

Facilitating Effective Science-Industry Collaborative Research: A Literature Review

RESEARCH ARTICLE

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Abstract

Existing research indicates that science-industry collaborative research might be a powerful source of innovation and an important factor of high innovation performance and economic growth. Although a number of public policy initiatives promote collaborative research, its potential is still not being adequately reached. This paper presents a review of existing literature on science-industry collaborative research. It elaborates and discusses motives and determinants of collaborative research, and identifies obstacles to joint science-industry research, from both the companies' and public research organizations' perspective. Based on the literature review, the paper provides recommendations for innovation policies.

Keywords: innovation, science-industry link, collaborative research, knowledge and technology transfer

JEL classification: O31

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1 Introduction¹

Cooperation between science and industry (hereafter *S-I collaboration*)² is one of the most important elements of the innovation system and a factor that could lead to high innovation performance, company success and economic growth (OECD, 2002; Fontana, Geuna and Matt, 2006; Azagra-Caro, Carat and Pontikakis, 2009; Muscio, 2010; Arvanitis, Kubli and Woerter, 2011; Arza and López, 2011; Ankrah et al., 2013). S-I collaboration is increasingly seen as a driver of innovation through knowledge exchange (Ankrah and Al-Tabbaa, 2015), and as such it is in the focus of innovation policies in EU countries (Perkmann and Walsh, 2007; Švarc, 2011; Švarc and Dabić, 2017). Although a number of public policy initiatives promote S-I collaboration (Radosevic, 2011), its potential is still not being adequately reached, especially in less developed economies (Kalar and Antončič, 2015). There is a consensus that S-I cooperation needs to be improved, and knowledge and technology transfer has to be intensified (Arvanitis, Kubli and Woerter, 2011).

S-I collaboration has attracted considerable attention in academic literature (Bučar and Rojec, 2015). Although S-I interactions have been explored from different perspectives (D’Este and Patel, 2007; Perkmann and Walsh, 2007; Raesfeld et al., 2012), accumulated knowledge on this topic is still fragmented (Ankrah and Al-Tabbaa, 2015). Among S-I interactions, collaborative research between science and industry is one of the most important and effective channels for conveying scientific knowledge to industry (Roessner, 1993; Schartinger, Schibany and Gassler, 2001; Perkmann and Walsch, 2007). Collaborative research is the research where several parties are engaged in achieving shared objectives and collectively build on their individual backgrounds in the creation of new knowledge. That research includes collaboration between universities and public research organizations on the one hand, and industries, small and medium

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² University-industry collaboration refers to any type of cooperation between universities, their researchers and companies in order to jointly develop new goods/services or improve existing goods/services.

of collaboration in several ways. These differences include higher risk and uncertainty related to research agreements due to more ambitious research targets, and a higher rate of unpredictability of outcomes and activities. The management and planning of joint research activities is more challenging as well (Siegel, Waldman and Link, 2003; Morandi, 2013).

This paper could be interesting to researchers and policy-makers in Croatia since there are few studies by Croatian authors that have examined S-I linkages (e.g., Švarc, Grubišić and Sokol, 1996; Švarc and Lažnjak, 2003; Švarc, 2014; Radas and Vehovec, 2006; Radosevic, 2011; Jeleč Raguž, Budimir and Letinić, 2015). At the same time, the efforts of the Croatian government to establish a proper framework for S-I cooperation have not yielded expected and visible economic effects. S-I collaboration is weak⁴, and public R&D infrastructure is not adjusted to firms' technology upgrading needs (Račić, Radas and Rajh, 2004; Radas, 2005; Švarc, 2014; Radosevic, 2016).⁵ As Croatia is currently in a transition stage towards innovation-driven growth (Radosevic, 2011), more understanding is needed on how to strengthen S-I collaborative research.

The paper is organized as follows. Section 2 presents the methodology. Section 3 examines the factors that drive S-I collaborative research from the companies' viewpoint, while section 4 deals with S-I collaborative research issues from the public research organizations' point of view. Section 5 concludes the paper with main implications and recommendations for innovation policies.

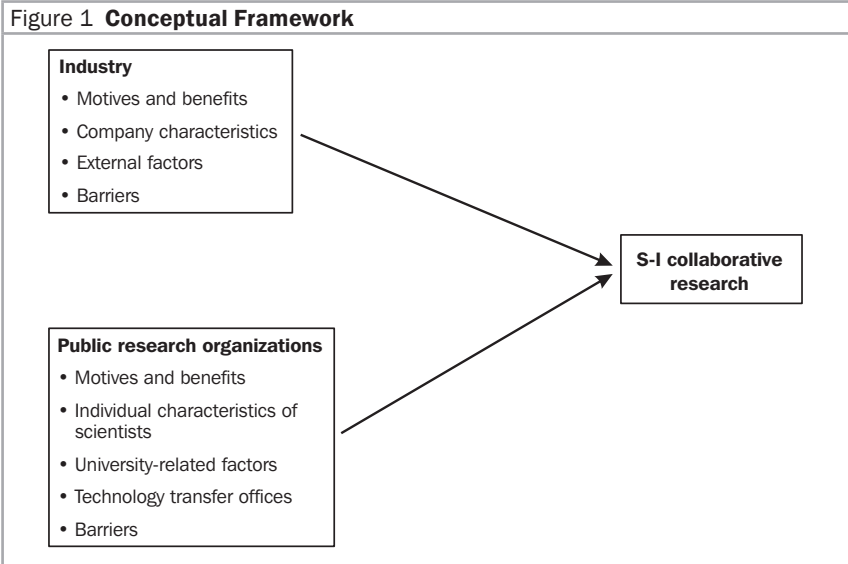
⁴ The study by Jeleč Raguž, Budimir and Letinić (2015) suggests that the share of joint research in total S-I cooperation in Croatia is about 10-25 percent.

⁵ In general, in less developed countries, S-I collaboration typically involves low-level industrial innovation and consultancy, while industry aims to adapt and upgrade imported technology rather than undertake R&D (Pinho and Fernandes, 2015).

2 Methodology

The literature review was conducted using a procedure commonly used in earlier research (Perkmann and Walsh, 2007; Perkmann et al., 2013). First, relevant keywords for literature search were identified. Search for the titles of published, peer-reviewed academic journals (full papers only) on the topic was conducted in several bibliographical databases, including EBSCO (Business Source Complete, EconLit with Full Text, CAB abstracts), Web of Knowledge and ScienceDirect. A manual search of top-ranked journals in the field over the past 20 years was conducted as well, including *Research Policy*, *Technovation* and *Journal of Technology Transfer*. Only articles published in English and Croatian were taken into account. Complementary information was taken from reports by the European Union, OECD, government agencies and research organizations. Papers by Croatian authors were additionally searched by using databases Hrčak (Portal of Scientific Journals of Croatia) and CROSBIB (Croatian Scientific Bibliography). Searching criteria included the titles of papers and keywords. Keywords used were: “science/university collaboration/cooperation”, “collaborative research”, “knowledge and technology transfer”, “technology transfer offices”. The search using these terms initially generated a large number of studies, more than 3,000 results. For final analysis, only those papers were selected that focus on S-I collaborative research, as well as those that examine S-I collaboration from a broader perspective and include S-I collaborative research as one of the modes of collaboration. The analyzed papers explored motives, collaborative factors and obstacles to S-I collaborative research. The final list of studies that were relevant for this research and had the sufficient quality included 72 papers.

Figure 1 presents the framework used in this study. The paper examines collaborative factors, i.e., motives, benefits and other factors that were recognized in previous literature as having an effect on S-I collaborative research from the industry and public research organization point of view.



Source: Author's compilation.

3 Companies' View on S-I Collaborative Research

3.1 Motives and Benefits

Previous research has examined and identified various motives of companies to engage in collaborative research with public research organizations. The list is quite long. Although motives differ from study to study, a few of them persistently appear to be important. According to Borrell-Damian, Morais and Smith (2014), key motives for companies to engage in collaborative research projects include strengthening their R&D capacity and increasing their competitive advantage. Further motives include applying research developed in academia to solve industrial challenges, develop new innovative products or improve existing ones. Having access to academic expertise and working with high-profile institutions with strong research capacity in areas relevant for the company are also shown to be relevant motives for companies (Borrell-Damian, Morais and Smith, 2014). According to Ankrah and Al-Tabbaa (2015), motivations for industry include necessity factors (i.e., responsiveness to government initiatives), reciprocity (i.e.,

3.2 Collaborative Factors

Collaborative factors examined in this study are company characteristics and external factors that might drive S-I collaborative research. Although the list of these factors is long, there is no definitive conclusion on their impact on S-I collaborative research. The most frequently mentioned collaborative factors in previous research are given in Table 1.

Factor	Impact
Industrial sector/company's activity	<ul style="list-style-type: none"> Positive impact for companies operating in biotechnology, information technology and pharmaceutical industry (e.g., Veugelers and Cassiman, 2005; Fontana, Geuna and Matt, 2006; Perkmann and Walsh, 2007; Arvanitis, Kubli and Woerter, 2011)
Company's size	<ul style="list-style-type: none"> Positive impact: Caloghirou, Vonortas and Tsakanikas (2000); Schartinger, Schibany and Gassler (2001); Fritsch (2003); Mohnen and Hoareau (2003); Capron and Cincera (2003); Laursen and Salter (2004); Veugelers and Cassiman (2005); Schmidt (2005); Fontana, Geuna and Matt (2006); Božić (2007); Arvanitis, Kubli and Woerter (2011)
Company's age	<ul style="list-style-type: none"> Positive impact: Arvanitis, Kubli and Woerter (2011) No relationship: Schartinger, Schibany and Gassler (2001); Laursen and Salter (2004) Start-ups have a higher probability of benefiting from academic research (Fontana, Geuna and Matt, 2006)
Legal status	<ul style="list-style-type: none"> Positive impact for independent companies: Fontana, Geuna and Matt (2006)
Foreign ownership	<ul style="list-style-type: none"> Negative impact: Fontana, Geuna and Matt (2006)
Company's long-term orientation	<ul style="list-style-type: none"> Positive impact: Laursen and Salter (2004); Capron and Cincera (2003)
R&D intensity	<ul style="list-style-type: none"> Positive impact: Fritsch (2003); Capron and Cincera (2003); Laursen and Salter (2004); Schmidt (2005); Fontana, Geuna and Matt (2006); Božić (2007); Arvanitis, Kubli and Woerter (2011) No relationship: Mohnen and Hoareau (2003)
Human capital intensity	<ul style="list-style-type: none"> Positive impact: Arvanitis, Kubli and Woerter (2011)
Patenting	<ul style="list-style-type: none"> Positive impact: Mohnen and Hoareau (2003); Capron and Cincera (2003); Schmidt (2005)
High risk	<ul style="list-style-type: none"> Negative impact: Fontana, Geuna and Matt (2006)
High innovation costs	<ul style="list-style-type: none"> Positive impact: Veugelers and Cassiman (2005); Fontana, Geuna and Matt (2006)
Strategic protection methods	<ul style="list-style-type: none"> Negative impact: Schmidt (2005)
Organizational and institutional obstacles	<ul style="list-style-type: none"> No relationship: Arvanitis, Kubli and Woerter (2011)
Geographical distance	<ul style="list-style-type: none"> Negative impact: Rosa and Mohnen (2008)
Degree of openness of the company	<ul style="list-style-type: none"> Positive impact: Schmidt (2005); Fontana, Geuna and Matt (2006); Božić (2007)
Government support	<ul style="list-style-type: none"> Positive impact: Mohnen and Hoareau (2003); Capron and Cincera (2003)
International competition	<ul style="list-style-type: none"> Positive impact: Arvanitis, Kubli and Woerter (2011)

Source: Author's compilation.

Other company characteristics that might affect S-I collaboration are legal status and ownership of the company. Mohnen and Hoareau (2003) find that independent companies rely more on collaborations with academic institutions than companies that are a part of large organizations. Previous research shows that foreign ownership (foreign headquarters of a company) has a negative effect on cooperation with universities. For example, foreign subsidiaries located in Belgium tend to be less involved in S-I collaboration (Veugelers and Cassiman, 2005). Therefore, a high share of foreign-owned enterprises in an economy may be a restricting factor to S-I collaboration, as the local affiliates of multinational enterprises may not carry out the type of basic research that strongly relies on new scientific knowledge. Basic R&D is typically conducted centrally at a headquarter level (Veugelers and Cassiman, 2005).

The study by Arvanitis, Kubli and Woerter (2011) shows that long-term orientation of a company has a positive impact on knowledge and technology transfer (Arvanitis, Kubli and Woerter, 2011). Newer studies examine the impact of STI (science and technology-based innovation) mode of learning, which relies on scientific human capital, public and private R&D organizations and universities, and DUI mode of learning (i.e., learning by doing, using and interacting), which relies on non-scientific drivers. Empirical evidence shows that a combination of STI and DUI modes of learning is more effective for product innovation, while process innovation is more closely linked to DUI-related partnerships undertaken by companies (González-Pernía, Parrilli and Peña-Legazkue, 2015; Parrilli and Heras, 2016).

Previous research suggests that R&D intensity (the share of R&D expenditures in sales, the share of R&D employees, gross investment per employee) is positively related to S-I collaboration (Fritsch, 2003; Schmidt, 2005; Veugelers and Cassiman, 2005; Fontana, Geuna and Matt, 2006; Arvanitis, Kubli and Woerter, 2011), although there are papers that did not find a correlation (Mohnen and Hoareau, 2003). Companies that invest heavily in R&D are likely to possess a high technological capability that allows them to absorb the knowledge developed outside the firm (Fontana,

Geographical proximity of the company also affects S-I collaboration (D'Este, Guy and Iammarino, 2013; Maietta, 2015), although there are studies indicating that companies give more preference to the research quality of a university partner than to its geographical closeness (Laursen, Reichstein and Salter, 2011). The studies in favor of geographical proximity show that companies located near universities frequently collaborate with them and benefit from knowledge spillovers. The theory of localized knowledge spillovers suggests that profits will be greater in agglomerations and spatial clusters, since the access to tacit knowledge is easier. The study by Rosa and Mohnen (2008) indicates that distance matters. It is found that a 10 percent increase in distance decreases the proportion of total R&D paid to a university by 1.4 percent for enterprises that do not report any codified transfer of knowledge flow, and by half as much for enterprises that report codified knowledge flows.

Existing studies conducted by Croatian authors show that companies with more intensive collaboration are those with a stronger technology and innovation orientation (Radas, 2005). Croatian enterprises with experienced and highly-educated employees tend to develop more intense collaboration with other enterprises and scientific institutions. Božić (2007) further suggests that the number of radical innovations and the amount of investment in R&D are the variables that contribute the most to collaboration on product innovation in Croatia. The study by Aralica, Račić and Redžepagić (2008) shows that innovation activities tend to be enhanced when a company is a part of a multinational enterprise.

3.3 Barriers

Various barriers significantly negatively affect S-I collaborative research. Although the list of barriers is quite long, there are some obstacles that often appear in the literature. One of the most frequently cited factors is a discrepancy in objectives and expectations between industry and the scientific community (Fontana, Geuna and Matt, 2006; Bruneel, D'Este and Salter, 2010). While companies search for the commercial value of research,

Croatian authors have identified a few factors that hinder S-I collaboration. Božić (2007) suggests that enterprises that do not collaborate with other partners on product innovation lack qualified and educated employees. Moreover, they develop radical innovations significantly less and invest less in R&D (Božić, 2007). The study by Bučar and Rojec (2015) suggests that a lack of companies with in-house R&D activities is the main structural deficit for S-I cooperation. Short-term development vision, lack of funds for R&D, and non-availability of advanced technologies are all factors that negatively impact cooperation with scientists (Radas, 2005).

4 S-I Collaborative Research from the Point of View of Public Research Organizations

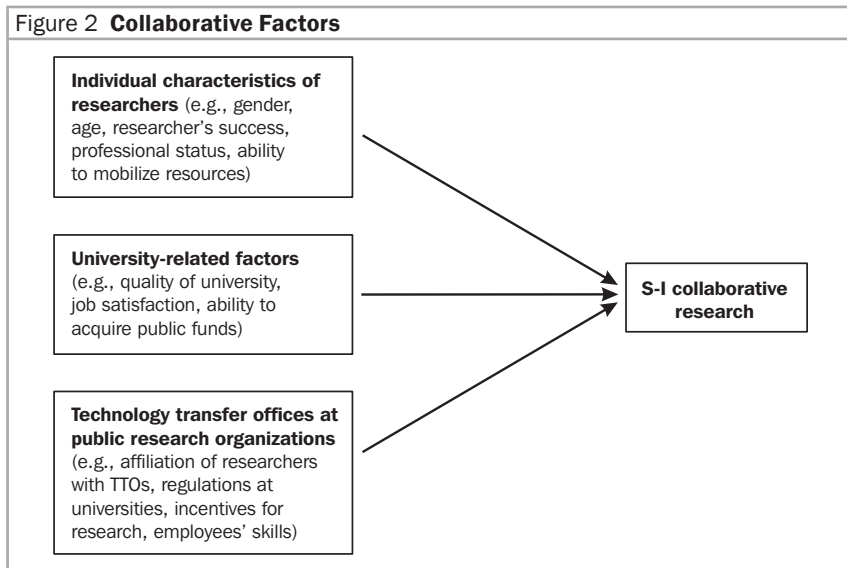
4.1 Motives and Benefits

For scientists, cooperation with companies represents an opportunity to obtain government support and additional funding for their research, purchase new equipment and hire new researchers (Lee, 2000; Morandi, 2013; Ankrah et al., 2013; Borrell-Damian, Morais and Smith, 2014). S-I collaboration provides an opportunity for researchers to test practical applications of their theories and to translate them into specific outcomes. Academic institutions also highlight the opportunity to develop high-quality research that could lead to an increase in the number of publications (Borrell-Damian, Morais and Smith, 2014). According to Ankrah and Al-Tabbaa (2015), motivations for universities include necessity factors (i.e., responsiveness to government policy), reciprocity (i.e., access to complementary expertise, equipment, facilities and employment opportunities), efficiency (i.e., access to funding for research, business opportunities, financial gain for academics), stability (i.e., discovering new knowledge, testing application of theory, publication of papers) and legitimacy (i.e., societal pressure, services provided to the industrial community, innovation promotion and contribution to national economy).

Studies conducted by Croatian authors show a few indicative motives of scientists to engage in S-I collaborative research. Radas and Vehovec (2006) find that intellectual challenge and additional income are two major motives for S-I collaboration. Bučar and Rojec (2015) additionally confirm that public funding, access to specific empirical data that can result in publications, and additional employment opportunity for graduate students are important motives for scientists to engage in S-I collaboration in Slovenia, which might be indicative for Croatia as well.

4.2 Collaborative Factors

Collaborative factors examined from the point of view of public research organizations are characteristics of the scientists, university factors and involvement of technology transfer offices at the research organizations. The most frequently mentioned factors in previous research are presented in Figure 2.



Source: Author's compilation.

being rather satisfied with their university and department policies for entrepreneurialism, although they think some policies need improvement. The “engager-professors” think “outside the box” to overcome institutional limitations and are the key drivers of university-industry collaboration (Dabic, Gonzalez-Loureiro and Svarc, 2012).

To support S-I collaboration and commercialization of research results, many universities have established technology transfer offices (Perkmann et al., 2013; Borrell-Damian, Morais and Smith, 2014; Empirica, 2014).⁶ The existence of TTOs and the affiliation of researchers with them increase the likelihood of researchers to participate in S-I research projects and commercialization (Perkmann et al., 2013). Success factors of TTOs include: fruitful cooperation among TTOs, the existence of trustful links between TTOs and researchers, as well as between TTOs and industry, the existence of scientific excellence and adequate scientist incentives, adequate technology transfer skills of employees at TTOs, developed technology transfer networks, and conducive university regulations and procedures for technology transfer (Borrell-Damian, Morais and Smith, 2014). Muscio (2010) suggests that universities make greater use of TTOs if they have a clear mission and objectives, and are run by non-academic managers.

⁶ *The TTOs’ responsibility includes identifying the needs of companies and matching those needs with the know-how of public research organizations, bringing together research institutions and companies interested in collaborative research, informing companies about inventions and expertise of research institutions, negotiation with industry and commercialization of research results, helping researchers secure financial resources, providing legal and administrative assistance and guarding the university’s intellectual property (Siegel, Waldman and Link, 2003; O’Shea et al., 2005; Borrell-Damian, Morais and Smith, 2014; Weckowska, 2015). The role of TTOs consists primarily of support in contract negotiation (regarding intellectual property rights), disseminating information on open calls and potential funding sources for projects, and providing support for the development of the management structure of collaborative research projects. According to Empirica (2014), which was based on an online survey of European knowledge transfer offices (N=101) and interviews with 18 experts in EU countries, most of the TTOs in the EU are fairly young and two-thirds were founded after the year 2000. Three-quarters of the TTOs are affiliated with a university, and the rest with governmental or non-profit research organizations, hospitals or research parks. The average number of personnel in the sampled TTOs was seven, and the average number of staff with formal TT training was four.*

conflict between universities and businesses may arise from intellectual property disputes and patenting disagreements (Ankrah et al., 2013).

Another stream of literature examines technology transfer offices at public research organizations and barriers for effective knowledge and technology transfer (Wolson, 2007). These offices play an important role in S-I collaboration. The most important barriers for TTOs are the following factors: gap in expectations between industry and public research organizations, expected delays in research, lack of TTO competencies, complex administrative procedures at universities, complex management of intellectual property rights, limited capacity of TTOs and lack of continuous government funding. Further obstacles involve lack of human resources at TTOs and lack of support from the universities in technology transfer (Decter, Bennett and Leseure, 2007; Muscio, 2010; Empirica, 2014).

Croatian authors have also examined obstacles to S-I collaboration from the point of view of public research organizations. Radas and Vehovec (2006) suggest that scientists think major obstacles exist more in the internal organization of academic institutions than in external relationships with industry. Researchers are convinced that industry is not as interested in collaboration as they are (Radas and Vehovec, 2006). Scientists often perceive that most companies lack long-term vision and educated employees, and that they are not informed well enough about what scientists can do (Radas and Vehovec, 2006). Croatian researchers also point out that academic promotion rules do not include enough incentives for collaboration with industry and that it is not possible to earn enough from collaboration because of heavy taxation. They also find that firms implement the results of collaboration to a lesser degree. Other obstacles are more or less similar as those in other studies, and relate to discrepancies in objectives between industry and the academic community, and difficulty in publishing the results of the research collaboration with industry.

Additional insight into obstacles to S-I collaborative research might be derived from observing the obstacles related to TTOs in Croatia. The study by Anić (2016), which presents the results of interviews conducted with

Croatian TTOs, reveals that TTOs in Croatia are relatively young and the system is still at a developing stage.⁷ All TTOs in the sample were established after the year 2000 and have on average five employees. The TTOs are active in their work, but they cannot be considered successful enough. The TTOs' contribution to S-I collaboration is marginal. The most important barriers for Croatian TTOs refer to the following: lack of clearly defined sphere of responsibility, reliance on project-based funding, limited capacity of TTOs, limited financial resources and a high fluctuation of personnel. The reliance on project-based funding has resulted in variation in funding levels and the scope and quality of services that the TTOs can offer. This is also closely linked to the staffing and number of employees, and the types of backgrounds and qualifications that TTOs possess. Lack of experienced managers is another problem for TTOs. Other barriers involve delays in research, and different objectives and expectations between researchers and the business sector (Anić, 2016).

5 Conclusions

There is a consensus in the literature that S-I cooperation needs to be improved, and knowledge and technology transfer has to be intensified (Arvanitis, Kubli and Woerter, 2011). However, there is no consensus on the factors that affect S-I collaborative research. This paper presents a review of previous research and identifies motives, benefits, collaborative factors and obstacles to S-I collaborative research from the companies' and public research organizations' point of view. As such, it contributes to the better assessment of factors that might impact S-I collaborative research, which play an important role in designing innovation policies.

From the literature review, it could be concluded that companies and public research organizations have different views on S-I collaborative research. As many factors affect S-I collaboration, the issue becomes very complex

⁷ The study by Anić (2016) presents the results of five semi-structured interviews with the heads of TTOs at five public universities and research institutes in Croatia, which were conducted in November 2016. The interviews contained questions about the TTOs' profile, the type and scope of cooperation, the impact of cooperation, the barriers TTOs face and the measures that might facilitate more effective collaborative research and knowledge transfer.

to solve. Key motives for companies to engage in collaborative research projects range from strengthening the company's R&D capacity to applying for projects undertaken by academic institutions in order to solve industrial challenges and develop new innovative products or improve existing ones. Companies that are more likely to be engaged in S-I collaborative research are those that operate in the above-average innovative industries, are bigger in size, older, have a higher knowledge base and introduce advanced innovations more often. These companies also have higher R&D intensity, more educated employees and are more open to their external environment. Collaboration offers them the opportunity to apply for government subsidies, and to split and decrease the costs of innovation activities. S-I collaborative research is more effective for product innovation. The most important barriers to S-I collaborative research include a discrepancy in objectives and expectations between industry and the scientific community, lack of or reduced government support for R&D collaborative projects, potential conflicts regarding royalty payments, intellectual property rights and concerns about confidentiality, market risks, and uncertainty in the success of research results.

For scientists, cooperation with companies presents an opportunity to obtain government support and funds for their research, acquire new equipment and technologies, and hire new researchers. Scientists are motivated to test practical applications of their theories and translate research results into specific products. Scientists that are more likely to engage in collaborative research with industry are senior researchers, more productive researchers, researchers that are more satisfied with their job and work at higher-quality universities that are able to acquire public resources for S-I collaboration. The affiliation of researchers with TTOs at universities also positively contributes to S-I collaborative research. S-I collaboration provides an opportunity for scientists to engage in high-quality research that could lead to an increase in the number of publications.

Previous research also indicates that fewer scientists are involved in the commercialization of research results and that TTOs actually have a marginal role in knowledge and technology transfer. Barriers that affect

limited capacity of TTOs, limited financial resources and a high fluctuation of personnel.

From above-mentioned evidence (Radas and Vehovec, 2006; Radosevic, 2011; Jeleč Raguž, Budimir and Letinić, 2015), several recommendations for Croatian innovation policy can be provided. There is a necessity to improve Croatian innovation policy to create favorable conditions for S-I collaborative research. This includes the improvement of legal framework that would support and motivate the researchers and innovators better, allocation of more financial funds to the transfer of new knowledge and technologies, and the provision of better support for the commercialization of research results. Strengthening S-I collaborative research would also include raising awareness and better promotion of the added value of joint collaborative research. Both public research organizations and companies need to work together to overcome obstacles to their joint collaborative research. Some obstacles may be removed by introducing changes to academic rules and requirements that might include practical experiences resulting from collaboration with companies.

The role of TTOs at public research organizations should be strengthened. Some of the possible improvements for making TTOs more effective might include the improvement of overall innovation framework at the state level, which would define the status of TTOs better, enable the provision of more financial resources to TTOs by the government and university alike, provide better support to human resources, minimize bureaucracy and introduce more autonomy in the work of TTOs. Furthermore, improvements could be made in the national innovation system so that it could facilitate better networking and cooperation among national and international TTOs.

Finally, some recommendations for future research might be useful. In general, more studies on S-I collaboration and collaborative research need to be carried out in Croatia to update the research results found in previous studies. More empirical research targeting collaborative research and TTOs

might be carried out in the context of smart specialization strategies,⁸ linking collaborative research with concepts such as global value chains, industrial clusters, cluster initiatives, smart skills and various other strategy-related instruments. Future research might further explore the efficiency and performance impact of collaborative research in developing countries, as well as the relationship between academic engagement, commercialization and institutional aspects (Perkmann et al., 2013). Researchers might also improve the methodology, quality, reliability and validity of measures related to academic engagement, activities, motives, barriers and outcomes, which might improve the quality and comparability of conducted studies (Perkmann et al., 2013).

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⁸ The Croatian Smart Specialisation Strategy was officially adopted in April 2016. S-I links are a very important part of the strategy.

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