

# Exploring the performance of researchers of the selected thematic priority area within the Croatian Smart Specialisation Strategy

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## **Extended abstract**

Smart Specialisation Strategy (S3) includes smart diversification of activities of the organisations and institutions within national and regional economies, focusing on balancing between participants' competition and identifying relevant hidden opportunities. S3 is pre-conditional for using financial resources from the European structural investment funds for the thematic objective, promotion of research and development (R&D) activities and innovation. Implementing S3 programmes enables companies and research organisations to build their competencies, participate in higher value-added activities (Panori et al., 2021; Asheim et al., 2017), and increase R&D and innovation activities (EC, 2021). The selected Thematic priority area (TPA) named Energy and Sustainable Environment is one of five TPAs of S3.

In Croatia, S3 has been implemented since 2016. The S3 specific strategic objectives are related to increasing the capacity of the RDI sector to perform excellent research to serve the needs of the economy, overcoming the fragmentation of the innovation value chain and bridging the gap between the research and business sectors, modernising and diversifying the Croatian economy through private

R&D and non-R&D investment, upgrading in the global value chain and promoting the internationalisation of Croatian enterprises, working in partnership to address societal challenges, and creating smart skills, i.e. upgrading the qualifications of the existing and new workforce for smart specialisation (Vlada RH, 2016). Within S3, Croatian scientists can contribute to the S3 programmes related to increasing the capacity of the RDI sector, which is at the same time the S3 specific strategic objective. Thus, for the Croatian scientists who are affiliated with the TPA, the principle that more participation in various S3 projects implies more outstanding scientific excellence and better usability of the research results should be valid.

In the last few years, the implementation of the S3 has faced a few challenges for public policy in the context of research organisations related to greater utilisation of EU funds and fulfilment of S3 objectives. Nowadays, it has become essential to ensure greater participation of the researchers in obtaining EU research grants, which would contribute to greater research output, strengthen the collaboration among research groups, and promote innovation activities and R&D cooperation. Therefore, it is essential to measure the number of articles published in the high-ranked journals as research output and observe articles' citations (Gonzalez-Brambila and Veloso, 2007). Following this notion, we performed a mapping study in the TPA Energy and Sustainable Environment, defined by the Croatian S3 for the period 2016-2021 to identify and analyse the output of researchers, structure and dynamics of research projects, commercialisation of research, innovation, and collaboration activities of researchers active in analysed TPA Energy and Sustainable Environment.

We applied the framework of Cappelo et al. (2020: 3) regarding mapping. According to Cappelo et al. (2020), the scientific, innovation and societal potential of cities, regions, and countries can be measured using this approach. In doing this, it is crucial to know how information obtained can inform policymaking. In our research, we adopted the approach by Capello et al. (2020) and used available individual data, which can be helpful for innovation policymaking in Croatia. Following this approach, we used relevant information about the performance of researchers that are useful for innovation policymaking in Croatia and discussed how they are related to S3 goals, particularly to utilisation of EU funds, fostering science-industry link, achieving scientific excellence in research output, research grants, collaboration, innovation activities and commercialisation of research results in the field of analysed TPA Energy and Sustainable Environment. We were interested in projects where researchers acted as team leaders and team members regarding research grants.

The main challenge in our analysis was that the data about the researchers and their research performance were not readily available in the national information system, so we first had to identify these researchers and then collect the data. In the first phase, we collected relevant information about more than one thousand scientists from more than eighty scientific organisations in Croatia. These scientists were either appointed by their scientific organisation as experts for topics energy and environment or were being detected by the employees from public bodies responsible for the S3 programmes as researchers who participate in the S3 projects related to the analysed TPA. In this way, we collected information about researchers' participation within the projects. Also, using the Web of science website, we collected information about the number of Web of Science (WoS) and SCOPUS published articles and citations of articles that appeared in the WoS database.

The data on researchers' output, research grants, collaboration, innovation, and commercialisation activities were collected by an online questionnaire that was carried out from October 7 to November 21, 2021. Since more than thousands of researchers were identified in the first phase of mapping, we approached the sampling intending to send questionnaires to an adequate number of researchers. The sample was stratified into six strata by using two criteria: (1) Whether the researchers was appointed by its institution to answer the questionnaire, using this criterion all nominees were selected in the sample; (2) The number of projects within the Implementing S3 policy instrument in which the researchers participate or participated in projects.<sup>1</sup> According to this criterion, the researchers were divided into three groups: researchers without projects, researchers with one project and researchers with two or more projects. The final sample consisted of 510 researchers in the analysed TPA. Two hundred fifty-three researchers completed the questionnaire, generating a response of 49,6%. We hired a professional interviewer to remind the respondents to reply to the questionnaire to boost the response rate. Out of those, 185 researchers pointed out that they have research and projects' activities primarily related to TPA Energy and Sustainable Environment, whereas 68 researchers are affiliated with another topic such as information and communication technologies (ICT), key enabling technologies (e.g., Aralica, 2020) or that they were affiliated with other TPA. The data were analysed using descriptive statistics, frequency distributions, factor analysis, cluster analysis, chi-square test, and ANOVA (analysis of variance).

Using the earlier mentioned data from the online questionnaire, the results reveal that following faculties most often appear as the leading ones: Faculty of Electrical Engineering and Programming,

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<sup>1</sup> Only a few Croatian S3 programmes has finished yet. Therefore, in majority projects of S3 programmes the researchers participate.

Faculty of Mechanical Engineering and Naval Architecture, Ruđer Bošković Institute, Faculty of Mining Geology and Petroleum Engineering, and Faculty of Agriculture. These results should be taken with caution. Any small change in contest of programmes can qualified or disqualified researchers to apply to the programmes. For example, by introducing the programmes related to nanotechnologies or advanced materials, more researchers from Ruđer Bošković Institute or the Faculty of Chemical Engineering and Technology, can be expected to apply on the programmes, compared to scenarios without these programmes. Moreover, by using factor and k-means cluster analysis based on indicators such as the number of published scientific papers, number of projects, and cooperation activity, we identified three groups of researchers with significantly different research performance labelled as (1) researchers with excellent scientific results, (2) project-oriented researchers, and (3) researchers with a lesser scientific contribution.

The main contribution of this research is that we shed more light on a connection between the participation of public scientific organisations within various projects and the research results by researchers within these institutions. The study identified the areas with the highest concentration of researchers, research groups, and excellence. A further contribution of this study is the construction of a database of researchers related to their performance and activities within the TPA. We have not found any similar study about the mapping of researchers within the thematic priority area of S3 strategy, so this is a clear contribution to the literature.

The paper is organised as follows. After an introduction section, we explain in Section 2 the conceptual framework of researchers' mapping in the context of S3, including methodology related to measuring research and other relevant indicators. Section 3 presents the main results of the study. Concluding remarks are shown in Section 4.

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