

D4.3 SEARCH DERIVERABLE

Policy implications from the research on the future impact of strengthen innovation diffusion and knowledge flows within EU territories and ENC and on the evaluation of instruments for favouring future integration and cohesion through the diffusion of innovation

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Deliverable 4.3. Policy implications from the research on the future impact of strengthening innovation diffusion and knowledge flows within EU territories and ENC and on the evaluation of instruments for favouring future integration and cohesion through the diffusion of innovation¹

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1. Introduction

The **SEARCH project** is aimed at analysing the impact of the European Neighbourhood Policy (ENP) on the integration of the neighbouring countries with the EU with respect to several areas, such as trade flows, people mobility, human capital, technological activities, innovation diffusion and institutional environment.

Within this framework, the Work Package 4 focuses on the innovation diffusion issue and the increasing importance of technological networks which implies interactions among agents located in different geographical areas. The theoretical literature has largely analysed the characteristics of the network structure and their consequences on knowledge diffusion. It has also been noticed that previously separated regions and countries are not easily penetrated by knowledge flows or by the diffusion of innovative impulses, primarily because their flow depends heavily upon trust among the participants. The high-value attached to tacit exchanges is a reflection of their exploitation potential in commercialized goods and services, but tacit diffusion requires sufficient periods of prior engagement and integration before building a cross-border innovation system. This raises the question of how newly engaged agents in previously separated territorial units, for instance in the NCs, eventually become able to

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exchange and exploit innovative ideas and opportunities together (Lundquist and Trippi, 2009; Trippi, 2009). From all these considerations it is clear why in the last years the analysis of innovative activities (such as R&D expenditure and patents) has been integrated with a detailed investigation into the different types of interactions (such as patent citations, patent co-inventorships FP partnerships; R&D collaborations, firms' technological alliances) among firms and other institutional actors.

The aim of this report is to shed light on the policy implications related to the investigation on the innovative performance of countries and regions in the European Union (EU27) and in the 16 European Neighbouring Countries (ENC). More specifically, empirical analysis has been aimed at understanding to what extent this performance depends on the one hand on the endogenous ability in knowledge creation and on the other hand on the absorptive capacity to adopt and imitate other regions' innovations taking advantages of various form of research and technological networks. The research effort collects 28 working papers, linked to 5 different tasks, analysing several aspects on this topic.

Main results highlight the important role of knowledge diffusion and research networks by enhancing the innovation endowment of regions for both EU countries and ENC. All indicators confirm the large gap between EU countries and ENC and the great heterogeneity among ENC with the only exception of Israel. The low levels of literacy and schooling rates have been one of the most crucial obstacles in these countries. Also when we look at the productive structure, we observe a great heterogeneity among countries and such a gap is even greater in terms of technological activity and performance. The great diversity of regions and nations does not only result from their development level or endowment in resources for innovation; it also results from their highly heterogeneous efficiency in exploiting these resources.

Great attention has been devoted to the determinants of innovation. Among them, the potential of manufacturing activities and formal R&D expenditure remain influential factors of the capacity of regions/nations to innovate. Moreover, our results confirm the widespread consensus that the transfer of knowledge is significantly favoured not only by spatial closeness among agents involved in the innovation process, but also by the intentional relations they develop within a-spatial networks, such as those shaped by institutional, technological, social and organizational links. In the case of innovation adoption, its main determinant is cooperation and a key role seems to be played by the level of trust among people within each country, by the improvement of communications and simplification procedures, as well as by high educational levels. Competition has been identified as another factor that affects, although to a much lesser extent, product innovation adoption directly acquired from external firms.

The presence of a-spatial relationships like institutional, historical, cultural, cognitive, social and organizational links has been proved to facilitate also the exchange of knowledge fostering innovation diffusion and the creation of research networks. Results from the CIS suggest that developing countries (the EU12) generate innovation and may contribute to the overall knowledge space but they need to increase their export exposure and their internal level of knowledge to foster the ability to generate innovation and adopt existing technologies at the same time. Looking at the cross border knowledge flows, it appears that the degree of internationalization of innovative activities is extremely limited among countries which have a

very different economic background and level of development. Nonetheless the relationships are increasing along time and especially the largest countries, are becoming important partners for the European countries. Results show also that firms' agreements represent an important channel of knowledge exchanges generated along the variety of activities carried out before, during and after the deal. If we focus on cross-border innovation cooperation of the Russian firms, a detailed study survey indicates that the economic interactions among Russian and EU firms are still predominantly determined by traditional channels of export and import. Despite a certain improvements in terms of international trade and technology transfer since the beginning of transition to market economy in Russia, there are still relevant improvements which can be made to reinforce the collaboration among EU and Russia in terms of science, technology and innovation activities.

Regarding the impact of R&D collaboration on regional innovation performances, the results point to positive and significant impact, but this impact is not systematic. The results related to the knowledge production function including both spatial and relational neighbourhoods suggest that external knowledge matters for innovation and additionally they show that two different types of neighbourhoods play an equally important role as a source of external knowledge. In addition, results show that the EU policy implemented through the Framework Programme appears as an effective way to diffuse knowledge among European regions. The study also reveals that although the effect of contemporaneous flows from neighbours is small in magnitude, they are in play in time because evidence is found on the effect of past inventive activity on the current inventive activity. This highlights the necessity of considering dynamic effects for a more a proper assessment of the importance of knowledge flows from neighbourhoods. But the positive impact of inter-regional flows of knowledge is not systematic. Peripheral regions (in geographical terms as well as in relational terms) remain weakly integrated into these global networks and thus suffer from a difficulty to access external knowledge.

In conclusion, for the neighbouring countries the prospective of cross border knowledge flows due to inter firms agreements, innovation networks and research program cooperation is very important and potentially rewarding. However the ENC still face some difficulties and impediments in getting engaged with appropriate knowledge bases and to thus take a full advantage of these potential benefits due to the presence of large differences in terms of institutional, cultural, social and economic risk factors.

2. Policy aspects of research results

In order to achieve all the objectives of the SEARCH project, the effort made by the researchers involved has been twofold. First, the scientific contribute has been highly significant with the production of a large number of scientific contributions. Moreover, taking into account one of the main objective of the project, each scientific contribution has also developed some policy elements in order to provide useful policy suggestions to policy makers and social stakeholders, such as NGOs, associations and networks working in fields closely related with neighbouring countries.

In the case of Workpackage 4, great attention has been devoted to the policy actions required for the development of international S&T and innovation cooperation as an important part of

the European Neighbourhood Policy. In the following sections, we will try to summarise the policy suggestions distinguishing three main topics strictly linked to the scientific results.

The determinants of innovation - Among We have classified the traditional determinants of innovation on the basis of their efficiency in enhancing innovation in ENC. This result is of great importance because, in terms of EU Neighbourhood policy, it could help policy makers to choose the most efficient tool to support the easiest growth path. The first general policy advice is that regions and countries still need to focus on actions aimed at **increasing the endowments of well-educated labour force**, given their strong and pervasive role in determining **both** the internal creation and the external absorption of knowledge. The impact of graduates on innovation activities is much stronger than formal R&D expenditures. Moreover, results highlight the existence of several channels of interregional spillovers and externalities, which calls for a **coordinated strategy able to attain the optimal social outcome with differentiated interventions**. It is increasingly clear that there is no “one size fits all” policy and that heterogeneous regions need to set different targets to be achieved with diverse instruments. Strategies which recognize that each region innovation potential is unique because of different geographical, cognitive, social, institutional and organizational structures and networks, and each region requires specific local platform policies based on differentiated knowledge structures.

By analysing the determinants of innovation, we also focus on the effects of the increasing internationalisation on innovation, technological upgrade and productivity of manufacturing firms in Russia. As a matter of fact, Russia and the countries of Eastern Europe and Central Asia are important partners of the European Union for the political, economic and social development. Countries of Eastern Europe and Central Asia have particular potentials in terms of existing research capacity in a variety of scientific disciplines and therefore there is a strong bilateral interest in enhancing the S&T cooperation. This analysis suggests that **Russia should reveal the potential of internationalization to stimulate industrial innovation through effective policy making and institutions building and trade costs should be lower** in order to increase firm productivity gains in manufacturing. The case of Russia could be an example of efficient EU neighborhood policy for countries aiming to increase the innovation endowment and diffusion.

The empirical analysis investigates also on cross-border cooperation increasingly focusing on the case of Russia. Results suggest that **one of the main factors hampering development of cross-border cooperation is the limited scope of innovation activity in Russian economy accompanied with low role of innovation as the factor of competitiveness and short horizon of planning** (more than 60% of firms consider the appropriate time span of process innovation development to be one year). Thus, the **most efficient way to foster international collaboration is to improve the framework conditions for innovation** attracting more resources and competences into this area of activity. This is a clearly recognized objective for Russian Government reflected in a number of recent strategic documents of different level, but still the challenge is far from accomplishing. From the account of other actors, the success could be associated with wise integration accompanied by clear and feasible objectives as well as readiness to act as a risk-taker or at least efficient risk managers. At present, **there remains high demand for the intermediary platforms of different kinds, aimed at informing potential**

partners on the allocation of the available skills (as well as technological expertise) and market capacities in both Russia and EU.

All these results suggest that it is important to elaborate relevant policies and instruments in order to **overcome administrative barriers making trans-national S&T cooperation difficult** (visa, taxation, customs duty, intellectual property rights, etc.). Moreover, it could be recommended to **improve the legal basis for cooperation** (agreement between country partner and the EU in science, technology and innovations). There is no S&T agreement signed between the EU and some of EECA countries. It could be recommended to consider an opportunity and rationality to conclude separate S&T agreements between the EU and some of EECA countries in addition to existing PCA. Agreements open wider opportunities for cooperation. The existence of the S&T agreement provides a balanced legal basis for the cooperation in specific area of mutual interest. It provides a flexible framework for developing cooperation, including the area of research-based innovation.

Furthermore, the EU **should provide more instruments for wider involvement of EECA countries to the programmes of RTD international cooperation** (e.g. Horizon 2020 and others). At the same time **EECA countries should consider a provision of EU scientists with an opportunity to open access to its S&T programmes.**

The investigation has also concerned the role of **incubators and technoparks**. One of the most important questions regarding them relates to their effectiveness as a regional and local development strategy that might achieve economic growth and social cohesion among the peripheries of developed countries. This is an important issue as regional development and cohesion is the umbrella concept used by the EU and member states to support the increasing amount of funds directed towards the development of incubators. In line with this view, the analysis aimed at verified if incubators might contribute to regional performance, subject to the existing regional endowments base. The main policy implication of this comparative research in the EU27 and NC16 member countries is that **different countries place emphasis at different instruments, depending on their endowments**. Therefore, the successful performance of technoparks, which are the focus of Northern European countries, requires a richer background as regards knowledge creation and the institutional environment to support the generation, diffusion and commercialization of knowledge. On the other hand, Eastern and Southern European countries seem to reasonably place increased emphasis on the development of business incubators. Obviously, the latter require fewer endowments compared to technoparks.

Diffusion of innovation and research networks - Results about the **diffusion of innovation and research networks**, have shed light on the importance of **past relationships among countries**. The presence of a-spatial relationships like **institutional, historical, cultural, cognitive, social and organizational links** has been proved to facilitate also the exchange of knowledge fostering innovation diffusion and the creation of research networks. Also in this case this result should be taken into account if the goal is to make easier the innovation diffusion process. As a matter of fact, such a diffusion can be enhanced when economic agents in different context can communicate more easily and reduce knowledge barriers, either

tangible or intangible. In other words, proximity among agents and firms can lessen transaction costs and facilitate knowledge transmission. In this sense results suggest that **policy makers should promote mutual knowledge of cultures and languages among EU countries and ENC** in order to encourage the intensification of partnership. Useful tools could be student mobility but also the enhancement of **mutual knowledge of cultures and languages among EU countries and ENC** in order to encourage the intensification of partnership and intellectual property collaborations.

Also looking at flows of knowledge generated by inter-firm agreements, results suggest that proximities and network features play a composite role in driving the complex diffusion of knowledge. As knowledge flows between EU and ENC countries are concerned, **the most important factors are still given by geographical proximity (which is difficult to be influenced) but also by technological proximity**. In particular, the importance of the technological space implies that regions and countries should focus on the creation and strengthening of relationships along common cognitive and technological trajectories. **Policies should support the formation of specialised networks among firms which go beyond the geographical clusters**. Moreover, despite the modest influence of social proximity, the relative importance of network links is evidenced by the presence of preferential attachment and transitivity effects. More specifically, the significance of the other types of proximities, such as institutional and organizational, leaves some space for policy interventions which act directly on moderating the effect of such distances. In particular, **financial and technical support for firms aiming at widening their spectrum of potential partners may be an good option to overcome high entrance costs in the international scenario**. These policies, which help firms to start establishing some form of international links, are aimed at facilitating other potential agreements and exchanges in the future.

In this framework, we were interested to observe the role played by inventors' cross-regional mobility and collaborations in fostering knowledge diffusion across regions and subsequent innovation. The empirical analysis support the hypothesis concerning the importance of collaborations and, to a lesser extent, of labour mobility as the means fostering the geographical diffusion of knowledge highlighting that greater geographical as well as cognitive distances between two regions tend to hamper knowledge workers' mobility. The importance of R&D policies has already been underlined by the target of the Lisbon strategy, whereas for diffusion policies remain a further need for action for policy makers. **Knowledge externalities flow easily among regions whose individuals are in contact thanks to the mobility of skilled workers or thanks to technological collaborations**, irrespective of their geographical proximity, and so, policies with this target seems to be well founded. Hence, from a policy perspective, these results illustrate that, not only R&D and human capital efforts are important to generate innovations at the regional level, but also the degree of connectivity of agents with the outside world, which give them access to global knowledge hotspots is useful for innovation, supporting also results on the importance of level of education and institutional, historical, cultural, cognitive, social and organizational links in order to make easier innovation diffusion.

Another result to be stressed from the point of view of the policy impact is the one related to the **EU policy implemented through the Framework Programme**. Results show that **it appears as an effective way to diffuse knowledge among European regions**. But our results also suggest that the positive impact of inter-regional flows of knowledge is not systematic. **Peripheral regions** (in geographical terms as well as in relational terms) **remain weakly integrated into these global networks and thus suffer from a difficulty to access external knowledge**. Thus, if we consider ENC regions close to the peripheral ones, we should take this result into account by considering and organising the participation of extra-EU institution into Framework Programme as a mean to diffuse knowledge. Focusing on Neighbouring regions and on the basis of an empirical analysis about the relationship between interregional knowledge flows and productivity of research at the regional level, it is possible to state that **those EU neighboring country regions where good quality universities and public research institutions are located could potentially build research collaboration networks competitive with networks maintained by many European regions**. Thus **intensifying the participation of neighboring countries in EU Framework Program funded research projects could result in an increase in research productivity of those neighboring country regions where already substantial research capacities are built at local universities or public research facilities**. This increased research productivity might later form the basis of regional economic development policies taking advantage of potentials accumulated at their higher education institutions or public research institutes. Policies aiming at attracting private research labs of industries closely related to the region's research specialization paired with suitable complementary interventions (such as building up human capital assets in the region or physical infrastructure development) could potentially initiate a longer run cumulative process that possibly ends up in a substantial regional industry concentration.

By looking deeper at the effect of participation in FP projects and the resulting knowledge flows on regional patenting activity, results suggest that while for regions in old EU member states FP research subsidies seem to act as a substitute for funding from other sources, innovation in CEE Objective 1 regions tends to rely more on external knowledge transferred from FP funded research networks to compensate for their less developed local knowledge infrastructure. Findings are important as they suggest that **strengthening research excellence and international scientific networking in relatively lagging regions (such as regions in CEE and ENP countries) could be a viable option to increase regional innovativeness**, which in combination with other policies could form a base for a systematic support of regional development.

The innovation adoption process - In order to shed light on the way territories increase their innovation endowment, the empirical analysis has also focused on the innovation adoption process. Results highlight that countries which display the highest level of innovation are also those which show the highest adoption rate and conversely countries with weak capacity to innovate are also weak adopters. Thus, **the complementary dynamics linking innovation and adoption seems to be at work**. However exceptions exist which are certainly not to neglect if we are to understand how countries can react to European incentives. These exceptions are Luxemburg which displays low level of adoption compared to their innovative capacities, and Slovakia, Hungary and Latvia which have a very high rate of adoption compared

to its rate of innovation. In this last group of countries (Easter and Baltic countries), acting towards a better integration to the EU, using the **policies oriented to reinforce the Internal Market may permit to increase their capacity to adopt innovation**. We should underline however that **such a policy might have no effect if it is not accompanied by actions aiming at reinforcing the own innovative potential of these countries in order to boost their absorptive capacity**.

In any case, the analysis on European regions stresses that **the main determinant of innovation adoption is cooperation**. In particular, a key role seems to be played by the level of trust among people within each country, by the improvement of communications and simplification procedures, as well as by high educational levels. Therefore, **policies contributing to reinforce social trust within/across countries especially through “communication and simplification procedures”** (within the broadest proxy for “regulatory and administrative opacity”) **are likely to develop cooperation among firms and consequently to achieve higher levels of diffusion/adoption**. Strengthening human capital also appears as an efficient way to enhance cooperation and consequently innovation adoption.

Moreover, we study the pre and post EU enlargement framework as the closest example of what could happen in the future if the EU would further extend toward east and south, involving EN countries. Main results suggest that if **FDI policies** that bring innovative firms to ENP countries **will stimulate new innovative practices**. Expanded trade and mobility policies can also be expected to contribute to an expansion of patenting activity. The effects of several ENP initiatives will influence which ENC regions can take fullest advantage of potential knowledge flows within relevant citation exchange communities.

Focusing on ENC, results suggest that while EU accession countries rapidly established important links to patented knowledge bases in the EU15, the ENC regions, over the last 30 years, appear to have steadily lost such knowledge linkages with the EU15, North America, Japan, and even within ENC regions. The sole exception is a very slow growth of knowledge linkage with the EU accession countries from an extremely small base. **Much more effort will be required to enable ENCs to adopt and incorporate external patent knowledge into the design and production of important goods and services**.



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