

Exploring researchers' performance in selected thematic priority area within Croatian Smart Specialisation Strategy

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Introduction

Methodology

Main results

Contribution and Recommendations

- 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 investments, 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).
- 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.
- The main goal of the presentation is to present main indicators related to the scientific sector within the Thematic priority area (TPA) Energy and Sustainable Environment and to illustrate the process of data collection.

- In the absence of official relevant information, we needed to design methods to identify, collect and analyse the data, leading to useful inputs for policymaking.
- We used relevant information about researchers' performance that are useful for innovation policymaking in Croatia and discussed how they are related to the program implementation, particularly to the utilisation of EU funds.
- We performed a mapping study in the observed TPA, for the period 2011-2021 to identify and analyse researchers' output, structure and dynamics of research projects, and research commercialisation, innovation, and collaboration activities.

- In countries like Croatia, the policy analysis is focused **on functioning of governmental bodies** instead of **policy efficiency analysis** (cf. Petak, Petek, 2009), much more than in developed countries.
- In our research, we adopted the argument relates to mapping of innovation (Capello, Kleibrink, Matusiak (2020)). According to these authors **the mapping of innovation is fundamental tool for providing policy-makers with the right information on which to build a smart innovation strategy.**
- We used available **individual data about the researchers**, which can be helpful for **innovation policymaking** in Croatia.
- The conceptual framework describes the mapping activities, which includes the description of those activities of scientists within the TPA sector Energy and environmental protection.

- How to collect data about researchers affiliated with TPA Energy and Sustainable Environment?

1. Identify researchers and information about their activities relevant for policymaking

- The main challenge was that data about researchers and their performance were not readily available in the national information system, so we first had to identify these researchers and then collect the data.
- We collected relevant information about more than one thousand scientists (**1163**) from more than eighty scientific organisations in Croatia. These scientists were either appointed by their scientific organisation as experts for topics related to analysed TPA or were detected by public bodies responsible for the S3 programmes as researchers who participate in the S3 projects related to the analysed TPA.

Researchers database and the analysed information

Information in database	Sources
A) General Information about researchers/institutions:	
Name and surname	Secondary sources
Institutions name	Secondary sources
Institutions acronym	
e-mail	Secondary sources
Number of researcher projects (e.g., SIIF, O ZIP, CALT, HR ZOO, TWINN, STRIP, ZCI, INFRA, IRI 1 IRI 2, PoC, I&R climate),	Secondary sources
Researchers nominated by institutions.	Secondary sources
Sub thematic priority area (STPA 1) Energy technologies, systems and equipment (STPA 2) Environment friendly technologies, equipment and advanced materials)	Secondary sources

Researchers database and the analysed information (II)

Information in database	Sources
B) Information about scientific excellence	
Number of WoS papers	Web of knowledge – Website
Number of citation of WoS articles	Web of knowledge – Website
Number of SCOPUS articles	Scopus – Website
First year of publishing	Web of knowledge – Website
Number of citation of SCOPUS articles	Scopus – Website
Web of Science'field dominant area	Web of knowledge – Website
Field of Science area	We used concordance which converts information about WoS areas into FoS categories
C) Other information	
Part of sample/no part of sample	Additionally added from the online survey
Answer on the survey/No answer on the survey	Additionally added from the online survey
Being part of Sub thematic priority area (STPA 1, STPA 2) within the analysed thematic priority area (TPA), another TPA, horizontal topics (ICT+KET, another area of interests)	Additionally added from the online survey

2. Create a sample of researchers to collect additional data via survey.

- The sample was stratified into six strata by using two criteria
 - I. **Whether the researchers was appointed by its institution** to answer the questionnaire (using this criterion all nominees were selected in the sample).
 - II. **The number of projects** within the Implementing S3 policy instrument in which the researchers participate or participated in projects (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.

3. Survey implementation.

- 253 researchers completed the questionnaire, generating a response of 49,6%.
- **185 researchers (73,1%) pointed out that they have research and projects' activities primarily related to analysed TPA**, whereas 68 researchers are affiliated with other topics such as: information and communication technologies (ICT), key enabling technologies (e.g., Aralica, 2020), or that they were affiliated with other TPA.

The objective of survey and main areas of questionnaire

In order to identify the research capacity in the analysed S3 TPA, we used information about:

- Two Sub thematic priority areas (STPA)
- Scientific research organisation location
- Researchers' field of science (FoS1 and FoS2) (OECD, 2007);
- Researchers' Web of Science fields

The questionnaire was divided into following areas:

- Basic information about researchers
- The analysis of scientific excellence
- Research and development projects
- Cooperation
- Patents and commercialisation of knowledge
- Research infrastructure
- Dissemination of knowledge

The researchers and their activities

Key indicators in the analysis	Sources
Utilisation of EU funds	Information received from various experts in the ministries and/or the governmental agencies; Institutions' or specialised website(s) e.g., Poirot.hr
Fostering science-industry link	Online survey
Scientific excellence in research output	Specialised website webofscience.com
Research grants	Online survey
Collaboration	Online survey
Innovation activities	Online survey
Commercialisation of research results	Online survey

The datasets as side effects of the proposed methodology

Program	Number of projects	Value of projects (eligible cost)	Value of project – Croatian Scientific organization	Intensity of aid	Period of the project implementation	Name of project	Thematic priority area/ Topics	Partners on the projects
SIIF	x (6)	x	N.A. (7)	x	x	x	x	x
O ZIP	x	x	N.A.	x	x	x	x	x
CALT	x	x	N.A.	x	x	x	x	x
HR ZOO	x	x	N.A.	x	x	x	x	x
TWINN	x	x	N.A.	x	x	x	x	x
STRIP	x	x	N.A.	x	x	x	x	x
ZCI	x	x	N.A.	x	x	x	x	x
INFRA	x	x	N.A.	x	x	x	x	x
IRI 1 (3)	x	x	N.A.	x	x (1)	x	x	x
IRI 2 (3)	x	x	N.A.	x	x (1)	x	x	x
I&R climate	x	x	N.A.	x	x (2)	x	x	x
PoC public (4)	x	x	N.A.	x	x (2)	x	x	x
HRZZ	x	x (5)	N.A.	x	x	x	x	x
H2020	x	x	x	x	x	x	x	x
FP7	x	x	x (3)	x	x	x	x	x
EIT	x	x	- (8)	-	-	x	x	x
COST	x	x	-	-	x	x	x	x

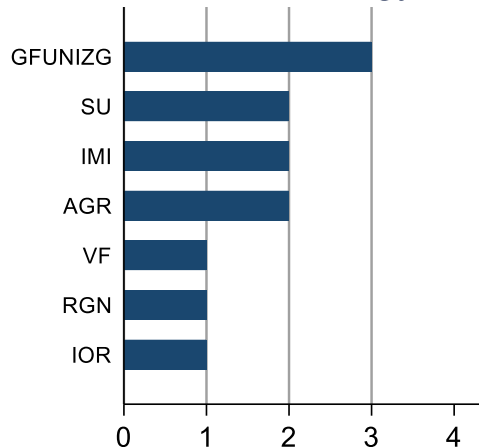
Clarification of the labels from the previous table

- (1) Time of project implementation is given at program level (e.g., IRI 1 or IRI 2);
- (2) There is only information about the beginning of the project implementation, there is no information about the end of it;
- (3) All these projects failed to gather information on financial values, as well as the name of the coordinator in Croatia and the team he/she works with;
- (4) No program description;
- (5) There is no amount of funding for individual partners, but only for the whole project;
- (6) x - data exists;
- (7) N.A. - not applicable to the analysed programs;
- (8) - (dash) information on certain categories are missing;

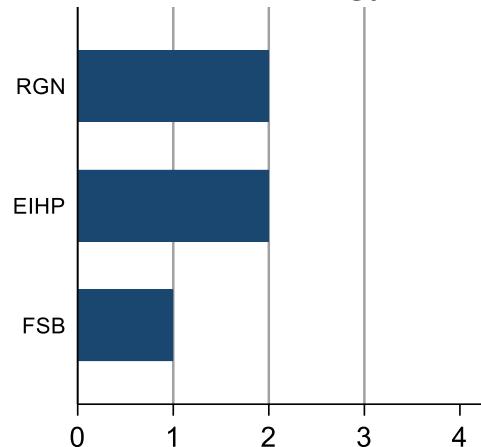
Main results

Utilisation of EU funds

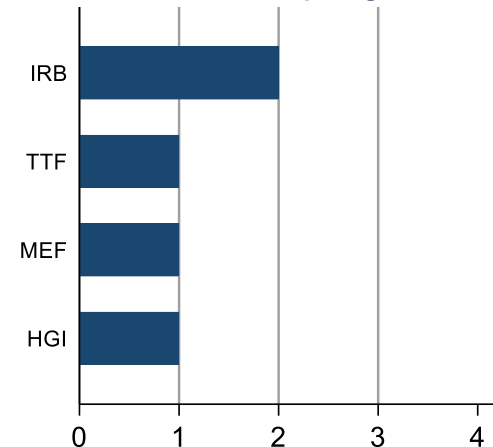
FP7 Ecology



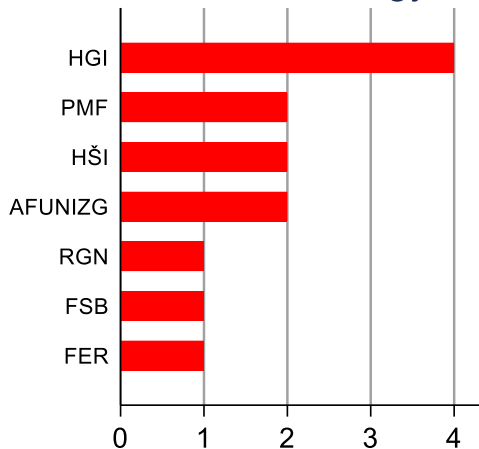
FP7 Energy



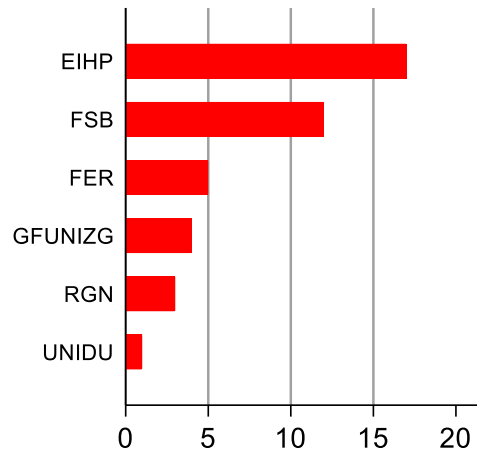
FP7 Nano programe



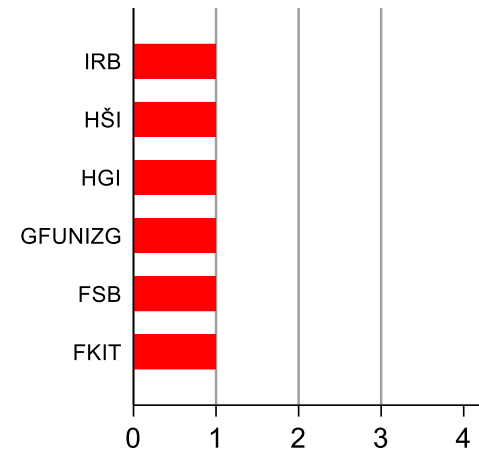
H2020 Energy



H2020 Climate

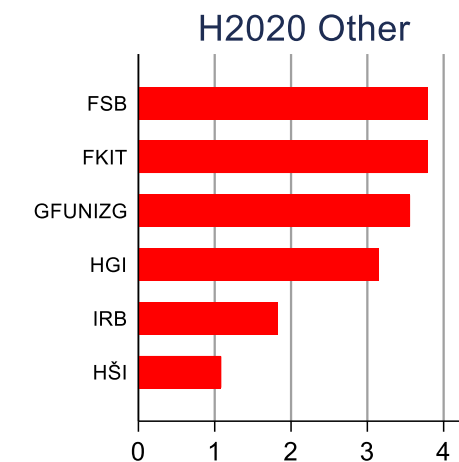
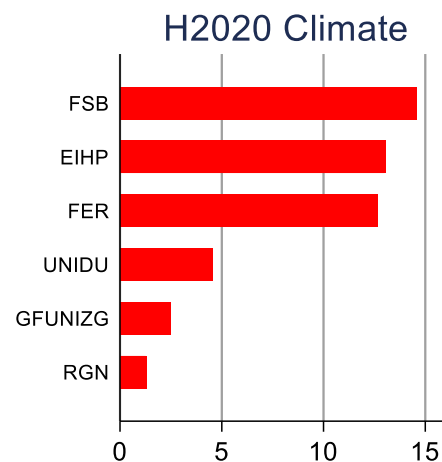
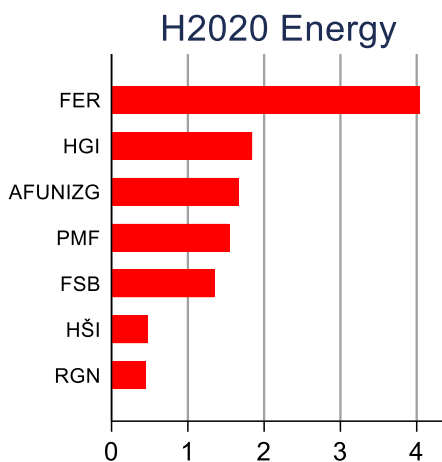
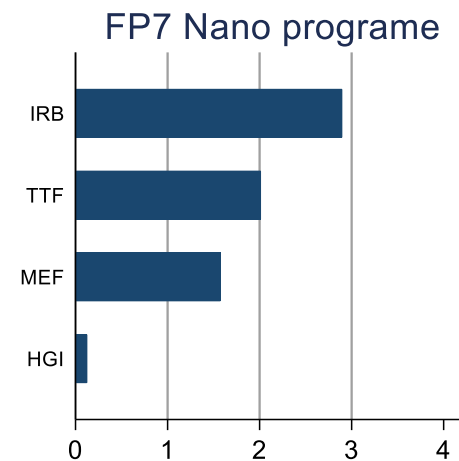
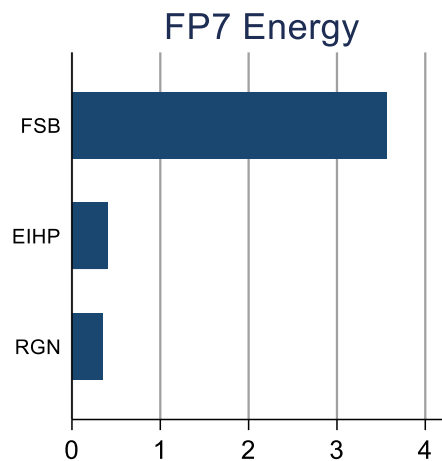
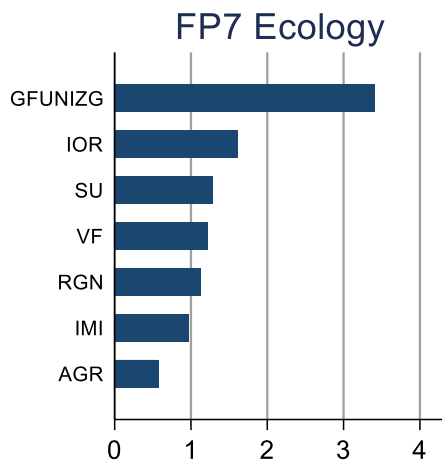


H2020 Other



Number of projects

Utilisation of EU funds



Total project value in mil. HRK

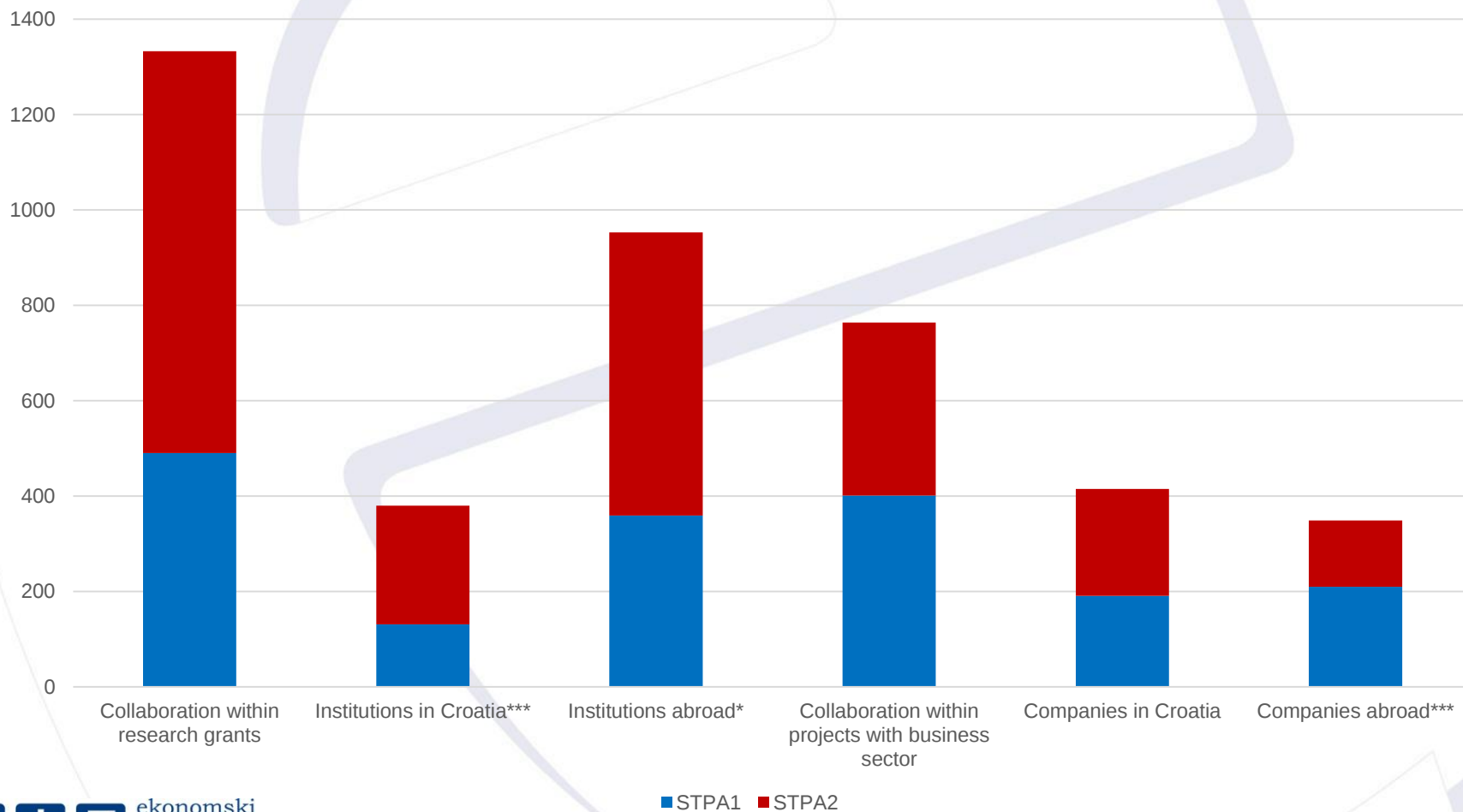
Research output

	STPA1 (n=66)	STPA2 (n=119)	Sample (n=185)
Number of articles published in TPA during the 2011-2011 period			
Articles published in WoS journals*	1,200	2,557	3,757
Average no. of articles published in WoS*	18.2	21.5	20.3
Articles published in SCOPUS journals	1,358	2,498	3,856
Average no. of articles published in SCOPUS	20.6	20.9	20.8
Citations of researchers' articles in WoS journals regardless of TPA			
	STPA1 (n=65)	STPA2 (n=117)	Sample (n=182)
Total number of citations**	23,974	60,147	84,121
The average citation**	368.8	514.1	462.2

Notes: Average publication means number of articles published per researcher. Differences between STPAs are statistically significant at *0.1; **0.05; ***0.01.

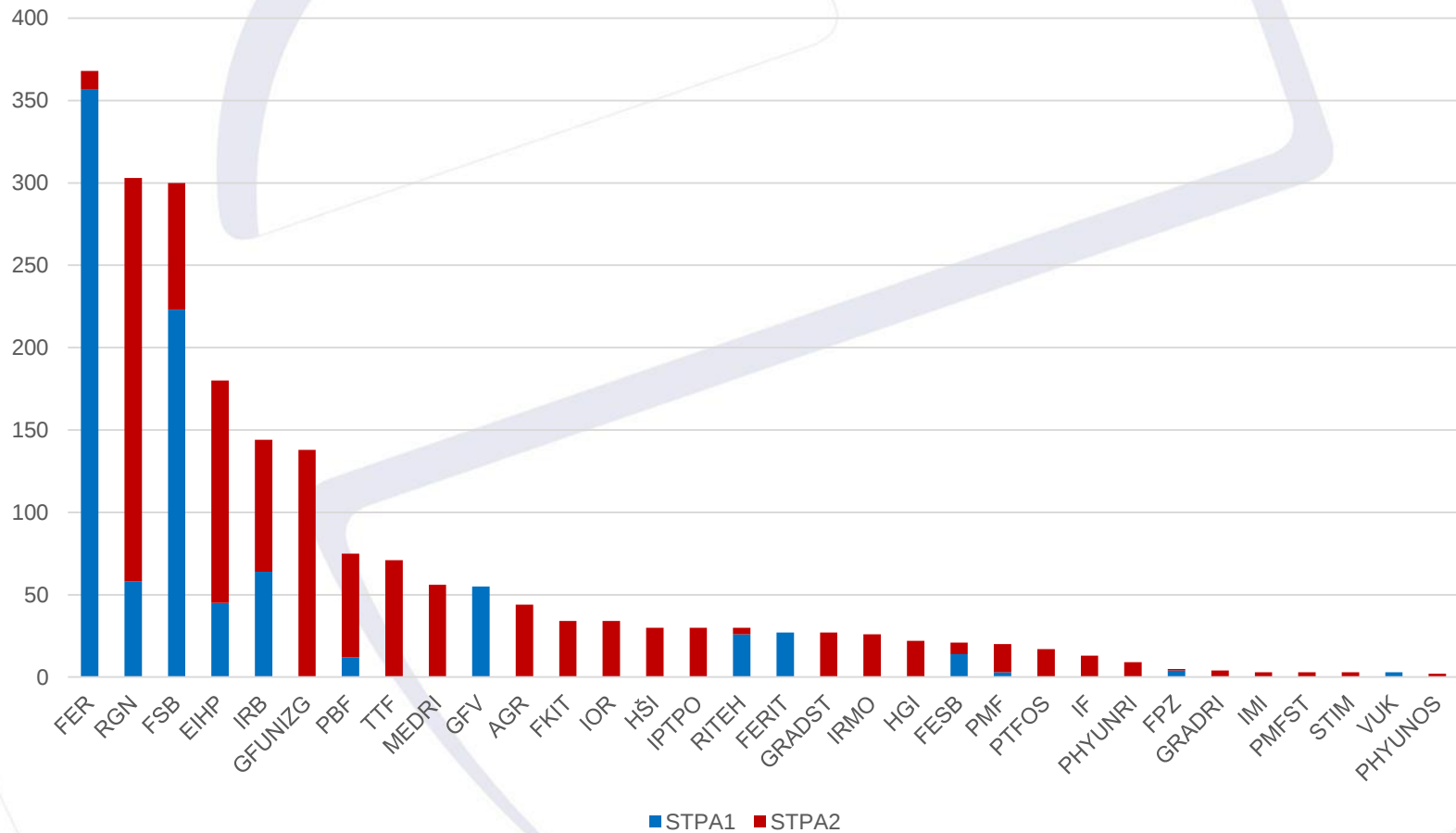
Collaboration

No. of collaborations in projects in the last 10 years, n=124



Fostering science-industry link

No. of collaboration in projects with business sector in the last 10 years, n=124



No. of research grants of project leaders during the 2011-2021 period

Source of funding	STPA1 (n=25)				STPA2 (n=56)			
	Done	Ongoing	Total	Average	Done	Ongoing	Total	Average
EU grants	16	16	32	1.3	46	17	63	1.1
Structural funds	16	32	48	1.9	13	19	32	0.6
UKF	0	0	0	0.0	4	0	4	0.1
PoC	2	1	3	0.1	9	0	9	0.2
IRCRO&RAZUM	0	0	0	0.0	0	0	0	0.0
HRZZ	10	13	23	0.9	20	24	44	0.8
Other	70	9	79	3.2	44	16	60	1.1
Total	114	71	185	7.4	136	76	212	3.8

Notes: EU grants - FP7, Obzor 2020, COST program, i EIT , Structural funds - ERDF projekte, npr. IRI I, IRI II, SIIF; UKF - Unity through Knowledge Fund. Other projects include e.g., projects like ERASMUS, UNESCO, KlimaDigital, Interreg University grants, IPA projects.

No. of research grants of team members during the 2011-2021 period

Source of funding	STPA1 (n=49)				STPA2 (n=81)			
	Done	Ongoing	Total	Average	Done	Ongoing	Total	Average
EU grant	67	28	95	1.9	70	44	114	1.4
Structural funds	23	39	62	1.3	27	70	97	1.2
UKF	0	0	0	0.0	6	0	6	0.1
PoC	7	0	7	0.1	6	0	6	0.1
IRCRO&RAZUM	1	0	1	0.0	0	0	0	0.0
HRZZ	32	14	46	0.9	54	52	106	1.3
Other	45	13	58	1.2	32	14	46	0.6
Total	175	94	269	5.5	195	180	375	4.6

Innovation output and commercialization

New products/services, processes and designs developed	STPA1		STPA2		Sample
	Total	Average	Total	Average	
New products developed**	62 (n=28)	2.2	90 (n=45)	2.0	152 (n=73)
Commercialized new products	19 (n=13)	1.5	27 (n=16)	1.7	46 (n=29)
New products in pipeline***	58 (n=22)	2.6	72 (n=47)	1.5	130 (n=69)
New processes developed***	43 (n=20)	2.2	56 (n=39)	1.4	99 (n=59)
Commercialized new processes***	9 (n=6)	1.5	10 (n=8)	1.3	19 (n=14)
New processes in pipeline***	39 (n=19)	2.1	40 (n=31)	1.3	79 (n=50)
New designs developed***	14 (n=11)	1.3	7 (n=5)	1.4	21 (n=16)
Commercialized new designs***	3 (n=2)	1.5	2 (n=2)	1.0	5 (n=4)
New designs in pipeline***	4 (n=4)	1.0	12 (n=10)	1.2	16 (n=14)

Notes: Differences between TPA are statistically significant at *0.1; **0.05; ***0.01.

Groups of researchers

Factor analysis	Factor 1:	Factor 2:
Research output/factor loadings	Research output	Projects and collaboration
Articles in WoS journals	0.963	0.091
Articles in SCOPUS journals	0.939	0.116
Citations of articles in WoS journals	0.833	0.119
Number of grants (team member)	0.052	0.886
No. of collaboration in projects	0.181	0.857

- **Cluster analysis** was carried out to identify groups of researchers with similar output based on factor analysis.
- Three groups of researchers were identified based on their output: **(1) Excellent scientists, (2) Project-focused researchers, and (3) Researchers with less contribution**

Groups of researchers

	Group 1 (n=3): Excellent scientists	Group 2 (n=15): Project-focused scientists	Group 3 (n=83): Researchers with less contribution
Research output***	1,611	466,1	64,8
Projects and collaboration**	18.7	18,5	10,3
Articles in WoS journals, average***	78.0	48.5	14.7
Articles in SCOUPS journals, average***	64.0	53.4	14.6
Citations of WoS journals***	4,691.0	1,296.3	165.0
Leaders of research projects (%) **	100.0	73.3	50.6
Team member in research projects (average)**	7.0	8.7	5.0
Leader in projects with business sector (%)	33.3	46.7	31.1
Total number of collaborations*	30.3	28.7	15.6
New products developed	1.5	3.0	1.6

Notes: Differences between STPAs are statistically significant at *0.1; **0.05; ***0.01.

Contribution and Recommendations

The main contributions of this research:

We shed light on a connection between the participation of public scientific organisations within various projects and the research results by researchers within these institutions.

We identify areas with the highest concentration of researchers, research groups, and excellence.

We construct a database of researchers related to their performance and activities within observed TPA.

Recommendations to the public policy bodies responsible for science and innovation policies

- Perform mapping of other TPAs as well, a complete picture of participation of science sector within Croatian S3 could be achieved.
- Introduce continuous monitoring of projects within the program in an identical, mutually comparable way, using identical information: project duration, eligible costs, project participants, institution partner, budget and project manager.
- In addition, the parts of the monitoring related to the project objectives e.g, the planned and achieved value indicators should be included.
- Enable tracking of researchers and their institutions, preferably with numerical identifiers held by researchers (e.g, OIB, ORCID) and their institutions (OIB). The existence of unique identifiers enables faster formation of a database of researchers and their activities related to S3 in Croatia.



Thank you for your attention.