meagre, up to BAM 400,000.00 (Federal Ministry of Development, Entrepreneurship and Crafts, 2022a).

In recent years, this area has gained the interest of international development aid/interoperation projects in BiH. The German Agency for International Cooperation (hereinafter: GIZ) implements the multi-donor Innovation and Digitalisation in SMEs in Bosnia and Herzegovina / EU4DigitalSME project, which started in 2019 and is expected to last until 2024 (GIZ, 2021; GIZ, 2021a). The project aims to support the creation of a conducive ecosystem that will incentivise and enable the digital transformation of SMEs with the goal of improving their productivity and competitiveness. Among others, the project tends to stimulate business collaboration between SMEs and the IT industry and support the setup of Digital Innovation Hubs that provide services to SMEs willing to access innovative technologies and digitalise operations. Relatedly, the European Bank for Reconstruction and Development (EBRD), the EU and the GIZ have launched a project Go Digital in Bosnia and Herzegovina aimed at small and medium-sized enterprises in May 2022. Funds available through the project are intended for making investments in various types of digitalisation of business operations, including investments in software. The initiative introduced a loan scheme, followed by subsidy (15% of the loan amount) and technical assistance, and is implemented in cooperation with the FMDEC (Federal Ministry of Development, Entrepreneurship and Crafts, 2022c).

Along with the domestic business sector not being capable of generating sufficient demand for software services, sluggish progress achieved in the previous years in the domain of digitalisation of public services and governance represents a missing chance for demand boosting. The level of digitalization of the public sector in BiH is usually considered low (UNDP, 2020), which results in the unavailability of many ICT-enabled services within the public sector (International Telecommunication Union, 2018), lower satisfaction with public services among citizens, lower transparency and, finally, in a less conducive environment for doing business (MEASURE-BiH, 2018). For the sake of illustration, 96% of 369 companies that have been surveyed in MEASURE's 2018 study said that "when interacting with public administration, they are required to submit hand-signed hard copy forms" (MEASURE-BiH, 2018, p. 8). The Global Competitiveness Report ranked BiH as 110$^{th}$, out of 141 economies, in terms of e-participation in the public sector (Schwab, 2019). Along with resulting in poor governance and public service delivery, slow progress in this domain also represents a missing chance to create a greater demand for IT/software solutions, which could be beneficial for domestic software companies and the industry as a whole. Finally, existing initiatives aiming at digitalisation in (F)BiH – such as 'smart cities', 'e-governance' and 'e-commerce' initiatives – are fragmented and lack a strategic approach (Talić, 2021).

Despite the slow pace of the digitalisation of the economy and governance, a comprehensive and ambitious strategic policy effort to promote digitalisation is lacking. There is no strategy for digitalisation in place on the state or entity level. The state-level Information Society Development Policy of BiH expired and was never backed with a strategy that would translate high-level goals and ambitions into specific and implementable actions (UNDP, 2020; Economic Institute Sarajevo, 2019). At the entity level, no other strategy than the Development Strategy of the FBiH for the period 2021-2027 tackles this policy area; industry-specific strategies only nominally mention digitalisation or even lack to mention it.

The FBiH Development Strategy (Official Gazette of the Federation of BiH, no. 40/22) defines relevant measures within Priority 1.1 (Increasing the digitalisation of the economy) of the first strategic goal (Accelerated Economic Development). Two measures are especially important in the context of this chapter: 1. establishing a public digital infrastructure and 2. accelerating the digital transformation of small and medium enterprises. The second measure envisages the improvement of the legal framework for e-commerce, but also the introduction of public support for investments in e-commerce and the digitalisation of businesses through subsidies and affordable loans offered by the Development Bank of the FBiH. Additionally, the Strategy envisages the introduction of functional systems of e-governance at all administrative levels (entity, cantonal and municipal levels) under Priority 4.2 (Putting public administration in the service of citizens) of the fourth strategic goal (Transparent, Efficient and Accountable Public Sector). Measure 4.2.6 calls for developing and adopting the Strategy for the Development of E-governance, adopting the Law on Electronic Signature and, generally, improving the legal framework to create preconditions for the digitalisation of both the public sector and businesses. However, the implementation progress of the Strategy is yet to be observed.

As a result, there is a low demand for software solutions that would incentivise software companies to orient more toward the creation of software products. However, most of the key informants do not see the domestic market as an ultimate destination for product development. To achieve the necessary scale, the regional or global market is needed. Yet, as some key respondents stated, the domestic market has the potential to boost smaller-scale, tailor-made, software solutions but also to be the first market for piloting innovative software products that would be upgraded and scaled after the initial commercial success/piloting within the local market.

### 3.3.3 Entrepreneurship policy related gaps and barriers

Entrepreneurship is widely recognised by the existing body of knowledge as an engine driving innovations and disruptions in the market. The Schumpeterian tradition recognises entrepreneurship as one of the two main patterns of innovation within the industry: to claim their

position in the market and achieve a competitive advantage, new companies ('new entrants') start innovating and bringing new products, production strategies and organisational processes. This pattern is called 'creative destruction'[16] and represents the widening of innovations in the specific industry/market (Breschi et al., 2000). In essence, the rationale is that new entrants would compete against incumbents by innovating and improving efficiency (Colombelli et al., 2016).

New entrants or, more precisely, start-ups play a central role in bringing software and software-based innovations within the tech industries (Tessler et al., 2003; Klotins et al., 2019; conceptual discussion on software start-ups: Unterkalmsteiner et al., 2016). Successful tech start-ups either evolve into well-established - often large-sized – tech companies or end up being purchased by market leaders, incumbents that use the acquisition of start-ups as a strategy to get rid of competition or absorb external knowledge or innovations. The prominence of software start-ups can be explained by the fact that the software industry is a low-investment industry, without significant financial and capital barriers for R&D investment (Tessler et al., 2003), except in cases when the product is a combination of software and investment-intensive equipment (e.g. robotics, tech-based bio-engineering, etc.). However, the flexible and lean structure of start-ups allows the innovation to be tested and verified by the market as well as reiterated and adapted in an agile, creative and easy-to-dissolve way.

Therefore, along with making the business climate conducive for new entrants, start-up promotion is an important policy measure for stimulating innovations through new entrants. Governments use a wide range of specific measures to encourage the occurrence of new entrants in the market and, specifically, provide support to start-ups aimed at their establishment and survival during the early stages of development. These measures usually (i) address finance-related barriers and obstacles (e.g. grants, zero-interest loans or loans with low interests, micro-loans, co-financing, early-stage equity, etc.), (ii) develop business/start-up support infrastructure, i.e. business incubation and acceleration support, (iii) address gaps related to access to quality human capital, including training schemes aimed at providing entrepreneurship skills, and/or (iv) create or facilitate access to market for products and/or services of start-ups (delivered as advice to entrepreneurs, knowledge-building on placement, distribution channels and sales, networking, business links with diaspora, etc., or creation of 'early adopters' by promoting co-evolution/industry convergence through digitalisation and technological upgrades in other sectors, etc.) (Cirera et al., 2020, pp. 239-275, Mason & Brown, 2014, pp. 3-6; Li, 2021; PwC, 2018).

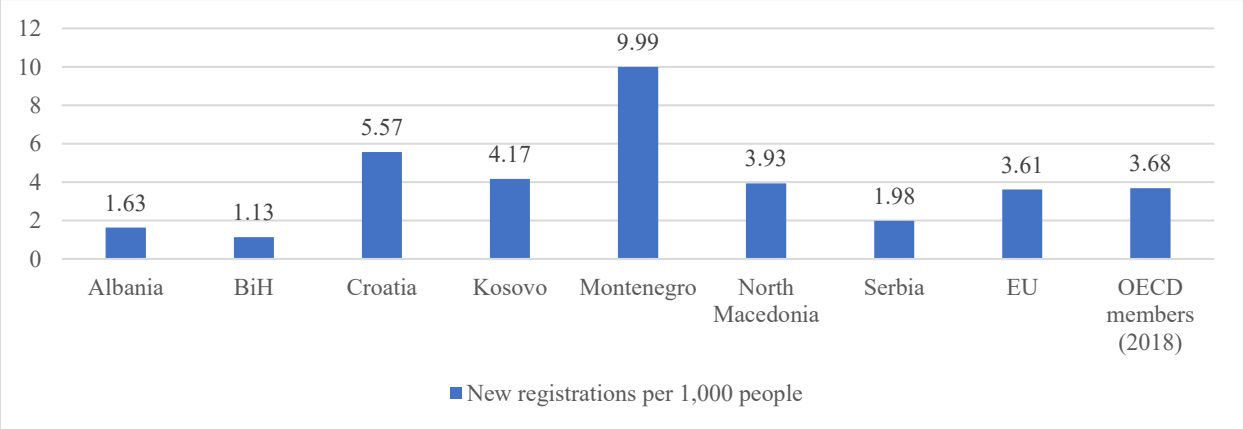
However, the contemporary discourse on start-up support policy emphasizes the importance of focusing on 'innovative startups' instead of promoting a general notion of 'startup'. Namely, as

[16] The second pattern is 'creative accumulation', in which industry's incumbents (usually large companies in oligopolistic markets, companies that innovated before) use accumulated R&D capabilities and knowledge to maintain their market position by innovating (so-called 'deepening') (Breschi, Malerba, & Orsenigo, 2000).

concluded by Shane (2009, p. 141), "typical startup is not innovative, creates few jobs, and generates little wealth", thus qualifying conventional wisdom that start-ups are a tool for quickly addressing the labour market issues and enhancing innovation as 'a dangerous myth' policy-makers believe in. In reality, few start-ups innovate, while the majority are replicators (followers), i.e. "a minority of genuine Schumpeterian innovators are neck to neck to innovative followers, passive replicators and defensive and necessity entrepreneurs." (Colombelli et al., 2016, p. 6). Therefore, Colombelli et al. (2016) propose shifting the attention of policy-makers and policy discourse from 'startups' to 'innovative startups' as a source of value creation.

The Federation of BiH underperforms regarding entrepreneurship development and outcomes. The Global Competitiveness Index 2019 has ranked BiH as the 117th (out of 141) country regarding business dynamism, with the costs of starting a business and the time needed to register a business being among the least favourable in the world (Schwab, 2019). As a result, new business entry is extremely low in BiH: according to World Bank's data, new business density (new registrations per 1,000 people aged 15-64) was 1.1 in 2019[17], notably below ratios in neighbouring/Western Balkan countries, EU and OECD (Figure 11).

*Figure 11: New business density in WB-6, EU and OECD in 2019*




*Source: World Bank (2023a).*

Key informants have relatively consistently assessed the start-up support ecosystem as underdeveloped and inefficient. As stated by several key informants, despite the existence of a few public schemes supporting start-ups/new entrants and support provided through donor projects, outcomes are poor for numerous intertwined reasons. This is in line with the existing (but limited) evidence on the entrepreneurship ecosystem in BiH. As can be seen from Table 4, many crucial

[17] The last available figures are for 2020. However, the last pre-pandemic year has been used here considering that the COVID-19 pandemic/crisis heavily affected business/entrepreneurial behaviour in 2020. Data for years 2021-onwards has not been available at the time of writing this thesis.

elements of the ecosystem that are needed for the successful support of start-ups from the pre-ideation stage to the SME (well-established enterprise) stage are missing or are inadequate. The Global Startup Ecosystem Index 2022 has ranked BiH as the 95th country among 100 countries observed by the report and Sarajevo as the 895th city out of 1000 observed cities in terms of startup ecosystem robustness (StartupBlink, 2022)[18]. The country has been downgraded by 22 positions over the period 2020-2022, which indicates an unfavourable pace and/or direction of startup ecosystem development relative to progress of other countries.

*Table 4: The Innovation Journey Map in Bosnia and Herzegovina: Assessment of the entrepreneurial and innovation ecosystem*

| Entrepren. phase → Stakeholders ↓ | **Pre-idea and culture** | **Ideation** | **Start-up** | **Valley of death** | **SME** |
|---|---|---|---|---|---|
| **Entrepreneurs** | Entrepreneurial interest | Engage with problems | Develop business models | Build collaboration | Expand |
| **Finance** | Research funding | Seed funding | Angel investment | Venture capital | Business finance and loans |
| **Entrepreneurial support** | Entrepreneurial events | Hackathons and competitions | Co-working and support | Incubators and accelerators | Business association |
| **Private sector** | Success stories | Research programmes | Lab programmes | B2B and support services | Skill training programmes |
| **Academia** | Entrepreneur community | Basic research | Spin offs | Soft skill trainings | Human capital |
| **Public sector** | Vision and strategy | IP and R&D support | Tax support | Public procurement | Trade policy |
| GREEN = WELL-SUPPORTED, YELLOW = INADEQUATE, RED = WEAK/MISSING | | | | | |

*Source: Adapted from International Telecommunication Union (2018).*

First, the systemic approach to the development of a startup/business support ecosystem is lacking. According to the latest comprehensive country-wide data, there are 25 business support centres and 13 start-up/innovation intermediates in the country (Aridi & Lopez, 2019). More recent official data shows that 14 business support centres, focused on providing support to the establishment of new businesses, existed in the Federation of BiH in 2020 (Federal Ministry of Development, Entrepreneurship and Crafts, 2022, pp. 48-49). The ecosystem is supported by Regional Development Agencies, which facilitate or implement programmes tailored to support

[18] The report defines a startup "as any business that applies an innovative technology-enabled solution that has the potential to achieve scalability" (p. 12).

entrepreneurship (Aridi & Lopez, 2019). However, the effectiveness of these business/startup support organisations at the outcome level is not fully known due to a lack of data (Aridi & Lopez, 2019) but partial evidence suggests that both sustainability and effectiveness are under the question mark (Aridi & Lopez, 2019; International Telecommunication Union, 2018; ABC Accelerator Group, 2017). Namely, start-up/business support schemes and, relatedly, business support organisations/intermediaries were in recent years heavily supported by international donors and driven by donors' development agendas, which bring both long-term sustainability and adaptivity to a question (Aridi & Lopez, 2019). Strategic public actions are almost absent: (a) the entity lacks a strategy for promoting startups, meaning that support measures are not guided by a clear and coherent strategic perspective (Startup Europe - Western Balkans Network, 2019), while (b) Law on Entrepreneurship Infrastructure, which would create legal preconditions for the systemic development of startup/business support ecosystem, has not been adopted yet.

Public schemes that directly support the establishment of new enterprises are poorly designed and usually primarily focused on financial transfers covering costs of registering business and salaries and/or social contribution costs, whilst non-financial support usually lacks or is under-delivered. The Federal Ministry of Development, Entrepreneurship and Crafts does not have a regular programme of support for the creation of new businesses within its portfolio. This Ministry provides support only to already established businesses in the form of financial support for obtaining equipment and raw materials or technological modernization of business processes (author's conclusion based on the analysis of the Ministry's intervention portfolio according to the Federal Ministry of Development, Entrepreneurship and Crafts, 2023). On the other side, the Federal Employment Institute has a regular programme for supporting self-employment. The Institute has allocated BAM 12 million and, out of that, committed BAM 8.8 million for self-employment (start-up) measures in 2021 (Federal Employment Institute, 2022). None of these programmes has defined any criteria (or provided additional stimulus) related to the sector, value creation or innovativeness. Besides, programmes target all unemployed people, regardless of their working experience, skills and educational background/level (Federal Employment Institute, 2021). Although inclusive, such a targeting puts a question mark on the ability of applicants to launch and run a business, especially if they lack proper previous work experience. Finally, this measure implemented by the Federal Employment Institute lacks proper mentoring and advisory support, which undermines its effectiveness (International Labour Organization, 2022). When it comes to Sarajevo Canton, the Ministry of Economy implements a start-up scheme aimed at unemployed young people aged 18-35 who are willing to start a business and submit a sound business plan (Support to Youth for Establishing Start-up) (Ministry of Economy of Sarajevo Canton, 2022). However, the measure is sector-agnostic and does not integrate mechanisms for promoting innovative software/digital product development.

Finally, the current policy measures aimed at start-up creation support do not promote 'innovative supports' but new businesses in the general sense. Namely, as indicated by some key informants, the conceptual difference between start-ups and new ventures or newly established micro-enterprises is lacking in the existing measures. Start-up support programmes usually target business ideas non-selectively, which results in most of the supported businesses being non-innovative micro-enterprises (imitators), predominantly registered in traditional business spheres – e.g. hairdressing salons, automobile repair shops, etc. The desk research confirmed this notion,[19] considering that start-up measures are mainly tailored to meet social criteria (support to specific target groups) rather than promote economic advancement. In Sarajevo Canton, the startup measure implemented by the Ministry of Economy in 2022 (Support to Youth for Establishing Start-up) has encompassed a criterion related to innovativeness, which provided up to 10 out of 100 points when scoring applications (Ministry of Economy of Sarajevo Canton, 2022), but the innovativeness is not the primary concern of the measure. According to some of the key informants, donor-supported start-up support programmes often follow the same logic, thus aiming support to the establishment of new micro businesses under the 'start-up' label.

Yet, little has been done in recent years to substantially improve policy and institutional framework to promote innovation-intensive enterprise creation. The Reform Agenda for Bosnia and Herzegovina for the period 2015-2018, a mid-term reform initiative initiated and backed by the international community in Bosnia and Herzegovina, has put economic issues, including business climate, high on the policy agenda. Annual Economic Reform Programmes adopted in the period 2015-2022 also nominally positioned policy improvements aimed at stimulating and enhancing entrepreneurship in (F)BiH high on the agenda. However, both the country, in the general sense, and the Federation of BiH, in particular, made sluggish progress in implementing policies envisaged by strategic documents, thus keeping the investment and entrepreneurship environment at an unsatisfactory level (European Commission, 2022). Measures defined by annual Economic Reform Programmes are slowly implemented and the majority of measures have been postponed year after year (European Commission, 2021; Numanović, 2021). For instance, the adoption of the new laws on contributions and personal income tax in the Federation of BiH was envisaged by the 2017 Economic Reform Programme to reduce and still has not been implemented. In that sense, the change of the salary tax wedge in this entity did not occur for more than a decade[20]. Similarly, limited progress has been made in this entity in terms of reducing parafiscal charges or easing and improving procedures of starting a business despite the fact that some of these changes have been planned by Economic Reform Programmes in 2016 (for more, see European Commission, 2022;

[19] Measures provided by the Federal Ministry of Development, Entrepreneurship and Crafts, Federal Employment Institute and Ministry of Economy of Sarajevo Canton have been reviewed within this section, thus covering all key large-scale measures at the entity level and in Sarajevo Canton.

[20] In the meantime, labour taxation policies in Republika Srpska were subject to change on several occasions and the tax wedge has been reduced by around 4 percentage points in the period 2015-2021, thus amounting to approx. 35% in 2021 (Numanović, 2021).

European Commission, 2021; Numanović, 2021). Some improvements in the area of sole proprietorship have occurred in September 2021 when the new Law on Crafts was adopted in the Federation of BiH, but considering that crafts/sole proprietorship do not represent a proper form of registration for innovative software startups/enterprises, its effect in this domain is almost negligible.

However, the Development Strategy of the Federation of BiH has defined a set of policy measures aiming to improve the business climate and entrepreneurship in this entity. Namely, under Priority 1.3 – Support the development of the private sector, the Strategy defines the following goals/targets: to achieve the 70$^{th}$/190 place on the Doing Business ranking list and to increase the number of companies per 1,000 people from 27.8 (the 2019 baseline) to 40, among others. The first measure (1.3.1) within this priority is to simplify and speed up the process of entering and exiting a business activity (e.g. one-stop-shops) in a way to progress from the 184$^{th}$ to 100$^{th}$/190 position against the Doing Business indicator on starting a business activity. This measure also includes the introduction or strengthening of financial support schemes for startups (grants, co-investing, guarantees, etc.) and mentorship provisions. The second relevant measure (1.3.2) is to support the economy by reducing the tax burden on labour, thus having a target to reduce the tax wedge on the average salary to 34%. The Strategy also promotes policy support aimed at the creation of startups in the software industry (1.1.5), however without focusing on innovative product-based startups.

Action Plan for Innovations in Small and Medium-sized Enterprises in the Federation of BiH for the period 2021-2023, which was developed by the Federal Ministry of Development, Entrepreneurship and Crafts in line with the FBiH 2021-2027 Development Strategy, also does not envisage concrete measures aimed at stimulating occurrence of innovative tech product-based startups. It only envisages measures that support start-up development at its more mature stages of growth. Namely, Measure 2 (Sectoral networks to enhance innovations) includes (i) strengthening of collaboration between SMEs and R&D institutions to improve innovativeness and SMEs and (ii) improved inter-sectoral collaboration between the IT industry and other industries (such as metal or wood processing industries) under the Triple Helix model. However, none of the measures defined by the Action Plan is focused on creating preconditions and supporting an ecosystem for the increase in the incidence of innovative startups.

Furthermore, the Government of the Federation of BiH has adopted the Decision on the Creation of the MSME Development Strategy of the Federation of Bosnia and Herzegovina for the period 2022-2027 in February 2022 (Official Gazette of the Federation of BiH, no. 10/22). The initial draft of the strategy has been created and defines three strategic objectives: (1) Competitive MSME economy based on innovation, digitalization and green circular economy, (2) Development of a conducive business environment and improvement of entrepreneurial infrastructure, and (3)

Internationalization of MSMEs through regional and global value chains. The Draft Strategy recognises the importance of stimulating entrepreneurship development in the software industry (Strategic Objective 1) and envisages improvements regarding business climate, which includes the establishment of effective one-stop shops, improved access to capital, and development of business infrastructure (e.g. business support organisations), among others (Strategic Objective 2). Yet, a comprehensive intervention aimed at stimulating innovative digital/software start-up creation is lacking in the version of the draft available at the time of conducting this analysis (Federal Ministry of Development, Entrepreneurship and Crafts, 2022). However, the version of the document analysed in the thesis was a very initial draft, which did not specify and elaborate on particular policy measures, and there is a chance that the final document will notably differ from the version analysed here.

Finally, it seems that the software industry misses a chance to put questions related to the promotion of entrepreneurship and the development of the entrepreneurial ecosystem higher on the policy agenda, although some contributions to policy dialogue are being made in a fragmented and occasional manner. The Bit Alliance's IT Manifesto devotes one out of three strategic areas to the matter of developing a more conducive business climate for the growth of the IT sector, including an improved entrepreneurial and startup ecosystem. Thus, the second strategic objective in this domain is to enhance the IT start-up ecosystem by strengthening incubators, and technology centres and introducing support measures (Bit Alliance, 2019, see also Strik Consulting, 2017). Under the first strategic goal – "to create better business opportunities in the IT industry for domestic businessmen and investors" (Bit Alliance, 2019) – IT Manifesto calls for introducing subsidies for employment in the IT industry. The initiative was mainly translated into requests for exclusive tax incentives for the industry (this topic and recent policy developments have been mentioned and analysed in Chapter 3.3.1.1). The lack of more intense and substantial action oriented toward the development of a more conducive and vibrant ecosystem for innovative start-ups can be, at least partially, explained by the industry's software service export (outsourcing) orientation: the creation of new businesses is led by 'pull' factors (high demand on the international market) and new software company founders are usually ex-employees of other IT companies willing to be independent or people with experience of working in the IT industry overseas, rather than entrepreneurs in a Schumpeterian sense of the word (Vaz-Curado & Mueller, 2019).

On the other hand, there is a consensus among key informants that new entrants in the market can be a driver of the industry's shift toward products. Namely, the vast majority of key respondents have recognised the development of sound start-up ecosystems and culture as an opportunity for promoting and stimulating product innovations. One of the key reasons, according to key informants, is that, compared to larger software companies with a well-established service export business, start-ups are small and agile and, thus, can afford to experiment and fail.

## 3.4 Strategic policy framework promoting systemic improvements relevant to software product innovation: an overview of key strategic documents

There is a growing recognition of the importance of IT innovations in strategic documents in (F)BiH. However, strategic documents are often not backed with clear and implementable action plans or funding. This section provides a brief, high-level, overview of strategies at the state and entity levels that directly or indirectly tackle software innovations. These are strategies fully or partially focusing on the promotion of innovation, science development, digitalisation and/or IT/software industry development.

Information Society Development Policy of Bosnia and Herzegovina for the period 2017-2021 (ISDPBiH) (Official Gazette of BiH, no. 42/17): This state-level document promotes the utilisation of ICT potential for wider socioeconomic development. It defines seven strategic pillars of ICT development in the country that are aligned with the Digital Agenda for Europe (European Commission, 2010). These pillars are the following: (i) establishing a single digital market, (ii) establishing a framework for interoperability and standards, (iii) promoting trust and security, (iv) establishing fast and ultra-fast internet access, (v) stimulating the development of the software industry and investments in research and innovation, (vi) enhancing digital literacy, skills and e-inclusion, (vii) applying ICT solutions for addressing the key challenges faced by BiH society. The fifth pillar is of central importance for the topic of this thesis. Besides recognising the software industry as the fastest-growing segment of the ICT sector in BiH and the industry of strategic importance, the fifth pillar also recognises that the software industry is mainly concentrated around 'outsourcing' and that shift toward the development of its own commercial software products/solutions should be encouraged by research and innovation related subsidies. However, the Policy has never been translated into a concrete strategy and/or operationalised through action plans (Economic Institute Sarajevo, 2019, pp. 18-19; UNDP, 2020).

Development Strategy of the Federation of BiH for the period 2021-2027 (DSFBiH) (Official Gazette of the Federation of BiH, no. 40/22): After the Development Strategy 2010-2014 failed to ambitiously set objectives and measures for achieving an innovation-intensive digital economy – but rather focused on the development of basic infrastructure and the creation of preconditions for the digital economy – the new Strategy for the 2021-2027 period made some progress in that regard. The Strategy identifies 'innovations and digitalisation' as one of three key accelerators for the economic development of the Federation of BiH. Measures relevant to the context of innovation policy for the software industry are defined within the first strategic goal (out of four goals): Accelerated Economic Development.

Under this goal, one of the priorities is to increase the level of digitalisation of the economy (Priority 1.1). It should be realised through the set of measures (Table 5) and actions, which include

the articulation of the strategic framework for the development of the digital economy (action plan) that would lead to the establishment of the FBiH Cloud Computing Centre, improvement of the policy framework for e-commerce, digital skills development, the adoption of the strategy for the development of Artificial Intelligence and the establishment of the Institute of AI that would perform monitoring and R&D activities in this domain.

*Table 5: The list of key measures under Priority 1.1 - Increase the digitalisation of the economy*

| **Measure** | **Measure's indicator** |
|---|---|
| Measure 1.1.1: Establish a public digital infrastructure | Indicator 1.1.1.1: Broadband internet traffic, million GB; Baseline (2019): 323; Target: 1,000 |
| | Indicator 1.1.1.2: Cloud computing centre established; Baseline (2020): No; Target: Yes |
| Measure 1.1.2: Accelerate the digital transformation of small and medium-sized enterprises | Indicator 1.1.2.2: E-commerce sales* (small enterprises, 10-49 employees); Baseline (2019): 20%; Target: 50% |
| | Indicator 1.1.2.3: E-commerce sales* (medium enterprises, 50-249 employees); Baseline (2019): 22%; Target: 50% |
| | ** Enterprises with e-commerce sales of at least 1% turnover as share of all enterprises* |
| Measure 1.1.3: Improve the digital skills of the population, especially skills tailored to the needs of the labour market | Indicator 1.1.3.1: % level of basic digital skills of individuals; Baseline (2019): 16; Target: 50 |
| | Indicator 1.1.3.3: Digital skills of the population (World Bank); Baseline (2019): 3.7; Target: 5 |
| Measure 1.1.4: Develop artificial intelligence and its application | Indicator 1.1.4.1: an institute for Artificial Intelligence established; Baseline (2020): No; Target: Yes. |
| | Indicator 1.1.4.2: AI Strategy adopted; Baseline (2020): No; Target: Yes |
| Measure 1.1.5: Encourage the development of innovative digital solutions and companies in the software industry | Indicator 1.1.5.1: % annual change in the number of companies in the IT sector; Baseline (2019): 10.7; Target: 20 |
| | Indicator 1.1.5.2: % annual change in the number of employees in companies in the IT sector; Baseline (2019): 18.5; Target: 30 |
| | Indicator 1.1.5.3: share of gross value added of the IT sector in total GDP; Baseline (2018): 1.2; Target: 4.0 |
| ** IT Sector, as defined in the Strategy, include companies registered under both J.62 and J.63* | |

*Source: DSFBiH*

Although all five measures defined under Priority 1.1 have the potential to directly or indirectly affect software-related innovation outcomes, Measure 1.1.5 specifically focuses on encouraging the development of innovative digital solutions and the creation of companies in the software industry. It proposes adopting the legal framework (law) for stimulating the development of the strategic industries and envisages recognising the IT industry as the most prosperous sector in the entity. Furthermore, this measure proposes the adoption of the R&D programme for the ICT sector(s) that would create opportunities for financial support to R&D and innovation in this industry, with the aim of ensuring preconditions for the fourth industrial revolution. Finally, it envisages the introduction of a financial product (loans) by the Development Bank of the FBiH to support acquiring of the technical infrastructure and equipment, but also the adoption of tax incentives that would encourage investment in the digitalisation of business and tech processes. However, it is not specified what type of tax incentives and under which conditions are recommended.

When it comes to the overall R&D and innovation policy, the Strategy encompasses measures under Priority 1.2: Supporting transfer and development of technologies. The Strategy envisages the establishment of the Fund for the Development of Technology, Research and Innovation with the role of financing R&D as well as cantonal science and technology parks (hereinafter: S&T parks). S&T parks would be created as a joint venture of universities and companies, while cantons would support their establishment by introducing subsidies for this purpose. It also envisages improved cooperation with European entrepreneurial and research networks. In terms of the policy framework, the adoption of a new legal and strategic framework regarding innovations, R&D and smart specialisation is envisaged by the Strategy.

Along with these two priorities, the remaining two priorities are of high relevance for nurturing a more innovative and digitalised economy. One priority is focused on supporting the development of the private business sector, which introduces measures aiming to improve the business climate and stimulate entrepreneurship, whilst the second one is focused on supporting export and the creation of high-value-added products.

Science Development Strategy of Bosnia and Herzegovina for the period 2017-2022 (SDSBiH) (Official Gazette of BiH, no. 22/18): The Strategy defines a set of framework principles, goals and measures/recommendations on developing capabilities, quality and outcomes of science in BiH. The strategy is mainly focused on the development of science through the academic and policy landscape but tackles two important points. First, it envisages that one of the priorities for supporting research in the area of engineering and technology should be research that contributes to the development of (domestic) software products (Section 9.3.2. of the Strategy). Second, it promotes tax incentives as a tool for stimulating private investments in R&D and innovations, under the Strategy's general priorities (Priority: establishment of legal regulation of scientific

research, R&D and technological activities). There is no entity-level strategy for science development in the Federation of BiH yet.

United Nations Sustainable Development Goals (hereinafter: SDGs): BiH has committed to implementing the United Nations Agenda 2030 for Sustainable Development in September 2015 (United Nations, 2021). SDGs define areas for improvement and corresponding targets that promote digitalisation, technological advancement and R&D and innovation as some of the means of sustainable and prosperous economic development. The Agenda defines 17 SDGs encompassing 169 targets (United Nations, 2022). Two SDGs are especially relevant to the matter of policy endeavours towards promoting innovations as means of software industry development (moving up the value chain): the 9th SDG – 'Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation' and partially the 8th SDG – 'Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all'.

*Table 6: Key SDGs, targets and indicators defined by the SDGs Framework in BiH*

| **Sustainable Development Goal** | **SDG's target** | **Indicator** | **Indicator's baseline and targets, as per BiH Framework** |
|---|---|---|---|
| SDG 9: Build resilient infrastructure, promote inclusive and sustainable industria-lization and foster innovation | 9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of R&D workers per 1 million people and public and private R&D spending | 9.5.1 Research and development expenditure as a proportion of GDP | Baseline (2015): 0.20<br>Mid-term (2023): 0.53<br>Target (2030): 2.00 |
| | | 9.5.2 Researchers (in full-time equivalent) per million inhabitants | Baseline (2015): 354<br>Mid-term (2023): 500<br>Target (2030): 800 |
| | 9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities | 9.b.1 Proportion of medium and high-tech industry value added in total value-added | Baseline (2015): 18<br>Mid-term (2023): 21<br>Target (2030): 25 |

*(Table continues)*

*(Continued)*

*Table 6: Key SDGs, targets and indicators defined by the SDGs Framework in BiH*

| | | | |
|---|---|---|---|
| | 9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in the least developed countries by 2020 | 9.c.1 Proportion of population covered by a mobile network, by technology | N/A |
| SDG 8: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all | 8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors | 8.2.1 The annual growth rate of real GDP per employed person<br><br>Alternative SDG indicator 8.2.2: Estimated GDP (2011. PPP $), per sex | Alternative SDG indicator 8.2.2: Estimated GDP (2011. PPP $), per sex:<br>Baseline (2018): 17,123 (men), 8,432 (women)<br>Mid-term (2023): 21,100 (men), 11,080 (women)<br>Target (2030): 28,500 (men), 20,150 (women) |
| | 8.3 Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services | Not relevant | Not relevant |

*Source: Own work based on UNDP (2020a).*

# 4 POLICY IMPLICATIONS OF FINDINGS

## 4.1 Comeback of industrial policy: implications for promoting software product innovation policy

The World Economic Forum's 2023 Markets of Tomorrow Report positions BiH as the 6th country, out of 126, regarding the share of respondents who cited digital platforms and apps as a strategic priority of the country: 28.6% of respondents are of this opinion compared to the 16.8% of the global average (World Economic Forum, 2023). Although this finding, based on the global Executive Opinion Survey 2022 (World Economic Forum, 2023, p. 48), does not discuss the economic justification of recognising digital platforms and apps as technologies that should be prioritised with the aim of creating/shaping new markets, it clearly indicates a prevailing sentiment mirrored by respondents covered by the Survey. This tendency is, to some extent, nominally set and outlined by some of the key strategic documents, as elaborated in Chapter 3.4.

Relatedly, the 2023 policy study Towards Effective Industrial Policy in the Western Balkans published by the Vienna Institute for International Economic Studies recognises IT as one of six strategic sectors in the Western Balkans whose development should be supported through industrial policy due to its multilayered potential (Jovanović & Vujanović, 2023, pp. 12-20). The focus of the industrial policy for the IT industry proposed by the authors highly corresponds to areas recognised by this thesis and includes financial instruments for supporting innovation activities, start-up support measures and increase of IT workers supply. According to the authors, "the overall strategy for the IT industry should be to focus on greater innovation while supporting the successful development of the sector in general." Jovanović & Vujanović, 2023, p. 22). This could be done by focusing on the below-listed areas that are directly cited from the policy study:

- „Providing special support for innovation activities through financial aid and guarantees, so that local innovative companies can become leaders in their fields of operation;
- Providing an attractive ecosystem for the development of the sector by supporting start-ups, opening technological parks etc.;
- Increasing the availability of IT workers by expanding the capacity of the educational institutions in this field;
- Providing favourable financing opportunities for firms that want to invest in this area and expand their activities." (Jovanović & Vujanović, 2023, p. 22).

However, as recognised by authors, the Western Balkan economies are at the early stages of effectively introducing industrial policies. Even if they are nominally devised – such as in Albania, Kosovo and Republika Srpska in Bosnia and Herzegovina – they are usually designed as horizontal strategies and have not been effectively translated into policy actions (Jovanović & Vujanović,

2023). Furthermore, out of 6 Western Balkan economies, BiH is the only one that did not start the preparation of the smart specialisation strategy (Jovanović & Vujanović, 2023; see p. 11 of the report for more information about smart specialisation strategies).

The comeback of the 'industrial policy' in the economic discourse that happened after the 2008 financial crisis gives an opportunity to economic scholars and policy practitioners to devise and propose targeted state-led interventions aimed at stimulating productive transformation, learning, functional and technological upgrading and good jobs promotion (Rodrik, 2022). Although industrial policies have never disappeared from policy practice, they were 'silent' and 'less explicit' over approx. three decades, from the 1980s to the late 2000s, as the neoclassical free-market paradigm dominated both academic and policy discourses (Mazzucato, 2015; Rodrik, 2022; World Trade Organization, 2020). However, the explicit interest in targeted interventions – in the form of modern industrial and/or innovation policies – is on the rise in both practice and theory and is often focused on innovation and capability enhancement (Cherif & Hasanov, 2019; Rodrik, 2022; Feingold, 2023). This is especially relevant in the context of digital/tech technologies whose development was notably driven by the public sector/governments, either directly or indirectly, as elaborated in Chapter 2.1.

World Trade Organization (2020, p. 30), based on UNCTAD (2018), provides an illustrative list of examples of new industrial policies and technological upgrading strategies adopted in both developed and developing countries since the mid-2010s. The list includes, for instance, the High Tech Strategy 2025 in Germany, the Smart Nation Plan in Singapore, the National Strategy for Internet of Things and the Brazilian Strategy for Digital Transformation ("E-Digital") in Brazil, and Thailand 4.0 National Strategy, among others. Although strategies listed for 26 countries are mainly focused on or related to manufacturing, it suggests the active interest of governments to support and shape the development of domestic industries with a focus on digital/4.0 transformation and advancements. In that sense, capabilities to produce, absorb and diffuse software play one of the central roles within the overall productive transformation picture.

Based on the primary research and secondary literature reviewed within the research, the thesis proposes a government-led strategic approach to supporting the development of capabilities to produce innovative software products/solutions in the FBiH. This chapter briefly presents (i) some of the key rationales for strategic policy intervention(s), accompanied by high-level discussion on the design of the strategic policy intervention, and (ii) some of the key policy areas that should be encompassed by policy mix.

## 4.2 Rationale for strategic policy intervention

This chapter does not discuss the theoretical rationale for innovation policy, which can be accessed in Chaminade and Edquist (2010). The chapter tries to provide some of the potential policy justifications (rationales) for employing strategic state intervention to support the software industry to move up the value chain and enhance capabilities to innovate and produce software products. The list of identified rationales is informed by both primary research and secondary literature and is not definitive, meaning that can be further expanded by future research.

Key informants interviewed within the primary research consistently reported that the industry needs government support to transform, although their thoughts differed in terms of policy areas that should be prioritised and type of the support; the second will be discussed in the next chapter.

The thesis recognised the following four main rationales:

1 Supporting sustained growth in the long-term perspective. As elaborated in chapters 2.2.4 and 2.2, the outsourcing model that is predominant within the FBiH software industry is characterised by notable downsides and risks, which threaten the sustainability of its growth in the long-term perspective. Diminishing price competitiveness, which is driven by huge demand for workforce combined with labour shortages, is the most notable inherent contradiction of the model. Functional upgrading toward the higher-end activities (B2B or B2C software product delivery) within the industry and diversification of the development paths would make the industry more resilient to shocks, more productive and more innovation-intensive.

2 Preventing lock-in in lower-end service export model(s). Decisions of companies to invest or not to invest in developing capabilities for specific segments of the value chain can result in a constrained ability to adapt or shift to new trajectories in the future and expand operations to other parts of the value chain. As briefly presented in Chapter 3.2, the primary research has found that companies struggle to perform high-end activities related to both the design of software products and the placement of products (sales, marketing, etc.). This challenge has been recognised by literature exploring IT/software outsourcing, as elaborated in Chapter 2.2.4. In other words, although learning by exporting services to clients within outsourcing chains can improve the capabilities of domestic firms to upgrade within the existing model, thus moving from lower-end service delivery models (e.g. data entry, coding, software testing, etc.) to higher-end modalities (e.g. IT consulting, innovation co-creation, etc.) (Gereffi & Fernandez-Stark, 2010), it results in a missed opportunity to accumulate knowledge and develop capabilities in spheres of full-cycle software product development. As mentioned in Chapter 2.2.4, the predominant choice over the development model can influence other choices within the wider ecosystem by, for instance, affecting education/skills-development policy or approach. Therefore, a strategic approach that creates incentives and supports capability

development within the wider market framework has the potential to lessen the risk of lock-in of the existing capabilities in the service export model.

3 Supporting the transition to Economy 4.0. Software is one of the centrepieces of the transition toward the 4.0 economy (Schwab, 2016; Lee, 2019 on Industry/Economy 4.0). In other words, software is a general-purpose technology, which is increasingly integrated with all business aspects of most industries and influences their development and competitiveness to a great degree (Tessler et al., 2003). Therefore, public support for the software industry development should be an integral part of the development policy of any country tending to participate in the contemporary knowledge-based global economy (Tessler et al., 2003), which is becoming more and more relevant as the 4.0 revolution leads to convergence of traditional industries and software/tech. Some authors see the recent technological developments as an opportunity for developing countries (so-called latecomers) to 'leapfrog' to Economy 4.0 (Lee, 2021; Vijayabaskar & Babu, 2014). Therefore, to be able to reduce an economic and welfare gap between themselves and advanced economies, latecomers (developing countries) should invest in developing capabilities to absorb, produce 4.0 products and services, and innovate.

4 Promoting diversification of the industry/economy. There is a rich body of research that explores the effect of diversification of economic activities within companies, industries and regions/economies (Goschin, 2019; Coulson et al., 2020). It is widely confirmed that diversified portfolios of activities/products are more resilient to economic and other shocks (e.g. the 2008 global financial crisis and the COVID-19 crisis). In recent years, an important shift has happened in the discourse on specialisation vs. diversification, whereby recent empirical research made a strong argument for moving from 'specialisation', which was considered as conventional wisdom for decades, to 'diversification'; the latter models demonstrate better outcomes and resiliency compared to the former ones (Hausmann et al., 2021; Olayele & Goel, 2020). Therefore, instead of specialising in outsourcing-based service export within GVCs, the FBiH software industry should diversify for a wider range of activities that are both service- and product-oriented. In that sense, the promotion of the development of product creation capabilities does not mean that the ITO segment of the industry should not be further supported and developed, but rather that incentives for diversification should be introduced to avoid the development inertia pointed out only in the outsourcing direction.

The aim of the strategic policy intervention should be to promote the development of capabilities within the economy to independently design, create and place innovative software products/solutions. This should be realised in the form of a comprehensive innovation policy that supports functional upgrading of the existing capabilities, primarily within the software industry. However, although the proposed innovation policy should be targeted at the software industry primarily, it should not be sectoral (vertical) for three reasons:

1 The state-level policy framework discourages explicit industrial/vertical innovation strategy: the state-level Law on State Aid System (Official Gazette of Bosnia and Herzegovina 10/12, 39/20) prohibits any kind of government support to individual businesses or specific industries, except those stipulated by the Law. Considering that this thesis considers a lower administrative level (entity), the proposed policy should be compliant with state-level laws unless they are changed. The thesis is agnostic towards the question should be this state law changed, considering the lack of evidence within the thesis to support any claim, but accepts the reality of the current policy setup. Yet, further research in this area should explore this matter in more detail and eventually propose amending the current law.
2 As elaborated in chapters 2.1 and 3.3, to successfully support (product) innovations, it is not sufficient to meet preconditions and develop capabilities on the supply side. Demand side measures aimed at both private (e.g. e-commerce promotion) and public (e.g. e-governance) sectors as well as entrepreneurship promotion play important roles in creating a conducive environment for innovative software products. Therefore, a comprehensive policy implies a policy mix that encompasses a wide range of instruments and is cross-sectoral in many domains.
3 The global digitalization of the economy and transition towards 4.0 industries increase the importance of software in all industries, meaning that the 'secondary software industry' (see Chapter 2.2.1 for a more elaborate explanation of the term) is of great importance. Policy solutions that would target only the primary IT/software industry would exclude a vast number of companies able to innovate and produce software solutions/products on their own but could also potentially create or exacerbate displacement of jobs (moving software professionals from software-intensive non-software industries to the software industry) or investments due to government-offered opportunities in the primary software industry.

On top of the aforementioned reasons, some economic literature indicates that innovation policy aimed at picking specific industries represents a poor economic policy and, therefore, is in favour of supporting key broader industries and technologies (Chapter 2; Atkinson & Ezell, 2012).

Therefore, the proposed innovation policy should be realised as a 'digital transformation strategy' that, among others, encompasses measures for developing incentives and capabilities of software firms and non-software firms with in-house software units to produce innovative software products, thus indirectly promoting the functional upgrading of the industry. This is in line with the overall orientation of the strategic documents reviewed in Chapter 3.4, which recognised this issue but have not been able to propose a comprehensive set of measures for addressing the lack of software product creation in (F)BiH.

Some of the key informants, although recognising the importance of the policy intervention, have warned that government intervention(s) should be limited and carefully designed to avoid negative

and harmful effects on the industry. This concern is recognised as important in this thesis. The vast literature on state interventionism and, specifically on industrial and innovation policy, has documented a wide range of 'governance failures' associated with this type of policy intervention. It ranges from potential corruptive behaviour of government officials to various market distortions arising from information asymmetries, lack of knowledge or lack of other capacities to properly implement measures (UNCTAD, 2016 provides an overview of the criticism aimed at industrial/structural transformation policies). Whilst the first remark (corruption, nepotism) is beyond the boundaries of this research and can be addressed by following the best international practices introduced to protect the integrity of policy interventions, the second set of issues will be briefly tackled in this chapter.

Namely, the design of the policy intervention and accompanying measures should be carefully designed to avoid (i) creating 'false' incentives that are not justified by the market (in terms of price, quantity or scope) and thus over-incentivise the creation of capabilities that cannot find their application in a non-supported market environment, (ii) substitution effect, whereby companies invest in less productive or market-relevant activities due to availability of 'free money' or other incentives, and (iii) displacement of private investments, among others. Thus, the policy intervention should be designed to improve incentives and preconditions for the existing companies or potential new entrants willing to experiment with software product models rather than to over-incentivise the market to deprioritise profitable niches because of 'aggressive' policy intervention. In other words, the strategic policy intervention (innovation policy) should be designed in a way to enable diversification of the industry instead of incentivising the industry to shift from one to another model.

This approach is rooted in the understanding that one of the roles of innovation policy, as recognised by the literature, is to keep the balance between variety-creation (innovations, i.e. new products, practices, organisational modes, etc.) and selection (abandonment of the least efficient or least promising solutions) within the industry or economy (Edler & Fagerberg 2017). In that sense, innovation policy can prevent or address the issue of path dependency, which often arises as a result of the selection process (choosing one technology over other available technologies, choosing one business/organisational model over others, etc.). Considering that the industry developed capabilities and knowledge in line with the initially preferred option, it is hard for the industry to make a shift to other technologies/practices or absorb new knowledge/trends, thus being locked into its current setup and trajectory (Edler & Fagerberg 2017; Cohen & Levinthal, 1990).

## 4.3 Policy areas and measures to be considered in the innovation policy mix

Based on insights obtained through a partial review of systemic constraints and capability gaps within some of the key areas concerning innovation policy mix in Chapter 3.3, this section provides a set of high-level recommendations for both supply side and demand side measures as well as for innovative start-up promotion measures that could be part of the innovation policy mix for the FBiH software product development. As mentioned in Chapter 2.1, this set of recommendations tackles only several policy areas that have been covered by the thesis and focus only on some of the key policy instruments that can be deployed; future research in this area should seek to expand knowledge to other areas and revise priorities. Similarly, considering that the findings in this thesis are qualitative, further articulation of specific policy measures should be accompanied by comprehensive quantitative insights into relevant matters. However, the findings of this thesis suggest the policy actions outlined below.

On the supply side, the innovation policy mix should focus on the promotion of private investments in R&D aimed at software product creation and human capital development to provide both qualities (knowledge and skills) and quantities needed to encourage experimentation with the product-based models.

When it comes to stimulating private investments in R&D aimed at yielding innovative software products, the introduction of R&D tax incentives should be considered as an instrument of mobilising the profits of software companies into R&D activities. Characteristics of the R&D tax incentive design should be based on further empirical analysis. However, as demonstrated by Straathof et al. (2014), R&D tax incentives aimed at R&D wages are considered the best practices for three main reasons: (i) stronger positive externalities as R&D diffuses knowledge by moving from one company to another, (ii) low administrative and compliance costs of this type of incentive, (iii) easier establishment of distinction between R&D and non-R&D staff than between R&D and non-R&D investment. This design also corresponds to the nature of the software industry, considering that software innovations are mainly based on cognitive capital (see Chapter 3.3.1.2). In addition, innovation vouchers should be introduced, tested, adapted and scaled to encourage the acquisition of knowledge from knowledge providers specialised in those areas for which companies lack internal knowledge. This measure is already envisaged by the Action plan for innovation in SMEs in the FBiH 2021-2023 and, therefore, correspond to the current strategic thinking in this domain.

When it comes to human capital (skills supply), an ambitious and comprehensive strategic approach is needed to improve education outputs in terms of both size and diversity of skills. Although the increase in the IT professionals supply (software developers, engineers, etc.), as noticed by some of the key informants, would primarily feed the growth of the existing service

export (outsourcing) model, interview-based evidence indicates that software companies are sometimes reluctant to start or maintain innovative product-oriented projects due to scarcity of workforce (see Chapter 3.3.1.2). This can be done by (i) systemically promoting the expansion of capacities of higher education to absorb more students and produce more workforce in line with the local and global trends in demand for IT workforce (including the promotion of the establishment of new study programmes), (ii) encouraging enrolment in IT study programmes by offering scholarships and full coverage of faculty-related study costs (as already introduced in Sarajevo Canton in 2022), (iii) systemically promoting high-quality retraining options for predisposed professionals from other fields and the unemployed to enter IT professions and (iv) introducing brain gain policies, including the simplification of the procedures for granting working permissions for foreign IT professionals. In terms of skills diversity, the policy should promote more focus on entrepreneurial skills and full-cycle software product management within the existing IT study programmes.

On the demand side, the innovation policy mix should focus on the development of a comprehensive and large-scale strategy of digitalisation that would encompass both the digitalisation of public administration and governance and the digitalisation of the business sector. Regarding the former, a strategy for the digitalisation of the governance/public administration should be developed, which is in line with Measure 4.2.6 of the Development Strategy of the Federation of BiH 2021-2027 that envisages the development and adoption of the Strategy for the development of e-governance. This can be part of a wider digitalisation strategy too. The strategy should define a suitable use of PPI (including potential policy reforms needed in this realm) to encourage the creation and absorption of software products in line with the overall needs of digitalisation. However, this should be based on sound research evidence that would identify needs and effective ways of using PPI in line with international experience and the local policy context. Regarding the latter, policies should provide (i) large-scale and diversified portfolios of support measures (e.g. grants, subsidies, low-interest loans, etc.) aiming at digitalisation of business operations in various segments, including production, business management and sales, but also (ii) promote collaboration of the software industry and other industries through tailor-made programmes encouraging non-IT and IT companies to enter the joint software-based or software-related projects or commercial transactions, and (iii) raise awareness of benefits of investing in digitalisation (e.g. knowledge-sharing initiatives, educations, media campaigns, etc.). Measures should be continuously monitored and evaluated to ensure adaptive performance-based management of policy measure portfolio and maximise the effectiveness of the intervention by regularly improving the design of measures based on findings of monitoring and evaluation. It is expected that ambitious policy initiative in the aforementioned two areas would create strong demand for software products and serves as a pull force for the diversification of the software industry and shift toward product-based models. On the flip side, it will enhance the overall

performance of the FBiH regarding the digital economy and its position within the international rankings.

Finally, regarding the entrepreneurship policy, the focus should be put on improving and consolidating strategic framework for the promotion of innovative tech start-ups with a focus on the high value-added value chain niches. Namely, as presented in Chapter 3.4, the current strategic approach to developing the start-up ecosystem is scattered and underdeveloped. Some policy aspects relevant to the start-up ecosystem development have been covered by the Development Strategy of the Federation of BiH 2021-2027 and the accompanying Action Plan for Innovations in Small and Medium-sized Enterprises in the Federation of BiH 2021-2023. The draft version of the MSME Development Strategy of the Federation of BiH 2022-2027 also tackles some of the relevant areas in this policy realm. However, the holistic approach to start-up ecosystem development and the focus on innovative or product-based start-ups are lacking. Therefore, the strategic policy document in this area could consolidate and systematise long-term ambitions regarding the systemic start-up ecosystem development approach.

# 5 CONCLUSION

The software industry in the FBiH has experienced immense growth over the past decade. In terms of job creation, the industry grew by 449% during the period 2012-2022. The industry today generates attractive and decent jobs that are, on average, paid as twice as an average job in the entity. However, the industry is largely concentrated around the service export model or, precisely, outsourcing, thus providing a wide range of software development and IT consulting services to overseas clients. It means that the industry is mainly focused on the lower value-added segments of the value chain. Although this integration in global software value chains has enabled the industry to grow and expand rapidly with relatively low entry barriers, the model is characterised by substantial disadvantages and risks (vulnerabilities) that are recognised by the existing literature and key informants interviewed within the primary research. These drawbacks include inability to achieve the economies of scale, diminishing price competitiveness due to labour costs increase, uncertainty over long-term attractiveness to overseas clients due to new emerging IT outsourcing destinations and replacement of low-end and routine coding tasks by automatised AI-based solutions, among others.

This master thesis has explored some of the key systemic constraints and disincentives for moving up the value chain/functional upgrading from the lenses of the innovation policy, whereby innovation policy has been understood in its broader sense (as policies influencing various areas relevant for capacities and capabilities of the industry for functional upgrading). Although the recent strategic documents have started recognising the IT/software industry as a strategic industry as well as the importance of the currently lacking ability of the industry to produce its own software

products, the overall policy landscape misses concrete strategic vision and instruments that would support potential transformation or diversification of the industry toward the product-based model(s).

Therefore, based on the findings, the thesis proposes the development of a systemic and comprehensive innovation policy that will promote the development of capabilities of the industry to diversify toward the product-based model and create a conducive environment for software product development. The policy should be horizontal and encompass a wider range of policy areas and instruments on both supply and demand sides, including human capital development instruments, R&D incentives, digitalisation of both private and public sectors, and support to innovative product-based startups.

The thesis aims to contribute to the wider policy debate on the development of the software industry or, more generally, tech industries in the FBiH. Considering that the current discourse is mainly focused on measures that could support the further growth and expansion of the outsourcing model, the intention of this thesis was to open both academic and policy debates on the innovation policy that could move up the FBiH software industry toward high-end segments of the value chain. To the best of the author's knowledge, this is the first comprehensive research that explores this topic and, therefore, has the ambition to stimulate further knowledge creation in this domain.

However, this research has several important methodological and formal limitations, including (i) the lack of comprehensive firm-level quantitative data on innovation/product-oriented investments and general performance (growth, revenues, profit, etc.) within different business models, (ii) the inability to extensively assess the relevancy of variety of policy instruments for promoting functional upgrading and (iii) lack of empirical assessment of outcomes of different policy scenarios (policy mixes). Therefore, further research is needed to thoroughly explore the topic and provide in-depth empirical evidence for making policy decisions and shaping policy mix to properly support the long-term evolvement of the software industry in the FBiH.

# REFERENCES

1. Ćatić, H., Pale, M., & CEDES. (2020). *Innovation and digitalisation in SMEs in Bosnia and Herzegovina.* Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

2. Abbott, P., Zheng, Y., Modi, S., & Du, R. (2012). Moving Up The Value Chain: Exploring The Issues For Chinese Software & Services Outsourcers. *The 16th Pacific Asia Conference on Information Systems (PACIS 2012)*.
3. ABC Accelerator Group. (2017). *Southeast Europe Startup Report 2017.* ABC Accelerator Group / EIT Digital.
4. Agency for Statistics of Bosnia and Herzegovina. (2022). *Gross Domestic Product of Bosnia and Herzegovina 2021 Production Approach, First Results.* Agency for Statistics of Bosnia and Herzegovina.
5. Alcacer, J., & Oxley, J. (2013). Learning by Supplying. *Strategic Management Journal, 35*, 204–223.
6. Alfonso, D. (2022, August 26). *Africa emerges as hot spot for outsourcing tech jobs*. https://www.worklife.news/technology/africa-emerges-as-hot-spot-for-outsourcing-tech-jobs/.
7. Aridi, A., & Lopez, A. O. (2019). *Towards a Private Sector led Growth Model Bosnia and Herzegovina Innovation and Entrepreneurship Assessment.* The World Bank.
8. Armando, E., Azevedo, A. C., Fischmann, A. A., & Pereira, C. E. (2016). usiness strategy and upgrading in global value chains: a multiple case study in Information Technology firms of Brazilian origin. *RAI Revista de Administração e Inovação, Volume 13*(1), 39-47.
9. Arora, A., & Bagde, S. K. (2010). *Human Capital and the Indian Software Industry.* National Bureau of Economic Research.
10. Arora, A., Arunachalam, V., Asundi, J., & Fernandes, R. (2001). The Indian software services industry. *Research Policy, 30*, 1267–1287.
11. Aspray, W., Mayadas, F., & Vardi, M. Y. (2006). *Globalization and Offshoring of Software: A Report of the ACM Job Migration Task Force.* Association for Computing Machinery.
12. Association of Employers of the Federation of BiH. (2022). *Liberalizacija uvoza deficitarne radne snage.* Association of Employers of the Federation of BiH.
13. Atkinson, R. D., & Ezell, S. J. (2012). *Innovation Economics: The Race for Global Advantage.* Yale University Press.
14. Bengt-Åke, L. (2003). Technology policy in the learning economy. In D. Archibugi, J. Howells, & J. Michie (Eds.), *Innovation Policy in a Global Economy.* Cambridge University Press.
15. BISNODE (n.d.). *Portfolio Intelligence*. https://bisnode.ba.
16. Bit Alliance. (2019). *IT Manifesto*. https://bit-alliance.ba/itmanifesto/.
17. Bit Alliance. (2019a, February 13). *IT sektor u BiH*. https://itkarijera.ba/html-page/68/it-sektor-bih.
18. Bit Alliance. (2023). *About us*. https://bit-alliance.ba/about/.

19. Borrás, S., & Edquist, C. (2016). Conceptual Underpinnings for Innovation Policy Design – Indicators and Instruments in Context. *OECD Blue Sky Forum on Science and Innovation Indicators 2016*, 1-22. Ghent.
20. Breschi, S., Malerba, F., & Orsenigo, L. (2000). Technological Regimes and Schumpeterian Patterns of Innovation. *The Economic Journal, 110*(463), 388-410.
21. Campbell-Kelly, M. (2003). *From Airline Reservations to Sonic the Hedgehog: A History of the Software Industry.* Massachusetts Institute of Technology.
22. Carvalho, A. (2011). *Why are tax incentives increasingly used to promote private R&D?* CEFAGE.
23. Chaminade, C., & Edquist, C. (2010). Rationales for Public Policy Intervention in the Innovation Process: Systems of Innovation Approach. In R. E. Smits, S. Kuhlmann, & P. Shapira (Eds.), *The Theory and Practice of Innovation Policy: An International Research Handbook*, 95-114. Edward Elgar Publishing Limited.
24. Cherif, R., & Hasanov, F. (2019). *The Return of the Policy That Shall Not Be Named: Principles of Industrial Policy (WP/19/74).* International Monetary Fund.
25. Cirera, X., Frías, J., Hill, J., & Li, Y. (2020). *A Practitioner's Guide to Innovation Policy: Instruments to Build Firm Capabilities and Accelerate Technological Catch-Up in Developing Countries.* World Bank.
26. Cohen, W. M., & Levinthal, D. A. (1990). Absorptive Capacity: A New Perspective on Learning and Innovation. *Administrative Science Quarterly* (35), 128-152.
27. Colombelli, A., Krafft, J., & Vivarelli, M. (2016). *To Be Born Is Not Enough: The Key Role of Innovative Startups.* Institute for the Study of Labor (IZA).
28. Coulson, N. E., McCoy, S. J., & McDonough, I. K. (2020). Economic diversification and the resiliency hypothesis: Evidence from the impact of natural disasters on regional housing values. *Regional Science and Urban Economics, 85,* 1-17.
29. Council of the European Union. (2008). *Council Conclusions: A Fresh Impetus for Competitiveness and Innovation of the European Economy (10174/08).* Council of the European Union.
30. Czarnitzki, D., Hünermund, P., & Moshgbar, N. (2018). *Public Procurement as Policy Instrument for Innovation.* ZEW - Centre for European Economic Research.
31. Decision on the Creation of the MSME Development Strategy of the Federation of Bosnia and Herzegovina for the period 2022-2027, *Official Gazette of the Federation of BiH, no. 10/22*.
32. Deloitte. (2015). *Outsourcing is good for Job Creation in South Africa.* Deloitte and Touche.
33. Development Strategy of the Federation of Bosnia and Herzegovina for the period 2021-2027, *Official Gazette of the Federation of BiH, no. 40/22*.

34. D'Costa, A. P. (2004). Export Growth and Path-Dependence: The Locking-in of Innovations in the Software Industry. In *India in the Global Software Industry: Innovation, Firm Strategies and Development*, 51-82. Palgrave Macmillan.
35. Dragan, A. (2018, April 25). *BR Exclusive. Romania has tax incentives for the IT industry in place, but companies can't really use them*. https://business-review.eu/news/romania-has-tax-incentives-for-the-it-industry-are-in-place-but-the-companies-cant-really-use-them-166607.
36. Economic Institute Sarajevo. (2019). *Analiza potrebnih vještina za softversku industriju u Bosni i Hercegovini: 2019.* UNDP.
37. Edler, J., & Fagerberg, J. (2017). Innovation policy: what, why, and how. *Oxford Review of Economic Policy, 33*(1), 2–23.
38. Edler, J., Gök, A., Cunningham, P., & Shapira, P. (2016). Introduction: Making sense of innovation policy. In J. Edler, P. Cunningham, A. Gök, & P. Shapira (Eds.), *Handbook of Innovation Policy Impact*, 1-17. Edward Elgar Publishing.
39. Engelhardt, S. v. (2008). *The Economic Properties of Software.* Friedrich Schiller University / Max Planck Institute of Economics.
40. European Commission. (2010). *A Digital Agenda for Europe.* European Commission.
41. European Commission. (2018, November 9). *Public Procurement of Innovative Solutions*. https://digital-strategy.ec.europa.eu/en/policies/ppi.
42. European Commission. (2020). *Izvještaj o Bosni i Hercegovini za 2020. uz dokument Saopštenje Komisije Evropskom parlamentu, Vijeću, Evropskom ekonomskom i socijalnom odboru i Odboru regija Saopštenje o politici proširenja EU-a za 2020.* European Commission.
43. European Commission. (2021). *Bosnia and Herzegovina 2021 Report.* European Commission.
44. European Commission. (2022). *Bosnia and Herzegovina 2022 Report Accompanying the document Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions 2022 Communication on EU Enlargement policy.* European Commission.
45. EUROSTAT. (2022, November). *R&D expenditure*. Eurostat Statistics Explained. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=R%26D_expenditure&oldid=551418#:~:text=An%20analysis%20of%20R%26D%20expenditure,the%20world%20(foreign%20funds).
46. EUROSTAT. (2023, January 11). *Digital economy and society statistics - enterprises*. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Digital_economy_and_society_statistics_-_enterprises#Access_and_use_of_the_internet.

47. Fagerberg, J. (2004). Innovation: A Guide to the Literature. In J. Fagerberg, D. C. Mowery, & R. R. Nelson (Eds.), *The Oxford Handbook of Innovation.* Oxford University Press.
48. Fagerberg, J. (2017). Innovation Policy: Rationales, Lessons and Challenges. *Journal of Economic Surveys 31*(2), 497-512.
49. Federal Employment Institute. (2021). *Program sufinansiranja samozapošljavanja - Start-up 2021.* Federal Employment Institute. https://fzzz.ba/ckFinderFiles/files/Projekti/2021/Program%20sufinansiranja%20samozapo%C5%A1ljavanja%20-%20START%20UP%202021.pdf.
50. Federal Employment Institute. (2022). *2021 Annual Report of the Federal Employment Institute.* Federal Employment Institute.
51. Federal Ministry of Development, Entrepreneurship and Crafts. (2022). *Draft Strategy of Development of MSMEs in the Federation of BiH 2022-2027.* Federal Ministry of Development, Entrepreneurship and Crafts.
52. Federal Ministry of Development, Entrepreneurship and Crafts. (2022a). *Trogodišnji plan rada Federalnog ministarstva razvoja, poduzetništva i obrta za period 2022-2024.* Federal Ministry of Development, Entrepreneurship and Crafts.
53. Federal Ministry of Development, Entrepreneurship and Crafts. (2022b). *Izvještaj o dodijeljenim sredstvima sa listom korisnika grant sredstava tekućih transfera za 2022. godinu.* Federal Ministry of Development, Entrepreneurship and Crafts.
54. Federal Ministry of Development, Entrepreneurship and Crafts. (2022c, November 11). *Kreditna linija za digitalizaciju MSP-a*. Retrieved from Federalno ministarstvo razvoja, preduzetništva i obrta: https://bit.ly/3IOEU4P
55. Federal Ministry of Development, Entrepreneurship and Crafts. (2023). *Javni natječaj za grant sredstva u 2023. godini*. https://www.fmrpo.gov.ba/javni-natjecaj-za-grant-sredstva-u-2023-godini/.
56. Feingold, S. (2023, May 2). *Industrial policy has officially made a comeback, chief economists say*. https://www.weforum.org/agenda/2023/05/growth-summit-industrial-policy-officially-comeback-chief-economists/.
57. Fijuljanin, S., & Fijuljanin, A. (2017). The Survival of ICT Companies in Bosnia and Herzegovina: Research and Development Tax Credit. In I. Vrdoljak Raguž (Ed.), *DIEM 2017: 3rd Dubrovnik International Economic Meeting. 3*, 219-227. University of Dubrovnik - Department of Economics and Business Economics.
58. Georghiou, L., Edler, J., Uyarra, E., & Yeow, J. (2014). Public procurement as an innovation policy tool: choice, design and assessment. *Technological Forecasting & Social Change*(86), 1-12.
59. Gereffi, G., & Fernandez-Stark, K. (2010). The Offshore Services Value Chain: Developing Countries and the Crisis. In O. Cattaneo, G. Gereffi, & C. Staritz (Eds.),

*Global Value Chains in a Postcrisis World: A Development Perspective*, 335-373. The International Bank for Reconstruction and Development / The World Bank.

60. GIZ. (2021, May). *Promoting business innovation and digitalisation in Bosnia and Herzegovina*. https://www.giz.de/en/worldwide/76894.html.
61. GIZ. (2021a). *Digital Business for the Digital Age*. https://eu4digitalsme.ba/en/about-project/.
62. Goschin, Z. (2019). Specialisation vs. Diversification. Which one better upholds regional resilience to economic crises? *Journal of Social and Economic Statistics, 8*(2), 11-23.
63. Gouardères, F. (2021). *Fact Sheets on the European Union - 2021: Innovation Policy.* European Parliament.
64. Government of India - Ministry of Electronics and Information Technology. (2021, September 9). *National Policy on Software Products (NPSP) – 2019*. https://www.meity.gov.in/national-policy-software-products-npsp-%E2%80%93-2019.
65. Government of Sarajevo Canton. (2022, June 9). *Studentina koji upisuju I ciklus IT studijskih programa troškove studija snosit će Kanton Sarajevo*. https://vlada.ks.gov.ba/aktuelnosti/novosti/studentima-koji-upisuju-i-ciklus-it-studijskih-programa-troskove-studija-snosit.
66. Gunn, D. (2021, August 12). *10 Best Countries to Outsource Software Development, Based on Data*. https://www.codeinwp.com/blog/best-countries-to-outsource-software-development/.
67. Hadžibegić, M. (2023, April 15). *Maglajlić: Rezovi u IT sektoru na globalnom nivou bez značajnijeg uticaja na domaće IT kompanije*. FENA - Federalna novinska agencija. https://fena.ba/article/1527055/maglajlic-rezovi-u-it-sektoru-na-globalnom-nivou-bez-znacajnijeg-uticaja-na-domace-it-kompanije.
68. Hakemulder, R., & Wilson, A. (2016). *Facilitating youth employment in the information technology (IT) sector in Bosnia and Herzegovina.* MarketMakers.
69. Hall, B., & Van Reenen, J. (2000). How effective are fiscal incentives for R&D? A review of the evidence. *Research Policy, 29*(4-5), 449-469.
70. Haskić-Suša, M. (2022, July 23). *Bez fiskalnog rasterećenja IT sektor će stagnirati i gubiti radnike*. Bloomberg Adria. https://ba.bloombergadria.com/ekonomija/bih/4779/bez-fiskalnog-rasterecenja-it-sektor-ce-stagnirati-i-gubiti-radnike/news/?fbclid=IwAR2AqdD-nbvrniCDTLzMMUflFtGZ_uh13nWYZ7LQz1WQvk0bGuBPTzVKH3c.
71. Hausmann, Ricardo et al. (2021). *What Economic Complexity Theory Can Tell Us about the EU's Pandemic Recovery and Resilience Plans.* Growth Lab / European Politics and Policy.
72. Hoch, D. J., Roeding, C. R., Purkert, G., Lindner, S. K., & Müller, R. (2000). *Secrets of Software Success: Management Insights from 100 Software Firms around the World.* Hardvard Business School Press.

73. Huang, S., Asundi, J., & Xing, Y. (2021). *Plugging into Global Value Chains of the Software Industry: The Experiences of India.* National Graduate Institute for Policy Studies.
74. Humphrey, J., & Schmitz, H. (2002). How does insertion in global value chains affect upgrading in industrial clusters? *Regional Studies, 36*(9), 1017-1027.
75. Imamović, L. (2017). *IT industry - A development opportunity for Bosnia and Herzegovina.* National and Kapodistrian University of Athens.
76. Information Society Development Policy of Bosnia and Herzegovina for the period 2017-2021, *Official Gazette of BiH, no. 42/17.*
77. Institute for Statistics of FBiH. (2020). *Research and Development in 2019.* Institute for Statistics of FBiH.
78. Institute for Statistics of FBiH. (2022). *Research and Development in 2021.* Institute for Statistics of FBiH.
79. Institute for Statistics of FBiH. (2023). *Employment, Unemployment and Wages in Federation of BiH by Cantons and Municipalities, 2022.* Institute for Statistics of FBiH.
80. International Labour Organization. (2022). *Review of Policies for the Introduction of the Reinforced Youth Guarantee: Bosnia and Herzegovina.* International Labour Organization.
81. International Organization for Migration. (2022). *Emigration of Health and Information and Communication Technology Professionals from Bosnia and Herzegovina: Challenges and Opportunities.* International Organization for Migration.
82. International Telecommunication Union. (2018). *Digital Innovation Profile: Bosnia and Herzegovina: ICT centric innovation ecosystem snapshot.* International Telecommunication Union.
83. Jovanović, B., & Vujanović, N. (2023). *Towards Effective Industrial Policy in the Western Balkans (Policy Notes and Reports 66).* Vienna Institute for International Economic Studies (wiiw).
84. Kaloudis, A., Aspelund, A., Koch, P. M., Lauvås, T. A., Mathisen, M. T., Strand, Ø., . . . Aadland, T. (2019). *How Universities Contribute to Innovation: A Literature Review-based Analysis.* NTNU.
85. KLIX. (2019, September 28). *IT industrija na nogama: Ako prođu zakoni Vlade FBiH, stotine miliona KM bit će izgubljeno*. https://www.klix.ba/biznis/it-industrija-na-nogama-ako-prodju-zakoni-vlade-fbih-stotine-miliona-km-bit-ce-izgubljeno/190928029.
86. Klotins, E., Unterkalmsteiner, M., & Gorschek, T. (2019). Software engineering in start-up companies: An analysis of 88 experience reports. *Empir Software Eng, 24*, 68-102.
87. Korte, W. B., Hüsing, T., & Dashja, E. (2017). *High-Tech Leadership Skills for Europe: Towards an Agenda for 2020 and beyond.* Empirica / European Commission Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs.

88. Kumar, R. (2009). *The Development of the Software Industry in Postreform India: Comparative Regional Experiences in Tamil Nadu, Andhra Pradesh, and Kerala.* Cambria Press.
89. Law on State Aid System, *Official Gazette of BiH, no. 10/12, 39/20.*
90. Lee, K. (2019). *Economics of technological leapfrogging.* United Nations Industrial Development Organization (UNIDO).
91. Lee, K. (2021, March). *How developing countries can take advantage of the Fourth Industrial Revolution*. Industrial Analytics Platform. https://iap.unido.org/articles/how-developing-countries-can-take-advantage-fourth-industrial-revolution.
92. Li, C. (2021). *Understanding Convergence: The Next Wave of Digital Transformation.* Altimeter.
93. Lippoldt, D., & Stryszowski, P. (2009). *Innovation in the Software Sector.* OECD.
94. Mason, C., & Brown, R. (2014). *Entreprenurial Ecosystems and Growth Oriented Entrepreneurship.* OECD / LEED.
95. Mazzucato, M. (2015). *The Entrepreneurial State: Debunking Public vs. Private Sector Myths.* PublicAffairs.
96. McGrath, J. (2019). *Analysis of shortage and surplus occupations based on national and Eurostat Labour Force Survey data: Shortages and surpluses 2019.* European Commission: Directorate-General for Employment Social Affairs and Inclusion.
97. McKinsey & Company. (2022). *McKinsey Technology Trends Outlook 2022.* McKinsey & Company.
98. MEASURE-BiH. (2018). *Assessment of Bosnia and Herzegovina E-governance and E-administration.* MEASURE-BiH.
99. Ministry of Economy of Sarajevo Canton. (2022, July 1). *Javni poziv za podnošenje prijava za Program: "Podrška mladima za pokretanje start up poslovnih subjekata", broj: 07-04-11-25721/22.* https://mp.ks.gov.ba/sites/mp.ks.gov.ba/files/javni_poziv_-_mladi_2022.pdf.
100. Mudambi, R. (2008). Location, control and innovation in knowledge-intensive industries. *Journal of Economic Geography, 8*(5), 699–725.
101. Muellmann, S., Brand, T., Jürgens, D., Gansefort, D., & Zeeb, H. (2021). How many key informants are enough? Analysing the validity of the community readiness assessment. *BMC Research Notes, 14*(85).
102. Murphy, G., & Siedschlag, I. (2011). Human Capital and Growth of Information and Communication Technology-intensive Industries: Empirical Evidence from Open Economies. *Regional Studies, 47*(9), 1403-1424.
103. Murphy, G., & Traistaru-Siedschlag, I. (2007). *The Effect of Human Capital on Output Growth in ICT Industries: Evidence from OECD Countries.* ESRI.
104. Nübler, I. (2014). A theory of capabilities for productive transformation: Learning to catch up. In J. M. Salazar-Xirinachs, I. Nübler, & R. Kozul-Wright, *Transforming*

*economies: Making industrial policy work for growth, jobs and development*, 113-149. International Labour Organization.

105. Nano, E., & Stolzenburg, V. (2021). The Role of Global Services Value Chains for Services-Led Development. In Y. Xing, & E. Gentile (Eds.), *Global Value Chain Development Report 2021 - Beyond Production*, 105-133. Asian Development Bank, Research Institute for Global Value Chains - University of International Business and Economics, World Trade Organization, Institute of Developing Economies – Japan External Trade Organization, China Development Research Foundation.
106. Nippard, D. (2022). *Developing the market for non-formal education provision in Bosnia & Herzegovina.* Helvetas Swiss Intercooperation, Kolektiv.
107. Numanović, A. (2021). *Performance of Western Balkan economies regarding the European Pillar of Social Rights: 2021 review on Bosnia and Herzegovina.* Regional Cooperation Council.
108. Numanović, A., & Obradović, N. (2020). *Performance of Western Balkan economies regarding the European Pillar of Social Rights Updated review on Bosnia & Herzegovina.* European Centre for Social Welfare Policy and Research.
109. OECD. (2007). *Staying Competitive in the Global Economy: Moving Up the Value Chain.* OECD.
110. OECD. (2010). *The OECD Innovation Strategy: Getting a Head Start on Tomorrow.* OECD.
111. OECD. (2011). *Demand-side Innovation Policies.* OECD Publishing.
112. OECD. (2017). *Public Procurement for Innovation: Good Practices and Strategies.* OECD Publishing.
113. OECD. (2019). *Measuring Tax Support for R&D and Innovation*. https://www.oecd.org/innovation/tax-incentives-RD-innovation/.
114. OECD. (2021). *Policy Highlights: The Digital Transformation of SMEs.* OECD.
115. Olayele, F., & Goel, P. (2020). *Economic Diversification, Resilience, and the Path to Inclusive Growth.* NYCEDC.
116. Pankowska, M. (2019). Information Technology Outsourcing Chain: Literature Review and Implications for Development of Distributed Coordination. *Sustainability, 11*(1460), 1-28.
117. Paylab. (2022). *Salaries in the category: Information Technology (Austria)*. https://www.paylab.com/at/salaryinfo/information-technology?lang=en.
118. Paylab. (2022a, December). *Programer IT – software (Bosna i Hercegovina)*. https://www.plata.ba/plata/it-software/programer.
119. Pillai, B. P. (2006). *Role of Government in the Growth of Inida's Software Industry.* National University of Singapore.
120. PricewaterhouseCoopers. (2018). *Istraživanje softverske industrije u BiH.* PricewaterhouseCoopers.

121. Pussep, A., Schief, M., & Widjaja, T. (2012). The Software Value Chain: Methods for Construction and Their Application. *ECIS 2012 Proceedings. 116.*
122. Pussep, A., Schief, M., Widjaja, T., Buxmann, P., & Wolf, C. M. (2011). The Software Value Chain as an Analytical Framework for the Software Industry and Its Exemplary Application for Vertical Integration Measurement. *17th Americas Conference on Information Systems*, 1-8. Association for Information Systems.
123. PwC. (2018). *Drive or be driven: Understanding the third wave of industry convergence.* PricewaterhouseCoopers.
124. Qureshi, M. A., Qureshi, J. A., Ahmed, A., Qaiser, S., Ali, R., & Sharif, A. (2020). The Dynamic Relationship Between Technology Innovation and Human Development in Technologically Advanced Countries: Fresh Insights from Quantiles-on-Quantile Approach. *Social Indicators Research, 152,* 555–580.
125. Raee, M. A., Ritzen, J., & Crombrugghe, D. d. (2017). *Innovation Policy & Labour Productivity Growth: Education, Research & Development, Government Effectiveness and Business Policy.* Maastricht Economic and Social Research Institute on Innovation and Technology.
126. Ramachandran, K., & Ray, S. (2005). Creating information technology industrial clusters: learning from strategies of early and late movers. In T. Thatchenkery, & R. R. Stough (Eds.), *Information Communication Technology and Economic Development: Learning from the Indian Experience*, 149-166. Edward Elgar.
127. Reenen, J. V. (2021). *Innovation and Human Capital Policy.* The National Bureau of Economic Research (NBER).
128. Rocheska, S., Angeleski, M., & Mancheski, G. (2015). A New Methodological Approach for Designing the Software Industry Value Chain. *ECOFORUM, 4*(2), 87-93.
129. Rodrik, D. (2022). *An Industrial Policy for Good Jobs.* Brookings Institution.
130. Rose, J. (2010). *Software Innovation: Eight work-style heuristics for creative software developers.* Aalborg University.
131. Rose, J., & Furneaux, B. (2016). Innovation Drivers and Outputs for Software Firms: Literature Review and Concept Development. *Advances in Software Engineering, 2016*, 1-25.
132. Saraswati, J. (2012). *Dot.compradors: Power and Policy in the Development of the Indian Software Industry.* Pluto Press.
133. Saxena, K. B., Deodhar, S. J., & Ruohonen, M. (2017). *Business Model Innovation in Software Product Industry: Bringing Business to the Bazaar.* Springer India.
134. Schief, M. (2013). *Business Models in the Software Industry: The Impact on Firm and M&A Performance.* Springer Gabler.
135. Schleife, K., Niemann, F., Dupuis, D., Beckert, B., & Wydra, S. (2017). *The Economic and Social Impact of Software & Services on Competitiveness and Innovation.* European Commission - DG Communications Networks, Content & Technology.

136. Schwab, K. (2016). *The Fourth Industrial Revolution.* Geneva: World Economic Forum.
137. Schwab, K. (2019). *The Global Competitiveness Report 2019.* World Economic Forum.
138. Science Development Strategy of Bosnia and Herzegovina for the period 2017-2022, *Official Gazette of BiH, no. 22/18*.
139. Shane, S. (2009). Why encouraging more people to become entrepreneurs is bad public policy. *Small Business Economics, 33*, 141-149.
140. Sharpe, M. (2009). *Playing to Win in the New Software Market-Software 2.0: Winning for Europe. Report of an Industry Expert Group on European Software Strategy.* Industry Expert Group on European Software Strategy.
141. Shllaku, L., Selimi, S., & Uraguchi, Z. B. (2020, August 24). *How can Outsourcing Drive Inclusive Economic Development in the Western Balkans?* https://www.helvetas.org/en/switzerland/how-you-can-help/follow-us/blog/inclusive-systems/business-process-outsourcing-Western-Balkans.
142. Soete, L. (2007). From Industrial to Innovation Policy. *Journal of Industry, Competition and Trade, 7*, 273–284.
143. Sridharan, E. (2004). Evolving Towards Innovation? The Recent Evolution and Future Trajectory of the Indian Software Industry. In *India in the Global Software Industry: Innovation, Firm Strategies and Development*, 27-50. Palgrave Macmillan.
144. Startup Europe - Western Balkans Network. (2019). *Policy Recommendations.* Startup Europe - Western Balkans Network.
145. StartupBlink. (2022). *Global Startup Ecosystem Index 2022.* StartupBlink.
146. Sterlacchini, A., & Venturini, F. (2019). R&D tax incentives in EU countries: Does the impact vary with firm size? *Small Business Economics*, *53*(3), 687-708.
147. Straathof, Bas et al. (2014). *A Study on R&D Tax Incentives.* CPB Netherlands Bureau for Economic Policy Analysis.
148. Strik Consulting. (2017). *Studija razvoja IT sektora u Kantonu Sarajevo.* Sarajevska regionalna razvojna agencija SERDA.
149. Talić, A. (2021). *Budućnost sigurne digitalne transformacije - Pređimo sa strategije u akciju! [Interviewed by Dunja Bezdrov]*. B2BiT. https://b2bit.ba/buducnost-sigurne-digitalne-transformacije-predjimo-sa-strategije-u-akciju/.
150. Tessler, S., Barr, A., & Hanna, N. (2003). National Software Industry Development: Considerations for Government Planners. *Electronic Journal of Information Systems in Developing Countries, 13*(10), 1-17.
151. Toner, P. (2011). *Workforce Skills and Innovation: An Overview of Major Themes in the Literature.* OECD Directorate for Science, Technology and Industry.
152. UNCTAD. (2012). *Information Economy Report 2012: The Software Industry and Developing Countries.* United Nations.
153. UNCTAD. (2016). *Virtual Institute Teaching Material on Structural Transformation and Industrial Policy.* United Nations.

154. UNCTAD. (2018). *World Investment Report 2018: Investment and New Industrial Policies.* United Nations Conference on Trade and Development.
155. UNDP. (2020). *Digital Transformation in the Public Sector in Bosnia and Herzegovina Project (2020-2024).* United Nations Development Programme in Bosnia and Herzegovina.
156. UNDP. (2020a). *The SDGs Framework in Bosnia and Herzegovina.* UNDP.
157. United Nations. (2021, March 17). *A Path Towards the SDGs Financing Ecosystem in Bosnia and Herzegovina*. https://bosniaherzegovina.un.org/en/122244-path-towards-sdgs-financing-ecosystem-bosnia-and-herzegovina.
158. United Nations. (2022). *The 17 Goals*. https://sdgs.un.org/goals.
159. Unterkalmsteiner, Michael et al. (2016). Software Startups – A Research Agenda. *E-Informatica Software Engineering Journal, 10*(1), 89-123.
160. Uyarra, E., & Flanagan, K. (2009). *Understanding the innovation impacts of public procurement.* The University of Manchester - Manchester Business School.
161. V, J., & Sharma, P. (2011). *Indian Software Industry - Moving up the Value Chain and Managing Nonlinear Growth.* Synopsis.
162. Vaz-Curado, S. F., & Mueller, A. (2019). The concept of entrepreneur of Schumpeter in comparison to Kirzner. *MISES: Interdisciplinary Journal of Philosophy Law and Economics, 7*(3), 613-642.
163. Vijayabaskar, M., & Babu, M. S. (2014). Building capabilities in the software service industry in India: Skill formation and learning of domestic enterprises in value chains. In J. M. Salazar-Xirinachs, I. Nübler, & R. Kozul-Wright (Eds.), *Transforming Economies: Making industrial policy work for growth, jobs and development*, 239-266. ILO.
164. Violette, A. (2022, June 10). *Outsourcing to Africa: The big tech scramble in Africa*. Code of Africa. https://www.codeofafrica.com/EN/blog/Outsourcing-to-Africa.
165. Westmore, B. (2014). Policy incentives for private innovation and maximising the returns. *OECD Journal: Economic Studies, 2013*(1), 121-163.
166. World Bank. (2023). *High-technology exports (% of manufactured exports) - Bosnia and Herzegovina, European Union*. https://data.worldbank.org/indicator/TX.VAL.TECH.MF.ZS?end=2021&locations=BA-EU&start=2007&view=chart.
167. World Bank. (2023a). *New business density (new registrations per 1,000 people ages 15-64)*. https://data.worldbank.org/indicator/IC.BUS.NDNS.ZS?locations=BA&view=chart.
168. World Economic Forum. (2023). *Markets of Tomorrow Report 2023: Turning Technologies into New Sources of Global Growth: Insight Report 2023.* World Economic Forum.
169. World Trade Organization. (2020). *World Trade Report 2020: Government policies to promote innovation in the digital age.* World Trade Organization.

170. Yan, Q., & Islam, S. (2011). *Moving Up the Value Chain: How to Make the Smiling Curve smile? Case studies of ICT firms from an emerging economy.* University of Gothenburg - School of Business, Economic and Law.
171. Zhang, J. (2003). *High-Tech Start-Ups and Industry Dynamics in Silicon Valley.* Public Policy Institute of California.

# APPENDICES

## Appendix 1: Povzetek

S študijo želimo ugotoviti potencial državne podpore industriji programske opreme v Federaciji Bosne in Hercegovine z vidika funkcionalne nadgradnje dejavnosti z višjo dodano vrednostjo prek krepitve inovacijskih zmogljivosti industrije za proizvodnjo konkurenčnih programskih izdelkov. Glavni cilj magistrskega dela je predstaviti trdne dokaze in utemeljitev za vladno podporo industriji programske opreme FBiH na področju funkcionalne nadgradnje v smeri višjih dejavnosti. Konkretna raziskovalna vprašanja magistrskega dela so:

1. Kakšna je struktura, razvojna pot in položaj znotraj vrednostne verige industrije programske opreme v Federaciji BiH?
2. Kakšne so trenutne zmogljivosti, potrebe in omejitve, s katerimi se sooča industrija programske opreme v Federaciji BiH pri ustvarjanju programske opreme?
3. Koliko manevrskega prostora je za odpravljanje sistemskih in zmogljivostnih omejitev ter vrzeli z odzivom javne politike, natančneje z inovacijsko oziroma industrijsko politiko?
4. Povezano s tem, kakšen je najprimernejši politični pristop ob upoštevanju obstoječega znanja ter značilnosti domače industrije in institucionalnih ureditev?

Magistrsko delo temelji na kvalitativnem pristopu zbiranja in analize podatkov, pri čemer združuje ugotovitve sekundarnih raziskav, ki zajemajo obsežen pregled literature in dokumentacijskih raziskav, ter primarnih raziskav, ki zajemajo analizo ustreznih strateških politik in intervjuje s ključnimi sogovorniki.

Glavne ugotovitve magistrskega dela so:

- Opazovana industrija programske opreme je večinoma osredotočena na izvozni model storitev (outsourcing), ki se nahaja v sektorjih vrednostne verige programske opreme z nižjo dodano vrednostjo.
- Opazovana industrija programske opreme se pri preusmeritvi k poslovnim modelom, ki temeljijo na izdelkih z višjo dodano vrednostjo, srečuje z različnimi pomanjkljivostmi in omejitvami, vključno s pomanjkanjem znanja o netehničnih dejavnostih v vrednostni verigi (npr. tržne raziskave, prodaja), nizko stopnjo naložb za raziskave in razvoj, namenjene izdelkom, slabo razvitim lokalnim povpraševanjem po programskih izdelkih in slabo razvitim ekosistemom za podporo inovativnim zagonskim podjetjem.
- Najnovejši strateški dokumenti sicer priznavajo pomembnost informacijske industrije oziroma industrije programske opreme, vendar v splošnem političnem okolju primanjkuje konkretne strateške vizije in instrumentov, ki bi podprli morebitno preoblikovanje ali diverzifikacijo industrije v smeri modelov, ki temeljijo na izdelkih. Na podlagi ugotovitev študija predlaga oblikovanje obsežne horizontalne inovacijske politike, ki bo z odpravljanjem ugotovljenih pomanjkljivosti in omejitev spodbudila prehod na modele, ki temeljijo na izdelkih.

## Appendix 2: List of key informants

The structure of key informants includes representatives of organisations representing the IT and e-commerce industries, export-oriented software/IT service companies, product-based software/IT companies, software product start-ups, e-commerce companies and individual knowledge holders.

*Table A2.1: List of key informants*

| **Name** | **Role, organisation** | **Date** | **Duration of the core part of interview (does not include introductory and pre- or post-interview conversations)** |
|---|---|---|---|
| Damir Maglajlić | Executive Director, Bit Alliance | 1 August 2022 | 56:42 |
| Ismar Lačević | Director, Alaja ltd (IT start-up) | 11 August 2022 | 54:03 |
| Samra Tanović | Director of Services, Atlantbh | 7 September 2022 | 47:19 |
| Sara Lerota | Vice President of Strategic Partnerships, Ministry of Programming | 8 September 2022 | 48:26 |
| Haris Palalija | Interviewed in the capacity of knowledge-holder who has a multi-year experience of working for initiatives aimed at the development of the IT industry in BiH. Mr Palalija worked as Operations Manager for Bit Alliance during the period April 2017 – June 2021 | 10 September 2022 | 55:53 |
| Edin Mehić | Co-founder of Ant Colony and investor in tech start-ups | 17 October 2022 | 46:07 |
| Jasmin Marić | Business Development Manager, OLX Group and President of the Association for Internet Trade – eComm in BiH | 5 December 2022 | 46:24 |
| Lejla Pljevljak-Rašidagić | Chief Product Officer, ZIRA | 9 January 2023 | 34:00 |

## Appendix 3: Interview Guide

### Key Information about the Research Project and Research Process[21]

The research is conducted for the purpose of writing a Master's Thesis on the following topic: An Analysis of the Innovation Policy in the Context of the Software Industry in the Federation of Bosnia and Herzegovina. The thesis seeks to understand the current setup of the software industry in this entity, its value chain position and assess the potential of government support to the software industry in the FBiH in terms of functional upgrading toward the higher-end activities (moving up the value chain) by enhancing industry's innovation capabilities to produce competitive software products. The research is conducted under the supervision of Dr. Sabina Silajdžić within the joint second-cycle university programme "Economics and Management of Public Sector and Environment" of the University of Sarajevo and the University of Ljubljana.

The interview is anticipated to take approximately 45 minutes. Research participants have the right to refuse to answer any question they are not able or may not want to answer. None of the questions require sensitive information.

At the beginning of the conversation, the research participants are asked to allow the audio recording of the conversation, which can be refused. The audio recording is used to make the conversation more effective and will not be shared with third parties or used for any other purposes than for this research work.

Answers to all questions will be treated as strictly confidential. All inputs provided during the interview will be anonymized and the results of the research will be presented without making references to individual interviewees.

### Framework Questions

1. The conceptualisation of the value chain stages of the software industry development proposed by the United Nations Conference on Trade and Development identifies the following five stages/forms of the software industry development:

- Data entry
- Software/IT services for domestic market
- Software/IT services for export
- Software/IT products for domestic market
- Software/IT products for export

[21] All interviews were conducted in the local language.

According to your knowledge and understanding of the software industry in the Federation of BiH, in which of these five segments are software companies dominantly positioned? Can you make a rough percentage-based estimate on the current distribution of the software industry across these five segments?

2. To the best of your knowledge, do software companies in the Federation of BiH invest in innovation activities directed toward the development of their own software products?
2.A. If yes, how would you assess the level/intensity of these investments?
2.B. If no or if assessed as meagre: In your opinion, what are the key barriers that prevent companies from the FBiH software industry to invest in innovation activities aimed at the development of their own software products? Do companies strive to develop their own products at all?

2.C. Question for software companies only: Does your company have a commercial software product? If yes, can you briefly describe the capacities and capabilities that your company needed to develop to be able to create its own software product in terms of human resources, knowledge, infrastructure, managerial structure, etc.

In this context, innovation activities are defined as all activities related to designing and piloting software products (research and development) as well as activities aimed at the creation of preconditions, i.e. development of capacities of companies to create innovative software products (e.g. investments in human capital to develop adequate engineering, managerial or other skills, investment in organisational capacities and/or capital needed for research and development, etc.).

3. Could you assess to which extent each of the below-mentioned factors, in your opinion, influences the lack of investments in innovation activities aimed at software product development? Please use the 1-5 scale, whereby 1 = not at all and 5 = to a huge extent but also comment on your assessments[22].

- Lack of financial resources for investments in software product R&D;
- Lack of human resources having adequate skills for software product R&D;
- Lack of government support (including all government levels) to financing software product R&D;
- The absent or uncertain market for software product placement;
- Too much competition in the local market;
- Too little competition in the local market;

[22] The methodological purpose of this question is not to provide quantitative assessments but to provide a better understanding of the importance of specific barriers/gaps and encourage the provision of critical reflections on each of the mentioned barriers.

- Inadequate knowledge/experience of software company managers to manage innovation processes aimed at the creation of new software products;
- Lack of knowledge accumulated within companies regarding the creation of new software products;
- Lack of other partners, such as R&D centres, institutes, etc., with whom software companies can collaborate regarding software product R&D.

4. Do you think there are convincing market reasons that would motivate software companies to invest in innovation activities related to the development of their own products?

4.A. Question for software companies only: Why does your company have or does not have an interest in investing in innovations that lead to the production of its own software products?

5. Are companies from other industries in BiH able to afford software products (and services) produced by the FBiH software companies that are currently focused on the software service export to overseas markets? How does the export orientation of the software industry affect the affordability of software products/services for FBiH companies from other industries?

5.A. Question for software companies only: Has your company had the opportunity to cooperate with domestic companies and how would you describe the cooperation with the domestic market in the light of this question?

6. Please assess to which extent, in your opinion, the government support or action in the following policy areas can be effective in the context of incentivising or encouraging to invest in innovation activities aimed at the creation of their own software products. Please provide a critical reflection on potential justification, benefits and risks associated with government interventions in the below-mentioned policy areas:

- Policy measures aimed at the improvement of skills supply in (i) quantitative and (ii) qualitative sense in the areas of (i) formal education, (ii) non-formal education and (iii) workforce import;
- Policy measures designed as financial incentives to R&D in the sphere of digital/software products provided to software companies;
- Policy measures aimed at the digitalisation of the public sector (governance);
- Policy measures aimed at the digitalisation of the business sector (e.g. e-commerce, digitalisation of production, etc.);
- Policy measures aimed at the creation of innovative startups focused on software products.

6.A. Which of the above-mentioned policy areas should be prioritised? Are there any additional or specific measures that, in your opinion, should be introduced regarding the encouragement of software product innovations?

6.B. Question for software companies only: What would be the most useful form of government support for your company?

**Appendix 4: Overview of insights obtained through primary research**

This appendix encompasses a structured overview of key insights obtained through interviews with key informants. It represents notes made by the author based on audio recordings of interviews, meaning that all notes are the author's summarised interpretations of information provided by key informants, not citations or transcripts.

To protect anonymity of responses, the following has been done: (i) numbers marking specific key informants are non-consistent throughout different thematic fields, meaning that responses for different topics cannot be connected; (ii) specific information or statements that could reveal the identity of key informants have been left out of the table, (iii) author kept his style and terminology when making notes and only a few, non-specific, original descriptions or phrases provided by key informants were kept when it was necessary to preserve the very essence of information.

*Topic 1: Structure of the software industry in the Federation of BiH following the UNCTAD conceptualization.*

Key informant 1: Software/IT services for export comprise around 50% of the software industry's volume, software/IT services for the domestic market comprise around 40% of the industry's volume, while software/IT products for the domestic market and software/IT products for export combined comprise around 10%. Data entry is potentially marginally present within the software industry.

Key informant 2: Software/IT services for export comprise around 70% of the software industry's volume, software/IT services for the domestic market comprise around 15% of the industry's volume, while software/IT products for the domestic market and software/IT products for export combined comprise around 15%. There are very few software products, they mainly relate to accounting and financial services. Data entry represents a minor share of the overall industry's volume.

Key informant 3: Software/IT services for export comprise around 80% of the software industry's volume. Product-based industry niche is almost non-existent, which is concerning.

Key informant 4: Software/IT services for export comprise around 70% of the software industry's volume, software/IT services for the domestic market comprise around 10% of the industry's volume, software/IT products for the domestic market comprise 10% and software/IT products for export comprises around 9%. Data entry is maybe around 1%. When it comes to the domestic software product market, it mainly relates to products for the financial industry.

Key informant 5: Software/IT services for export comprise around 70% of the software industry's volume, software/IT services for the domestic market comprise around 10% of the industry's volume, software/IT products for the domestic market comprise 10% and software/IT products for

export comprises around 10%. The software industry in BiH is not notably present in the data entry niche. The majority of products are related to software solutions for accounting and banking, the demand in other spheres was not large in previous years. These products are software applications.

Key informant 6: It could be said that the majority of IT companies are data entry companies, considering that the majority of their tasks are in essence entering data. Therefore, 90% is data entry. There are less than ten software companies in BiH that have their own product.

Key informant 7: Software/IT services for export comprise around 80% of the software industry's volume, software/IT services for the domestic market comprise a negligible share of the industry's volume, while software/IT products for the domestic market and software/IT products for export combined may go up to 20%. Data entry seems not to be a present business model in the BiH IT industry.

*Topic 2: Level/intensity of investments in software product innovations.*

Key informants 1: Investments in innovative products are almost an anomaly, they are almost non-existent, even though the majority of leaders in the industry are aware that it should be different, i.e. that the shift toward products has to come. There are very few companies with business models different from the standard outsourcing model, the Ministry of Programming is an example. Some software service export companies implement small-scale activities trying to develop innovative software solutions – such as allocating a few hours a week for experimental tasks, allocating some financial resources, and doing hackathons – by using the knowledge gained through experience performing these tasks for overseas clients.

Key informant 2: Investments in this domain are almost non-existent, they occur sporadically, and even when occur it is usually for the purpose of providing challenges for teams or as one of team-based activities, however, they are not institutionalised. It seems that some rare companies, with different business models, such as the Ministry of Programming, may invest and conduct more in this domain, but this is negligible in the context of the whole industry.

Key informant 3: The level of investments focused on software product innovations in the local IT industry is negligible.

Key informant 4: Some products exist, but it is usually side activity, while the main focus is software service provision.

Key informant 5: The level of investments in R&D activities aimed at the creation of new products is marginal. The creation of software products declined after 2012, the industry has reoriented toward the international market. The discourse on innovations intensified only when the COVID-19 pandemic occurred, considering it prompted the need for agility and digitalisation.

Key informant 6: There are very few activities and investments in R&D aimed at the creation of software products within the BiH software industry. It is usually related to small-scale activities performed by the largest IT companies that can allocate, for instance, 10% of resources for innovation-related activities, however, it is not structured and strategic but rather ad hoc.

*Topic 3: Barriers/capability gaps to shifting toward product-based business model(s).*

Key informant 1: The outsourcing niche is more attractive because it offers short-term and low-hanging fruit, and money can be earned quickly and easily. This is contrary to the product-based model, which requires long-term planning and investments before starting to yield results.

It will be even harder to shift to other business models in the future, considering that the market is getting more and more complex, IT professionals in the local labour market are increasingly expensive, which complicates potential product-oriented endeavours.

The first barrier is the lack of local examples of product-based companies that would influence the mindset of entrepreneurs to enter that business model. The market is corrupted by the service export (outsourcing) model, considering it provides easy-to-achieve opportunities. The second barrier relates to a lack of knowledge, the local IT industry has knowledge of producing different components of software but lacks knowledge on how to manage the whole process. The third barrier is under-developed local demand for software products – local businesses do not generate significant demand, while governments do not do anything substantial in the digitalisation domain. The fourth barrier is the lack of access to international venture capital, while the locally available funds are insufficient to encourage investments in experimental product-oriented projects. There are decent financial resources available within the local market/industry, but they are not properly channeled, i.e. they are not directed toward innovation-aimed investments.

The current startup ecosystem is underdeveloped in terms of both financing and knowledge/expertise, resulting in a low potential to encourage the creation of innovative, product-based, software companies.

BiH society lacks an entrepreneurial spirit/mindset, it should be promoted and stimulated.

Local market is viable to test and develop software solutions, then the next step for the IT industry is to find ways to internationally scale products.

Key informant 2: The current service export (outsourcing) model is well-established and employs many people. To move toward other business models, IT industry leaders have to exit their comfort zone and enter a model that is less secure; the prevalent mindset has to be changed.

Local IT companies have good quality knowledge in software development but lack knowledge on business development, placement of products on other markets, investment attraction, etc. The industry lacks this type of knowledge considering that companies do not have experience in

performing other steps of software product creation and commercialisation beyond the software development. Lack of managerial knowledge regarding product creation is one of the most important barriers to entering product-based models.

Also, a well-developed wider R&D ecosystem (research institutes, business incubators, accelerators, etc.) is an important missing element, considering that IT companies could rely on external parties to gain knowledge and support regarding the non-technical product creation elements, such as business development support, networking, acquisition of specialised knowledge, etc.

Financial resources are not an important barrier, they are in place but the issue relates to priorities. This industry does not require heavy investments in equipment, the costs are mainly related to human resources. However, it is easier to invest in a service export model considering it likely leads to returns than to product experimentation that is risky and will not necessarily generate returns.

Local competition is not an important obstacle for moving to product-based models, products cannot rely on the local market.

There is no lack of market for software products – a market has to be created; good software products can create their markets if there is knowledge of product placement. However, BiH cannot be the final market for software products due to its size and purchasing power, it can be good for piloting new solutions, but to achieve scale, it is important to internationalise the product.

Key informant 3: One of the main reasons why the industry is predominately concentrated around services is related to knowledge/competencies. Product-based model requires some competencies that the industry does not possess and there are two ways to gain them: to develop them or to acquire them from third parties. There were some attempts to develop this type of competency, but these attempts failed. For instance, market research and sales are non-core competencies within IT companies focused on service export (outsourcing), meaning that companies do not have this knowledge in-house. The process of acquiring these skills is resource-intensive. There is an example of a business-to-business product development project that failed due to underdeveloped market research and sales capabilities. Poor market research resulted in product ideas that appeared to be non-attractive to clients, leading to significant resource waste. Managerial skills to manage the full value chain are lacking, when it comes to product placement it is almost non-existent.

Relatedly, there is a lack of high-quality market players that would be able to provide skills and knowledge that IT companies are lacking (e.g. market research, sales).

The local IT industry has good quality technical knowledge, the industry is able to produce quality software based on requirements defined by clients.

The majority of larger IT companies in BiH have financial resources and space to invest in innovative product development, however, there is a lack of incentives among top management to allocate resources to this type of project.

Competition is not an important factor in terms of disincentives to shift toward product-based models.

The domestic market is not conducive for software products, considering that companies from other industries are often not ready to pay a proper price for software solutions, i.e. considering the overall low level of digitalisation and awareness of its importance.

Key informant 4: There are three core reasons for keeping the status quo. The first reason is a risk-averse attitude, especially considering that domestic IT companies have a well-tested and well-established service export model that currently works for them; therefore, IT companies avoid the risk of entering a completely new and unknown product-based business model. The second reason is a lack of finances to invest in a model companies lack knowledge of; it requires significant financial resources and implies potential significant losses. However, even when financial resources are in place, companies lack the motive to invest in R&D. The third reason can be considered as macroeconomic, considering that the current situation results in low investments; this model requires significant (foreign) investments and venture capital, which are not sufficiently available in the country. It is challenging for IT companies from BiH to get multi-million investments for product ideas.

Therefore, barriers are high, including a lack of necessary knowledge for shifting to product-based models along the aforementioned barriers. One of the approaches to shifting to this model could be buying innovative product-based startups in other countries but our companies probably do not have the knowledge to manage this business niche. It requires multi-layered knowledge in multiple spheres to be learned by managers and then transferred to staff. For instance, there are no study programmes in BiH on the management of full-cycle software product development. It results in a lack of full-cycle product managers, meaning that the lack of specialised talents is one of the important impediments to shifting to product-based models. On the other side, the existing technical knowledge and skills related to software development are sufficient, meaning that the local market has good-quality software developers and engineers.

The market for software products is highly uncertain, meaning that uncertainty of the market is an important barrier. Furthermore, the international market is already saturated by products and many niches are already dominated by specific, incumbent, software products. Considering that the transition from one to another software product is not easy, it is hard for companies to introduce products that would overthrow the existing ones. Yet, innovative software products – in new niches or with innovative features – have a chance to penetrate the market.

However, the local competition is not an impediment to the shift to product-based models.

The software product market in BiH is further constrained by the low level of digitalisation, meaning that many solutions cannot be supported by wider infrastructure. Relatedly, it constrains digital innovations, considering they cannot be tested/piloted in the local market. Governments should put more effort into creating a more conducive digital environment, especially when it comes to the public sector.

Key informant 5: The most important barrier is a reluctance to take risks. The existing software service export model is well-established and generates millions of revenues. It generates revenues quickly, while the products take a longer period to start yielding returns. The BiH market is not attractive to multinational companies and considering they do not enter this market, IT companies do not feel pressure to compete. Also, the widespread perception is that it is extremely difficult to create a brand-new software product, it is sometimes mystified.

Local IT companies probably do not lack financial resources; therefore it can be perceived as a moderately important barrier.

The BiH market is characterised by low purchasing power, meaning that domestic software products can be only for mass consumption and not niche solutions. However, there are examples of products that succeeded in the local market, e.g. in the accounting niche, indicating that software products can find their place within the domestic market.

Local software developers are well-educated and have good-quality skills, therefore technical knowledge is not a barrier. However, local engineering knowledge that is closer to technological frontiers, such as Artificial Intelligence, which is necessary for R&D in the software industry is still insufficiently developed. Furthermore, lack of managerial and entrepreneurial knowledge and skills within the IT industry is an important constraint, considering that IT companies are often established and run by people who have great technical knowledge but are not necessarily competent managers.

Competition – its lack or excess – is not a barrier or disincentive for shifting to product-based models in any sense.

Key informant 6: IT companies choose an easier path – they prefer to enter and stay within the service export niche because it is an easier way to generate revenues.

IT companies struggle with labour shortages, they are struggling to ensure a sufficient quantity of workforce for their core activities (service export), meaning that even if they allocate some percentage of staff for work on innovation-related activities, they would be very soon pulled out and returned to core activities considering that service export (outsourcing) projects ensure very existence of BiH software companies. Therefore, there is no continuity in that domain. There is an example of a company that started developing its own product, the company was very devoted and

allocated resources, but ultimately it was interrupted and stopped due to the need for a workforce within the service export (outsourcing) projects.

Financial resources are not an important barrier.

Software developers in BiH are good quality performers, the issue is not quality but quantity.

The market for all products exists, but the question is are the software companies able or afraid to enter the (product) market? However, custom-made solutions are too expensive for other sectors' companies in BiH, meaning they are not likely to buy products created by the IT sector. The overall level of digitalisation is very low and there is a lack of awareness about the benefits of implementing digital solutions.

For that reason, the BiH software companies are reluctant to work on the domestic market; the local market is not lucrative. On top of that, local IT companies lack sales knowledge to explain benefits and convince other businesses that their product is beneficial.

Competition is not an important factor, the only issue is that companies are competing for scarce labour force, which constraints opportunities for allocating staff to potential product development.

Lack of managerial knowledge of product-based models is an important barrier.

The two most important barriers are the low quantity of developers and the lack of know-how for managing the whole cycle of innovative product creation, including the placement of products.

Key informant 7: The lack of managerial knowledge and experience needed for the management of a product-based business model is one of the most important barriers.

Market size is one of the constraints, considering that the BiH market for products is very small, having in mind the total population is up to 3.5 million, therefore IT companies perceive the available international service market as more lucrative than the local product market. However, it is only a moderate barrier.

The lack of capabilities needed for market research and validation of ideas is one of the most important factors.

Domestic industries are not digitalised, owners/managers are still more inclined to use non-digital solutions instead of investing in digital solutions, meaning that the local market is limited. Companies managed by younger and digitally literate managers are more likely to buy and implement digital solutions. On the other side, IT companies sometimes do not present the value offered by a software product properly.

Financial resources are not a barrier, the industry has the financial capacity to invest in R&D.

Technical quality of talents does not represent a barrier.

Key informant 8: Product-based model is much more complex and difficult compared to the service-export model. First, the product-based model requires heavy investments in developing domain expertise for a specific product. It is not sufficient only to have good software developers/engineers, but is also very important to have experts in specific fields related to a product. It is also important to have well-developed presentation and sales capabilities across the company. Second, product creation requires years and years of investments and development, it requires dedication, therefore it is much easier to deliver a specific software service to a client. The product-based model requires heavier initial investments than the service export model, meaning that entry barriers are somewhat higher. Third, the organisation of the product-based company is much more complex compared to software service export companies, it relies on complex operations considering that it has to provide constant support to clients and ensure proper adaptation in line with clients' needs. Hence, this model requires operations beyond the technical delivery of output.

It is much harder for BiH-based companies to penetrate international markets compared to those based in the EU, therefore it requires the company to establish offices in other countries to be able to place its product on the international market.

BiH has good quality developers, it is not a barrier for product-based models. However, a product-based model requires specific expertise, and domain expertise, this capability has to be developed.

*Topic 4: Disadvantages and risks associated with the service export/outsourcing model of the FBiH software industry.*

Key informant 1: IT professionals prefer to work on products rather than to do coding for overseas clients, it is more attractive for them to be members of the team developing innovative software products even if it is less paid.

Considering labour shortages, the potential for further expansion of the model is limited, now IT companies are 'cannibalising' each other.

The software service export inflates prices of software services and digitalisation to local companies, considering that the majority of IT professionals are employed by software service export companies and that high demand for labour in this niche makes the labour costs of IT professionals high, meaning that they are less accessible to other companies/industries.

Key informant 2: Service export (outsourcing) is a limited business model, a software service export business requires constant search for new clients or projects and the company's business development occurs on a client-by-client basis.

The service export market in BiH become overcrowded and labour costs are on a constant rise, meaning that BiH software service export companies are less and less competitive on the global market.

Software products can be scaled, while it is not possible with software services.

Key informant 3: Product-owning companies have assets beyond people, they have a product, therefore there is a value source and value proposition beyond individual staff.

IT service export companies (outsourcing) are not the owners of their outputs.

Product-based companies are more likely to have long-term and loyal employees.

If a company 'sells' software developers, as is the case with software service export companies, one can generate profit margins on the specific number of people working on a project. On the contrary, once a software product is created, a company sells licences or subscriptions and implementation services, regardless of its staff. This enables to generate additional revenues without increasing the number of employees, i.e. without a proportional increase of costs related to labour.

Key informant 4: The whole service export model is very simple, it is based on a cheap labour force and the ability to connect to clients in other countries. This service export (outsourcing) model has to come to an end, the only question is when. First, "coding dactylography" that is performed by developers within the current model will be gradually automatized, meaning that the need for this type of service will diminish. Second, the cost of labour (services) is increasing but the quality of performance, good English language skills, time zone and working culture are keeping the local software service export industry attractive to overseas clients despite the increasing price of services. However, this will slow down the industry's growth.

Key informant 5: Product-based models avoid the issue of depending on the constant inflow of the workforce. On the other side, software service companies struggle with labour shortages and rising labour costs. There is a simple choice, to constantly employ new people within the service export model or to develop a company's own product and generate revenues on the basis of smaller teams.

The service export model is more prone to fluctuations in the staff size, while the product-based model allows a more strategic HR policy.

Key informant 6: It is the model with low entry barriers, it depends on the possibility to provide the supply of IT professionals to (overseas) clients for some fee. However, companies from other locations could offer the same or similar service quality at a lower price; Africa is emerging destination in that regard. Therefore, the competition is mainly rooted in price. Considering the scarce supply of IT professionals, prices are going up, meaning that the competitiveness of industry (of a specific country) diminishes over time. For instance, the costs of IT professionals in BiH are

getting closer to Austria. In addition, as in other industries, many transactions in the BiH IT industry evade taxation at the moment [meaning that it contributes to keeping labour costs/prices lower than it would be the case if everything is properly taxed]. Along with prices, the second part of this model's formula is the availability of talents (supply quantity), which is also limited and, therefore, reaching limits of supply expansion is the second vulnerability of this model.

Contrary to the software service export (outsourcing) model, the product-based model enables growth without a constant increase of workforce, it provides an opportunity to apply multiple revenue-generation models (e.g. subscription), it enables companies to lock their clients in their product, i.e. it is harder for clients to move to offerings of other companies compared to the outsourcing model, it enables steady and predictable revenues, it is easier to change staff members without need for justifying it to clients as it is the case within the outsourcing model, etc. The product-based model enables a company to achieve economies of scale, which is not possible within the service export (outsourcing) model.

Another important risk is the automatisation of coding tasks (code creates code), whereby it can be anticipated that the role of software developers will be more to correct and improve codes [meaning that it could affect demand for software developers].

Key informant 7: The outsourcing niche within the local IT is much larger, but its value is lower compared to IT companies selling their own products, such as Infobip or Zira. Product-selling companies have better profits, better-quality jobs, and more stable and more strategic development pathways.

The concentration of the IT industry in the outsourcing/service export niche creates weaknesses and volatilities. In the case of shocks in this global market, almost the whole local IT industry will be negatively affected.

The BiH market is oversaturated with software service exports, but it has to come to an end, profit margins are going to decrease considering that competition is increasing.

Costs of local engineers/developers significantly rose, and IT companies need to offer high-quality developers to stay competitive keeping in mind how expensive the local IT industry became for overseas clients.

New markets are arising and creating pressures, e.g. markets in Africa and Asia.

The service export (outsourcing) niche cannot lead to the achievement of the economies of scale, it can happen only in product-based niches.

*Topic 5: Policy solutions.*

Key informant 1: Measures aimed at improving the quantity and quality of the workforce can support the shift from outsourcing to a product-based model, considering companies would not be

pressured to deal with labour shortages and could allocate adequate resources to more experimental tasks.

Tax incentives and similar measures can motivate decision-makers within IT companies to allocate financial resources to R&D aimed at new product development. Financial resources are already in place, but this type of measure would lower the risk and incentivise top management to allow this type of investment. At the moment, top management is more inclined to spend money on making a pool in the office building rather than invest in R&D.

Digitalisation measures can encourage the software product niche, but IT companies can be reluctant to enter partnerships with the public sector (government).

Startups can be a driver of software product innovations, considering they are small and agile, but the startup ecosystem is underdeveloped. There is a lot of money flowing around, but many startups participating in the ecosystem do not have innovative products but rather use available funds only to sustain themselves. The approach based on (poorly targeted) financial support has been followed by the donor initatives as well, thus limiting outcomes of the support. Startup support should move from simple financing to more extensive advisory/technical support.

Key informant 2: Government support in the form of incentives would notably help reduce some of the barriers, especially for mid-size companies and incentivise top management to allocate funding for experimental product development efforts. Financial incentives can also be used to acquire services from external parties and fill internal capability gaps.

It would be also important to improve the workforce landscape through improved education, reskilling and immigration, this is the basis for the IT industry's growth.

Digitalisation of the economy – including both the public and private sector – would incentivise the supply of software products, it would create a space for various software products, meaning that many IT companies would enter this sphere.

Startup promotion can be a good measure to promote software product innovations, but the shift has to be made toward really innovative startups that are established around specific, innovative, solutions that solve specific issues.

Key informant 3: Government support can be easily mis-targeted and misused. There are some recent examples of big IT companies that possess large financial resources applying for employment subsidies and other incentives provided by the cantonal government. IT company that employs a hundred or more employees apply for subsidies to employ several new people, whereby that company exports software service and returns to the local economy and society are questionable. Therefore, measures should be tailored to avoid these issues and misuse.

Digitalisation measures can boost demand for software products and, therefore, stimulate IT companies to invest in the creation of innovative software solutions. The public sector is especially important in that regard considering its volume and power – the public sector digitalisation would create notable demand for software.

Considering heavy labour shortages within the IT sector, public measures will be unfruitful if they are not followed by the increase in talent supply/availability.

Key informant 4: Subsidies or attractive credit lines for software products should be introduced. Also, governments should introduce tax incentives for investments in innovative startups. This type of measure should be accompanied by a proper marketing campaign launched by the government to promote the importance of using this incentive for creating new software products. This type of incentive has the potential to create an 'explosion' of software products produced by local companies, considering it would lower risks and therefore support the mobilisation of resources.

More ambitious digitalisation policies would encourage the production of software products in the local market, e.g. subsidies for digitalisation.

Vouchers for buying domestic digital solutions (software products) can also stimulate the local market for software products.

Startup support measures should be redefined to support innovative startups instead of supporting any kind of newly established enterprises, such as hairdressing salons.

Key informant 5: The key role of government is to improve macro-economic conditions and wider technological context, i.e. create conditions for economic growth and investments as well as to promote digitalisation of the economy. The role of government should not be direct intervention in the IT industry, it does not need to help the industry but rather not to undermine the industry's growth. Priorities for public policy are: (i) Digitalisation of the public sector, especially data to be in machine-readable formats. This would create demand and opportunity for various software products. (ii) Introduction of subjects on digital economy and entrepreneurship in secondary schools. On the other side, policies promoting workforce supply increase would probably further feed the existing model (outsourcing/service export).

Key informant 6: Policy measures aimed at increasing workforce supply would be beneficial because the increased supply would lower wage pressures, i.e. high labour costs, which negatively affect the industry. If the number of developers is increased, companies would be able to expand their workforce bases and properly allocate people to innovation-oriented activities. The establishment of a new, modern, faculty for IT technologies at the University of Sarajevo is a necessary step in this regard – and this faculty needs to have a multidisciplinary approach to develop the multisectoral perspective needed for the creation of innovative software products.

Furthermore, the import of the workforce is also very important, considering it is not only about quantity but the sector would be able to attract specific expertise that is not offered within the domestic labour market.

Also, it would be beneficial to create something like a government-sponsored digital hub/centre that would enable IT companies to present their digital (software) products. This should be accompanied by funds available to companies willing to create their own product, but this fund should be conditioned by outputs to prevent companies from using funds without any tangible end results.

Public sector digitalisation is an important way to boost software product and service supply, considering that local IT companies are interested and have adequate knowledge to respond to potential requests.

Policy measures aimed at the digitalisation of the private sector can be encouraging for product development, but have to be well-designed and properly identify the needs of the local economy. This measure should be governed by a specialised government unit to ensure that the measure corresponds to the local needs. Some form of one-stop shop can be established to match businesses in need of digital solutions with specific products/IT companies offering software products and services.

Financial incentives, such as tax benefits, can be helpful in encouraging product innovations, but there are several questions: First, the question is who would be able to assess if something is innovative - it requires this type of competency within the public sector. Second, IT companies lack capabilities related to non-technical aspects of software product development, such as product placement, meaning this capability has to be developed for successful outcomes of innovative products developed with public financial support. Mentoring support is needed to help companies successfully manage the product development cycle. Third, there is a lack of venture capital, and angel investors, for a prolonged financial source for financing the product development. Public financial support should not be limited to IT companies, there are companies from other sectors that have the needs and capacities to develop digital solutions.

Key informant 7: Policy measures aimed at non-formal education could be supportive, considering that non-formal education covers a wide range of areas and enables exposure to various topics, which is important for ideation. Similarly, the import of talents from other countries can bring new knowledge, experience and perspectives needed for ideation.

Digitalisation of the public sector would enable introduction, adaptation and/or adoption of a variety of digital tools, which would boost this market niche but also improve the overall quality of public services and performance of the public sector. Similar applies to measures aimed at the digitalisation of the private sector, considering it would boost adoption/demand and consequently the supply of software products. However, digitalisation of the public sector is the most important

measure to promote the local software product industry considering its volume, purchasing power and market share.

Startup support measures already exist but they are inadequate and of poor outcomes. Therefore, a substantial shift in startup support policy is needed to focus more on knowledge transfer and knowledge building regarding market research, validation and product placement. The current measures focus on financing businesses based on business plans.

Key informant 8: The digitalisation of government, healthcare, smart parking, and similar public-led projects would surely significantly spur product creation within the local software industry. The easiest way for a company is to start from the local market. Local software service export (outsourcing) companies have strong software development capabilities (technical capabilities), they could invest in domain knowledge and provide products for governments if they accelerate digitalisation.

**Appendix 5: Analysis of curricula of selected IT study programmes**

This indicative analysis includes a sample of 6 IT study programmes out of 34 observed by Economic Institute Sarajevo (2019) and covers both entities, considering that some degree of internal migration of IT professionals can be assumed.

*Table A5.1: Analysis of curricula of selected IT study programmes*

| **University, faculty and study programme** | **Software Product Management** | **Entrepreneurship** | **Business** | **Software Design – Operational Process** |
|---|---|---|---|---|
| Faculty of Information Technologies, Džemal Bijedić University, Mostar<br><br>Software development / Software engineering (1st cycle) | No | No | Yes<br><br>1 elective course in Business Introduction (4 ECTS)<br><br>1 elective course in Introduction to Management (4 ECTS) | Partially<br><br>1 elective course in Business Intelligence (6 ECTS) |
| Faculty of Information Technologies, Džemal Bijedić University, Mostar<br><br>Software development / Software engineering (2nd cycle) | No | No | 1 elective course in Internationalisation of Business (6 ECTS) | No |
| Faculty of Electrical Engineering, University of Sarajevo<br><br>Computer Science and Informatics (1st cycle) | No | No | Partially<br><br>1 elective course in Business Web Systems (5 ECTS) | No |

*(Table continues)*

*(Continued)*

*Table A5.1: Analysis of curricula of selected IT study programmes*

| | | | | |
|---|---|---|---|---|
| Faculty of Electrical Engineering, University of Sarajevo<br><br>Computer Science and Informatics (2nd cycle) | No | No | No | No |
| Pan-European University APEIRON<br><br>Business Informatics – Programming and Software Engineering (1st cycle) | No | No | No | No |
| Pan-European University APEIRON<br><br>Business Informatics/Information Technology and Engineering (2nd cycle) | No | No | Partially<br><br>1 elective module in Digital Economy (10 ECTS), which incl. business-related topics | No |
| Faculty of Engineering, Natural and Medical Sciences, International Burch University<br><br>Information Technology (1st cycle) | No | Only as university-level elective course (meaning it is not adapted to the IT/software industry) | Partially<br><br>1 elective course in Introduction to E-Business/E-Commerce (5 ECTS) | No |
| Faculty of Engineering, Natural and Medical Sciences, International Burch University<br><br>Information Technology (2nd cycle) | No | No | 1 elective course in Operations Management (6 ECTS)<br><br>1 elective course in E-Bus/E-Commerce (6 ECTS) | Partially<br><br>1 elective course in Business Intelligence (6 ECTS) |

*(Table continues)*

*(Continued)*

*Table A5.1: Analysis of curricula of selected IT study programmes*

| | | | | |
|---|---|---|---|---|
| Faculty of Electrical Engineering, University of Banja Luka<br><br>Software Engineering (1st cycle) | No | Yes<br><br>1 elective course in Engineering Entrepreneurship (4 ECTS) | No | No |
| Faculty of Electrical Engineering, University of Banja Luka<br><br>Computer Science and Informatics (2nd cycle) | No | No | No | No |
| Sarajevo School of Science and Technology<br><br>Information Systems (1st cycle) | No | No | Partially<br><br>1 core course in E-business in Emerging Environments (8 ECTS) | Partially<br><br>1 core course in Business Intelligence (6 ECTS) |
| Sarajevo School of Science and Technology<br><br>Computer Science (1st cycle) | No | No | No | Partially<br><br>1 core course in Business Intelligence (6 ECTS) |
| Sarajevo School of Science and Technology<br><br>Computer Science and Information Systems with focus on Big Data (2nd cycle) | No | No | No | No |

*Source: Own work.*