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Regional competitiveness in the context of "New industrial policy" – the case of Croatia*[1]

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Abstract

The purpose of this paper is to do research on regional conditions that are most conducive to maximising the positive effects of the implementation of "New industrial policy" (policy based on Smart specialisation strategy) to regional competitiveness in Croatia. Rather than using the standard but fragmented system of counties, this small post-transition economy is first mapped into five regions following the concept of regional innovation systems (RISs). Essentially, RIS concept rests on an idea that interactions among regional agents lead to the creation of optimal innovation output, while policy based on Smart specialisation strategy in Croatia is a national policy that promotes creation of innovative products and services in five promising domains and 13 sub-thematic areas. Analysis is carried out in two steps, firstly using a data-driven approach employed in a multidimensional framework for assessing regional accessibility, absorptive capacity and diffusion of knowledge in the context of Smart specialisation strategy (S3) implementation. In the second step, the assumption of post-transition reliance on the external knowledge and technology in producing innovation output is examined via regional presence of high-technology firms, GDP per capita and international trade and investment variables and patents per 100.000 inhabitants using cluster analysis (Ward method). The results show that highly internationalised regions with higher density of high-technology firms already produce relatively more innovation output per capita. With

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already favourable conditions in place, these progressive regions are most likely to reinforce their competitive advantages through the transformation of their economic structures enabled by implementation of S3.

Key words: *smart specialisation, regional innovation systems, regional competitiveness*

JEL classification: *R11, O30, F63*

1. Introduction

Smart specialisation belongs to the group of industrial and innovation policy approaches that emerged after the financial crisis in 2008, being coined "New industrial policy" (Radosevic, 2017). The concept is implemented as a key part of Europe 2020 strategy, striving to make European Union economy more competitive globally. Tailor-made smart specialisation strategies are created across European Union, either for country or regional level. Smart Specialisation process has required that policy makers, working in partnership with various types of actors with entrepreneurial capabilities, examine the opportunities and potentials of region/national economy, and develop policies that are aimed at facilitating entrepreneurial activities in these arenas (McCann and Ortega-Argilés, 2015). Due to complex implementation requirements, this "policy experiment" needs strong institutional capacities and rather efficient inter-institutional coordination.

In the economic literature, there are three broad ideas on how R&D and innovation contribute to economic growth (Rodríguez-Pose, Cresenzi, 2008: 53–55). The first strand of literature implies a positive relation between investment in R&D (on national and/or regional level) and the innovative capacity and the economic growth. The second group of approaches include as 'systems of innovation' (Lundvall, 1992) and 'learning region' (Morgan, 1997). Finally, there is a large group of scholars who have concentrated mainly on the diffusion and assimilation of innovation (e.g. Jaffe, 1986; Cantwell, Iammarino, 1998).

Croatia started to pursue this concept shortly after becoming a member of the EU. The work on the strategy document lasted few years and by March 2016 Smart specialisation strategy of the Republic of Croatia for the period 2016-2020 (S3RC) was officially adopted, along with the Action plan for implementation over the period 2016-2017 (Vlada RH, 2016). The main goal of S3RC is the transformation of Croatian economy and enhancement of its competitiveness through the use of research capacities and infrastructure in key identified priority domains: 1. Health and the quality of life; 2. Energy and sustainable environment; 3. Traffic and mobility; 4. Security; 5. Nutrition and bio-technology. These domains were identified through entrepreneurial discovery process and establishment of critical mass for research, development and innovation. Commercialisation of innovation is at the heart of S3, as well as promotion of cooperation between the private and public sector, with the available sources of finance earmarked at the national and the EU level. On a national scale, by encouraging R&D in identified areas of specialisation, the issue of low Gross domestic expenditure on R&D (GERD) (in particular low level of Business expenditure on R&D – BERD), is addressed as this was one of key obstacles to creating innovation.

The purpose of this paper is to look into the regional aspects of S3RC implementation. It must be acknowledged that principles that aim to lessen regional disparities across the country are given weight in S3RC implementation. Moreover, S3RC implementation has the potential to strongly influence the competitiveness of Croatian regions by directly supporting promising projects in nationally-defined thematic domains along with other supportive activities (e.g. such as supporting the establishment of national clusters of competitiveness). It is these spheres of S3RC influence to regional economies that are further researched in this paper. The antecedents to regional competitiveness issue (and the associated concept of regional innovation systems) is researched in Bačić and Aralica paper (2016), so findings from this work are acknowledged and to some extent used in the research design of this paper.

Hypotheses examined in this paper are set entirely with the purpose to broadly explore how the regional competitive push of S3 is most likely to occur. The main hypothesis is that regions with more technologically complex economic structures as well as regions with already developed technological and scientific infrastructure in place are in a better position to absorb the funding through S3 implementation. This is due to proneness of firms in technologically-complex activities to innovate and to shape stronger synergies within their region and internationally, while having already developed technological and scientific infrastructure and developed cooperation with these institutions may help developing projects of higher quality for S3RC programmes funding.

The supportive hypothesis includes the notion of importance of reliance on external research and development (R&D) for firms in post-transition economies. Reliance on external R&D in Croatia is, most likely, associated with serious financial constraints in undertaking innovation activity by SMEs that is reported by Božić and Rajh (2016). In majority of new EU member states, new technologies and knowledge flows are appropriated through import and foreign direct investment from EU 15 members (cf. Knell and Rojec, 2007). Importantly, the level of internationalisation may also be a factor that is likely to strengthen the capacities of firms to undertake own R&D and to create innovative products and services through S3RC implementation. Thus, the formulation of the supportive hypothesis is as follows – regions with a higher degree of international openness will also have more supportive pre-conditions in place to benefit from S3RC implementation.

With over a year of S3RC implementation and few years invested in preparing the "level playing field" and setting appropriate conditions for implementation, this paper examines what regional conditions are most conducive to maximising the positive effects of S3RC implementation to regional competitiveness. The aforementioned setting of conditions in the wider sense includes stronger support to financing the development of open scientific infrastructure, establishing national clusters of competitiveness, scientific centres of excellence and similar activities of strengthening the supportive institutions. Innovation system approach will be used as the appropriate conceptual foundation. The main reason lays in the fact that other approaches to examining the contribution of innovation and R&D to economic growth/performance require econometric modelling. Having a relatively short period of S3RC implementation, this latter approach could not be applied. Thus, a combination of qualitative and quantitative data is used to overcome this obstacle via use of few methods which will be elaborated in the following chapters.

The paper consists of six sections. After introduction, a literature review is given in section 2. In the third section research design is elaborated. Data and empirical results are presented in the fourth section, followed by results and discussion in the fifth section. The paper ends with conclusion in the sixth section where contribution to understanding the potential of S3RC implementation to influence the competitiveness of regions is explained and some implications for economic policies are drawn.

2. Literature review

Smart Specialisation has become ex-ante conditionality for the EU regional and cohesion policy (Karo, Kettel, 2015). In the context of industrial policy, Smart Specialization approach could be considered as a continuation of horizontal approach of industrial strategy. Achieving competitive advantage through turning focus to innovation is the key idea of the horizontal approach of industrial policy. This brought about changes in EU approaches, programmes and policy instruments, and importantly firms and institutions on regional level were recognised as key entities in industrial policy implementation. Policy programmes and policy instruments were drawn based on small and medium sized enterprises (SMEs) needs. New programmes supported SMEs at a local level through the creation of decentralised business networks and industrial clusters, with an emphasis on RISs, the “knowledge economy” and “knowledge transfer” from public research and higher education institutions to the business sector (Bartlett 2014, referring to Cooke, 2001).

RIS is a territorially defined concept that acknowledges that innovation output is the result of the formal and informal interaction between institutions and companies on a regional level, or may come as a result of innovation cooperation with the international partners. Two policy goals were set before RISs as policy concept. The first goal is strengthening regional competitiveness (Evangelista et al., 2001), and the second goal is reducing regional disparities across the EU or economic convergence of less dynamic regions to the EU average (Wintjes and Hollanders, 2011). Regional competitiveness in terms of RISs is based on innovation diffusion built on upon knowledge created in regional area (Asheim and Gertler, 2005) and upon use of knowledge external to the region (cf. Aralica, et al. 2008) – via import (e.g. equipment acquisition) and/or foreign direct investments. The prerequisite to both knowledge creation and the use of external knowledge leading to innovation in the region can be seen in adequate absorptive capacities (Cohen, Levinthan, 1989, p. 569). Absorptive capacities may be explained as capacities embodied in social capital of a region. Some of the desired characteristics of this capital in terms of RISs is that it should stimulate cooperation and learning among regional actors.

In new member states (NMS) of EU, this policy approach is demanding in the sense that it requires establishment of new institutions and organisational bodies with the goal of increasing competitiveness of new firms. For example, for post-transition countries such as Croatia, an important antecedent to implementing S3 was an earlier stage of development of science-technological infrastructures. Another example are clusters of competitiveness, comprising of various public and private actors in a sectoral scope, established to promote and support competitiveness of a promising industry or a sector. These “clusters” are by definition closer to cluster initiatives and can be perceived a mechanism for facilitating structural change and for providing a framework for other policies such as research, innovation and regional policy.

The role of existing regional/national institutions also requires redefining, universities and research institutes being an obvious example. The science sector is, within S3 realm, given a wider role in responding to major societal challenges through partnerships with the private & public sector. This is expected to reinforce development of science-industry cooperation on a larger scale, also across regional economies as this type of cooperation emerges often among well-known regional actors.

The main policy action within S3 – Research and Innovation Strategies for Smart Specialisation (RIS3) differs from previous horizontal approach in industrial and innovation policy in terms of positioning regions/regional clusters within global value chain and local production system. Thus, regions that set out to implement S3 should have appropriate government capacity, including policies for entrepreneurial discovery, promoting technology platforms and networks, as well as diagnostic and indicator-based tools and infrastructure (OECD, 2013). A growing number of researchers is also recognising the importance of various channels through which internationalisation influences innovation activity (e.g. Foray, 2012; Altomonte,

2013) such as imports, exports, foreign direct investments, technology transfer channels (strategic alliance, joint research, licencing intellectual property rights) (Knell, Rojec, 2007).

The format of S3RC design does not "pick" industries to be supported, but foremost promotes specialisation in widely defined domains. This approach allows a level-playing field for industries along the value chains across these selected domains to take part in S3RC implementation.

3. Methodology

Three distinct methodological approaches and tools will be pursued to explore the questions arising from hypotheses set in the introduction, as elaborated in the remainder of this section.

3.1. Mapping of regions based on RIS concept

The idea of RIS, previously introduced, is operationalised through mapping regions across Croatian economic space. Counties are selected as the prime unit used in mapping and by using relevant indicators, counties are mapped into larger units – regions that will be further analysed throughout the paper. As mentioned, findings from previous papers are acknowledged (Bačić, Aralica, 2016) in finding relevant criteria to purse the mapping procedure and determine the borders of regions and their centres – major cities that are cores of regional economic activity.

In the first step of the mapping procedure, the major regional urban centres across the country are identified. Additional reasoning can be found in the fact that the technological and scientific infrastructure/capacities (as important elements of RIS) are assumed to follow this pattern. In the second step, county economic structures are differentiated through sectoral shares (agriculture, industry, market services) and assigned to the regional urban "centre" through their economic complementarity and proximity. Complementarity will be sought in the similarity of the economic structure of counties surrounding the urban centre, recognisable in distinctly larger shares of (at least) one of sectors. For example, while the City of Osijek as an urban centre of the Eastern part of the country is specific for a larger share of market and public services while its neighbouring counties have a distinctly larger share of agriculture activities. This type of sectoral pattern emerges throughout other parts of the country. Hence, as the result, borders of regions will be recognised and constituencies of regions will be identified (i.e. counties). Importantly, the system of indicators is "wide" enough to encompass and pick-up variations in the systemic constitution of regions based on RIS concept and sectoral constitution of regional economies.

3.2. Multidimensional system of indicators for policy assessment

After having clearly identified RISs across Croatia, a system of indicators is composed with the purpose to assess the potential of S3RC to transform regional economies and innovation systems. This goal requires compiling an entirely new set of indicators that will be related to S3RC implementation. This task is pursued by building within a larger conceptual framework of Wintjes and Hollanders (2011) who analysed the potential effect of Smart specialization to regional development across European Union, with a particular emphasis placed on innovation activity. Three dimensions that are put forward by these authors and further pursued in this paper are Regions' accessibility, Absorptive capacity and Diffusion of knowledge. The underlying logic of aforementioned authors is that these three dimensions are accountable for regions' technological change and innovation activities. Each dimension is examined through a number of relevant indicators constituting a coherent approach to the research topic. Some of these indicators are integrated also in this paper, while an additional selection of indicators rests of specifics of conditions setting and implementation of S3RC.

Importantly, the system of indicators is "wide" enough to encompass and pick-up variations in the systemic constitution of RISs and sectoral constitution of regional economies. In total, there are 25 indicators, drawing on various data sources, from publically available data, aggregated from county level and from firm-level data. A comprehensive overview of the system of indicators is given in Table A1. in the Appendix. Data are aggregated following the composition of Croatian regions based on RIS concept proposed in this paper. Indicators related to regional R&D scope, technological complexity of regional economic structure, and regional technological & scientific infrastructure will be used in assessing Region's accessibility. Absorptive capacity' indicators mostly represent the capacity of regional labour force to absorb the new technologies and knowledge that will eventually be translated into innovation and new products. Diffusion capability is assessed through regional competitiveness and internationalisation of regional economies indicators.

Some of the indicators are specifically included due to the post-transition context, including assessment of the regional economic structures beyond technologically most advanced groups as these (low-technology) industries often represent potent regional economic forces (i.e. industries that are "regional or national champions"), even in terms of S3RC implementation. Using various data sources, data availability problem at regional level were overcome.

3.3. Clustering

One of the methods to be used in this paper is clustering via Ward method. Ward method falls into hierarchical cluster analysis that builds hierarchies of clusters.

Cluster analysis will be performed using the following county-level variables: foreign direct investment (FDI) per capita, goods exports per capita, number of patents per 100.000 population, number of high-technology firms per capita per 100.000 population and gross domestic product (GDP) per capita. The method will be used with the purpose of discerning groups (or clusters) of counties that carry similar traits with regard to regional competitiveness (approximated with GDP per capita) and innovation potential (approximated with other variables).

4. The data and empirical results

At the relatively early stage of implementation of S3RC, selection of analytical methods in assessing possible avenues of S3RC influence to regional economies is rather limited. Additionally, data issues emerge as a further hindrance. To overcome these obstacles, many data sources that contain microeconomic data, sectoral data, macroeconomic data, spatial data and the relevant data on institutional activity are employed in the analysis with the purpose of providing a more complete overview of the regional conditions setting for S3RC implementation. Results of the applications of methods are presented in this section.

4.1. The data

Throughout this section data are presented following the previously outlined research design:

a) Mapping RIS is carried out using various data sources that contain mostly spatial, regional and microdata. The number of firms per counties in May 2016 was gathered from the Business Croatia database (BCD) and thus represent the latest data at the time of the writing of this article. Human resources data refer to the share of university-educated employees in legal persons in 2015, published by the Croatian Bureau of Statistics (CBS). Regional GDP data from CBS from 2014 are used to calculate the share of value added in county GDP (presented in Table 1). Institutional data that refer to the location and the number of different scientific and research organisations and public technological infrastructure organisations across regions are gathered from Croatian Scientific Bibliography database, Ministry of Science and Education and institutional web-sites.

b) The multidimensional framework rests on 25 indicators that are calculated using the latest available data from nine different sources, if organisational web-sites are not added to this number. The most important sources of data are State Intellectual Property Office, The Ministry of Finance, BCD, technology parks' institutional websites, Ministry of Science and Education, Ministry of Economy and Entrepreneurship, CBS, Croatian National Bank, Agency for Investments and

Competitiveness and Eurostat. Each indicator is complemented with the exact source of data in Table A1 in the Appendix.

c) Clustering is carried out also using few various data sources – cumulative data on regional FDI (1993-mid 2017) is taken from Croatian National Bank statistics, regional goods exports value (2016) and regional gross value added (2014) are calculated from CBS data, regional data on patents are compiled by State Intellectual Property Office and the number of legal business entities across technology groups (in 2016) are based on the data from Business Croatia database.

4.2. The empirical analysis

Results of applying three distinct methodological approaches are presented in the remainder of this section:

a) The identification of regions based on RIS concept across economic space

In this section, the concept of RIS is applied to Croatian economic space through mapping procedure. Earlier pan-European competitiveness and innovation reports (EC, 2014; JRC 2013) have ranked Croatian regions (at NUTS 2 level) as moderate to modest innovators. As regional innovation policy *per se* is not pursued, a question arises of its regional focus and borders would be if it were in place? Current focus of regional development policy are counties, but these units by definition do not meet RIS criteria. Furthermore, Bačić and Aralica (2016) find in their research of RIS in Croatia that that NUTS 2 level, which is used as a unit of comparison in cross-European regional competitiveness research, is not a "natural" regional economic unit to be considered when designing regional innovation policies and strategies in Croatia. In the context of S3RC, industrial and innovation policies, more obvious regional units emerge from firm and human resources agglomeration pattern and the pattern of technological-scientific infrastructure[4].

This line of reasoning is followed in this paper. The first step in the mapping procedure is to recognise the pattern of technological and scientific infrastructure and the associated capacities for innovation. Major universities, research institutes and technological parks, also the bulk of dynamic economic activity are located in several urban centres. When observing geography through these criteria, four regional urban centres emerge instantly and those are cities of Zagreb, Osijek (in the eastern part of the country), Rijeka and Split (in the south part of the country). City of Zagreb, the capital, is economic, cultural and administrative centre of the country and constitutes a county in its own right, while other cities-regional centres are a part of wider counties. Technological and scientific infrastructure are

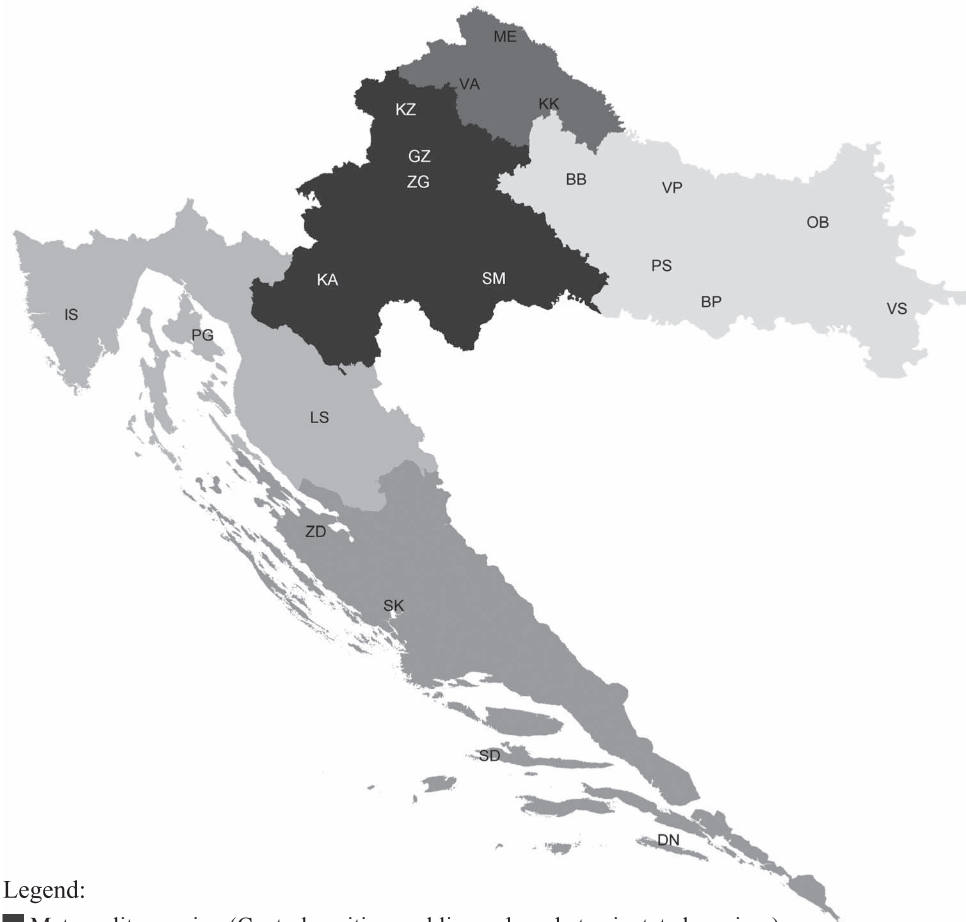
[4] Overview of regional technological infrastructure is given in the Appendix, in table A3.

important determinants in the mapping procedure also due to the fact that S3RC envisages improvement in science-industry collaboration. Additionally, a rather agile new centre can be recognised in the city of Varaždin in the north[5], with an emerging regional economy, a promising technology park established as early as 2003 and a new university in its region. A rather distinctive feature of Varaždin-centred region is the share of industry in its economy, mounting to nearly 40 percent (as can be seen in Table A2 in the Appendix), nearly 15 percentage points higher than the runner-up region.

In the second step of the mapping procedure, constituencies of regions are identified. In total, five urban centres represent centres of regions, while borders of these regions are defined through connectedness of surrounding counties to the core. Clearly, all urban centres have a larger share of services due to advantages arising from agglomeration. County economic structures are assigned to the core based on their proximity to the core (neighbouring counties are automatically signed to the regional core) and further choices are based on the similarity of other-than-the-core county economic structures. Similar sectoral shares (agriculture, industry, market services) across other counties are sought and assigned to the "regional core". Similarity is recognisable in distinctly larger shares of at least one of sectors. Using this logic, in total five regions can be recognised across Croatian economic space (Figure 1), with their constituencies (counties) and with well-defined borders. These regions will be the major unit of observation in further analysis. Regions are presented using typology based on geography and distinct sectoral-technologic traits provided in Table A2 in the Appendix and to some extent, in the spirit of Wintjes and Hollanders regional typology (2011).

[5] Bačić (2014) used sectoral specialisation and development levels of Croatian counties in an analysis of regional specialisation, found that in 2011 (compared to 2001) the northern counties appeared more homogenous and less dependent on the economic dynamics of the capital-city Zagreb.

Figure 1: Identified regions in Croatia and their constituencies (county abbreviations in brackets)



Legend:

- Metropolitan region (Central position, public- and market-orientated services)
- Skilled industrial Northern region (industry-orientated)
- Traditional coastal region (South, tourism-orientated)
- Skilled technology coastal region
- Traditional agriculture region (East)

Note: Abbreviations stand for counties (in brackets) – VA (C. of Varaždin), ME (C. of Međimurje), KK (C. of Koprivnica and Križevci), KA (County of Karlovac), SM (C. of Sisak and Moslavina), ZG (C. of Zagreb), GZ (City of Zagreb), KZ (C. of Krapina and Zagorje), BB (C. of Bjelovar and Bilogora), VP (C. of Virovitica and Podravina), PS (C. of Požega and Slavonia), OB (C. of Osijek and Baranja), BP (C. of Slavonski Brod and Posavina), VS (C. of Vukovar and Sirmium), IS (C. of Istria), PG (C. of Primorje and Gorski Kotar), LS (C. of Lika and Senj), ZD (C. of Zadar), SK (C. of Šibenik and Knin), SD (C. of Split and Dalmatia), DN (C. of Dubrovnik and Neretva).

Sources: The Authors' assessment based on Bačić (2014) and Bačić and Aralica (2016) *b) Effects of S3RC implementation for competitiveness and development of Croatian regions*

The accessibility-absorption-diffusion perspective is pursued in this section via use of most appropriate statistical indicators. The multidimensional system od indicators is built on and adapted from Wintjes and Hollanders' system of indicators (2011). Three dimensions are a larger frame of decisive factors of innovation activity and technical change. Regions' accessibility to knowledge is underlines issues of availability of infrastructure, connectivity and the institutional quality. Region's absorptive capacity is the capacity needed to absorb external knowledge (technology) and this capacity depends on regions' social, entrepreneurial and human capital and the industry structure. The regions' diffusion capability represents regions' regional and international inflows of knowledge and technology, in particular, high-technology products and machinery. (Wintjes and Hollanders, 2011)

Compared to the Pan-European research, in this paper "the post-transition", some economic specifics are considered in the choice of statistical indicators. Croatia is a small open economy where the appropriation of external knowledge largely depends on the internationalisation of its regional economies i.e. technology predominantly flows in mostly through trade activity and foreign direct investment (FDI). Furthermore, enterprises that are "national champions" can often be found in lower-technology manufacturing groups. Due to their capacities and widely defined priority domains (without pre-defining eligible sectors or industry branches) of S3RC, these enterprises may be eligible for S3RC financing. This is the reason why indicators are provided also for lower-technology groups. Multidimensional system of indicators elaborated in section 3. are applied to Croatian data and presented in Table A2 in the Appendix.

Variation in the value of indicators across all three dimensions is directly observable at regional level, justifying the necessity for considering the regional scope of S3RC implementation and its effects on regional competitiveness and development. Regional accessibility to knowledge varies immensely, both when using patents or indicators of enterprises density in different technology complexity groups. Metropolitan region is undoubtedly the core knowledge-economy region. An obvious advantage of this region is that its concentration of resources is incomparable to other Croatian regions.

Financing coming through S3RC is envisaged for firms launching products based on R&D. The source of this idea can be traced back to resolving the issue of rather low business expenditures on R&D (BERD) in Croatia, both when compared to the EU or benchmarking economies such as Slovenia (Kutlača, 2015) that shares a similar economic and political history to Croatia. Another problematic issue is that R&D financing is largely in the public domain, based on budgetary financing to the scientific sector. Given their technologically advanced economic structure, Metropolitan Region and Skilled Technology Coastal Region stand out as most likely candidates to benefit directly from S3 related financing.

Within S3RC a call aimed at financially supporting firms was opened in 2016 to support creation of new R&D-based products and services in priority domains and sub-domains. Financial support is provided for R&D activities, for first investments into material and non-material assets needed for R&D and for collaboration activities with the scientific community (MINGO, 2016, 2016a)[6]. The issue of strengthening business-science collaboration is further tackled within "Centres of competence" call opened for applications until the end of 2017. This programme aims at financing scientific and technological infrastructure and also at financing supporting collaborative projects. Both projects are expected to lead to structural changes in the Croatian economy, through diversification, transition or radical changes in the business sector.

The technological infrastructure is already in place across regions (Table A1 in Appendix), but S3RC document calls for further transformation of technological parks (TPs) towards full-fledged science-technology parks and recognises business incubators as having an important role. TPs have been established in Varaždin and Rijeka, while the City of Zagreb's TP has been established as early as 1993 and later transformed into Zagreb Development Agency. However, Zagreb's ambitions for an influential TP are slowly evolving and are to be realised through cooperation with major Zagreb-based research institutions. Rijeka is the only city that has established a Science and technology park (StepRi) that is integral to the University of Rijeka. Notwithstanding, the business-science cooperation and the expected knowledge transfer through TPs is evolving rather slowly, while firms' interest for TPs is notable, including foreign firms. The major Croatian universities have stepped up to the new phase of science policy orientation with the establishment of technology transfer offices in Zagreb, Rijeka and Split. The very first positive examples of university spin-offs are appearing and are well promoted to provide an impetus for further activity across university locations.

However, S3RC implementation requires alignment with its priority domains and this is turn calls for institutional specialisation instead of previously taken broad approach to supporting innovation potential. In the science sector, S3RC has served as a platform for the establishment of scientific centres of excellence (SCE) in Science, Technology, Engineering and Mathematics fields (STEM). In 2014 and 2015, after competing in a rigorous procedure that has included both national and international reviewers, in total 10 SCE proposals were accepted (Table A2 in the Appendix). Coinciding with the education and science reform, corresponding

[6] Financial support will range from 25.000 to 7.500.000 EUR per individual user in a project and projects are to be completed in three years. (MINGO, 2016a).

principles of the scientific excellence were applied in the case of SCE where only internationally recognised and prominent Croatian scientists could lead and take part in SCE. The regional distribution of SCE shows that Zagreb-based institutions (i.e. institutions in Metropolitan region) were most competitive in STEM fields with 7 elected SCE, while Rijeka, Split and Osijek have one SCE each.

The ability to appropriate external knowledge and technology varies immensely across regions. The absorptive capacity embodied in social capital can be observed through structures of regional labour force and regional economy sectoral structures. Traditional coastal region has the most favourable number of students graduated per 100.000 inhabitants (900), followed by Metropolitan region and Skilled technology coastal region (894 and 870, respectively). Skilled industrial Northern region and traditional agriculture region are least favourable in this respect (734 and 740 students graduated per 100.000 inhabitants, respectively). Again, a clear point of differentiation are economic structures of Croatian RISs that can be noted through their broad specialisation: a) regional economy dominated by market services (Traditional coastal region) or additionally driven by public services (Metropolitan region recognised as the central knowledge economy region); b) industry- and market services driven regional economy (Skilled industrial Northern region and Skilled technology coastal region) and c) regional economy with a distinctive share of agriculture (Traditional agriculture region).

The performance of regions can be observed through the third dimension, through the capability to diffuse knowledge and technology. This capability can be observed through competitiveness indicators and through the extent of internationalisation of the economic activity. Metropolitan Region and Skilled Technology Coastal Region are driven by larger productivity, as seen in overall level of gross domestic product per capita and in labour productivity in industry (at 42,092 EUR in Skilled Technology Coastal Region and at 32,644 EUR in Metropolitan Region). Metropolitan Region also takes lead in labour productivity in market services at 33,763 EUR per employee and is followed by Skilled Technology Coastal Region and Traditional Coastal Region (at 33,336 and 31,976 EUR per employee, respectively). Skilled Industrial Northern Region is also strongly positioned in labour productivity in industry and its exposure to internationalisation through goods exports is notable among all RISs (with 4,588 EUR value of goods exports per capita), followed by Metropolitan region (with 3,883 EUR value of goods exports per capita).

FDI can be observed as another route to internationalisation of regional economic activity. Using data on FDI cumulative value for 1993-2017 period, Metropolitan region is top positioned with 15,044 EUR per capita, and is followed Skilled Technology Coastal Region (7,109 EUR) and Traditional coastal region (3,647 EUR). Traditional agriculture region, profiled as a regional economy with a significant share of agriculture is least well positioned internationally, and also produces rather low per capita export (1,606 EUR) and attracts low FDI per capita value (966 EUR). However, specialisation in agriculture can be observed as a regional asset as it ranked as the most important FDI sector in this region. Expansion of financial intermediation based on FDI can be observed almost throughout all regions (except in Traditional agriculture region). Major FDI has flown mostly into low technology/medium-low technology activities. The structure of metropolitan region's FDI largely reflects the home market effect on the one hand, and traits of the core, visible also in the fact that major firms' headquarters are situated in Zagreb, the capital city. Two regions situated in Adriatic Croatia, Skilled Technology Coastal Region and Traditional Coastal Region, both have significant shares of FDI into intermediation in real estate.

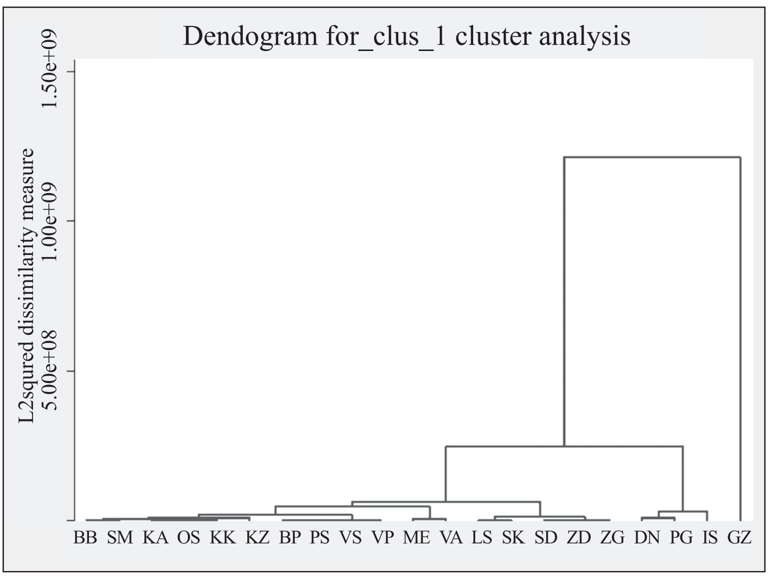
Clusters of Competitiveness (CCs) were mostly established throughout the year 2013. By 2016, there were in total 13 CCs covering different innovative industries and sectors, ranging from food processing industry to personalised medicine (list of CCs is provided in Table A3 in the Appendix). In the scope of their activities, they resemble more cluster initiatives rather than clusters. They are established as associations whose members are regional/local government, business clusters, enterprises and universities/research institutes, in line with the Triple Helix concept. The main goal of CCs is to strengthen competitiveness and excellence of sector/industry that it is representing by creating a network of relevant actors and pursuing various activities. In total, there are 346 members of CCs coming from the private sector, and more than half belong to Metropolitan region. Structure of Traditional agriculture region's members is striking as it reveals distinct specialisations of this RIS immediately – Wood processing and Food processing. Skilled Technology Coastal Regionand Traditional Coastal Region are specific for Maritime industry cluster membership.

c) The role of reliance on external R&D

A rather problematic issue for post-transition economies is the lack of own R&D in enterprises, as well as weak access to financing of these activities researched by Božić and Rajh (2016). This unfavourable circumstance is resolved through reliance on external R&D, and for post-transition economies, trade and FDI are channels of knowledge and technology flows. The goal of this research is to recognise the regional conditions that are conducive to maximising benefits of S3RC implementation and to enhancing regional competitiveness. Regions that were previously recognised through RIS concept consist of counties that are divergent in terms of the level of development, structural issues, geography and other factors. Overall result of these regions may be largely driven by their "core", a major city that represents the hub of the regional economic activity. Some of the recognised factors that may have significant influence to county innovation output may be examined outside RIS framework.

To pursue this proposition, cluster analysis via Ward method is employed. By applying the method, counties will be assigned to distinct groups (clusters) by their proximate characteristics (arising from relevant variables). S3RC is largely R&D driven, and to incorporate this aspect in the analysis, number of high-technology firms per 100.000 inhabitants is a relevant variable due to high R&D intensity of these firms, and the data are available for 2016. County competitiveness may be observed through the latest GDP per capita data, from 2014 (in EUR). Openness of counties to new technologies is integrated in the analysis with FDI per capita variable (in EUR, cumulative from 1993 to mid-2017) and with goods exports per capita variable (in EUR, in 2016). The innovation output is presumed to be well represented with county patents per 100.000 population. The result is graphically presented with a dendrogram, a tree diagram depicting clusters sorting (Figure 2).

Figure 2: Dendrogram for cluster analysis using Ward method



Source: Authors

Dendrogram shows that three major clusters or groups of counties can be discerned. The first one is the City of Zagreb as the knowledge-based urban economy. The second cluster consists of three coastal counties, two counties being from Skilled technology coastal region. All other (17) counties have fallen into the third cluster. Thus, further statistical analysis is based on three-cluster division in the interest of further differentiating the extent to which the country conditions may be conducive to enhancing regional competitiveness though S3RC funding programmes (Table 1).

Table 1: Clusters-summary statistics

Statistics \ Cluster	Cluster 1: "Most favourable conditions in place"	Cluster 2: "Favourable conditions in place"	Cluster 3: "Less favourable conditions in place"
Number of observations	1	3	17
Cluster members	GZ	IS, PG, DN	VA, ME, KK, KA, SM, ZG, KZ, BB, VP, PS, OB, BP, VS, LS, ZD, SK, SD
Mean value:			
Number of patents per 100.000 population in year 2012	274	110	61
Number of firms in HT, per 100.000 pop. in 2016	32	10	7
GDP pc, in EUR in 2014	17,908	11,816	7,362
FDI pc, in EUR (cumulative 1993-mid 2017)	25,522	7,027	1,687
Good exports, in EUR in 2016	5,071	1,704	2,177

Source: Authors' calculation

Values of statistical indicators across clusters (Table 1) show that counties that belong to Metropolitan region and Skilled technology coastal regions are most competitive and most open to international flows of investment and technology. Simultaneously, their innovation potential is most pronounced. Outstanding positions of these counties confirms the effectiveness of the multidimensional system of indicators' logic. By applying this system, City of Zagreb, County of Primorje and Gorski Kotar were already recognised as key knowledge-economy centres. The urban centres of other regions (cities of Varaždin, Osijek, Split) are found in the third cluster (Table 1), with lower openness and innovation indicators, despite similarity of their sectoral structures to Rijeka.

5. Results and discussion

The goal of this paper was to look closely into the possibilities for *regional* economic transformation through implementation of a *national* Smart specialisation strategy (S3) within a small post-transition economy – Croatia. The analysis employs the framework of regional innovation systems (RISs) as a broad policy approach that recognises configuration of various inter-connected actors that are jointly creating a system supportive of innovating activity within a spatially bound system, relying on a regional knowledge base. The advantage of this approach is that it implies that different systemic configurations may be in place, allowing a tailor-made policy approach to innovation. Conceptually, RIS is close to S3 in that it is a place-based approach, building upon economic assets/strengths and knowledge of regions. To the knowledge of the authors, this is the first paper dealing with the possible avenues of influence of S3RC implementation to regional competitiveness and the first one to use mapping procedure to discern regions based on RISs concept across space.

Importantly, using mapping procedure yields a finding that more "natural" regional units emerge as opposed to NUTS 2 level observed in pan-European research. These identified regional units may be described as space that is economically related to key regional "urban centres" and are constituted of several counties. Similar sectoral specialisation arises as a dominant feature of these units, and once patterns of established universities, research infrastructure and agglomeration of companies (as given elements of innovation system framework) are included in the mapping procedure, five regions based on RIS concept were identified. Using these systemic spatial units as observational units for examining effects of S3 implementation distinguishes this research from previously used approaches.

More developed regions with higher density of HT firms, higher value of goods exports and FDI per capita are found to produce more innovation output already. The leading regions are Metropolitan region and Skilled technology coastal region. This is strongly resonating with S3RC, as S3RC is aiming at raising the number of innovative products and services through available funds. This finding implies that regions with technologically more advanced economic structure and/or internationalised economic activity already have more favourable conditions in place.

This assumption was confirmed entirely outside RIS concept - via use of cluster analysis (Ward method). As identified regions are entities comprised of counties, in total 21 counties were sorted into distinct clusters in which cluster members share proximate characteristics of *innovation potential*, *development level* and *the intensity of internationalisation*. Clusters with higher innovation potential included the capital city-Zagreb (i.e. Metropolitan region, knowledge-economy region), members of Skilled technology coastal region-Country of Primorje and Gorski Kotar and Istria country. Additionally, Dubrovnik-Neretva county as a member of Traditional Coastal Region is also found to have favourable conditions for maximising benefits accruing from S3RC implementation. The proposition on the importance of internationalisation (Knell and Rojec, 2007) as channel of knowledge and technology flows in post-transition economies was also corroborated on county level. Greater level of internationalisation was associated with counties that add greater volume to county intellectual property.

The implications of the results arising from the analysis is that RISs can take on various configurations across regions. Factors such as more complex technological structure of the economy, well-developed scientific and technological infrastructure can be decisive for successful participating in S3RC implementation. Familiarity with traits of RIS would bring significant benefit to regional policy makers in tailoring regional development strategies – in particular in finding solutions to compensating for weak elements of RISs through supporting networking, attracting HT and MHT firms to the region, through attracting FDI, through providing scholarships for STEM students and similar actions.

6. Conclusion

Analysis based on and adapted from a larger framework of indicators has shown that even in the case of a small economy, vast economic, technological and social (in terms of absorption) variety can be found across regions identified using RIS concept. This type of indicators system, while being conceptually firmly grounded but methodologically simple, has shown comprehensive and effective in predicting innovation potential throughout RIS.

Working hypothesis on technologically advanced regional economic structure and internationalised economies as being success factors for accessing S3RC funds was confirmed both through the use multidimensional system of indicators and through empirical analysis. The indications on the key positions of Metropolitan region and Skilled Technology Coastal Region also confirm the hypothesis that regions with the strong urban centre are more likely to benefit from S3RC implementation partly due to their well-developed technological and scientific infrastructure and institutions that are expected to deliver work of scientific excellence and to collaborate with the industry on research, development and innovation.

The limitation of indicators system used in Croatian context are the usual limitations of cross-sectional data, and with only few regions based on RIS concept, the system lacks the ability to be used as base for determining statistical relations, but is instead indicating relations based on theoretical and conceptual framework. These shortcomings were partly overcome with the use of clustering method. On the other hand, advantages that arise from the use of the indicators' system is that it has been broad enough to allow for different configurations of regional systems. While some regions' central agent may be strong research infrastructure with its human capital or dynamic regional development agencies, in other regions central agents may be firms that are regional "champions", spearheading regional innovation. The configurations of these RISs certainly can be a line of future research arising from this paper. Another issue to be discussed are the limitations in the choice of indicators. Patents is one of the variables that is commonly used as an approximation of innovation performance, but in small economy post-transition setting with relatively weak access to finance for innovating firms, registering other types of intellectual property may prove a more viable solution. These limitations should certainly be considered in future research on RIS.

The scientific contribution of this paper can be found in providing indicators specifically arising from S3 implementation. The novelty of the research is also assessment of Croatian counties in terms of the internationalisation of their economic activity. This is important since some criticism is raised regarding participation of international companies taking part in S3 implementation in NMS of the EU, as being insufficient.

Implications can be drawn for regional, innovation and development policies. The paper certainly calls for a consideration of RIS concept in policy practice. In the context regional policy in a small economy, the concept of multiple regional "centres" and related economic space that differs in sectoral specialisation may be an interest avenue to purse. This calls for attention as duly promoted concept of "specialisation" is based on recognising regional assets and this idea is lost on NUTS 2 level. It is most obvious when observing "Continental Croatia" as NUTS 2 that encompasses highly developed, services-orientated City of Zagreb (centrally located) and the region of Slavonia, distinctive for its agricultural and food production specialisation (in the eastern part of the country). Specifics of these regions are lost to statistical averaging, and due to economic weight of more developed parts, true development stance of sub-regions is masked. Firstly, configuration of these RIS should be researched and innovation policy should consider these characteristics when designing and adapting policy framework.

Given the advantages of the technological structure of economic activities in two leading regions – Metropolitan Region and Skilled Technology Region, they are most likely to reap the benefits of S3RC implementation and provide an additional push for own regional competitiveness. This can certainly, to some extent, be "corrected" for by influential agents (e.g. regional "champions" or scientific or technological infrastructure organisations) in other regions as S3RC broadly defines priority areas and through value chain can include a variety of industries, but they are still less likely to compensate for advantages of the start position across more advanced regions.

There are many avenues for future research as S3RC implementation is a complex issue that involves many various innovation actors and various implementing authorities. Attractive lines of research in the future are microeconomic effects of S3RC implementation and the effects of S3RC implementation to the regional economic structures.

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Regionalna konkurentnost u kontekstu "Nove industrijske politike" na primjeru Hrvatske[1]

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Sažetak

Cilj ovoga rada jest istražiti koji su to regionalni uvjeti najpogodniji za maksimiranje pozitivnih učinaka provedbe "Nove industrijske politike" (politike zasnovane na Strategiji pametne specijalizacije) na regionalnu konkurentnost u Hrvatskoj. Umjesto uobičajenog korištenja sustava županija koji je poprilično fragmentiran, Hrvatska se kao post-tranzicijsko gospodarstvo u ovome radu prvo mapira u pet regija slijedeći koncepciju regionalnih inovacijskih sustava (RIS). Koncepcija RIS-a proizlazi od ideje da interakcije među regionalnim agentima vode stvaranju optimalnog inovacijskog outputa, dok je politika pametne specijalizacije u Hrvatskoj primijenjena kao nacionalna politika koja promiče stvaranje inovativnih proizvoda i usluga u pet obećavajućih tematskih područja i 13 pod-tematskih područja. Analiza u radu se provodi u dva koraka, prvo koristeći pristup koji se zasniva na upotrebi podataka u više-dimenzionalnom analitičkom okviru kojim se istražuju regionalna pristupačnost znanju, regionalni apsorpcijski kapacitet i širenje znanja u kontekstu provedbe Strategije pametne specijalizacije (SPS). U drugom se koraku ispituje pretpostavka o stvaranju inovativnih proizvoda temeljem eksternog znanja i tehnologije uz pomoć varijabli regionalna prisutnost visokotehnoloških poduzeća, BDP po stanovniku, međunarodna trgovina i strana ulaganja i patenti na 100.000 stanovnika koristeći pritom klaster analizu (Wardova metoda). Rezultati analize pokazuju da regije, koje su visoko-otvorene za međunarodnu razmjenu i u koje su pritekla značajna strana ulaganja, zatim u kojima je ujedno znatna koncentracija visoko-tehnoloških poduzeća već proizvode viši inovacijski output po stanovniku. S tim, već stečenim povoljnim uvjetima, velika je vjerojatnost da će te napredne regije vjerojatno dodatno ojačati svoje regionalne prednosti transformacijom svojih ekonomskih struktura koju omogućuje provedba SPS.

Ključne riječi: *pametna specijalizacija, regionalni inovacijski sustavi, regionalna konkurentnost*

JEL klasifikacija: *R11, O30, F63*

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Appendices

Table A1: Framework for assessing regional accessibility, absorption and diffusion in the context of Smart specialisation strategy

Dimension 1. "Accessibility to knowledge"

at regional level		
Indicator	Description of the indicator	Source of data
1.1. Research&development		
Patent applications per 100.000 inhabitants	Cumulative over the period 1996-2012.	State Intellectual Property Office.
No. of firms per 100.000 inhabitants.	*Number of active legal entities (in 2016) in the technology groups (OECD classification):*	
HT manufacturing (NACE rev. 2007: 26, 21)	High-technology manufacturing.	Business Croatia database.
MHT manufacturing (NACE rev. 2007: 20, 27, 28, 29, 30)	Medium high-technology manufacturing.	Business Croatia database.
MLT manufacturing (NACE rev. 2007: 19, 22, 23, 24, 25, 33)	Medium low-technology manufacturing.	Business Croatia database.
LT manufacturing (NACE rev. 2007: 10-18, 32, 33)	Low-technology manufacturing.	Business Croatia database.
Knowledge-intensive market services (NACE rev. 2007: 51, 51, 69-71, 73-74, 78, 80)	Knowledge-intensive market services.	Business Croatia database.
Knowledge-intensive HT services (NACE rev. 2007: 59-63, 72)	Knowledge-intensive high-technology services.	Business Croatia database.
Scientific R&D services (NACE rev. 2007: 72)		Business Croatia database.
1.2. Technological infrastructure		
Technology parks (technological infrastructure)	List of technological parks.	Technology parks' institutional websites.
Scientific centres of excellence (STEM)	Number of the scientific centres of excellence (in the fields of STEM) in 2016.	Ministry of Science, Education and Sports.
Applications for funding of Centres of competence (S3)	Number of pre-selected applications for public funding of Centres of competence in 2017.	Ministry of Economy.

Dimension 2. "Absorption capacity"

at regional level		
Indicator	Description of the indicator	Source of data
Students graduated, per 100.000 inhabitants	Students graduated, by their residence.	CBS.
Skilled labour	Share of employees in manufacturing industry with non-university degree (unqualified and semi-qualified workers are not included) in the in legal persons in 2015.	CBS.
Human resources	Share of employees with University education in legal persons in 2015.	CBS.
Share of value added in regional GDP:	In 2014.	
- agriculture	In percent.	CBS.
- industry	In percent.	CBS.
- market services	In percent.	CBS.
- public services	In percent.	CBS.

Dimension 3. "Diffusion capability"

at regional level		
Indicator	Description of the indicator	Source of data
3.1. Competitiveness indicators		
GDP pc, in EUR	Gross domestic product per capita in EUR in 2014	CBS.
Labour productivity in industry	Value added in manufacturing (B,C,D,E) per employee, in EUR in 2014	CBS.
Labour productivity in market services	Value added in market services (F, G, H, I, J, K, L, R, S, T, U) per employee, in EUR in 2014	CBS.
3.2. Internationalisation of economic activity		
Goods export pc, in EUR	Goods export value per capita, in EUR, in 2016	CBS.
FDI pc, in EUR	Foreign direct investment per capita, cumulative value 1993-mid-2017, in EUR	Croatian National Bank.
The largest volume of FDI per sectors	FDI at NACE 2-digit level	Croatian National Bank.
Clusters membership (S3RC)	Number of members from the business sector in the established Clusters of competitiveness of the Croatian economy in 2017.	Agency for Investments and Competitiveness.

Table A2: Indicators based on the framework for assessing regional accessibility to knowledge, absorption capacity and diffusion capability in the context of Smart specialisation strategy

Dimension 1. "Accessibility to knowledge"

Indicator \ Region	Metropolitan region	Skilled Industrial Northern Region	Traditional agriculture region		Skilled technology coastal region	Traditional Coastal Region
1.1. Research & development						
Patent applications per 100.000 inhabitants	158	105	58		139	78
No. of firms per 100.000 inhabitants:						
HT manufacturing	22.6	11.6	4.9		12.1	8.5
MHT manufacturing	49.3	34.4	14.7		53.0	30.3
MLT manufacturing	106.2	100.8	51.4		136.0	79.7
LT manufacturing	140.4	118.7	75.9		118.2	95.0
Knowledge-intensive market services	589.7	193.2	125.0		456.3	306.9
Knowledge-intensive HT services	189.7	62.2	31.8		90.2	55.0
Scientific R&D services	12.3	2.7	2.1		6.3	3.0
1.2. Technological infrastructure						
Technology parks	RAZA-TP Zagreb	TP Varaždin			Step Ri	
Scientific centres of excellence (STEM) (details in table A4. in the Appendix)	7	0	1		1	1
Applications for funding of Centres of competence (S3RC)	15	2	5		4	8

Source: Authors' calculation and compilation of data

Dimension 2. "Absorption capacity"

Indicator \ Region	Metropolitan region	Skilled Industrial Northern Region	Traditional agriculture region		Skilled technology coastal region	Traditional Coastal Region
Students graduated, per 100.000 inhabitants	894	734	740		870	900
Skilled labour	12.0	32.0	16.8		11.9	8.7
Human resources	26.3	14.7	20.1		21.3	22.5
% share of value added in regional GDP:						
- agriculture	1.6	7.9	14.1		2.0	2.9
- industry	20.3	39.7	21.9		25.6	11.1
- market services	52.4	35.1	40.5		53.8	61.9
- public services	25.7	17.3	23.5		18.6	24.1

Source: Authors' calculation and compilation of data

Dimension 3. "Diffusion capability"

Indicator \ Region	Metropolitan region	Skilled Industrial Northern Region	Traditional agriculture region	Skilled technology coastal region	Traditional Coastal Region
3.1. Competitiveness indicators					
GDP pc, in EUR	12,917	8,548	6,685	12,198	8,257
Labour productivity in industry, per employee in EUR	32,644	24,043	22,496	42,092	19,577
Labour productivity in market services, per employee in EUR	33,763	25,938	29,913	33,336	31,976
3.2. Internationalisation of economic activity					
Goods export pc, in EUR	3,883	4,588	1,606	2,173	909
FDI pc, in EUR	15,044	1,593	966	7,109	3,647
The largest volume of FDI per sectors	M. of coke and ref. petr. products	Finan. intermed.	Agriculture, hunting and related services	Financial intermediation	M. of other non-metallic mineral products
	Financial intermediation	Textile manufac.	M. of cellulose, paper and paper products	Intermediation in real estate	Financial intermediation
	Wholesale trade and intermediation in trade	Manufacture of leather and related products	M. of other non-metallic mineral products	Real estate equity	Intermediation in real estate
Cluster membership (S3RC)	198	20	56	38	34

Source: Authors' calculation and compilation of data

Table A3: Innovation infrastructure in Croatian RISs

Infra-structure / Region	Technology parks (TP)	Technology development & transfer centres and related institutions	Technology transfer offices (TTOs) at Universities	Business incubators providing technology and know-how transfer services
Metropolitan region	Zagreb TP - RAZA since	– Technology transfer Centre at Faculty of Mechanical Engineering and Naval Architecture, University of Zagreb – Ruđer Innovation	Centre for Research, Development and TT at University of Zagreb	
Skilled Industrial Northern Region	TP Varaždin	Technology Innovation Centre Međimurje, Regional development agency Međimurje		
Traditional agriculture region		Technology development centre TeraTehnopolis, Osijek		– Business incubator BIOS, Osijek – Business-technology incubator, Industrial park Nova Gradiška
Skilled Technology Coastal Region	The Science and TP of the University of Rijeka – Step Ri	– Technology-Innovation Centre of Rijeka – The Research Centre for Material in the Region of Istria – METRIS, Istrian Development Agency (2009)	TTO – University of Rijeka	
Traditional Coastal Region		– Technology centre Split – Mariculture Business Innovation Center of the University of Dubrovnik – MARIBIC	TTO – University of Split	

Source: Authors using Business Croatia and institutional web-sites

Table A4: Centres of Scientific excellence across Croatian RISs

Metropolitan region 1. Center Of Excellence For Advanced Materials And Sensing Devices 2. Scientific Center of Excellence for Reproductive and Regenerative Medicine 3. Scientific Center of Excellence for Biodiversity and Molecular Plant Breeding 4. Scientific Centre of Excellence for Marine Bioprospecting 5. Scientific Center of Excellence for Quantum and complex systems and representations of Lie algebra 6. Research Centre of Excellence of Fundamental Clinical and Translational Neuroscience 7. Scientific Center of Excellence for Science Data and Cooperative Systems
Skilled Industrial Northern Region -
Traditional agriculture region
Skilled technology coastal region Scientific Center of Excellence for Viral Immunology and Vaccines
Traditional Coastal Region Scientific Center of Excellence for Science and Technology – STIM

Source: Authors using information from Ministry of Science and Education

Table A5: List of Competitiveness Clusters (CC)

1.	Food processing industry
2.	Wood processing industry
3.	Automotive industry
4.	Creative and Cultural industries
5.	Textile, Leather Goods and Footware industry
6.	Defence industry
7.	Construction industry
8.	Electrical and Mechanical Machinery industry and Technology
9.	Medical industry
10.	Chemical, Plastics and Rubber industry
11.	ICT industry
12.	Maritime industry
13.	Personalized Medicine

Source: Authors using information from Agency for Investments and Competitiveness