

Chapter 11

Socialism to Capitalism: Technology Transfer and Entrepreneurship in the Republic of Croatia



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11.1 Introduction

The future development of contemporary economies, including those in post-socialist countries, is highly dependent on their capacity to generate and exploit various types of innovation and their ability to transfer knowledge and new technologies from the scientific sphere to production, and vice versa (Švarc et al. 2019; Dabić et al. 2019). Stojčić (2020) assessed the impact of a range of innovation policies in eight Central and Eastern European countries in terms of both the financial incentivization of R&D and the public procurement of innovation. The conclusions of this research exposed the positive results of both of these policy instruments. Companies with public procurement for innovation contracts or those receiving monetary support for innovation were more likely to innovate and attain high sales figures when selling new products. The push channel, in this instance, appears to be the driving force behind this innovation. Stojčić (2020) pointed out that this is especially evident in instances in which public procurement has not been created in such a way that companies are required to think of new products and processes. When

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this happens, these two policy channels often have less of an impact in comparison to those attained via push policies exclusively.

Technology transfer has many different meanings and there is an abundance of multidisciplinary literature on this topic (Wahab et al. 2012; Bozeman et al. 2015). Scholars' understanding of what is important in the management of knowledge and technology transfer has evolved continuously, but scientific research, innovation and, recently, entrepreneurship are considered to be inseparably intertwined with technology transfer (Audretsch et al. 2012). While some think that technology transfer is all about technological and managerial learning in companies, growing numbers of scholars since the 1990s have become increasingly more preoccupied with university technology transfer (UTT) (Allen and O'Shea 2014; López Mendoza and Mauricio Sanchez 2018; Breznitz and Etzkowitz 2016), which usually involves the commercialization of research results, different models of science/industry cooperation, and academic entrepreneurship. This approach has resulted in a large expansion of literature in this area, and this was mainly inspired by the ideas of the third university mission, initiated by the third university revolution (Etzkowitz and Viale 2010), the model of the triple helix (Etzkowitz 2008), academic capitalism (Slaughter and Leslie 2001; Rhoades and Slaughter 1997), and entrepreneurial university (Gibb and Hannon 2006; Silva et al. 2018). These theories and ideas have found fruitful grounds for policy applications in European development strategies; firstly within the Lisbon agenda (European Commission 2000) and most recently within the smart specialization strategy (S3) (Foray et al. 2009; Radošević et al. 2018), which established the concept of entrepreneurial university and figured university technology transfer as a fundamental mechanism to spur regional economic growth.

Following this, technology transfer in this study addresses the processes of knowledge transfer from the scientific to the business sector, and all types of academic engagement involving the cooperation of the science with industry (Perkmann et al. 2013; Breznitz and Feldman 2010). It goes beyond the pure commercialization of research results and involves both formal and informal channels of knowledge transfer between academics and stakeholders within an innovation system. Miller et al. (2018) identified, for example, 13 types of modes of engagement to encourage academics to participate in knowledge transfer ranging from the level of formality, to networking, to spin-outs; while (Dabić et al. 2016) identified the eight basic functions of an entrepreneurial university, of which technology transfer was one of the most prominent. The key research questions addressed in this article are whether or not the transition to capitalism and membership in the EU changed the university technology transfer model practiced in the socialist era and, if so, in what direction; whether the academic knowledge and research was infused into valuable economic activity and marketable innovation that would foster entrepreneurial innovation, or not; and whether knowledge transfer and the propensity to engage in entrepreneurship following capitalism were enhanced and, if not, why?

This research was conducted using Croatia as its subject: the newest, 28th EU member state as of 2013, and a country with controversial outcomes of the transition process in comparison to its peers. This controversy stems from the fact that Croatia was much more prepared for market economy in 1990s, and had numerous advantages over countries from socialistic blocks, in terms of price liberalization,

foreign trade liberalization, and reformation of the banking system (Uvalić 2018), leaving other Eastern European countries, at that time, behind. Nowadays, by contrast, Croatia is one of the least developed EU member states, lagging behind its eastern peers in growth rates of GDP and competitiveness of economy. It remains an upper middle-income country, with a GDP per capita of 11.806 EUR in 2017¹ which achieved around 60% of the EU-28 average, however future economic prospects are ambiguous. This research is conceptual, using the case study of Croatia to better understand how technology transfer and entrepreneurial innovation are determined by the political economy in a national context. The arguments in this article are three-fold. Firstly, we argue that UTT has not essentially changed today in comparison to socialism, as the socio-economic context remains adverse to innovation and entrepreneurialism, despite its transformation to capitalism. Secondly, we argue that UTT has evolved through three models since socialism: the science-based model practiced in socialism; the innovation-based model in transition; and the bureaucratic model of today. Thirdly, we argue that the current bureaucratic UTT model is driven by the Europeanization of national research and innovation policies, embodied in the smart specialization strategy, and in certain aspects of regression with regards to the two previous phases of UTT.

The chapter is structured as follows: in the next four sections the historical evolution and the main features of UTT are described, following on from socialism (Sect. 11.2), over the first (Sect. 11.3) and second (Sect. 11.4) phase of transition, to the present state of Europeanization of UTT (Sect. 11.5). Discussion of the results of the research is given in Sect. 11.6, leading on to some concluding remarks in Sect. 11.7.

11.2 Theoretical Framework

Schumpeter (1942) and Drucker (1985) posited entrepreneurial innovation as the source of productivity growth. This approach cultivated a view in which innovation and entrepreneurship were virtual synonyms which could be used interchangeably (Acs and Audretsch 2005), which had a negative collateral effect on the entrepreneurship. The term ‘entrepreneurship’ almost disappeared from the European scholarly agenda from the early twentieth century to the 1980s. The focus, in this period, was orientated towards science-based innovation and high technology sectors, carried out by large corporations and research institutes. The analytical framework used to study innovation was the national system of innovation (Nelson 1993); a concept conceived within the evolutionary economy (Nelson and Winter 1982) which focused on the institutions and structures that would foster research based innovation (Edquist and Lundvall 1993) in which an entrepreneur was absent or personified in big industries and large corporations (Autio et al. 2014; Acs et al.

¹Review: <http://www.hnb.hr/en/statistics/main-macroeconomic-indicators>

2014). This concept of entrepreneurship was productive in the post-war economic regimes of the managed economy, but significantly changed with the massive downsizing and restructuring of many large firms, which gave rise to entrepreneurial economy (Thurik et al. 2013) and brought individual entrepreneurs to the center of the innovation system (Acs et al. 2017; Gibson, et al. 2019). Scholars gathered around the GEDI project (Global Entrepreneurship and Development Index) (Szerb et al. 2013a, b), established the theoretical foundation of entrepreneurship capital (Audretsch 2007); entrepreneurship society and economy (Thurik et al. 2013); and the national system of entrepreneurship (Szerb et al. 2013a, b; Acs et al. 2014), which essentially replaced the national innovation system. These concepts, along with the construction of entrepreneurship as a separate research field (Carlsson et al. 2013; Landström and Harirchi 2018), marked the rise of a new era of entrepreneurial economy in which entrepreneurship re-emerged as a key agenda of economic policy.

However, a gap between entrepreneurship based on the narrow types of science-based innovation, which take place at technological frontiers (Autio et al. 2014, p. 1099), and traditional entrepreneurship simply based on new ventures neglecting technological innovation, still persists. According to Thurik et al. (2013) and Audretsch and Thurik (2000), the first type of entrepreneurship was inherent to a managed economy, while the latter is implicit in entrepreneurial economy. Traditional entrepreneurialism, which is often likened to just “another shop around the corner” (Block et al. 2013, p. 713), lacks the innovation dimension and has previously been seen to threaten technological progress and economic growth in the long run (Shane 2009). Discussions concerning the exploitation of new knowledge within the knowledge spill-over theory of entrepreneurship (KBST) (Audretsch and Caiazza 2016) and knowledge-driven entrepreneurial economy (Audretsch and Link 2018) definitely have a place within this context. On the other hand, it seems that a concept of entrepreneurial innovation that has recently entered the academic fora (González-Cruz and Devece 2018) could bridge the aforementioned gap, as entrepreneurial innovation assumes opportunity driven businesses (Mrozewski and Kratzer 2017) with a high potential for growth (Guerrero and Urbano 2017, 2019). Entrepreneurial innovation is focused, as concisely summarized by Autio et al. (2014, p. 1105), on radical innovation, and can generate growth without necessarily involving scientific research and infrastructures, which is a rather illusive feat for many entrepreneurs. Its nature and performance is determined by the different contexts of entrepreneurial innovation ecosystems (industrial, organizational, temporal, etc.), which generate different types of entrepreneurial innovation. However, it seems that the concept of entrepreneurial innovation is still theoretically and analytically vague and remains insufficiently distinctive from other forms of entrepreneurship. This entrepreneurship innovation is discussed from many angles such as: the narrative perspective of contextualizing innovation through relational, temporal, and performative efforts (Garud et al. 2014); its role for emerging economics within the model of the triple helix (Guerrero and Urbano 2017); interaction between opportunity and necessity entrepreneurship (Mrozewski and Kratzer 2017); its role in regional competitiveness and entrepreneurial university (Guerrero et al. 2015,

2016); the intelligence of the intellectual class (Burhan et al. 2017); and governance quality and economic freedom in the EU (Ignatov 2017), to name but a few of the theoretical approaches.

Following the ideas of Guerrero and Urbano (2017) and (Guerrero et al. 2016), entrepreneurial innovation can be understood to be a new technology entrepreneurship initiative which involves different kinds of university technology transfer (cooperative search, business incubation, etc.) and cooperative knowledge generation, through models such as that of the triple helix (Etzkowitz 2008). When it comes to transition economies, it could be argued that the entrepreneurial innovation or commercial exploitation of knowledge hardly exists (Kornai 2010; Švarc 2014; Krammer 2009). Croatia suffers from the same shortcomings in terms of innovation and entrepreneurship regardless of its transition to capitalism and irrespective of its embracing of the principle of entrepreneurial economy (Thurik et al. 2013). These reasons can be found in the inheritance of socialism and, on the other hand, in the particular processes of entrepreneurship development in the transition period. During socialism, private ownership was largely discouraged because it signified alienation from “social ownership” and compromised the principals of self-managing socialism (see the next section). When the planned economy collapsed, the population inherited slacked entrepreneurship capital (Audretsch 2007, 2018) and lacked entrepreneurial experience, skills, and institutions (Estrin and Mickiewicz 2011), which made the transition a nightmare (Ignatov 2017).

While the practice of university technological transfer largely relied on the legacy, practice, and scientific technological resources of ex-Yugoslavia, the development of entrepreneurship was rather uncharted territory. With no historical foundation, entrepreneurship has been developing according to two different plans. The first plan involved a new type of “political entrepreneurship” (Kshetri 2009) driven by tycoons’ non-transparent privatization of state enterprises, which led to today’s crony capitalism (Franičević and Bičanić 2007). Crony capitalism has had a disastrous impact on innovation dynamism and pro-innovation culture as it is considered to be a speculative (often criminal) form of entrepreneurship which displaces productive and innovation-based businesses. Innovation has lost its plausibility, social value and, economical effectiveness (Švarc 2017).

The second plan was developed quite separately from the privatization process and included the development of new small and medium-sized enterprises (SMEs). This new sector was encouraged by public policies, strategies, laws, and regulations, and through the state supporting programs where integration with the European Union played a key role. The process started with the adoption of the European Charter for Small Enterprises in 2003, which recommended ten key policy areas of action to support SMEs. The implementation of this was subjected to regular monitoring and evaluations (Švarc 2014). Owing to the Europeanization of entrepreneurship policy, Croatia put in place the basic legal and regulatory frameworks for SMEs rather quickly. The government started the nationwide “Business impulse” program to develop business capacities and support primarily traditional types of businesses. However, the technological and innovation capacities of the firms were rather neglected (mainly limited in terms of their acquisition of the new

equipment) and involved quite limited relationships with universities as a source of business competitiveness. Therefore, neither crony or “political” entrepreneurship nor the new SMEs sector nurtured entrepreneurial innovation. University technology transfer has developed along its own path, which is presented in the next sections with reference to entrepreneurship innovation where appropriate.

11.3 University Technology Transfer in Socialism and the Position of Croatia in ex-Yugoslavia

There is a vast amount of literature concerning the rise and fall of eastern socialistic economies, including Croatia and ex-Yugoslavia (Bartlett 2003; Dyker 2011; Dyker and Vejvoda 2014), as well as numerous case studies on particular countries’ transitions of research and innovation systems following socialism, which are well summarized in Meske (Meske 2000a, b) and Dyker and Radošević (1999). It is commonly perceived that industries in Croatia within ex-Yugoslavia have grown very quickly following the Second World War, when large industrial corporations were extended or founded, such as Podravka (food), Pliva (pharmacy), Rade Končar (electrical equipment), RIZ (electronics), Nikola Tesla (telecommunications), and Đuro Đaković (machinery), to mention only a few. In some technological sectors, ex-Yugoslavia has kept pace with developed western countries, and even exported technical services to Arab countries (Radošević 1994). Croatia was one of the six republics of Yugoslavia and, with the exception of Slovenia, was the most developed republic, boasting a relatively strong industrial base. According to some estimations (Stipetić 2012), Croatia had its greatest GDP growth between 1950 and 1973 and, at the end of this period, even surpassed countries within Central Europe, such as Hungary and Poland, and was only eclipsed by Czechoslovakia and Slovenia.

Most large corporations had in-house research institutes, which cooperated with different faculties and with the largest Croatian institute for natural sciences—Institute Ruđer Bošković—which was established in the 1950s for nuclear research. However, the knowledge-orientated basis for the development of proprietary technologies was insufficient, and thus the import of foreign technologies was the basis of technological development. The type of imported technology depended on the technological maturity of the sector and varied from low technological loan jobs in the textile industry, to various license contracts, consultations, and know-how, to the acquisition of complete “turn-key” services.

Nevertheless, it is important to stress the specific role that science plays in ideology and in the politics of socialistic economies, including those within Croatia. It is considered to be an important condition for economic development and is the main element of historical competition with the West (Meske 2000a). Science thus receives a lot of support from the government, including in-house industrial institutes, which sometimes result in the over-extension of research staff. When it comes to science-industry cooperation and knowledge transfer, it is commonly agreed that

the East and West have developed according to radically different logics (Hanson and Pavitt 1987; Högselius 2003). The main difference between the East and West is that innovation in the East was not spontaneously driven by the interest of stakeholders, but was centrally coordinated by the state, limiting the mutual co-evolution of industry and science in creating technical change. This substantial difference is a logical consequence of the political economy of socialism and capitalism, as a socialistic economy is based on the central planning of economy and state paternalism (the paternalistic relationship between the state and the firm) rather than market competition and private initiatives. This considerably reduced the willingness of companies and research institutes to respond to market incentives through innovation and marketable research. The central planning of innovation resulted in the fragmentation of the innovation system, which prevented the integration of R&D and production and inter-organizational learning.

Another essential fault of technological policy in socialism was the supposedly linear model of innovation (in which innovation takes place in consecutive phases from research to invention and innovation) or the science-push approach, which established science as the primary instigator of innovation and technological change. It is often forgotten that the science-based model of innovation was not only a dominant theoretical model in the West, in the period from the Second World War to the 1970s, but was also practiced by companies (Balconi et al. 2010, p. 3). The remaining shortcomings include the absence of small firms or “specialized suppliers”, very few technological trajectories, and a lack of appropriate selection environments (Hanson and Pavitt 1987); as well as imbalances between production capacities and absorptive capacities, technological obsolescence of equipment, imbalances in the production chain, and others (Radosević 1994).

Although Croatia shared the majority of these shortcomings with other countries of the Soviet bloc, its system of innovation had certain advantages compared to the Soviet system. Croatia, as a part of ex-Yugoslavia, developed a network of relatively strong mission oriented public and industrial research institutes, this was a stark contrast to the Soviet model, in which the Academy of Sciences was a superior scientific institution and the main producer of basic research. Besides, Yugoslavia developed specific workers’ self-managing socialism and, within it, a specific institutional set-up for science-industry cooperation—“the self-managing interest communities for science”—whose purpose was to lead science policy from a republic level, and mediate the “labor exchange” between suppliers (research organizations) and recipients of science (industry). In this way, research organizations in Croatia were funded from the state and from the production sector in two ways: via the “direct exchange of work” (direct contract with industry), or via “indirect exchange of work” mediated by the self-managed interest communities for science. Regardless of the efficiency of this funding, this shows that the government of ex-Yugoslavia has been aware, since the 1970s, of the importance of supporting the “links between knowledge and economic development” (IDIS 1980, p. 12), and has sought to encourage the “exchange of work” between research and industry. According to some estimations (Pisk 2001), “Institute Rudjer Boskovic” in 1989 accounted for 40% of its funds from the production sector, including the army, but these funds

were reduced in 1999 to only 13%. As we shall illustrate, such levels of science/industry cooperation would not be achieved in later periods, even up to the present.

11.4 Methodology

A longitudinal case study approach is used in this research to analyze the evolution of university technology transfer and its relation to entrepreneurial innovation over the last 30 years, during the transition from socialism to capitalism. It offers a discussion of the evolution of the UTT and entrepreneurial innovation from socialism to the current Europeanization of the technology transfer policies, through the historical overview of the three phases of UTT evolution, exemplified by Croatia. The research includes the analysis of a number of strategic documents, laws, programs, regulations, and reports on scientific and innovation policies in Croatia, from the mid-1990s to the most recent S3 strategy, supported by statistical data (e.g. Eurostat) and other relevant data from international resources (e.g. GEM, Doing Business Indicators) to capture main actors, funding trends, and policies regarding technology transfer and innovation challenges. This approach provides a theoretical insight and a critical reflection concerning the meaning of technology transfer and entrepreneurial innovation in different socio-economic contexts over time. Important resources include the country reports of OECD, World Bank, and the European Union (such as Erawatch/RIO reports) since their commencement in 2006,² as well as the recent HEInnovate background report carried out in 2018 by Dabić for the OECD/EC.

11.5 Results

11.5.1 *First Phase of Transition: Policy Learning and Establishing Initial Infrastructures*

Croatia became an independent state of ex-Yugoslavia in 1991, at which point it began its journey towards a modern capitalist economy. During the first turbulent decade of its independence, Croatia laid the foundations for new state institutions, exchanged its single-party system for parliamentary democracy, created its own new currency, repaired large-scale homeland war damages, and initiated reforms for its transition to a market economy.

The Croatian R&D sector has undergone, like all post-socialist countries, a similar process of restructuring, ranging from “shock without therapy” (Radosević 1996) to a gradual restructuring of research infrastructures and the organization of

²Further details, visit <https://rio.jrc.ec.europa.eu/en/country-analysis/Croatia/country-report>

science activities. The science base in Croatia, in terms of both human/resource capacities and investment in R&D, has shrank significantly (Prpić 2003) but the old socialist elitist approach to science, along with the linear model of innovation, helped to preserve the national knowledge base of public R&D during this turbulent transition period while the national economy was brought to ruin. In contrast, industrial R&D has undergone serious deterioration, corresponding with low-levels of absorption capacity in firms in terms of research and technology transfer. In line with the tremendous loss of industrial production during the 1990s, mainly due to the breakdown of export markets during the process of the privatization of state-owned companies, many leading technological companies (with 50 years of accumulated knowledge and technological competences) collapsed or were absorbed by foreign companies. These losses in industrial production in sectors with higher levels of technology content can be considered as one of the most severe transformations, with devastating consequences on technological development and transfer. Supply and demand for R&D and technological development either vanished or was greatly reduced. This process is perceived by sociologists as the “empty-shell model” of privatization (Županov 2001), which denotes the extraction of the company’s substance by tycoons and corrupt managers, usually culminating in the devastation of a company’s fixed assets and technological competences.

Similar devastation processes were also present in other post-socialist countries (Poland, Hungary, Slovenia, etc.) but these were mitigated by the countries’ membership in the EU and through their integration into the European techno-economic networks. Unlike these countries, Croatia was disabled by this process due to homeland war and the subsequent isolation of the European integration process until 2013. R&D and innovation were not the focus of the governmental agenda, as it was expected that innovation and technology development would be generated spontaneously as the result of companies’ privatization, macroeconomic stabilization, and trade liberalization (the holy trinity of transition). The fact that technology transfer was not an automatic and spontaneous process, which would follow from foreign direct investments and market liberalization, was overlooked. Instead, endogenous research and technological capacities, together with private initiative and entrepreneurial activities (which were suppressed during socialism) were needed.

Policies concerning the theory and practice of innovation and knowledge-based growth became a significant objective for policy-makers in the early 1990s (Mytelka and Smith 2002), and Croatia was no exception to this, particularly with regard to the evolutionary theory of technological change (Nelson and Winter 1982) and the concept of the national system of innovation (Freeman 1988). Both of these concepts perceive innovation as a phenomenon endogenous to society and economy, a social construct (OECD 1992) which requires an appropriate institutional support and deliberate policy actions to facilitate the smooth flow of knowledge between different sectors, primarily industries and universities. The most attractive of these was the concept for an innovation system in which the competitiveness of a nation does not depend on the scale of R&D, but rather “[...] upon the way in which the available resources are managed and organized” (OECD 1992:80). It provides a hope that even a small country with limited resources, like Croatia, could make

rapid progress and technologically leapfrog. South Korea, Ireland, and Finland serve as examples of this.

The learning of policies and the beginning of the Croatian innovation system can be traced back to the mid-1990s, when the Ministry of Science and Technology (today Ministry of Science and Education) made efforts to transfer advanced “Western” models of science/industry cooperation and financial support to innovative small and medium-sized enterprises. Technical assistance projects with Germany and Italy provided necessary expert knowledge for the modernization of Croatia’s technological policies and technology transfer (Lange and Švarc 1994).³ This first phase of launching the Croatian innovation system, which lasted until 2000, was focused mainly on technological infrastructures and resulted in the establishment of the first technology innovation centers in three university cities, Zagreb, Split, and Rijeka, closely followed by Osijek and Dubrovnik. These centers are still in function but now operate on more commercial principles.

Importantly, cooperation with Italy resulted in the establishment of the Business Innovation Centre of Croatia (BICRO), the pillar institution of the whole innovation system, with a mission to create financial models and instruments to support innovative or research based entrepreneurship and allow for possible evolution into the national development agency (like, for example, the IDA in Ireland). This has, unfortunately, never happened. BICRO passed many organizational and structural transformations, however it ceased to be in 2014 when it was merged with the Croatian Agency for Small Business, Innovation, and Investment (HAMAG). This large agency had little over a hundred employees, whose main task was to implement programs funded by the ESIF within the cohesion policy of the EU.

HAMAG-BICRO also provided support to Technology Transfer Offices in Croatia (TTO programs). The programs was focused on strengthening the role of TTOs in universities and public research institutions, as these represent central locations for encouraging and conducting technology transfer activities. The programs was funded from the budget for STP II, which was funded by the WB loan. Currently there are five TTOs in Croatia, all with the main objective of providing support to researchers in public science organizations in every phase of technology implementation, including the identification of ideas, market potential, the processes of protection and commercialization of IP, and the establishment of spin-off/spin-out companies.

³The projects were made within bilateral cooperation of the Ministry and the German Federal Ministry of Research, Science, Education and Technology using the expertise of FhG-ISI, Karlsruhe and VDI/VDE-IT, Berlin and with the Business Innovation Centre Friuli -Venezia Giulia, Trieste

11.5.2 Second Phase: The “Golden Age” of the Innovation-Driven Mode of UTT

The second phase of establishing the Croatian innovation system was marked by the launch of a programs called HITRA in 2001 (MoST 2002). This was the first nationwide government programs in innovation policy-making. It was a reflection of the desire of the new left-oriented government, who won power in the 2000 elections, to give momentum to innovation and technology development. HITRA was “a sort of diversion among the elitist-type oriented scientist while, for entrepreneurs, it was just a new trendy initiative of public administration with no significance for the real business” (Švarc 2011, p. 145). HITRA treats the national innovation system as a complex dynamic structure, wherein a system’s efficiency can be anticipated by its three constitutive parts: policy measures and programs; technological institutional infrastructure; and control mechanisms for monitoring system performance. The first HITRA programs included the development of commercially promising products and services from research organizations, prior to their commercial stage, and a programs for the development of knowledge-based companies, aimed at both entrepreneurs and scientists. These programs were subsequently upgraded and extended by a number of other innovation supporting programs, of which the Proof of Concept (PoC), introduced in 2010 with the aim of programs pre-commercial capital for the technical and commercial testing of innovation concepts, was the most successful.

Public administration designed HITRA rather ambitiously, tasking it with motivating scientific research to foster science-industry cooperation, reviving industrial R&D, and encouraging the commercialization of research results in order to support competition within the economy (Švarc 2011). This phase of UTT development can therefore be treated as innovation-driven technological policy—at least, when “good intentions” are considered. However, the reality of HITRA’s programs in practice presented many obstacles which prevented this innovation-based model of UTT from achieving its full potential. First of all, HITRA was faced rather early on with a lack of “systemic” innovation policy (Kuhlmann 2001). Many projects are obstructed by the deficiencies of the remaining parts of the innovation system, which are beyond the sphere of research and beyond the scope of HITRA itself; for example the lack of a sound policy concerning intellectual property protection, lack of venture and risk capital, absorption capacities of companies, etc. The Croatian government has not undertaken sufficient efforts to promote innovation policy at a national level, nor coordinated and harmonized the different ministries’ efforts towards technological development. Nonetheless, the “division of work” and competences between the line ministry of science and the economy have persisted. The fact that technology transfer processes imply that functional, organizational, disciplinary, or national and cultural boundaries need to be spanned was overlooked.

On the other hand, the mind-set of leading politicians and intellectuals did not change much in terms of understanding innovation as an interactive process, embedded primarily in firms. However, the linear process, which has been the dominant

approach since the 1970s, persisted as they failed to understand that technology transfer is based on a multichannel interactive model which does not necessarily involve R&D, and that innovation is primarily linked to firm-based learning and knowledge acquisition in the production process (engineering, testing, marketing, organization), while explicit R&D and links to research institutions is only a small part of these activities, if any (OECD 1998). Innovation systems and policies have thus developed within the wide framework of science policy, and yet have only occupied a peripheral position due to the strong resistance of the scientific community towards the “commodification of science”, and their efforts to preserve the traditional role of science as an “ivory tower”. The majority of scientists have resisted change, particularly with regards to scientific commercialization rather than to scientific ethos and principles. Studies of science-industry cooperation in Croatia have revealed rather weak connections between these sectors (Vehovec and Radas 2006; Radas 2006; Jeleč Raguž and Mujić Mehičić 2017) as well as weak entrepreneurialism in Croatian universities (Dabić et al. 2016). The elitist approach to science and the focus of industrial policies on privatization and FDI, which ignored engineering, applied sciences, and technologies, has hampered the recognition of innovation and technological transfer as the driving force of economic growth. For these reasons, HITRA remained fragmented initially, unable to spur knowledge-based growth as its main task. By 2013, when the government initiated major reforms of the research and science development (R&SD) system, all HITRA programs were terminated or substituted with ESIF programs. Despite its termination, HITRA had an irreversible influence on the management of research projects, and brought socio-cultural changes with it, enabling a shift from conventional science policies towards policies that promoted entrepreneurial spirit and knowledge transfer activities in the academic community.

This second phase of innovation policy, which lasted from 2001 to 2010, despite deficiencies, marks the “golden age” of the innovation system. During this decade, the national innovation system (NIS) had become a relatively complex system of supporting programs, infrastructures, and policy documents for improving innovation dynamics and technology transfer (Švarc 2011). New institutions, such as the Croatian Institute for Technology which develops technology forecasts and strategies, and the Technological Council of the Ministry of Science and Education which provides grants for applied research and technological projects, were established by the mid-2000s. New funds to support knowledge and technology transfer were founded in the period between 2005 and 2009, such as “the Unity Through Knowledge Fund (UKF)”, “the Science and Innovation Investment Fund”, and “the Partnership programs for the science/industry cooperation of the Croatian Science Foundation”. The landscape of interface institutions for technology transfer and innovation development was significantly extended in the coming years, with new centers for technology transfer emerging at universities, as well as technology and innovation centers and parks supported by local communities. Thanks to the EU Instrument for Pre-Accession Assistance (IPA), activated in Croatia in 2007, the large infrastructure—the Biosciences technology commercialization and incubation center (BIOCentre)—was supported with over €18 million, and the Centre began

operation in September 2015. The first (and, to this day, only) Science and Technology park at a university was established by the University of Rijeka (StepRi)⁴ in 2008, with the support of the then BICRO's programs for technological infrastructure development (TEHCRO). The Science Park and the engagement of the University of Rijeka with the local economy made this university almost the ideal entrepreneurial university: striving to implement a triple helix model of the industry-science-government relationship in practice. Seeking to increase entrepreneurship in the Faculties of Economics and Business in Zagreb, Faculty of Economics and Tourism "Dr. Mijo Mirković" in Pula and Faculty of Economic in Split, Croatia jointly with partners from Austria, Poland, France, Israel, Slovenia and Lithuania implemented project "Fostering Entrepreneurship in Higher Education" (FoSentHE), which was granted by the European Commission. The FoSentHE project was dedicated to the promotion of entrepreneurship amongst students and to the generation of interest in scientific commercialization (Dabić et al. 2012).

11.5.3 Present State: Europeanization of Technology Transfer and Entrepreneurship Policies

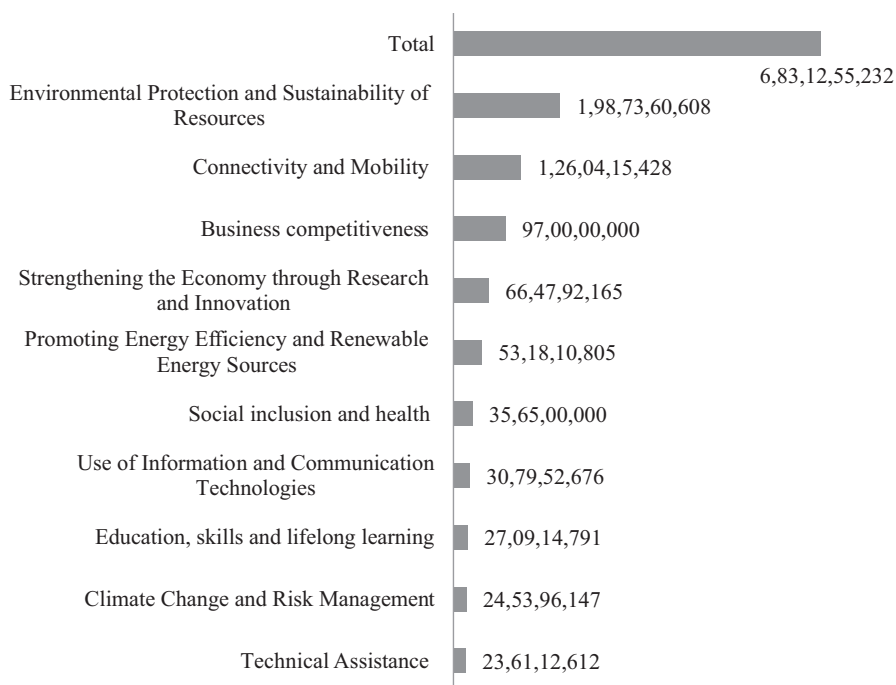
From 2010 onwards, the innovation system landscape was gradually reshuffled and, by 2013, almost all institutions and programs launched during the "golden age" were terminated or transformed. The Ministry of Economy took over programs for technology transfer in place of the Ministry of Science and Technology, marking a new era in innovation policy and UTT, which were traditionally under the auspices of the Ministry of Science and Education. In 2013, the government initiated major reforms of the R&SD system with regards to funding, organizing, and evaluating scientific work to improve scientific excellence. The reform marked the end of Croatia's innovation system, which had been building since the mid-1990s from a grounding focus on research activities and the supply-side of the innovation process. As a result of the budget austerity policy, the reform included serious cut-offs of the funds for scientific projects between 2013 and 2016. The reforms coincided with Croatia's entry into the EU in July 2013, which granted access to the European Structural and Investment Funds (ESIF) and allowed for the adoption of Smart Specialization Strategy (S3) as a pre-conditionality for using ESIF. Policymakers believed ESIF would serve to substitute a large portion of the scarce budget resources. Innovation policy and technological transfer in Croatia has become, like in other EU countries, largely determined by the common European strategy of research and innovation (Dabić et al. 2015a, b). ESIF, as a critical source of funds for R&D in Croatia, which significantly surpasses the national funding abilities for research activities, brought not only money but also its scientific policy (research priorities, goals and purpose of research, and financial priorities) as pre-determined

⁴For further details, visit <http://www.step.uniri.hr/o-nama>

by the S3 (Švarc et al. 2019). It led, as Kuhlmann (2001) expected, to the “post-national” innovation systems striving towards centrally mediated policy-making. S3 has not only made dramatic changes, but has significantly affected both innovation policy previously determined by the National Innovation Strategy, 2014–2020, and science policy, which was defined in the Strategy for Education, Science, and Technology, 2014–2020. S3 was primarily developed as a central mechanism of the new European cohesion policy which should have enabled all EU countries, especially those less developed, to follow their own path of development (Foray et al. 2009). S3 was launched by the European Union as a new approach to economic development, based on the targeted support of R&D activities and innovation. It set the strategic directions for the development of R&D activities in the forthcoming period. The cohesion policy within the S3 is no longer based only on inclusion into the ERA (European Research Area) framework programs, which is featured by the frustratingly low participation of innovation followers and mainly serves the interest of the most developed countries (Bečić and Švarc 2015). Innovation followers are also no longer supposed to impartially copy innovation supporting instruments, which usually achieve weak or negligible success in the recipient country.

S3 preserved the basic idea of science/industry/government cooperation but on different premises which allowed countries to specialize in their own specific sectors, depending on their capabilities. In contrast to previous innovation policies, which followed a centralized top-down approach, the S3 strives to identify research and technology areas for public interventions based on the analysis of the strengths and potential of the local economy through the Entrepreneurial Discovery Process (EDP), which is led by local entrepreneurs. This “strengthening of the strengths” policy focused on entrepreneurs and designed cohesive policies that would encourage regional development and SMEs in technologically peripheral countries in the EU. This has evolved over time into a new industrial and innovation policy for regional development all over the EU (Radošević 2018). The S3 in Croatia is coordinated by the Ministry of Economy, Entrepreneurship, and Crafts (MEEC), who drafted the analytical background for the S3 with the support of an EU cofounded expert team. The Smart Specialization Strategy was adopted by the Croatian government on 30th March 2016. The implementation of S3 in Croatia is funded under the European Regional Development Fund (ERDF) within Operational Programs “Competitiveness and Cohesion 2014–2020” (OPCC) through two priority axis: Priority Axis 1—Strengthening the economy through the application of research and innovation, which will focus on research, technological development, and innovation; and Priority Axis 3—Business Competitiveness, which will provide support for small and medium-sized businesses (SMEs). In parallel, through the ESF-OP Efficient Human Resources (OP EHR), a significant contribution will be provided for S3 implementation in the field of smart skills. It seems that the implementation of S3 has finally pointed UTT in the right direction, after 15 turbulent years of “national” innovation policy, with a modest impact on technology development. The S3 policy marks two important milestones: firstly, the beginning of a new innovation ecosystem with a stronger focus on companies’ needs and regional development, complemented by entrepreneurial culture and spirit; and secondly, the

scientific community’s efforts to embrace cooperation with companies through knowledge and technology transfer, something that was avoided for almost 20 years. It is commonly perceived that the EU Structural and Investment Funds (ESIF), with a fund of €10.68 billion for the period 2014–2020, provided Croatia with the remarkable opportunity to address their needs in research, innovation, and skills. It makes €1.5 billion per year (World Bank 2012), over 3% of GDP on an annual basis, and about ten times as much as it did from 2007 to 2013 (European Commission 2015). Of these funds, €664.79 m is used with the intention of strengthening the economy by applying research and innovation, as determined by the budget of the Operational Program “Competitiveness and Cohesion”, 2014–2020. The majority of resources (€4.321b) come from the European Regional Development (ERDF) which seeks to form cohesion policies through balanced regional development. An overview of the ESIF in Croatia between 2014 and 2020 is provided in Fig. 11.1. The ESIF budget for research and innovation significantly outweighs national budgets, allowing S3 to have a significant impact on national R&D and technology transfer policies. In Croatia, the total national budget funds for competitive research projects in basic sciences in the five year period between 2013 and 2017 was around €108 million (Martinović Klarić 2019), compared to ESIF’s contribution towards for strengthening the economy through research and innovation,



Source: Authors

Fig. 11.1 ESIF allocation (€) by OPCC 2014–2020. (Source: Authors)

which reached around €95 m per year (€664 m in total between the 2014 to 2020 programming period⁵) (see Fig. 11.1).

Table 11.1 shows a provisional public overview of the ERD funds between 2014 and 2020.

Classified under “entrepreneurship, research and innovation” reveals that ERDF programs can be divided in three groups according to their targets: (1) entrepreneurship development; (2) cooperation between research and business sectors (conditionally: university technology transfer); and (3) scientific research and infrastructures. Although this overview is only provisional, it clearly demonstrates that the majority of ERDF resources are geared towards entrepreneurship development and business-supporting institutions (over €550 m), which do not include technology development or technology transfer activities conducted in cooperation with the research sector. Financially, the most generous programs for entrepreneurship aim to: (1) upgrade business development and improve the technological readiness of SMEs through new production capacities, constructions, and business units (SME competence and development); and (2) commercialize innovative products or services that are new to the markets (innovation in S3 areas) (Table 11.1).

The next group of activities funded by the ERDF can be considered technology transfer activities devoted to new products/services and the technological upgrading of companies through cooperation with public research organizations or universities. Following the principles of EDP, the projects’ goals and activities are shaped by the interests and needs of companies and strive to tailor technological development according to the capabilities of local firms. Currently, these projects are orientated around three large programs, worth over €100 m each, geared towards the development of new products and services emerging from R&D activities and the Centers of Competence (Table 11.1). Unfortunately, only a segment of the research community can take advantage of these funds: those which have research fields that are close to their industrial application. Researchers in other disciplines (natural, medical, social, etc.) are, for the most part, not eligible for ERDF funding. However, ERDF has earmarked, within the third group of activities, generous resources for the revitalization of public research infrastructures which could not be financed otherwise; for example, from the scarce state budget. This is a crucial contribution that the ESI provides to public science.

The European Union encourages entrepreneurship in Croatia in other ways, too. For example, the Croatian Venture Capital Initiative was established in June 2018 with a €35 million injection from the European Investment Fund (EIF) and has already raised €12.2 million of private-sector funding. In January 2019, the EIF and the Croatian Bank for Reconstruction and Development launched the Croatian growth investment program: a €70 million co-investment program to support fast-growing SMEs (European Commission 2020). ESIF has significantly increased Croatia’s state aid for SMES and regional development. However, most programs

⁵Further details, visit: <https://strukturnifondovi.hr/en/eu-fondovi/esi-fondovi-2014-2020/op-konkurentnost-i-kohezija/>

Table 11.1 A tentative overview of ERDF public calls related entrepreneurship, research, and innovation in Croatia within the OPCC 2014–2020 (data extracted on 26 February 2020)

Content of call	Status	Budget in million €
<i>Entrepreneurship Development</i>		
Development of a Network of Entrepreneurial Supporting Institutions (PPIs) through HAMAG-BICRO - Phase 2	Open mid 2020	6,7
SMEs Internationalization of Business - Phase 2	Open mid 2020	18
Quality signs	Open mid 2020	1
From product certification to market	Open mid 2020	4
Innovation Vouchers for SMEs	Open mid 2020	6,7
Innovation in S3 areas	Closed 2019	85,7
Innovation of newly established SMEs - Phase 2	Closed 2019	20
Promotion of entrepreneurship	Closed 2019	5,1
Improving the competitiveness and efficiency of SMEs through ICT	Closed 2019	7,2
From product certification to market	Closed 2018	5,1
Building and equipping SME production facilities	Closed 2018	27
Internationalization of SME business	Closed 2017	5,1
Entrepreneurship Promotion 2017 to 2019	Closed 2017	5,1
Commercialization of innovation in entrepreneurship	Closed 2017	15
E-impulse	Closed 2016	34
Innovation of newly established SMEs	Closed 2016	8,7
SME Competence and Development	Closed 2017	117
Improving the competitiveness and efficiency of SMEs through ICT (phase 2)	Closed 2018	49
Construction and equipment of SME production capacities	Closed 2018	69
WWW Vouchers for SMEs	Closed 2020	4
Introduction of business process and quality management systems (ISO and similar standards)	Closed 2020	5,1
Entrepreneurial Supporting Institutions (PPIs) (13 projects)		46
Development of entrepreneurship in five cities		9
Total		553,5
<i>Cooperation Between Business Companies And Research Organizations (UTT)</i>		
Development of new products and services resulting from R&D activities (IRI II)	Open by mid-2020	105
Development of new products and services resulting from R&D activities (IRI I)	Closed in 2018	100
Centers of competence	Closed in 2017	105
Total		310
<i>Scientific Research and Infrastructures</i>		

(continued)

Table 11.1 (continued)

Content of call	Status	Budget in million €
Preparation of R&D infrastructures	Closed in 2017	6
Synergies between Horizon 2020, Twinning, and ERA Chairs	Closed in 2018	7
Capacity building for research, development, and innovation	Closed in 2018	25
Croatian Science and Education Cloud	Closed in 2018	26
Centre for Advanced Laser Techniques	Closed in 2017	17
Organizational reform and infrastructure in the public R&D org.	Closed in 2017	102
Research centers of excellence	Closed in 2017	50
Children's center for translational medicine at Srebrnjak hospital	Closed in 2018	58
Total		291

Notes: Interreg programs are not included. Source: <https://strukturnifondovi.hr/natjecaji/>

lack adequate monitoring and evaluation mechanisms (World Bank 2018) and the evidence of the effectiveness and absorption of these funds is inconclusive. Although the latest reports (European Commission 2020) estimate that funds have been allocated to a specific projects in their entirety, only a small portion (around €2.8b) is spent on the selected projects, revealing that the level of implementation is well below the EU average (European Commission 2020). The Centers of Competences and Centers of Excellence are still in their formative stages, delivering no clear results. On the other hand, it is estimated that ESIF contributes towards the mobilization of important private investments of around €553 million of additional capital in the form of loans, guarantees, and equity, which is 5.6% of all of the decided allocations of the ESIF (European Commission 2020). A review of 150 successful entrepreneurial projects (MEEC 2018), such as Rimac Automobili, Microblink, Olival, etc., illustrate that ESI funds positively influence entrepreneurship and regional economies through investments in new production technologies, new products and services, production capacities, and so on.

There is also another problem when it comes to implementation of S3 as the process of building S3 in Croatia saw the principles of EDP adhered to only in part. The participation of stakeholders, especially those from science and business backgrounds, in the formulation of priorities for the technology transfer from universities to local businesses is rather formal (Mršić 2018). This simply means that organic links between stakeholders in formulating regional technological needs, and the subsequent submission of cooperative projects for ESIF funding based on common interest and importance for the local economy, are harder to find. On the contrary, project activities are mainly driven by the bureaucratic requirements of ESIF

operative programs and the “rules of the game” with regards to project submission, evaluation, and funding. Moreover, initiatives for project submissions regularly come from research organizations as companies are more focused on simply surviving and are less interested in knowledge transfer from universities. It is presupposed that “isomorphic mimicry” (Radošević 2018) will occur, in which EDP only imitates the interaction between the business and research community with the aim to “collect the free money”.

The fundamental question is not whether such imitations will occur, but in what proportion in relation to projects driven by authentic mutual interests. It seems that, at the moment, technology transfer within ESIF operational programs is just another top-down “bureaucratic” incentive (this time coming from the EU and not from the national administration) for science-industry cooperation. The only difference this has in comparison to previous government initiatives is access to larger amounts of ESIF resources, which can support bigger projects which may have greater potential impact on the economy if cooperation is efficient. Besides, low technological capacities of companies and the structure of the industry could yield little convergence with the EU (Bonaccorsi 2016; Muscio et al. 2015; Archibugi and Filippetti 2011). Such sub-optimal use of ESIF has already been seen in Greece (Liargovas et al. 2016), while the effects of EU transfers to Romania and Bulgaria are estimated as ambiguous and limited (Surubaru 2020). These are countries with which Croatia shares many obstacles when using ESIF, such as inefficient administration, corruption, and the declining competitiveness of economy.

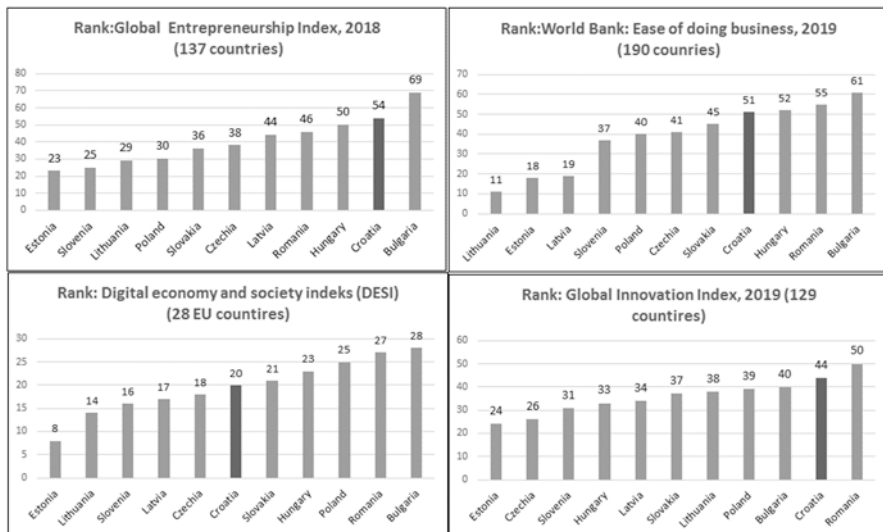
Despite these potential threats to the implementation of S3 and the weak partnerships between business, research, and governance institutions, S3 reshuffled dormant innovation systems, policies, and institutional landscapes, increasing interest in certain sectors of business and research for advanced technologies. S3 also provides significant funds for technology transfer activities, innovation, and entrepreneurship when compared to the scarce national resources available. The absorption of funds and the contribution towards growth are expected to be higher in 2020 and 2021 when most projects will reach their maturity.

11.6 Discussion

Despite almost 20 years of practicing innovation policies, many indicators reveal that Croatia has not progressed much in the economy, in technology, or in innovation during the last decade. According to the latest report of the European Commission (2020), Croatia’s GDP per capita – relative to the EU average – was still at the same level as it was 10 years earlier. This suggests that Croatia has experienced a lost decade in terms of economic catch-up when compared to the rest of the EU. The position of Croatia, in terms of its international rankings for innovation, business, and competitiveness, is rather low in spite of its investments over the past few years, its efforts in creating more friendly business environments (e.g., lower minimum capital for start-up companies, reducing notary fees, etc.), and its environment for

innovation. The performance of Croatian research and innovation systems is considered suboptimal and inferior when compared to the most of its Central and Eastern European peers (CEE: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak, Slovenia) and has been seen to deteriorate in recent years (European Commission 2019; World Bank 2018, p.33). The most common international comparisons, such as the Global Entrepreneurship Report, Ease of doing business, the Digital Economy and Society Index, and the Global Innovation Index (Fig. 11.2), show that the Croatian economy is less competitive than its peers. There is a worrying trend which shows a general “lagging behind” of the countries of the former Soviet Union, which were behind Croatia in the era of socialism. In the last couple of years, Croatia can be seen to lag behind not only Hungary, Poland, the Czech Republic, and Slovenia, which used to be Croatia’s peers, but also behind countries such as Bulgaria and Romania, which have always been behind the rest of Europe. It seems that these countries too will soon leave Croatia behind.

The summary innovation index of the European Innovation Scoreboard 2019 (EIS 2019) places Croatia at the bottom of the group of so-called moderate innovators, ranking 26th out of 28 European countries (only Romania and Bulgaria are behind). This reveals that Croatia has made no progress in improving its innovation performance in the last decade. It performs below the EU average in all innovation dimensions except non-R&D innovation expenditure by firms, companies with marketing/organizational innovation, and companies that provide ICT training (EIS 2019). It is worth mentioning that a rich landscape of over 350 business-supporting institutions (e.g. business incubations, entrepreneurial zones, etc.), complemented



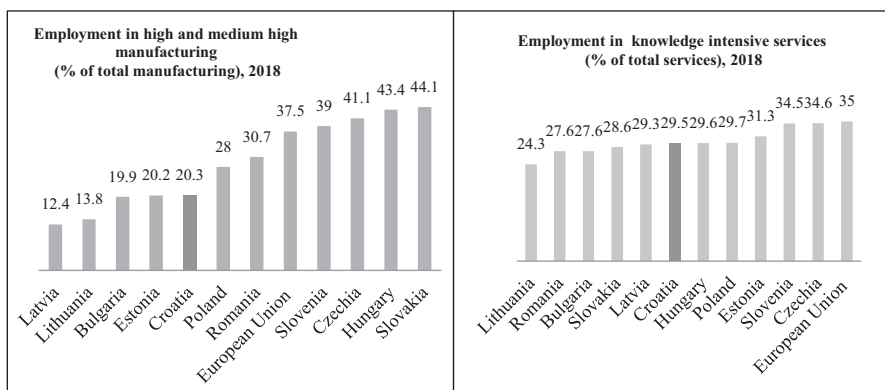
Source: Authors

Fig. 11.2 Rank of Croatia among CEEC by the select international composite indicators. (Source: Authors)

by a number of supporting programs intended to increase the innovation capacities of SMEs, turned out to be of modest efficiency. According to the latest GEM report (Singer et al. 2018), Croatian companies mainly invested in technological infrastructure (e.g. machinery), while new product investments were scarce: 72% of newly established companies and 83% of “old” companies did not produce “new to the market products” in 2017. This means that Croatian companies belong to the “red ocean”, in which competitors fight for dominance in the markets of known products, as opposed to the “blue ocean”, where demand is created by new products. This pattern of entrepreneurial activity (technological readiness without new products), when combined with the lowest motivational index (opportunity-based business) among the European countries, proves to be a significant factor when it comes to low business and innovation competitiveness.

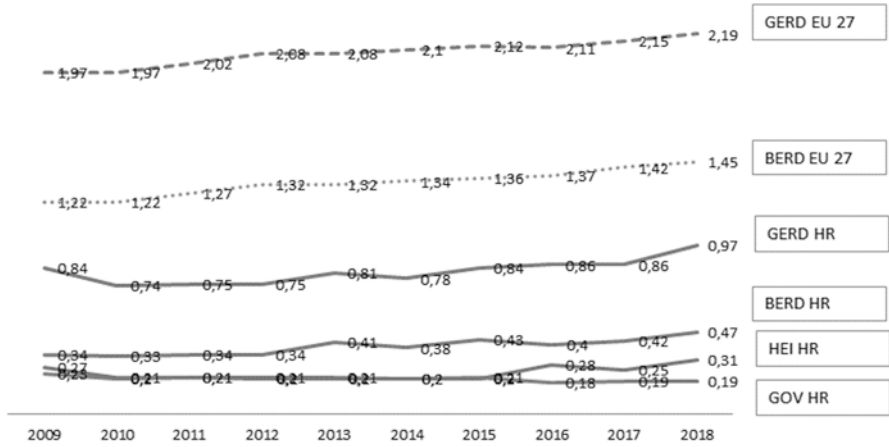
Low investment in R&D is a result of the structure of the economy, which has remained relatively unchanged over the last 15 years, with no shift towards more knowledge-intensive sectors (EC, 2018b, p. 275). Croatia is lagging in terms of its development of medium and high manufacturing and its knowledge-intensive services in comparison to its CEEC peers (Fig. 11.3). A high promotion of tourism and trade is averse to investments in R&D, innovation, and the stronger integration of Croatian companies in global value chains. Croatian expenditures on R&D are stagnant and low (below 1% of GDP), showing signs of recovery only in 2018, when it reached 0.97% of GDP (49% from private resources and 51% from public resources) (Fig. 11.4), but this is still insufficient in reaching Croatia’s national 2020 R&D target of 1.4 of GDP. Per capita investment in research achieved only 18% of the EU-27 average (€661.5 vs. €122.2 per inhabitant) (Fig. 11.4) R&D expenditures by sectors of performance, 2009–2018.

This increase in funding is usually attributed to ESIF, but data shows that the public research sector (government and higher education institutions) did not significantly increase funding from ESIF between 2016 and 2018, when the more



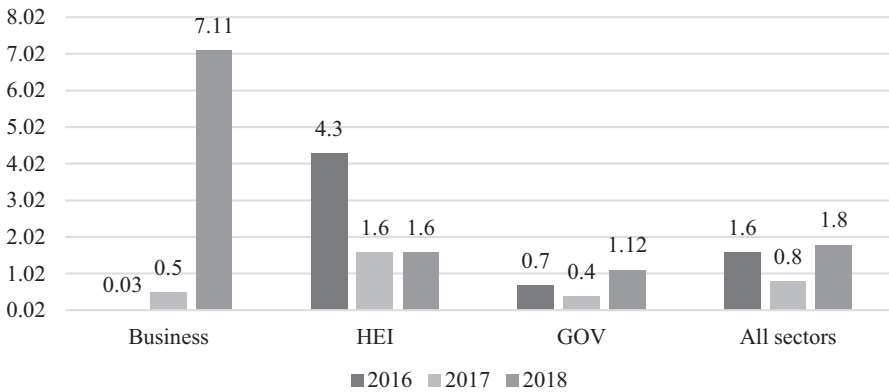
Source: Authors

Fig. 11.3 Employment in medium-high tech manufacturing and knowledge intensive services % of total manufacturing (service), 2018. (Source: Authors)



Source: Authors

Fig. 11.4 Employment in medium-high tech manufacturing and knowledge intensive services % of total manufacturing (service), 2018. (Source: Authors)



Source: Authors

Fig. 11.5 Share of ESIF in total funds for R&D, 2016–2018, by sectors. (Source: Authors)

intensive implementation of ESIF begins. Significant increases were recorded only by companies that increased ESIF funding from €47 thousand to over €five million (CBS 2019) (Fig. 11.5). It is reasonable to assume that the funds have come from the science-industry (technology transfer) programs (Table 11.1). At 0.47% of GDP in 2018, business R&D expenditure is among the lowest in the EU and reaches around one third of the EU average of 1.45% of GDP (Fig. 11.4). In 2017, a few large firms invested over 53% of the total funds (e.g. telecommunication, pharmaceutical, and food industry), medium-sized companies with up to 250 employees accounted for around 40% (e.g. chemical, metal, electrical products, motor vehicles, computer programming), and small companies invested only 7% of their total business expenditures on R&D (CBS 2019, p. 20).

Table 11.2 Key Data on Human Resources, 2013–2018

	Croatia 2013	Croatia 2018	EU27 2018*
HRST - human resources in science and technology (% of active population)	13.8	17.6	29.7
Persons with tertiary education aged 25–34 (% of active population)	29.6	37.5	40.9
Scientists and engineers (% of active population)	1.0	1.4	4.0
Researchers (FTE)	6529	7985	–
Researchers (FTE) (% of active population)	0.36	0.45	0.85
Students	164,623	165,197	–
Graduates % per 1000 population aged 20–29	56.2	57.8	71.2
Doctoral graduates per 1000 population aged 25–34	0,8	0,6	1.3

Source: Authors

*EU27 countries since 2020

Croatia performs significantly below the EU average in human resources, particularly in terms of its number of researchers, human resources in science and technology (HRST), and scientists and engineers (Table 11.2). Since 2013, the number of students has been seen to stagnate at around 165 thousand, while the number of researchers (FTE) has been oscillating between 6500 and 7500 for a decade. Researchers in the business sector are at low levels, accounting for around 20% of the total number of researchers. It is particularly worrying that the number of doctorates awarded has been decreasing since 2013, when doctoral studies were reformed and funding was transferred from the Ministry of Science and technology (MSE) to the Croatian Science Foundation (CSF).

Skill shortages, low R&D investment, rigidities in the business environment, and weaknesses in public administration are the key drivers of Croatia's productivity gap (World Bank 2018). This suggests that Croatian innovation policies have not been efficient in spurring on the economic development and competences of entrepreneurs. The Croatian innovation system is widely perceived to be inefficient, characterized by fragmentation, subscale investments, and poorly defined policies (European Commission 2015). The development of the Croatian innovation system, from its foundation in 2001 up until today, clearly shows that, in countries with economies of low technological capacity, UTT is challenged by the lack of business partners and the low absorption capacities when it comes to companies' research-driven innovation (Dabić et al. 2016). Technology transfer policies and policies for fostering entrepreneurship have followed a different evolutionary path, both from an institutional and conceptual point of view. Entrepreneurship has developed, as described in Sect. 11.2 according to two plans (tycoon privatization and creation of traditional SME sector), which both followed their internal development logic and dynamics and largely ignored entrepreneurial innovation and new technologies. On the other hand, technology transfer has mainly focused on the capitalization of science and research-based innovation, not taking into account the real needs of entrepreneurs. An attempt to merge these sectors into a single process took place rather

recently through the Europeanization of research and technology transfer policy, determined by the concept of S3 and implemented through the bureaucratic rules and requirements of the ESIF Operational programs.

Liberalization of economy, market competition, privatization of companies, EU membership, and other benefits resulting from the collapse of socialism have not brought with them the expected socio-economic progress anticipated in the first enthusiastic decade of the transition to capitalism. The reasons behind this sluggish economic development, in which technological transfer was largely absent, are still the subject of bitter disputes. Economists mainly blame the wrong (neoliberal) growth model, based on financialization and excessive sovietization of the economy (Radošević 2013), as well as classic obstructive elements, such as lack of managerial and strategic competences and entrepreneurial skills, strong national currency, or enormous bureaucracy and red tape. An important element is the large share of tourism in the economy (the indirect contribution of tourism to GDP was estimated to reach over 25% in 2017 (World Bank 2018), which is based on rents and creates an economic culture in which technological entrepreneurship and innovation play no role. Another reason for locking into the low and medium technological growth model is the strong role of the state-owned companies in national economy which contribute a fifth of total turnover and possess a third of total assets (World Bank 2018). Such companies (around 74) and hundreds of others which are under the state shield, management or interest are lacking genuine incentives for competition through innovation and research.

Sociologists believe that inherited cultural factors, such as egalitarianism (Vuković et al. 2017), and socio-political trajectories known as the state of semi-modernism. Processes of de-industrialization, re-traditionalization, de-scientization, and irrational administration (Županov 2001) have resulted in the cognitive, social, and political inability of political elites to accept global transformations as necessary for global innovation-driven growth (Švarc 2006, 2017). Industrial and technological policies have largely been associated with the mere transition to market economy and the privatization of companies, while technological developments have not been taken into account (Švarc 2017). Finally, political economists are more prone to finding obstacles in incorrect political systems, such as the “dependent market capitalism” (Nölke and Vliegenthart 2009) of the less developed countries in the European periphery. In Croatia, this specific type of crony capitalism was established during the first decade of transition. The characteristics of crony capitalism were described in a seminal article by Franičević and Bičanić (2007) and were extended by younger authors such as Čepo (2020), Šimić-Banović (2018), and Mačkić (2019). Crony capitalism essentially consists of systemic corruption and clientelism, which permeate all segments of economy and society, and divert companies’ focus from innovation and export-oriented businesses towards political protection and support from interest groups to help sustain their business and their own prosperity.

11.7 Conclusions

11.7.1 Implications

The implications of the given analysis are rather straightforward. Croatia urgently needs to recover its economy and to accelerate its integration with the EU. The entrepreneurial innovation and UTT are essential components of this process but are not sufficient and self-sustained. They are currently well supported within the framework of S3 and ESIF funds and both sides (scientific community and entrepreneurs) should take advantage of this European support and assistance. Seeking to increase the proper use of funds, the policy-maker should understand how the system of cooperation operates and how it functions in practice to avoid bureaucratic implementation of the ESIF programs and administrative allocation of the funds. The organic interest among stakeholders should be found and exchanged for formal implementation of the programs involving only administrative “business as usual” procedures (calls, evaluation, funding). In this line, more effort is needed from the local, regional, and national authorities to coordinate the entrepreneurial discovery process and to spur entrepreneurial innovation. More coordination is required in order to identify and implement ambitious joint projects and the strategic entrepreneurial innovation of broader economic interests or grand challenges. The inclusion of Croatia in the global value chains is wholly neglected in the innovation policies; however, other countries, such as those of Visegrad (Slovakia, Poland Hungary, Czech Republic), based their success precisely on their inclusion in the global value chains (GVC) (Grodzicki 2014). Research into the policy mix for technology and innovation upgrades through the variety of forms for GVC could be a fruitful future policy orientation (Kergroach 2018).

The benchmark analyses of the Croatian economy provide clear evidence that supporting programs, either for science/industry cooperation or for the business competitiveness of traditional SME, have not delivered the desired economic growth. Therefore, it is necessary to look beyond European programs to diagnose the roots of slow growth. Many analyses, including this one, point out that economic recovery requires complex socio-economic transformations, which have been slowed down in Croatia by the lack of action taken towards “economic hygiene”, or “getting the fundamentals right” (OECD 2001). The research implies that fundamentals, such as well-functioning markets, institutions, governance, and favorable macroeconomic conditions, as described in the World Bank report (2013) and European semester (European Commission 2015), should be established to raise Croatian competitiveness from last place in the EU.

The next policy actions involve fostering entrepreneurs, technology development, innovation, and scientific research, which is needed to re-affirm Croatia on international competitiveness and business scales. Because of the low technological capacities of firms, it would be useful to consider the unorthodox idea of the division of labor between public research and private businesses (Dosi et al. 2006) to

allow both spheres to develop through their inherent logic and dynamics. The mastery of productive entrepreneurship, and its ability to create demand for R&D (Radošević 2006) and the entrepreneurship abilities of the population in general, should be strengthened on the entrepreneurial pole” of the process. The prerequisite is the completion of the privatization process of the state companies, as well as intensive efforts against crony capitalism as a phenomenon adverse to entrepreneurial innovation and technology development. On the “science pole,” it is necessary to assure the sustainability of the scientific research system and the national knowledge base, which is a distinct process not crucially related to entrepreneurship (Švarc et al. 2020). The concepts of entrepreneurial economy and the national entrepreneurial system point out that entrepreneurship and science can develop separately. Entrepreneurial innovation does not necessarily involve R&D, while academics should be required to develop their “islands of excellence,” cutting-edge research, and technological frontiers to fulfil their social and economic role, which is a prerequisite for developing research-based entrepreneurial innovation.

UTT fills a structural void in terms of its lack of advanced technologies and is therefore an important but non-crucial part of the innovation system. Given that science-based technology development is often unpredictable and can produce unexpected commercial effects, these activities can give rise to new industries and therefore deserve full public support, as carried out under S3. Bio-medical research and robotization are examples of such prospective areas. Given the low investment in R&D, the low technology levels of companies, and the focus on tourism, another unorthodox idea worth considering would be to substitute the lack of R&D with a new sector of ICT companies. With a revenue growth of 4% and an employment rate of 8.5% per year, the ICT sector is one of the fastest growing in Croatia. It has created an income of around €4.2 billion and 1300 new jobs and has become one of the 12 largest export branches (Eurofast 2017). ICT companies operate with foreign capital and work in global markets, changing the landscape of traditional businesses that share weak and non-transparent state-based business models. In contrast to industrial innovation, which requires large R&D infrastructures and heavy investments, the ICT sector “democratizes innovation” as it is mainly based on software development, which drastically reduces entry barriers and learning costs for new companies (Paunov and Planes-Satorra 2019). As such, it should be considered as an alternative to hard-to-reach high technologies.

11.7.2 Limitations and Future Research

This research analyses the evolution path of the UTT in post-socialist countries, using Croatia as an example of this, with the aim of establishing whether or not the transition to capitalism and membership in the EU has enhanced UTT practices and related entrepreneurial innovation, and whether academic knowledge and research has filtered down to cultivate valuable economic activities and marketable innovation under these new circumstances. The main contribution of the research is the

identification of three models of UTT in transition countries using the longitudinal case study of Croatia: the science based model, which was practiced in socialism; endeavors towards an innovation based model during the transition period; and a bureaucratic UTT model, driven by the EU cohesion policy and access to the European Structural Funds. Insights into the evolution of these models suggests the following three relevant conclusions.

Firstly, the sluggish economic growth and technological stagnancy of the country suggest that there is no substantial difference in the efficiency of the different UTT models, which were in operation in different socio-political regimes. The proficiency of UTT was not improved during the switch from socialism to capitalism, nor through Croatia's membership in the EU, and is thus shown to have little influence on entrepreneurial innovation. UTT continues to suffer from almost the same shortcomings nowadays as it did in the era of socialism and in its transitional period. Fragmentation of the innovation system, poor connections between science and business sectors, low technology and innovation capacities of companies, low business investments in R&D, technological obsolescence of equipment, narrow technological trajectories, and the low interest of companies in innovation and cooperation within research sectors have all largely remained the same. Secondly, the suppression of innovativeness, entrepreneurship, and competition, which would otherwise stimulate UTT, is still strongly present, although it is based on different premises—primarily on the wrong growth model and crony capitalism. Sources of growth throughout a significant part of the transition were based on domestic consumption, defensive inter-sectoral restructuring (dismissal of workers or early retirement), and low technology foreign direct investments (FDI) (Lovrinčević and Teodorović 1998), instead of market competition, innovation, and technological upgrading. This model was not sustainable in the long run, and it led to poor market dynamism and a business environment that needed stimulation in the later stages of the development of its national competitiveness. This has contributed to the structural deficiencies of the R&D business sector in terms of low business investment in R&D and insufficient human resources for innovation dynamics within firms. Governance of innovations is often reduced to the buying of new machinery, incremental modifications, and products/processes which exclude risk taking and lead to low economic effect and non-export orientation. Negative effects also stem from the lack of transparency of corporate practices, and a close connection to state and authoritarian corporate management, which characterizes all periods of economic development, from socialism to the present day. Thirdly, the difficulties experienced throughout socialism, in terms of the practical application of research results and technological development, have not improved. The national innovation policy was launched in 2001 during the country's transition into capitalism and, as a result of a lack of entrepreneurial innovation, the inability of businesses to bridge the gap between scientific research and its commercial application, narrow-minded policymakers, and incorrect growth models, it has never come to function as it was hoped it would. This confirms the results of previous research (Staehr 2011), which state that, while EU membership has advanced democratic reforms, the effect on market-economic reforms has been either non-existent or negative. The overall results

suggest that, despite the dramatic change from socialism to capitalism, the basic mechanisms of economic functioning, such as state paternalism, lack of competition, private initiatives, and weak entrepreneurship, remain constant and produce modest improvements in the practices of UTT. Subsequently, sound action of the national government is needed to overcome economic and technological stagnation, and to exploit the benefits of the EU integration policies and ESIF.

The main limitation of this research refers to the qualitative methodology approach due to a lack of objective and systematized data for discussing the performance of technology transfer and entrepreneurship policy. Although the longitudinal case study and qualitative interpretive approach is an excellent method for critical analyses and understudying how the national socio-economic and political context determines technology transfer and entrepreneurial innovation, a lack of statistical data and empirical information about R&D, innovation, and entrepreneurship limit the achievements and scope of this research. It mainly concerns a lack of systemized data about ESIF operational programs (projects, stakeholders, beneficiaries, the share in national funds for R&D, etc.) and the technology complexity of the economy in general. The available international benchmarks and reports are not sufficient for efficient governance and the strategic coordination of innovation and entrepreneurship. A system of data collection, evaluation methods, and indicators should be established for diagnostic analyses (Edquist 2011), evidence-based innovation policy (Gault 2018), and better leverage of European funds. Therefore, future research should be focused on comprehensive empirical research and data collection concerning UTT, entrepreneurial innovation, and performance of the ESIF operational programs, with a view to explore their influence on national entrepreneurship, innovation, and scientific potential, along with their inclusion into the global value chains.

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