TURKEY'S INTEGRATION TO RESEARCH NETWORKS AND RESEARCH NETWORKS' EFFECTS ON SCIENTIFIC STUDIES: THE CASE OF METU

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

AYŞE IŞILAK

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
THE DEPARTMENT OF SCIENCE AND TECHNOLOGY POLICY STUDIES

SEPTEMBER 2022

Approval of the thesis:

TURKEY'S INTEGRATION TO RESEARCH NETWORKS AND RESEARCH NETWORKS' EFFECTS ON SCIENTIFIC STUDIES: THE CASE OF METU

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ABSTRACT

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September 2022, 209 pages

Research networks are instrumental to improve scientific productivity. There is a vast literature on the influence of collaboration on scientific productivity and how to improve the collaborative environment. Due to their critical position in scientific production, universities are the appropriate venue to focus on working on scientific productivity. Turkey employs global university rankings as a benchmark for tracking scientific productivity of universities. In the 11th Development Plan, Turkey aims to have at least two universities among the top 100 universities with respect to international academic rankings by 2023. Thus, this study aims to answer how should Turkish scholars be integrated into international research networks considering this target. In this respect, using a mixed methods approach —a combination of bibliometric assessment and semi-structured interviews— the study provides an overview of Turkey's integration to research networks, factors affecting network integration, and an evaluation of the effects of networks on research in the case of METU. Findings reveal that geographical, social/cultural, or organizational proximity

and using the same language and policies of the government could facilitate the strengthening of the integration with the research networks; infrastructure, capabilities of the partners, and funding channels are critical factors for network preferences. Factors facilitating or challenging the integration are classified under six main pillars: regulation, financial resources, human resources, infrastructure, ethics, and democratic issues. Focusing on the swift and easiest but the most important issues, the study also recommends actions to be taken on finance and human resources and logistics and infrastructure.

Keywords: Research Networks, scientific productivity, global university rankings, collaboration, Turkey

ÖZ

TÜRKİYE'NİN ARAŞTIRMA AĞLARINA ENTEGRASYONU VE ARAŞTIRMA AĞLARININ BİLİMSEL ÇALIŞMALARA ETKİSİ: ODTÜ İNCELEMESİ

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Eylül 2022, 209 sayfa

Araştırma ağları, bilimsel üretkenliği artırmada oldukça faydalıdır. İşbirliğinin bilimsel üretkenlik üzerindeki etkisi ve nasıl iyileştirileceği konusunda geniş bir literatür bulunmaktadır. Bilimsel üretimdeki kritik konumları nedeniyle üniversiteler, bu konuya ilişkin çalışmalarda ele alınması gereken en önemli kurumlardır. Türkiye, üniversitelerin bilimsel üretkenliğini izlemek için küresel üniversite sıralamalarını bir ölçüt olarak kullanmaktadır. Türkiye 11. Kalkınma Planı'nda 2023 yılına kadar uluslararası akademik sıralamalarda ilk 100 üniversite arasında en az iki üniversiteye sahip olmayı hedeflemektedir. Bu çalışma, anılan hedef doğrultusunda Türkiye'deki akademisyenlerin uluslararası araştırma ağlarına nasıl entegre edilebileceği sorusuna yanıt aramaktadır. Bu bağlamda, bibliyometrik değerlendirme ve yarı yapılandırılmış görüşmelerden oluşan karma bir yöntem kullanan çalışma, ODTÜ örneğinden hareketle, Türkiye'nin araştırma ağlarına entegrasyonuna, ağ seçimlerini etkileyen

faktörlere ve entegrasyonun Türkiye'deki araştırmalar üzerindeki etkilerine dair bilgi sunmaktadır. Bulgular, coğrafi, sosyal/kültürel veya kurumsal yakınlığın ve çeşitli devlet politikalarının araştırma ağları ile entegrasyonu -kolaylaştırabileceğini ortaya koymaktadır. Altyapı, işbirliğinde bulunanların yetenekleri ve finansman kanalları, ağlar ile entegrasyonu etkileyen diğer kritik faktörlerdir. Entegrasyonu kolaylaştıran veya zorlayan faktörler altı ana başlık altında sınıflandırılmaktadır: düzenleme, mali kaynaklar, insan kaynakları, altyapı, etik ve demokratik konular. Hızlı ve kolay ama en önemli konulara odaklanarak, Çalışma entegrasyonun geliştirilmesi amacıyla; finans ve insan kaynakları ile lojistik ve genel politika çerçevesi konularında çeşitli tavsiyelerde bulunmaktadır.

Anahtar Kelimeler: Araştırma ağları, bilimsel üretkenlik, küresel üniversite sıralamaları, işbirliği, Türkiye

To My Dreams

ACKNOWLEDGMENTS

I define myself as a professional student. Since the first day of primary school, I have always enjoyed being, trying, and learning with my friends and teachers. Although learning does not happen only in the classroom environment, I have always loved to be. During my studentship, I have experienced that some people and places augment this joy in immeasurable ways and dimensions. METU-STPS with its distinguished faculty and esteemed students is one of those places. I am always proud and thankful to be a member of such a community. Thus, I would like to extend my sincere thanks to all the Professors, the one and only research assistant of the Program -Seda-, and my colleagues in the Program. However, the most special thanks to my advisor Assist. Prof. Dr. Arsev Umur Aydınoğlu. I would like to express my deepest gratitude for his guidance, understanding, contribution, and unique perspective from the first day of the study till the end. It is always a pleasure to work with him.

I believe intelligence, diligence, and perseverance are crucial traits that help you succeed eventually. During my thesis, I had a chance to meet a distinguished group of academics of METU that I admired and respected for their qualifications and personality. They all share these attributes. I think we are lucky to have them and hope they continue to stay with us. I thank my anonymous interviewees for their time and contributions to my study, especially during such a hectic time for the entire world. I hope the study could help to improve the scientific and collaborative environment at METU and clear the deadlocks in our higher education system in Turkey. I presume myself lucky if I can do even a little.

Finally, I also would like to thank family and friends for their continuous love and support all through the way. My little caterpillars, supersonic, my anonymous, and my STPS colleagues Beyza, Gökçe, and Serra have always been with me. It is priceless to have them on my journey.

I wish to remember these days as the beginning of peaceful and bright times for me and all of us.

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LIST OF ABBREVIATIONS

EU	European Union
METU	Middle East Technical University
PDO	Office of Sponsored Projects
R&D	Research and Development
TÜBİTAK	The Scientific and Technological Research Council of Türkiye
YÖK	Council of Higher Education

CHAPTER 1

INTRODUCTION

Science is a way to overcome the limits of the resources that we have. With science, we can live longer and have more prosperous lives, explore our planet and new galaxies, drive global economies, and create new industries. With its enlarging aspect, science is also of great importance for governments both to satisfy the needs of their citizens -or the other actors that are important for the governments on the road to a welfare society- and to be a leading one in the global politics. Gomory (1992) indicated that the government's involvement in the basic research was used as a tool in the global power conflict, especially after World War II. While offering advantages to the governments, science or scientists also need the support of governments to overcome a lack of resources including technical, regulatory, and even ethical barriers that might be faced. Particularly, basic research which is highlighted with the foundational role in further progress but with no clear or determined path for its future use (OECD, 2015) benefits from government support to overcome lack of financial resources (Cockcroft, 1962) or underinvestment through subsidies by governments (Simon, 1999). In addition, governments can also remove the deficiencies of the market. In the basic research case, though it is not always as fruitful as expected, governments acted to control scientific research and their end products to eliminate the potential rise of monopolies (Bookshelf et al., 1930). Thus, the science community and governments could mutually benefit from the government's support of scientific research. While doing it, the government should allocate the resources to research and design the research-related environment in a way that warrants the most efficient outcome. The rules and regulations made by the government have a role in shaping the environment in which scientists functioned and the effect is larger than we might think. As such,

understanding the inner dynamics of the scientific research process and finding a way to measure the progress of science is critical. In the same vein, the literature on research and development (R&D), economic development, and policy design suggest that understanding the dynamics of research processes, i.e., "science of science" is crucial in shaping efficient policies. With that, though the motivation or aim is not the same with the governments, we reach the birth of bibliometrics and the vast literature on the science of science. "Science of science" is a discipline studying the way of doing science from a lot of perspectives and it is transdisciplinary by nature. With the help of developments in the scientific data sets, the structure and evolution of science can be presented by bibliometrics (Fortunato et al., 2018).

Solla Derek Price in his influential book "Little Science Big Science (1963)" discussed the progress of science by working on the science's inner dynamics rather than focusing on individual scientific discoveries and how science evolved from little science to big science. While doing so, he indicated that the evolution "*was less dramatic and more gradual than it appears at first*" (p.3), reflecting the law of exponential growth, yet it was extremely rapid at the same time. He also elaborated on the multiplicity or overlapping of discoveries, the role of science communication via the papers to sign the leading position in the area, and the appearance of invisible collages which gives "*the reputation and prestige the scientists deserve and ease the diffusion of knowledge through collaboration, especially with the worthy ones*" (p.66). He also argued that "*the collaborative works had been increasing instantly and more rapidly since the beginning of 20th century*" there has been no association between higher collaboration and the use of a big or more technical machine (p.83) though Big Science involves a great deal of collaborative work (p.40). Price also indicated the invisible colleges as a new venue for collaboration increasing the number of articles and representing a better cooperation structure and increasing the productivity of groups more than the increase in the number of participants (p.105).

Since then, the role of collaboration in scientific production is a well-accepted, more popular, and deeply investigated phenomenon. As Wagner (2008) has indicated, "modern science is intensely social" and collaboration is good as a way to provide

necessary resources including physical capital, knowledge, and capabilities. On a separate note, challenging Price's expectation on the trend of scientific publication and saturation of the scientific studies at a certain point, Wagner and Joong Kim (2014) argued that scientific production and communication landscape is in transformation and scientific publications would continue to its exponential growth. In line with that, the increasing role of research networks and globalization of science are among the recent tendencies in the science of science. Not only the scientists' individual preferences but also the actions of governments support this tendency. Countries are also promoting "internationalization" in their scientific systems to increase productivity. In parallel to this trend, there is growing literature on the effectiveness of these policies and how to improve the collaborative environment (Lee & Bozeman, 2005; Catalini et al., 2020; Abbasi et al., 2011). The respective literature in general measures productivity by the number of articles and patents and collaboration by co-authorship (Newman, 2004; Fagan et al., 2018), including the patent in the criteria would complicate the analysis as it is not always easy to acquire patent data and it would reflect different problems in patent applications and approvals, which are beyond the collaboration and science of science.

Scientific studies are carried out by government agencies, research centers, universities, and private companies. Increasing scientific productivity is accepted as a strategic aim for many of the actors in the scene. Yet, how scientific productivity is defined and how the respective targets are structured are not universal. Universities have a central role in scientific productivity and can be the engines of the growth in scientific productivity in many countries. Though they have different functions and responsibilities such as professional development of the work force, societal functions, etc. as well, the higher education system and universities are carefully observed and structured for increasing scientific productivity, particularly through higher education policies. University rankings, which are a combination of scientific production and many other factors, are used as the benchmark to determine the developments in these institutions on this front as well. They are the most well-known and publicly and openly shared benchmarks by institutions, universities, or governments. Turkey is not different than other countries and willing to increase productivity to reap the fruits of

its attached benefits. Despite its complexities and differences in application and perspectives, universities are the focal points for increasing scientific productivity as well. Turkey is also employing internationalization to transfer intellectual capital and increase scientific productivity. Turkey's most definite productivity target shared publicly for scientific productivity is announced in the 11th Development Plan of Turkey (On Birinci Kalkınma Planı, 2019). Turkey aims to have at least two universities among the top 100 universities with respect to international academic rankings.

As such, this study aims to answer how should Turkish scholars be integrated into international research networks considering the scientific productivity targets defined in terms of global university ranking in the last development plan.

To answer this main question, study aims to elaborate on the following questions:

1. Sub-Research Question 1: What effect does research network integration have on scientific productivity in terms of publications?
2. Sub-Research Question 2: Does the level of integration with research networks differ from region to region?
3. Sub-Research Question 3: Is the tendency to integrate with research networks the same in different disciplines?
4. Sub-Research Question 4: What are the factors that motivate academicians to be a part of research networks?
5. Sub-Research Question 5: What are the factors that make the research network integration easier?

In this respect, using a mixed-methods approach —the combination of bibliometric assessment and semi-structure interviews— we provide an overview of Turkey's integration into research networks, factors affecting network choices, and an evaluation of the effects of networks on research in the case of Middle East Technical University (METU). I focused on METU as it was ranked at the top of the research university review of Higher Education Council (YÖK) of Turkey in 2019 revealed in 2020. I focused on METU as it is one of the integrated, leading, oldest, and most

qualified universities of Turkey with technical capacity and consists of a wide range of disciplines in addition to operational easiness it provided me being my school.

The thesis first provides a brief literature review on the trend of scientific publication, research networks with a definition, the trend of research networks in the world, the importance of these networks in the research, and the factors affecting the integration to these networks and the productivity benchmark-university rankings, and Turkey's approach to scientific productivity and research networks. The third section informs on the methodology used in the study in detail from the choice of area of interest to the formation of an interview guide and the details of the bibliometric data formation. The fourth chapter presents the findings of both quantitative and qualitative pillars of the study in line with the factors emphasized in the first chapter. The final chapter includes a discussion of the (dis)alignment of the findings with literature and advice on what could be done to improve the integration of Turkey's research networks to increase scientific productivity.

CHAPTER 2

LITERATURE REVIEW

2.1 Research Networks

2.1.1 The Trend of Scientific Publications and Stylized Facts of This Trend

The scientific trends that Price shed light in his book in 1963 have preserved its focal policy position in the entire world through the differences of the importance attached by specific countries. Thus, the studies on the number and composition of the scientific publications by subject, authors, and diffusion and exploitation of these studies (via citations, impact analysis, etc.) have continued. For the sake of our research interest, it would be better to focus on the trends of these publications, whom they are produced, and how would be meaningful.

One of many, Bornmann and Mutz assessing the publications in the period between 1980-2012 and their citations have indicated an exponential increase in the global scientific publications in the respective period and estimated that the annual growth rate of publications is around 2.96%. In addition, looking at the cited references of these publications, there were three phases of the growth period since the mid-17th century. They also highlighted the lack of a database having information on all publications since the beginning of modern science (Bornmann & Mutz, 2014). This is largely acknowledged by many scientists. There are a number of studies comparing these databases in terms of their coverage, reliability, and suitability of the information provided by these databases for the specific aims of the academic world, governments, and other funders (Pranckutė, 2021; Harzing & Alakangas, 2016; Martín-Martín et al., 2021). As highlighted by these studies, the databases are striving for improving their

coverage and methodology. Though the volume of scientific production is not still definitely known, different resources indicate that scientific output continued to increase. As such, I see merit in presenting this trend via the use of different resources. For example, the National Science Board of the USA in its Science and Engineering Indicators report also showed a similar trend and argued that global peer-reviewed science and engineering journal articles and conference papers increased about 4% annually over the last ten years (National Science Board, 2019). Please kindly note that the report uses the data drawn by Scopus database and even though the name indicates science and engineering the data covers social sciences and psychology as well. Table 1 provides information on the global scientific publications and scientific publications of the selected countries for the period of 2010-2018 annually.

As is shown in the table, though the general scientific production of the countries has followed an increasing trend, the share of the countries in the publications has changed through time. As such, the USA has been the leader until 2018, and China increasing its production continuously has reached 21% of world production and surpassed the USA as the second largest producer with a share of 17%. On the other hand, by 24% share in the world production, the EU countries as a group produced more than China or the United States though it could be due to a basis effect or any other reason. The growth of scientific production of the USA has been respectively slower. Indeed, the report also highlights that the USA's annual publication growth rate is estimated at 1% and has fallen below the world's average (4%). In addition, Figure 1 has shown the trend of the share of selected countries and regions in the world science and engineering production. The improvement by China and India deserves special attention. The report highlights that China (35%), EU (12%) and India (11%) have been placed in the top-three with their contribution to the growth in the world's publication output within the 2008-2018 period.

Table 1: World Scientific Output by Selected Regions/Countries (2010-2018)

Region, country, or economy	2010	2011	2012	2013	2014	2015	2016	2017	2018
World	1948805	2051840	2110004	2179056	2264127	2294092	2377180	2465689	2555959
Canada	76690	79050	82841	84559	87235	87767	89219	90518	92362
United States	486363	506948	517473	525373	535617	537423	541080	552148	548847
Europe	742768	776845	810749	833726	862532	873666	897520	914555	919860
France	94997	98498	102466	105178	106435	106099	106846	107448	104354
Germany	131261	136897	144603	146717	151366	151001	154913	156158	154301
Italy	75978	79060	84611	89440	93285	95347	96822	99130	100117
United Kingdom	130520	135062	140438	145446	149743	153429	156899	160060	161910
Turkey	29421	30507	32260	35008	35967	38102	41005	39442	39449
China	338291	355697	360520	393981	427736	448690	483862	523937	584407
India	69237	81974	89015	95633	106612	112539	123977	134241	150013
Japan	124144	127226	126358	126176	123172	119150	120505	121068	119942

Source: National Science Board (2019)

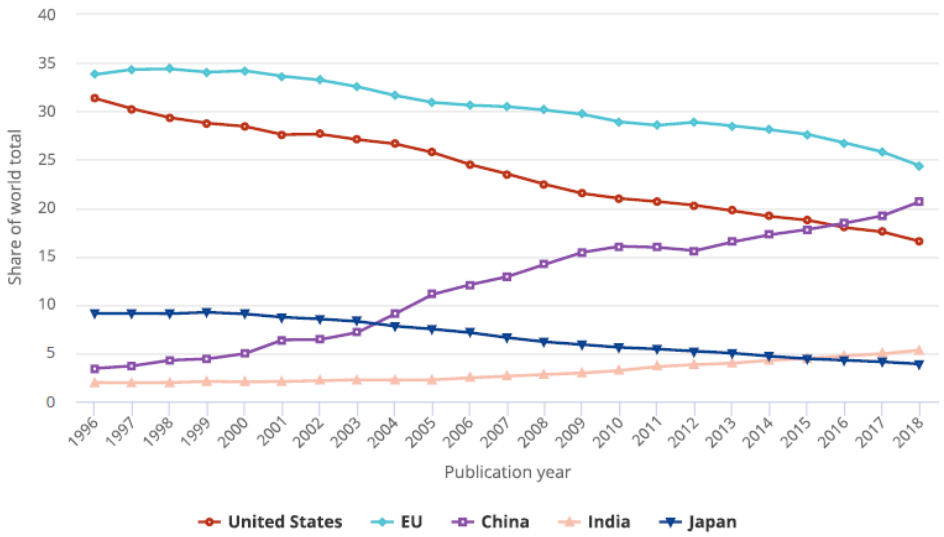


Figure 1: S&E articles, by global share of selected region, country, or economy: 1996–2018

Source: National Science Board (2019)

Figure 2 visualizes the respective data for a narrower group of countries in the semi-log format to allow comparison of trend free of scale effect. Similar to the one in the National Science Board Report (2019), the USA has preserved its leading position until recently. According to Table 2, China has attained the top position in the citable publications in 2020. In addition, total EU-28 production has always been above the other countries. Moreover, India by increasing its production has surpassed Japan in 2014. On the other hand, Turkey's scientific production has increased th rough its relative position has not changed significantly in terms of the number of publications. On a separate note, the values given for a specific country on the previous tables are not the same due to the differences in the focus and scope of the related databases used as a source.

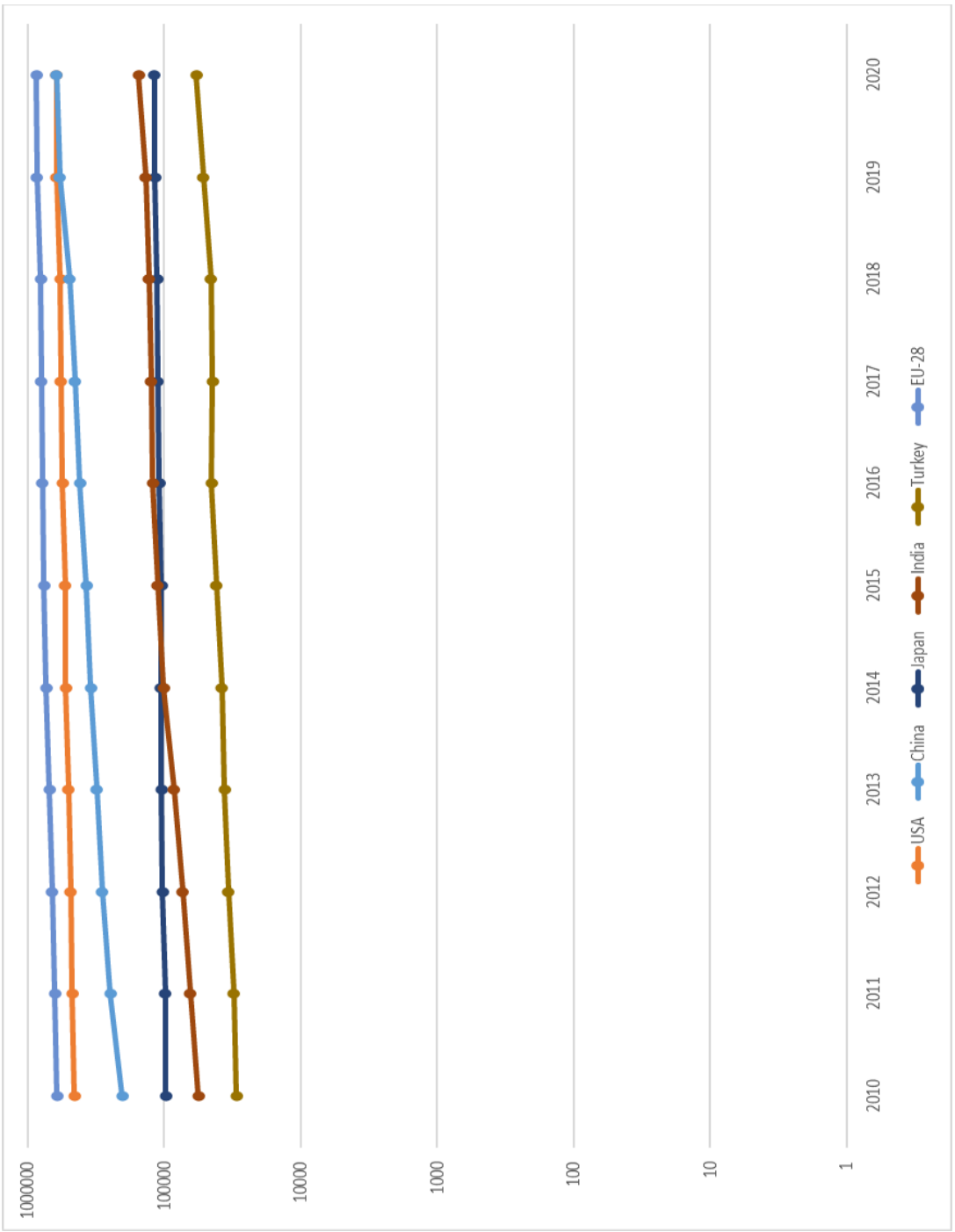


Figure 2: WoS Citable Publications Trend for Selected Countries for the Period 2010-2020 (semi-log scale)

Source: Author's own work

Table 2: WoS Citable Publications Data for Selected Countries for the Period 2010-2020

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	1119046	1194363	1269036	1334293	1412553	1468367	1555940	1607339	1652122	1805148	1857002
USA	455700	473246	487925	502910	526352	534102	557245	571191	575872	614609	615228
UK	128626	135864	140703	150548	154157	163899	172874	179239	180471	196138	198068
Germany	120368	123403	127642	132160	139040	143572	151533	154223	156353	166068	164906
China	203725	248488	285669	311596	344492	373869	417306	452995	493567	582151	617973
France	84970	86348	89176	93382	97569	100351	104090	104427	103811	106864	106998
Japan	97846	98186	102627	104780	105495	104708	108866	112073	113347	117554	118763
India	56229	64525	73522	85332	100853	111747	121527	124465	129547	137248	154633
Belgium	22561	23735	24870	26236	27787	29318	30337	30651	31809	33088	34033
Turkey	29598	30980	33940	36156	38037	41751	45007	44292	45454	51793	58134
Poland	27500	28441	31545	33545	37291	39911	44120	45021	47996	49146	51087
Greece	14515	14427	14924	15432	15852	16170	16592	17207	17289	18669	19163
EU-28	613997	635841	662629	697503	731901	758560	786104	801019	807207	859999	867474

Source: Incites (2022)

Bornmann and Mutz (2014) also conveyed that collaboration measured by co-authorship data has strengthened its place as the main method of work as Price presented in the 1960s. National Science Board also paid special attention to international collaboration and had a separate section on the issue (National Science Board, 2019). According to National Science Board Report, the share of publications produced with the collaboration of academics, and research institutions including universities from at least two different countries namely international collaboration has increased to 23% in 2018. This ratio was 17% in 2008. Referring to several academic studies, the report also indicated that this kind of collaboration could increase the impact of the respective research measured by the citations and argued that domestic collaboration has a similar effect on the impact. The report also elaborates on the collaboration outlook of 15 leading countries in terms of domestic and international ones in 2018. The respective information is presented in Figure 3.

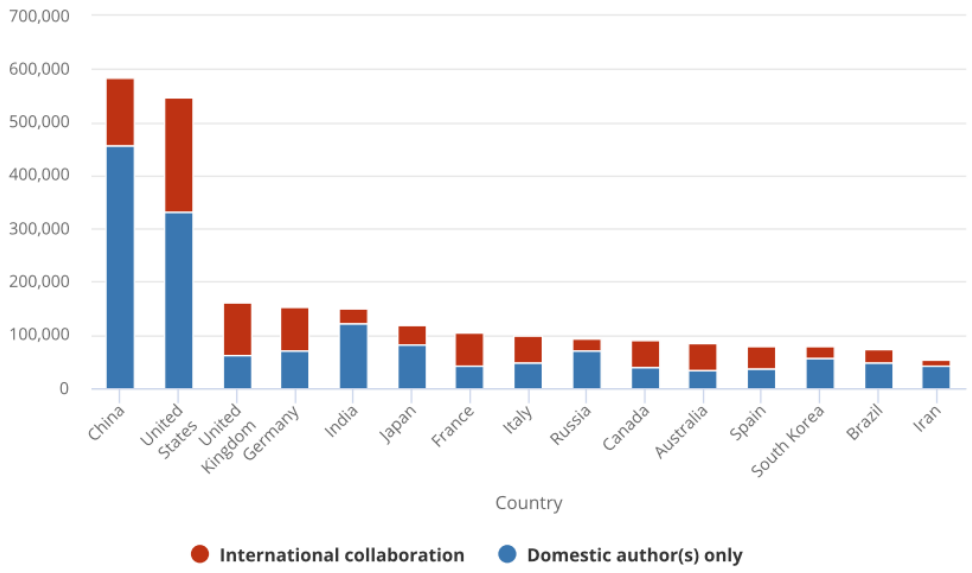


Figure 3: International and Domestic Collaboration of the Selected Countries in 2018

Source: National Science Board (2019)

Data obtained from the WoS also verify the increase in collaboration in the period of 2010-2020. Table 3 provides information on the share of international collaboration in the production of citable publications globally and for the selected countries.

Table 3: WoS Data on the International Collaboration of Selected Countries and Regions (2010-2020) (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	23.28	23.44	23.47	24.43	25.33	26.27	27.19	27.82	28.63	29.00	29.89
USA	27.94	29.14	29.93	31.57	32.86	34.60	36.25	37.10	38.27	38.87	39.91
UK	43.91	44.43	45.50	47.05	50.36	51.96	54.28	55.52	58.01	59.24	62.12
Germany	44.97	45.88	46.62	47.73	48.67	50.12	51.61	52.64	53.49	54.46	57.05
China	18.26	17.46	17.40	19.03	20.41	21.71	22.50	23.50	24.88	25.07	25.54
France	47.40	48.80	49.38	51.12	52.92	54.50	56.67	58.19	59.46	60.82	62.34
Japan	24.56	25.63	25.67	26.21	27.05	28.55	30.07	30.57	31.55	32.74	34.36
India	19.62	19.36	18.50	17.62	17.39	17.07	18.40	19.29	20.68	22.75	24.21
Belgium	56.23	57.64	58.06	59.88	61.92	63.79	64.95	66.50	68.27	69.26	71.49
Turkey	15.82	16.65	17.67	18.32	18.33	19.10	20.57	21.71	22.43	23.27	25.39
Poland	27.99	28.15	27.99	28.56	29.15	29.41	30.24	31.77	31.92	34.35	37.02
Greece	38.42	41.13	42.08	44.12	46.59	48.70	52.08	52.36	53.72	55.18	55.39
EU-28	33.17	34.13	34.60	35.82	37.32	38.68	40.48	41.58	43.07	44.26	46.38

Source: Incites (2022)

As seen from Table 3, around 30% of the global citable scientific publications are produced through international collaboration, and the role of international collaboration has followed an increasing trend within the given period. Though Belgium is not a leading country in the world scientific publication, it has kept its top position in international collaboration. EU-28 collaboration share reached 46.38% in 2020. The USA's international collaboration has been behind the UK, Germany, and France-leading and EU-28 averages in the entire period even the Greece has higher international collaboration. This could be because the USA has a larger base of scientific opportunities and a better ability to attract human capital for its scientific studies and mobilize the resource inflow to the country. Figure 4 summarizes the trend of international collaboration of a smaller group of countries. In addition, the respective ratio for Turkey has been below EU averages and even China for most of the period and always below the global baseline.

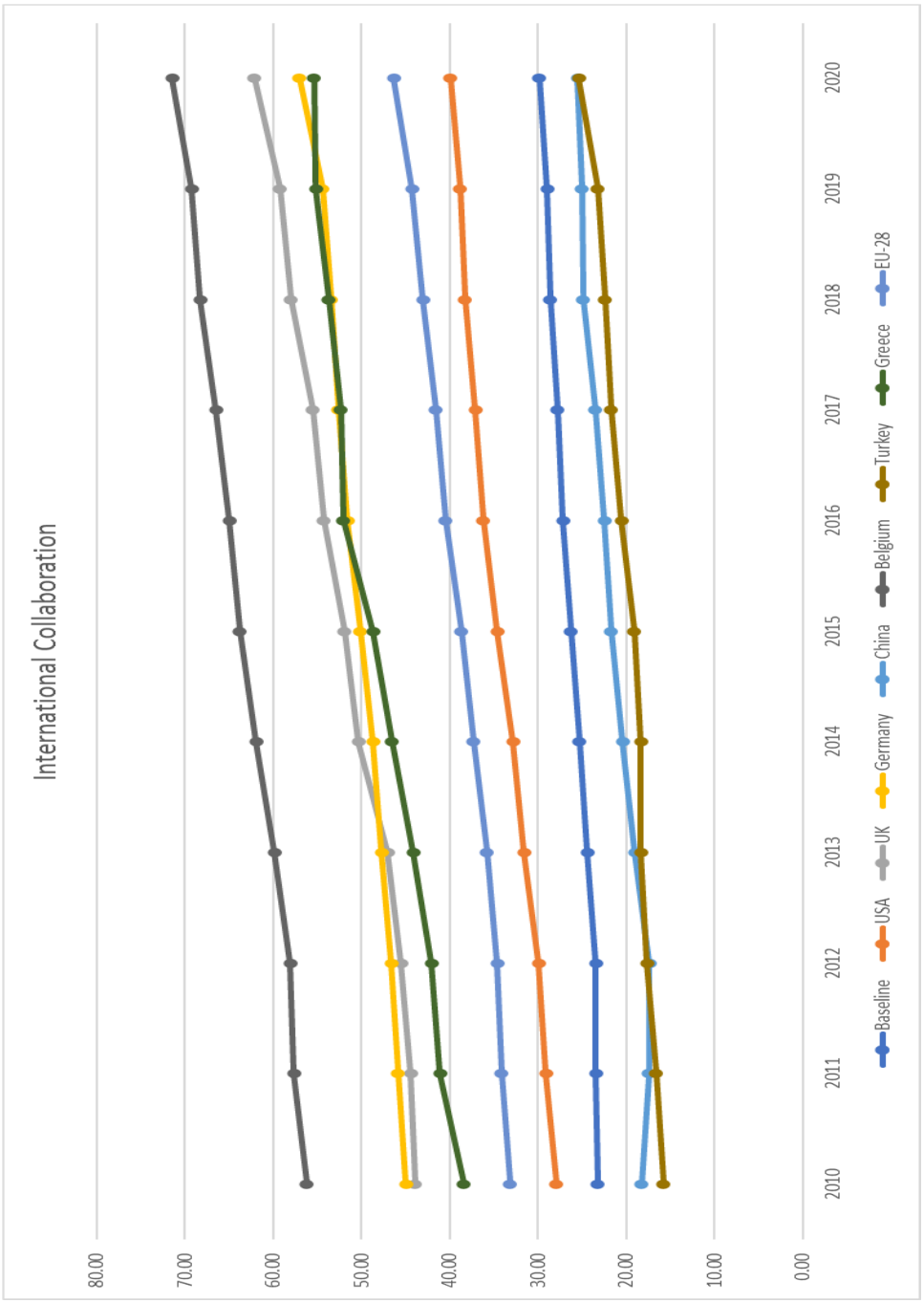


Figure 4: WoS Data on the International Collaboration of Selected Countries and Regions (2010-2020) (%)

Source: Incites (2022)

Although from time to time there could be a reverse relation between domestic and international collaboration it does not always have to be the case depending on the increase in the scientific publications of the respective set of countries. The WoS also collects information on the domestic collaboration of the scientific studies of a country. Table 4 gives information on the domestic collaboration's role in the related citable scientific publication for the same group of the countries. As presented in Table 4, domestic collaboration has also increased globally. Collaboration in the USA and the EU-28 has also followed an increasing path. The general trend could be defined as increasing yet in the countries such as the UK, France, and Belgium, domestic collaboration has been lower with respect to the beginning of the period, which is meaningful when we take the relative increase in their production and the trend of international collaboration in these countries into consideration. Similarly, domestic collaboration in China has increased while its international cooperation is increasing.

Figure 5 also visualizes the respective trends for a narrower group. Belgium has the lowest domestic collaboration values. The relative share of domestic collaboration in Turkey with respect to other countries was higher between 2011 and 2016, which is even higher than in China.

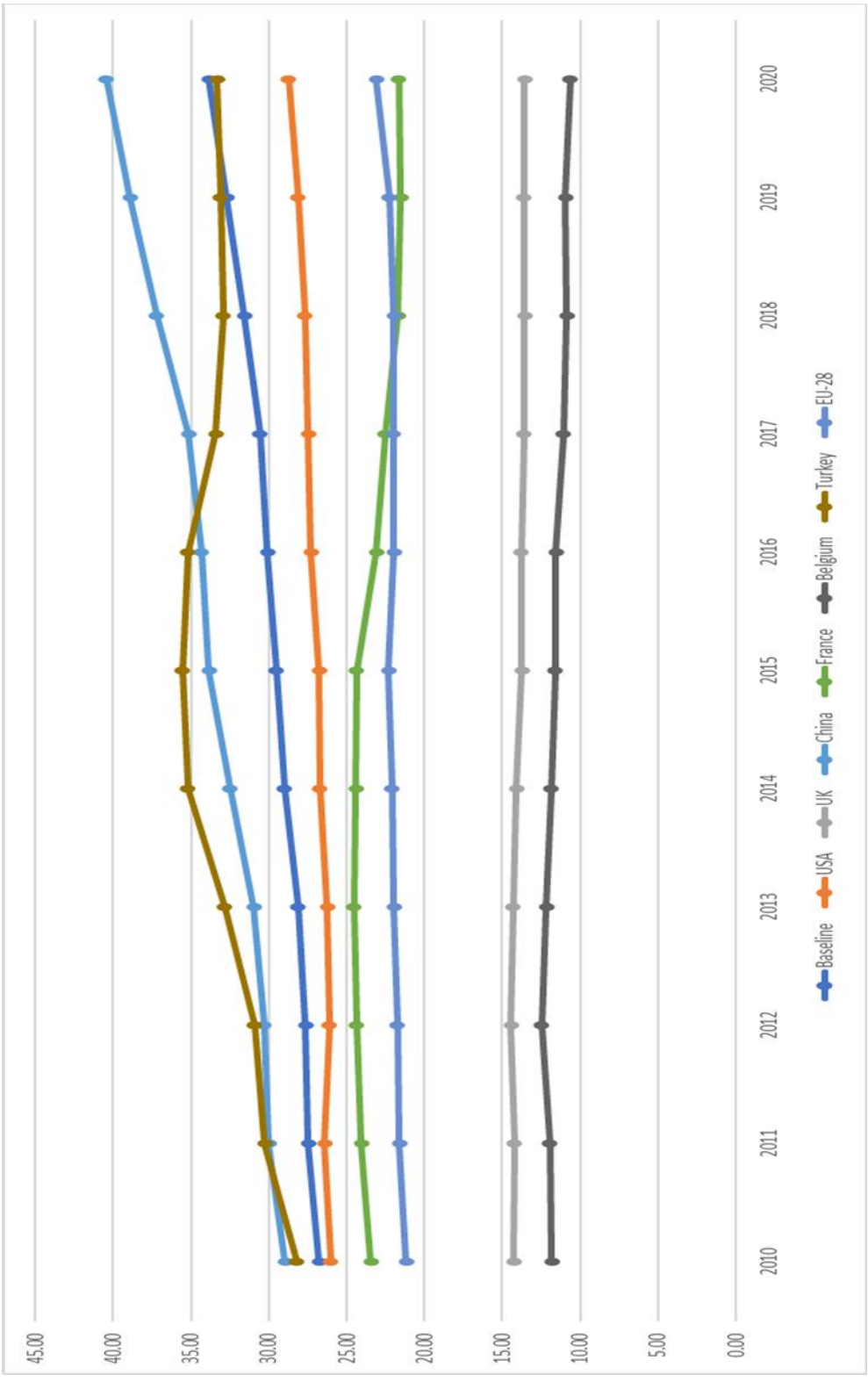


Figure 5: WoS Data on the Role of Domestic Collaboration in Selected Countries and Regions' Publications (2010-2020) (%)

Source: Incites (2022)

Table 4: WoS Data on the Role of Domestic Collaboration in Selected Countries and Regions' Publications (2010-2020) (%)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Baseline	26.75	27.48	27.65	28.11	28.99	29.51	30.10	30.58	31.59	32.70	33.84
USA	26.04	26.40	26.10	26.25	26.74	26.78	27.31	27.46	27.71	28.12	28.75
UK	14.29	14.21	14.46	14.33	14.07	13.75	13.80	13.61	13.59	13.62	13.55
Germany	16.59	16.95	16.91	17.08	17.30	17.23	16.93	17.33	17.32	17.60	17.91
China	28.98	30.01	30.29	30.98	32.50	33.84	34.35	35.16	37.20	38.91	40.47
France	23.47	24.08	24.38	24.55	24.43	24.35	23.11	22.52	21.72	21.52	21.68
Japan	32.44	32.30	31.81	32.40	32.88	32.59	32.57	32.83	32.77	32.80	33.39
India	23.68	24.73	25.32	24.81	25.58	25.64	26.90	26.98	27.77	28.47	28.82
Belgium	11.80	11.97	12.49	12.16	11.88	11.60	11.58	11.07	10.84	10.93	10.65
Turkey	28.21	30.28	30.94	32.87	35.19	35.55	35.22	33.42	32.94	33.11	33.34
Poland	16.08	16.98	17.68	18.77	19.04	20.13	20.19	20.31	20.82	20.76	21.26
Greece	19.97	20.07	19.02	19.16	18.79	18.78	17.38	17.92	17.57	17.76	19.28
EU-28	21.17	21.61	21.73	21.97	22.10	22.32	21.98	21.99	21.97	22.28	23.08

Source: Incites (2022)

Scientific fields can also be a factor affecting collaboration. Yet, the studies indicate that an increasing trend of collaboration has been a common feature of several disciplines (Wuchty et al., 2007). To exemplify, reviewing the university collaborations of 662 universities of USA under 172 sub-fields -classifying them under three main groups such as science and engineering, social sciences, and art and humanities- and the co-authorship of the papers produced between 1975 and 2005, Jones and others (2008) showed that collaboration have increased on all the main groups within the given period. There are studies investigating the trend of collaboration under specific disciplines. In the study on the collaboration trend of social sciences and its several components such as political sciences, sociology, psychology, economics, and history in India between 2000 and 2011, Sangam and Mogali (2013) showed that collaboration was increasing in these areas. Building on these and many others, there are other studies diving into the factors influencing the type of collaboration in social sciences with a disciplinary perspective (disciplinary or interdisciplinary) (Woolley et al., 2015). Another example is in the biomedical sciences, the share of international collaboration has increased from 26% in 2000 to 47% in 2015 in publications placed in the ranking journals (Conte et al., 2017).

In conclusion, while scientific production is increasing, collaboration in the academic world is strengthening all around the world. Thus, as argued by the Jonathan Adams, we observe the rise of research networks. Though the relation between the research networks and scientific production could be just a simple concurrence, the vast literature indicates that is not the case and "*new collaboration patterns are changing the global balance of science*" (Adams, 2012, p.1).

2.1.2 Definition of the Research Network

The literature on the research networks does not provide an official definition of the research network and research network has been approached as an application area of network theory or institutional theory or a combination of both, in general on a specific issue, research in this case. However, the definitions used in the studies have common properties. To be specific and review several definitions:

Elsevier- a global company offering information and information analytics and originated from the publishing of scientific outputs- defines itself as a global research network and argues that "*it offers an efficient way to keep up-to-date on the latest research and connect with relevant peers*" and defined several subject-based sub-research networks under its roof [1].

According to Law Insider, Research Network is "*a network intended solely to support research and development of new or enhanced products and services or advance academic endeavors*"[2].

Similarly, Kategile (1986) defines the research network as a "*cluster of scientists or institutions linked together by a common interest in working independently and inter-dependently on identified and shared, problems or potentials*" (p.1). Focusing on the African Research Network for Agricultural Byproducts (ARNAB) structure, he highlights that scientists, common problems, and the research program as the main pillars of a research network, and with his representation provided below underlines the interactive nature of the network and the importance of the interaction (p.3). On a separate note, Kategile's emphasis on the farmers in his schema has been a different and exceptional one with his user focus. The studies that I reviewed mostly focus on the dynamics of the network and their success to reach their defined aim, which is generally developing a solution or a tool and acceptance or diffusion of these tools not an issue of concern in general.

More broadly, a research network is also defined as a "*manifestation of scientific cooperation*" (Newman, 2001, p.1). In line with this, I also observed that there is a tendency to use research collaboration and research networks interchangeably, which I believe makes sense. Thus, I will refer to the studies focusing on research collaboration as well in the next section while discussing the factor that motivates the establishment of research networks and the advantages of these networks. Mensah and

[1] https://www.elsevier.com/solutions/ssrn/research-networks

[2] https://www.lawinsider.com/dictionary/research-network

Enu-Kwesi (2018) define research collaboration as "*interaction among persons and or entities of diverse interests to embark upon research and use the research findings for pre-determined purposes such as advancing knowledge in a scientific field and or innovation*" (p.5).

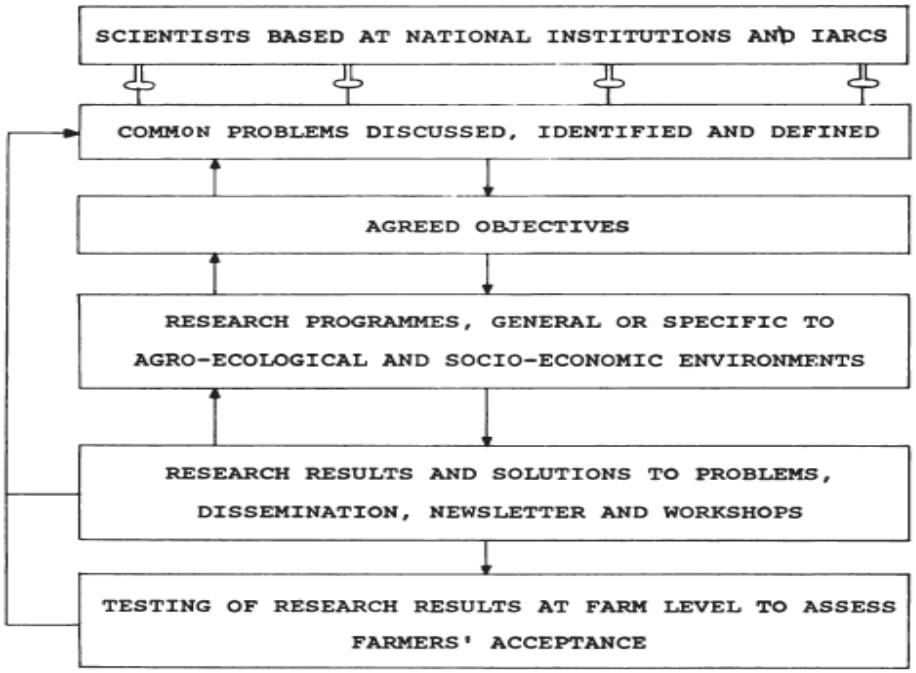


Figure 6: Visual Representation of the ARNAB

Source: Kategile (1986)

Therefore, in line with the definitions provided above and the studies focused on research collaborations, in the study I have used the research network terminology to refer to "a group of people or organizations that come together to answer a scientific question or with a scientific study endeavor".

The research network could be formed on a variety of bases such as topic (agricultural, medical and etc.), structure (formal, informal), geography (national, regional, international), working modalities or approach (disciplinary, interdisciplinary, or transdisciplinary) and any combination of these structures and others (public-private,

public-public, between universities, research centers and etc.). It is not possible to define a set of research networks due to the flexibilities in the definition. Any group of scientists who come together with a research endeavor would form a network, that we can only observe through their definite research outputs. Yet, it will be also useful to give several examples of these taxonomies mentioned above.

Holbrook et al. (2011) conveyed that Wixted and Holbrook defined the formal ones as the ones having "formal administrative structure, a specific amount of fund attributed for a certain research objective, obligation to train, and a requirement to meet a policy agenda" (p. 3-4). Thus, government-funded R&D programs are classified as formal and Partnership Grants Strategic Knowledge Clusters and the Michael Smith Foundation for Health Research of Canada have been referred to as examples of this form (Holbrook et al., 2011). Kegen (2012), for instance, employed the "implicit, personal, unspecific and not codified ties" definitions of informality and evaluated the informal and formal integration of women researchers with excellence clusters under the Excellence Initiative of Germany.

Based on their working modality on the research objective research networks could be disciplinary, interdisciplinary, multidisciplinary, or transdisciplinary. The use of knowledge from different disciplines while staying within their boundaries is called multidisciplinary. Transdisciplinary research is defined as the integration of other disciplines and exceeding their historical boundaries while interdisciplinary one is the establishment of a new coordinated and coherent whole by the synthesis of different disciplines, blending them into a new one (B. C. K. Choi & Pak, 2006). I believe the following Figure 7 is helpful to understand the distinction among these types. As such among many others, the Interdisciplinary Research Institute of Grenoble (IRIG), Interdisciplinary Research Center for Advanced Materials of Saudi Arabia, Harvard Transdisciplinary Research in Energetics and Cancer Center can be counted.

Geography-based examples (national, international, or regional-though the meaning of the region could be complicated from time to time as it means a region with a national border while it is a larger geographic one that could be defined as an international one): EMES (L'EMergence de l'Entreprise Sociale en Europe)

International Research Network, Korean Association for Social Economy Studies (KASES), The European Cooperation in Science and Technology (COST).

In conclusion, research networks are the group of scientists that come together with a scientific endeavor. The structure and forms of these networks could be framed in very flexible ways, and each has its own advantages or complexities that lead to preference of the respective format under the given capabilities of the researchers and the question(s) at hand, that could be more comprehensible with the issues touched upon in the next section.

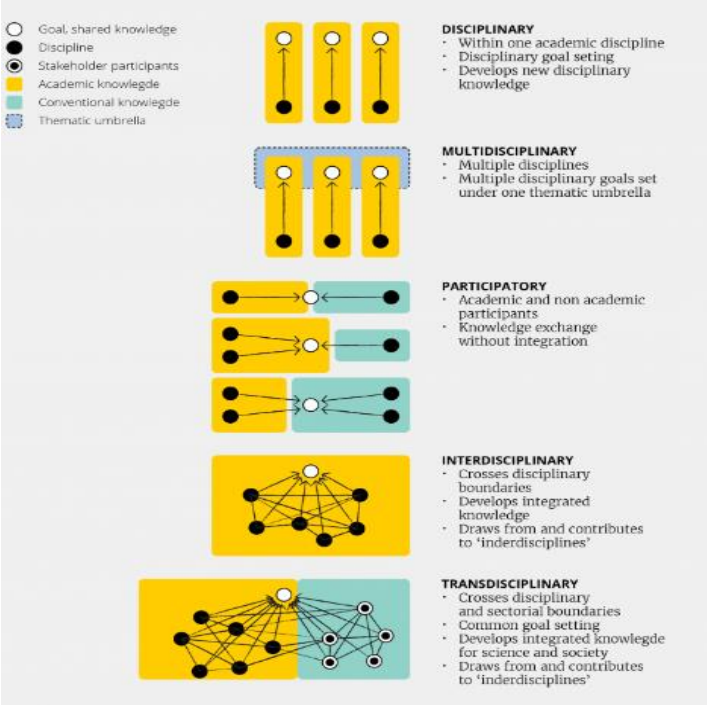


Figure 7: Disciplinarity Approaches

Source: Utrecht University Transdisciplinary Guide[3]

[3] https://www.uu.nl/en/research/transdisciplinary-field-guide/get-started/what-is-transdisciplinary-research

2.1.3 Why Research Networks Exist?

The rise of research networks, a form, and the manifestation of the increasing collaboration in the scientific community, is not a baseless and circumstantial event. Research Networks are used to maintain essential resources including physical capital, knowledge, and capabilities for the research. Depending on the question at hand, being a part of the research network could be obligatory, while it is facilitating in other cases. Adams (2012) argued that research networks are spreading globally, and new regional networks are empowering the competence and capacity of emerging countries. This has transformed the global outlook of research activity and with the creation of new and various methods in these regions, science superpowers could be surpassed and would need to step out of their routines to keep up with this shifting landscape. In other words, research networks could be motivated to explore new and different ways to even problems that are already solved or as a tool for international power conflict. One way or another, research networks have been employed due to their attached and presumed efficiency gains in the scientific studies and it has been motivated by the governments and particularly the policies applied with an internationalization focus is an indication of these benefits.

As highlighted above, it is not always easy to define and observe the existence of a research network and its effect, particularly in the case of informal ones. Though there are early studies indicating some of the authors have been listed as co-authors in some studies for social reasons rather than their contribution to research (Katz & Martin, 1997), others argued that no researcher unnecessarily shares authorship, which is a reflection of esteem and indicator of contribution (Abbasi et al., 2012). Against this background, the most common indicator of scientific collaboration is co-authorship (M. Choi et al., 2021; Jeck & BaláŽ, 2020).

There is a vast literature elaborating on the reasons motivating the research network formation and factors facilitating the integration of research networks and the association between research networks and productivity. These studies also provide insight on how research networks could be designed and how research productivity

could be increased in these networks, and even “how to become an important player in these research networks”.

Research networks' popularity is related to their potential advantages in the production (publications or patents), absorption, and diffusion (through citations) of knowledge. These advantages could stem from the funding, physical capacity, academic capabilities of the partner, partner's network, and even fame for the citation of the respective output. Increasing emphasis on big science and increasing complexity and scale are leading factors for increasing collaboration (Wuchty et al., 2007, p. 1037). The research and development in an environment of this complexity necessitate more specialized resources including knowledge and capacity (Woolley et al., 2015). In other words, scale and complexity are among the issues that research networks provide advantages (Katz & Martin, 1997). In addition, research collaboration also prevents duplication of research efforts (Ubfal, D. & Maffioli, 2010).

To focus on the factors referred above specifically, access to funding is an important factor in determining the limits and feasibility of an (international) research. Researchers or research organizations with access to funding are more likely to be part of international collaborations either by attracting potential partners to projects led by themselves through offered advantages or having more resources to support their expenses to be part of such networks. Similarly, the pooling of resources is also a way to make research possible in some cases, which is generally the case in the collaboration of the university-government and university-private sector partnerships or the collaboration of the different institutions. There are also funding programs that require collaboration in their requirement to harvest other benefits of collaboration - driving diverse expertise, promoting creativity and innovation, and leading scientific discoveries- as well (Woldegiyorgis et al., 2018, p.167-168). Haeussler and Sauermann (2020) convey that team size and composition in scientific studies are also affected by the demands of the funding agencies. Rigby (2009) argues practical evidence shows that funding of academic research is progressively carried out via the support of collaboration and larger networks are associated with high quality and capacity-building benefits for the system, although with significant transaction costs.

In addition, funding is also attached to performance criteria, particularly in the case of universities, which is directly related to the productivity and citation-related advantages of the research networks (Huang, 2014, p.93).

The funding could be provided by the private sector or public sector or a combination of these sources. These actors' willingness to take part in these activities is dependent on the volume of their resources, type of research, and attached social and private benefits and returns of the respective research. Though the funding by the private sector is increasing, public funding is still an important source, particularly in emerging economies (Friedrici & Hakenes, 2011; Ubfal & Maffioli, 2010). Ubfal and Maffioli (2010), though they focused on public funding, have proven the positive and significant impact of funding on collaboration in terms of the co-authorship of the articles in peer-reviewed journals. They have also indicated that public funding could function as an incentive for network formation which is at the center of knowledge/innovation creation via interactive learning.

Therefore, funding itself is a factor that motivates further collaboration (through the pooling of resources, as a requirement to join the network, or requiring collaboration for the funding allocation). In addition, an increase in the publication and citations could attract more funding in return. In other words, we could assume a circular and bi-directional relation between funding and the research network. Thus, funding is both a reason and a facilitator of research network formation.

Accessing a new or better infrastructure and facilities to carry out the research is another reason for participating in a research network. Equipment, knowledge-based resources including scientific databases and collections of resources, computing systems, and communication networks; and any other infrastructure of a unique nature essential in research is defined as research infrastructure[4]. Most of the cases, joint use of expensive or unique equipment through collaborations would make different research possible (Lee & Bozeman, 2005). Another advantage of collaboration is the

[4] https://ufukavrupa.org.tr/en/thematic-areas/research-infrastructures

optimum utilization of equipment through cost savings and prevention of duplicate purchases[5]. A group of academics participating in a study about the effects of collaboration within the EU programs has highlighted that collaboration helps in access to better equipment opportunities (Hakala et al., 2002). Similarly, Lee and Bozeman convey that a study done with the participation of 195 professors on their motivation and experience in their collaborative work highlights the partners' access to certain data or equipment as an important motivation for the collaboration (Lee & Bozeman, 2005, p.676).

Based on the nature of the problem studied, research also requires a certain set of capabilities that could come from the individual inborn skills of the performer, or are the ones attained by learning by doing or experience. One way or another, collaboration has eased access to certain skills or capabilities. Capabilities of the partner have similar implications with infrastructure such as making the research possible or improving efficiency. Lee and Bozeman (2005) and Katz and Martin (1997) highlight the importance of partners' capabilities and competence. Previous findings showed that having many competencies did not always imply an increase in performance (Wright & McMahan, 2011). Moreover, studies focusing on the attributes of human capital affecting scientific productivity suggest the importance of collaboration in research processes and maintaining the complementary combinations of academic attributes (Ballesteros-Rodríguez et al., 2020).

Last but not the least, the fame and reputation of the partner or standing of the partner university are also important factors that motivate the collaboration. The reputation of the partner by extending the web of links facilitates access to new resources either skills or resources, thus the production, and diffusion of knowledge through additional citations in such a competitive landscape (Lee & Bozeman, 2005; Cassi et al., 2008; Petersen et al., 2014). There is a preferential attachment-based up on reputation is commonly observed and sometimes surpasses the novelty as a stimulator (Wagner et al., 2019). Partnering with a famous academics through her/his network may provide

[5] https://dst.gov.in/sites/default/files/latest-02-July-2018-SRIMAN-Policy-Document.pdf

internal referring as well and increase the possibility of publication (Ubfal & Maffioli, 2010; Newman, 2004).

Building on the factors that motivate to establish or take part in research networks, some factors ease the integration to research networks and some of them are overlapping with motivating ones such as funding and skills, and I will not repeat them here.

Proximity including, physical, cultural, and linguistic is an important factor determining the architecture of the networks of goods, knowledge, and people. Cognitive proximity which is sharing a common understanding, social proximity which is attached to language, kinship, and other cultural factors, and organizational proximity indicating to scope and organization of relations in an institutional or organizational context are also indicated as dimensions of proximity that have a potential to affect the network (Jeck & BaláŽ, 2020).

Geographical proximity affects collaboration by increasing face-to-face communication and interaction and strengthening the trust that could induce and facilitate collaboration. In the case of immediate and local proximity, proximity functions as a facilitator, and the case of collaboration between academics from distant locations otherwise increases the transaction cost of knowledge. A study assessing the intensity of co-publications of 493 French Centre National de la Recherche Scientifique (CNRS) researchers in condensed matter physics during 1992-97 has found that the average co-publication intensity of researchers within the same laboratories is higher than the average intensity of the laboratories in the same towns and that it is 100 times higher than the intensity between laboratories which are at distant locations. This includes both the effect of geographical and organizational proximity which could be seen as a pillar of cultural proximity (Mairesse & Turner, 2005).

In the same vein, there are also studies working on the role of transportation costs in scientific collaboration as well. For instance, Catalini et al. (2020) studied the effect of new airlines routes on scientific collaboration preferences and have found that travel

costs are a determinant of collaboration and reduction in transportation costs boosts collaboration between 0.3 and 1.1 times and high-quality scientists are prone to be more positively affected by these reductions and novel and higher quality projects are stimulated more (Catalini et al., 2020).

Although there are studies indicating to diminishing effect of geographical proximity or "death of distance" on co-authorship and the decreasing relevance of territorial borders due to the improvement of information and communication technologies, reduction in transportation costs, the rise of English as the common language, physical distance still matters (Vlegels & Huisman, 2020). With a specific reference to the role of networks and face-to-face contact in the production and spread of tacit knowledge, Jeck and BaláŽ (2020) studied the co-authorship of the papers produced by the EU countries from the period of 1993-2017. They highlighted that due to human capital's critical role in scientific production, geographical, cultural, and linguistic proximities will continue to shape the research collaboration networks. In addition, human capital mobilization which is affected by proximity is a crucial determinant of the co-authorship ties and its importance is growing over time. (Jeck & BaláŽ, 2020).

The study looking into the growth, small-worldness, preferential attachment, and fragmentation of the research in the field of higher education field in 1976-2018 indicates that an increase in clustering while co-authorship increases and increasing variation in the citations and preferential attachment that is the willingness to connect with a more connected one in the network. As such the study highlights the role of efforts to reduce search and communication costs, reducing the risk of productivity and lower visibility and recognition in networking (Vlegels & Huisman, 2020). Another one in the ecology shows that collaboration is structured by geographical distance and socioeconomic factors some of which are also related to physical and social proximity and being in similar trade blocs, having similar scientific structure (i.e., number of citations per document) are associated with higher collaboration (Parreira et al., 2017). In their study about the factors affecting the embeddedness of countries into the global photovoltaics knowledge network between 1980 and 2015, Graf and Kalthaus (2018) also emphasize the role of language and proximity of

geography or institutional frameworks. As such, they note that European countries collaborate more frequently with international partners than their Asian counterparts and Asian countries' research is more domestically handled.

Looking into international collaboration with a broader perspective, Wagner et al. (2019) colleagues state that higher transaction costs due to working across time zones, the need to travel periodically long distances to work together, the loss of information with the use of sub-optimal communication routines, frictions among managements systems increases transaction costs and could have reflections on the collaborations. They also refer to the use of English as the common language in the scientific and work role or removing the language barrier in the development of new and novel studies. On the other hand, they also argue that though it has increased the citations, international collaboration tends to produce fewer novel works, and reputation and audience effects have surpassed the novelty.

Furthermore, through its focus on academic mobility, Paraskevopoulos et al. (2021), reviewing the individual "ego-networks of scientists" and the relation between the structure of academic collaborations, academic performance, and academic mobility highlight that *"the geographical distance, the different academic culture, and incentives might make it harder for a researcher to nurture its collaboration network"* (p.15). Their study exhibit that while the ego-network extends its limits, there happens an improvement in the production and impact of the scientist. Moreover, there are differences in the efficiency of international and domestic migrants in exploiting the advantages of a network, international ones seem to be better in employing their larger networks for a higher number of publications while domestic ones seem to be more effective in exploiting them for achieving high impact. Other important findings of the study have been the better performance of international migrants in enlarging their co-authorship network in their early careers (Paraskevopoulos et al., 2021). At this point, I see merit in emphasizing the positive role of having an education at the partner university and keeping in touch with the colleagues and advisors met there.

Last but not the least, policy preferences of the government also influence the research collaboration or integration into research networks. Governments' policies determine

the structure and the functionality of the research system and international collaboration. These policies could range on a wide range of issues that I mentioned about as the factors motivating to be a part of the research network, from access to funding, infrastructure, capability-building through higher education and employment policies, use of fame, or reputation-based indicators in the assessment and so on. Among many others, Graf and Kalthaus (2018) present that diffusion-oriented national research systems are more open to external knowledge flows and integration into the global research network is strongly influenced by the structure of the national research network as well as by national policies (Graf & Kalthaus, 2018).

In conclusion, many studies consisting of both theoretical and empirical ones that focus on regional, global, or field-specific ones indicate the positive role of research networks on scientific productivity. These studies also indicate that access to funding, infrastructure, and capabilities particularly the complementary ones are the main driving forces for the establishment or integration of research networks. In addition to these factors, geographical, social/cultural, or organizational proximity and using the same language and policies of the government could facilitate the strengthening of the integration with the research networks.

2.2 Scientific Productivity: Definition and Metrics

Scientific productivity is a matter of concern for policymakers for both stepping up in the development race of the nations and legitimizing their efforts and expenses on this front and accountability of the public budgets. In addition, this is important for scientists and institutions, and organizations where scientific studies are carried out to prove and measure their performance. This is also a way to access more and better resources for their future studies. Thus, scientific productivity sometimes functions as a gatekeeper. Having said that, defining what scientific productivity is and the indicators to measure scientific productivity turn into a critical task to be mastered. It should address the diverse needs of the societies, different dimensions of science, and various stakeholders whose acts are subject to it. As such, Tiwari and his colleagues

highlighted that it is critically essential to develop a holistic system for the calculation of scientific productivity and they call their efforts on the issue a "herculean task" (Tiwari et al., 2017, p. 1). In simple economic terms, productivity is a relationship between output generated and associated inputs used in the production process. Yet, it is not always easy to define the productivity in each sector as it is in the manufacturing or other material sectors of the economy, particularly in the ones with intangible nature, such as research and development-related activities (Tiwari et al., 2017).

There are lots of studies that focus on measuring scientific productivity and the factors affecting it and most of these studies while making their definitions of scientific productivity choose a sector as a research domain or a country. The common indicator for productivity measurement used in these studies is generally the number of countable material outputs, namely the number of publications and patents.

Among many others, the study by Lee and Bozeman on the effects of collaboration on scientific productivity of 443 researchers measured the productivity in terms of the number of journal publications (Lee & Bozeman, 2005). Elango and his colleagues compared the scientific productivity of India and South Korea between the years 2008 and 2018 by looking into rank and number of publications, global publication share and growth of publications, international collaboration pattern, quality of publications, and open access pattern (Elango et al., 2021). Another study on the productivity dynamics in higher education in Europe covering 266 universities from 7 seven countries between 2001-2005 used a non-parametric method and used the number of publications in the quality journals as an indicator (Parteka & Wolszczak-Derlacz, 2013). The study aims to elaborate on why Polish science lags behind its European peers and focused on the scientific productivity of the higher education system in Poland by using the number of publications per academic as an indicator of research productivity (Wolszczak-Derlacz & Parteka, 2010). The study advised that education burden and the lack of resources are the critical factors leading to current stance.

Assessing the role of personality traits in scientific productivity by working with a group including 471 Spanish academics, Ballesteros-Rodriguez et al. (2020) provided a good summary of the literature on human capital attributes and scientific

productivity. In the mentioned summary, the number of publications is one of the most referred indicators. In addition, citations are also included in several studies covered there. Building on this and to capture both quantity and quality aspects of productivity, they preferred to use the h-index. A study on the scientific productivity of middle-income countries and factors influencing the scientific productivity used the number of publications and a combination of the number of publications and impact factors (citations per publication within a period) interchangeably (Rivera Léon, 2021). Abramo and his colleagues (2011) in their studies focusing on the relationship between academic rank and research productivity in the hard sciences in the Italian university system used the number of publications and number of citations (as an indication of impact) as research performance indicators. Another study looking into the faculty productivity of the University of Zambia with an internationalization perspective and employing a mixed-method, looked at the number of research projects involved and the number of publication levels, and at the university level visited the h-index[6] of the university (Masaiti et al., 2021). Although the study indicated teaching as an important pillar of the faculty's productivity definition, it did not include the teaching and related activities in the assessment.

Therefore, I can say that there is a tendency to use the number of publications as a measure of scientific productivity in terms of quantity, on the impact side citations and indices built on the number of publications and citations such as the h-index frequently used. However, they are criticized for their appropriateness in clearly picturing scientific productivity and having a simple indicator valid for all cases is meaningless for the future of research or science. For instance, although Bozeman used very frequently the number of publications as an indicator of scientific productivity in his early studies, Bozeman and his colleagues said that as science and innovation management studies have moved beyond a narrow notion of scientific productivity, one based on such factors as publication counts, *"the sum of an individual researcher's*

[6] The h-index combines the number of articles produced and the number of citations to the respective articles. It is calculated by looking into how many of the scientist's publications have been cited up to h times by other publications (Masaiti et al., 2021, p.72).

professional network ties, technical knowledge and skills, and resources" emerged as an alternative for analyzing research capacity (Corley et al., 2019, p.682). Individual scientific productivity covers additional indicators beyond publications and patents and performance and productivity would mean different things in different stages of the professional development of a researcher (Corley et al., 2019, p.693). For example, the use of the number of publications is judged for breaking the linkage between the study and its impact. In this regard, replicating an industrial efficiency assessment model, Abramo and D'Angelo (2014) developed a model called Fractional Scientific Strength (FSS) using the salary, publication and citations data and calculating a weighted average, and compared the Italian universities with respect to traditional indicators and their method.

There are various efforts to improve alternative measures of scientific productivity. Tiwari and his colleagues (2017) studied the scientific productivity in the R&D with an analogy to different sectors of the economy. Underlining the role of reasons stimulating the productivity measurement and availability of data in definition and choosing the relevant indicators, they visited the use of productivity measure[7] in the R&D sector and recommended the use of a more holistic system. They advised that the measurement of scientific productivity should be structured at three levels, scientist level and organizational level, and its contribution to the national economy. With that, they recommended the use of the following factors as indicators of scientific productivity; increase in the number of publications and qualifications, citation index (h index), doctoral research guided, number of projects (national and international), technical learning, patents, technology transfers to industry, certifications acquired, and technical training provided and gained, involvement in policy-making, consultancy projects, involvement in survey and analysis works.

In conclusion, there is no commonly agreed definition of scientific productivity and set of indicators to measure it. Its definition could differ with respect to the focus of

[7] Productivity is a relationship between output generated and associated inputs used in the production process.

the assessment. In the case of assessing the scientific productivity of the universities or a country, its activities or resources attached to human capital building facilities such as teaching is also critical in the sense that it has both a capacity increasing role and crowding out effect on the academics' research endeavor and their potential network extension possibilities (Ynalvez & Shrum, 2011; Abramo et al., 2017; Wolszczak-derlacz & Parteka, 2010) and commercialization and transfer of knowledge are also crucial.

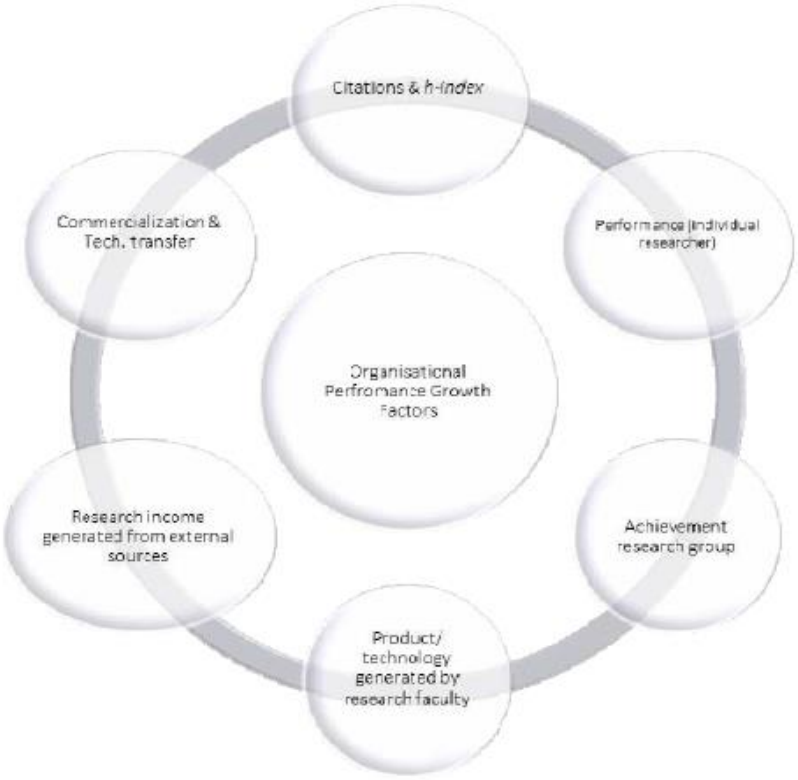


Figure 8: Scientific Productivity Framework Recommended by Tiwari and others

Source: (Tiwari et al., 2017, p.28)

Thus, using more comprehensive definitions of scientific productivity, more inclusive indicators and flexible use of indicators would be healthier to capture a better sense of

scientific productivity and better policy decisions. Yet, this comprehensiveness is not costless as we need more data.

We would also need to use tailor-made indicators that could limit the comparability among different segments. This is sometimes good as we relieve ourselves from comparing the oranges and apples and while it is bad in some cases bad as we could not transform the available data to similar units due to the differences among the countries, etc.

2.3 University Rankings

The role of organizations or institutions in science and R&D changes concerning the country (developed or developing, the potential of the private sector), and the focus of research (basic or applied) (Hannay, 1974; Ubfal & Maffioli, 2010), universities have been the leading one in the knowledge creation and an integral part of the production chain of innovations and skills and transferring them to business and society (AI-Youbi et al., 2021). Thus, they are the appropriate venue to study while working on scientific productivity.

Based on the role of collaboration on scientific productivity, governments that are interested in increasing their scientific capacity followed several various policies concerning their aims and relative positions in the area. As such, particularly the internationalization of the higher education system which is at the center of scientific productivity in most countries has become an important preference. Internationalization is seen as an important tool to address and help with economic growth and investment, foreign policy priorities, cultural functions, institution building and financial incentives, and improvement of quality research (de Wit, 1995). Internationalization of the higher education system or universities consists of international mobility of academics, international teaching, and research activities, and academics' views on international activities at both individual and institutional levels (RIHE, 2014; Knight, 2008). These issues along with other factors influencing

the capabilities of the human capital are included as indicators under the university/academic rankings.

University rankings are commonly used to measure and follow the progress of universities and to compare the universities nationally and globally by the international academic community, students and their families and governments, and even by the private sector. With that and based on the level of importance and role attached to these rankings by the respective stakeholders, they have the potential to affect the funding opportunities of the university, the inflow of good and qualified academics and students, and determine the network of collaboration of the university. All of which in return also positively feed into the ranking.

The rankings represent the standing of the university, which could affect the collaboration of the academics working at that institution and the university as an organization. They are also affected by the performance of academics affiliated with the respective university. Assumed to measure the scientific productivity of the universities, rankings also have a power on the mobilization of the resources to the sub-indicators themselves by the universities that aim to improve their position on that ranking. In other words, no matter whether it is intended or not, rankings affect the flow of resources to several educational and research-related activities. Though they provide a basis for comparison of the universities globally, they also force universities to follow the same route of activities for access to funding and human and physical capital. In other words, they motivate the follow of "one fits all" logic, which is not always leading to the best outcome for the country, university, and science.

Elsevier describes the university rankings as *"diverse, imperfect, and influential"*[8]. According to Elsevier, the number of global university rankings exceeds twenty, and though their common characteristics they all have a different vision, scope, working modalities, and statistical methods reflecting these. To name a few of them: QS World

[8] https://www.elsevier.com/research-intelligence/university-rankings-guide

University Rankings, Times Higher Education (THE) US News[9] and World University Rankings, Shanghai Rankings, CHE Rankings in Germany[10], the ranking system of the Leiden University in the Netherland, Ranking by the National Taiwan University (NTU), and University Ranking by Academic Performance (URAP) Rankings in Turkey. Though it is not directly related to the thesis, it is also interesting to note that some of the rankings of the USA, UK, and Germany have developed in cooperation or supported by the prominent publishers of the country such as US News, Times, and Die Zeit.

Rankings based on critics directed to themselves or to align with the changes in the academic environment revise their methodologies and sub-indicators periodically. I summarized some of the global university rankings in Table 5. As seen from Table 5, though they all include publications, citations, and international collaboration as an indicator of themselves, they also employed different factors such as open access, gender, industry, and teaching-related indicators.

Table 5: Summary of the Selected Rankings' Indicators

Ranking system	**Indicators used**
US News[11]	Global Research Reputation, Regional Research Reputation Publications, Books, Conferences, Normalized citation impact, Total citations Number of publications that are among the 10% most cited, Percentage of total publications that are among the 10% most cited International collaboration, International collaboration – relative to country Highly cited papers among the top 1% most cited in their respective field Percentage of total publications that are among the top 1% most highly cited papers

[9] https://www.usnews.com/best-colleges/rankings/national-universities

[10] https://www.daad.de/en/study-and-research-in-germany/plan-your-studies/che-university-ranking/

[11] https://www.timeshighereducation.com/world-university-rankings/world-university-rankings-2022-methodology

Table 5 (cont'd)

Ranking System	Indicators used
THE Ranking[12]	Teaching (Reputation,Staff-to-student ratio, Doctorate-to-bachelor's ratio, Doctorates-awarded-to-academic-staff ratio, Institutional income) Research(Reputation,Research income, Research productivity) Citations International outlook (staff, students, research collaboration) Industry income
Shanghai Ranking[13]	Quality of Education(Nobel Prizes and Fields Medals by the alumni) Quality of Faculty (Nobel Prizes and Fields Medals by the staff, Highly-cited Researchers) Research Output (Papers in Nature and Science, Papers indexed in Science Citation Index- Expanded and Social Science Citation Index) Per Capita Performance (Per capita academic performance of an institution)
URAP Ranking[14]	Article, Total Document, Citations, Article Impact Total, Citation Impact Total International Collaboration
Leiden Ranking[15]	Scientific impact indicators (Total number of publications of a university,total and average number of citations of the publications) Collaboration indicators (Total number of publications with more than one organizations or countries, distance based sub-segments) Gender indicators (The number and proportion of male and female authorships) Open access indicators (open access of publications and category of the publication, gold, hybrid, bronze)

The lack of the ideal ranking which is applicable for all and efficient is an accepted phenomenon. On the other hand, there are common deficiencies that most of them suffered. First, they all work on aggregations and there is no room for individuality

[12] https://www.usnews.com/education/best-global-universities/articles/methodology

[13] https://studyabroad.shiksha.com/shanghai-arwu-world-university-rankings-methodology-articlepage-2767#:~:text=For%20their%20ranking%2C%20the%20Shanghai,%2DExpanded%20(SCIE)%20and%20Social

[14] https://www.leidenranking.com/information/indicators

[15] https://urapcenter.org/Methodology

and creativity[16]. Only a limited set of them have reference to other social functions. They use a limited set of attributes on which internationally comparable data exist and suffer from a lack of internationally comparable data on teaching and learning, student, and societal engagement, and third mission. Even the ones including this kind of data use surveys and institutional submission for data collection. This sometimes ends up with sketchy, distorted, and unreliable data. There are also data flaws in the citations and publications. For example, US News Rankings do not include art and humanities data in citations while including them in the publications due to Clarivate database features. Moreover, some of them suffer from errors due to non-standardization of the relevant information such as the names of institutions (Dogan & Al, 2018). On the other hand, they generally tend to focus on articles and reviews and do not take other types of publications that have scientific inputs such as books and conference proceedings that are not covered. Though they aim to target capturing quality with the indicators using top-tier citations, these indicators are mostly focused on quantity. They also suffer from the frictions in the academic publishing world and flaws within such as the network tendencies and working practices of the respective journal and choosing the popular topic rather than the novel one etc. Most of them are also favoring English-speaking countries by including only the journals published in English (ARWU, US News, THE). Some of them refer to indicators that are strongly correlated to wealth such as; institutional age, tuition fees, or endowments, which could lead to self-perpetuation. (Hazelkorn, 2019; Pusser & Marginson, 2013).

Therefore, though they have been commonly used in policy-making globally and influencing the preferences of the stakeholders, university rankings with their limited coverage and flaws in their data resources are not always very successful indicators to build on the future of individuals and generations and they should be used with great caution.

Due to their extensive use and potential to be used as a supplementary tool, UNESCO European Centre for Higher Education (UNESCO-CEPES) and the Institute for

[16] https://www.elsevier.com/research-intelligence/university-rankings-guide

Higher Education Policy launched the International Ranking Expert Group (IREG) in 2004. The aim was to maintain responsible development, dissemination, and use of the academic rankings and make them more accountable. The IREG was restructured as a non-profit organization in 2009 and its name became IREG Observatory on Academic Ranking and Excellence. IREG Observatory has more than 50 members worldwide including universities, ranking institutions, and excellence centers[17]. In this regard, IREG developed the Berlin Principles on Ranking of Higher Education Institutions in 2006. Berlin Principles aim to develop a common understanding of rankings and improve clarity, transparency and continued and consistent progress. They address the purpose and goals of rankings, design, and weightings of the indicators, collection, and progress of data, and presentation of the ranking results[18].

In a similar vein, in 2012 a group of academics have come together to draw attention to the deficiencies in the measure of scientific output and their attached negative effects on science and scientists. They argue that the current system of measure - particularly the use of journal impact factor (JIF)[19]- is manipulable, opaque, incomparable effectively and not accessible by the public. However, with all these deficiencies they are affecting the career and resources of academics, the development of human capital, and the general flow of funds to research. Thus, to find accurate and wise ways to measure the quality and impact of the research, they released San Francisco Declaration on Research Assessment (DORA) in 2012. DORA underlines *"the need to eliminate the use of journal-based metrics in funding, appointment, and promotion considerations; the need to assess research on its own merits rather than*

[17] https://ireg-observatory.org/en/about-us/

[18] http://ireg-observatory.org/en_old/berlin-principles

[19] "The Journal Impact Factor of Thomson Reuters is a quantitative assessment of a journal's influence or impact. It is calculated by dividing the number of citations in a year by the total number of articles published in the two previous years." https://suffolk.libguides.com/c.php?g=654084&p=4589563#:~:text=According%20to%20Thomson%20Reuters%2C%20the,in%20the%20two%20previous%20years.

based on the journal in which the research is published; and the need to capitalize on the opportunities provided by online publication"[20].

DORA includes recommendations for researchers, funding agencies, institutions using these metrics in their employment decisions, organizations producing these metrics, and publishers. There are 18 recommendations in DORA. These recommendations mainly aim to remove journal-based metrics from the system, advise on the improvement of the current practices by increasing transparency, comprehensiveness, more explicit information on the calculations of metrics and author contributions, using alternative ones together, use of article metrics, and focusing on content rather than these metrics during assessments. Since 2012, DORA has gotten enormous support from academia and transformed into an Initiative. Today, more than 21,000 individuals and organizations in 158 countries have joined DORA. They all are working under the roof of DORA to increase awareness of inappropriate uses of metrics in research assessment, to promote tools and processes that facilitate best practice in research assessment in all scholarly disciplines and regions of the world[21].

University rankings affect the division and flow of resources among universities and the system criticized by DORA- journal-based metrics- mainly affects the resources of an individual or group of individuals. With that, they could be seen as irrelevant by some. However, they are closely related and complement each other and highlight the same critical deficiency, the lack of an adequate measure of research outputs, and problems it could create in the scientific community and science. In addition, they both address the same stakeholders, public authorities, institutions, university researchers, funding agencies, and publishers. Considering the methodology, they both suffer the problems of the journals' world, including the editorial manipulations, the assertiveness of several journals on the several issues or the techniques, and the

[20] https://sfdora.org/read/

[21] https://sfdora.org/2018/06/27/dora-roadmap-a-two-year-strategic-plan-for-advancing-global-research-assessment-reform-at-the-institutional-national-and-funder-level/

chicken-egg dilemma through the role of citations[22] and using a limited data set (on in journals and looking into articles etc.). Criticism of both rankings and the DORA underlines the necessity to find more quality and content-based, comprehensive, and inclusive methodologies to assess the research outputs. As a result of the need for improving rankings and a reflection of the different rankings having different focuses, a recent change in rankings has been the introduction of the impact ranking by THE in 2019. Impact Rankings assesses universities against the United Nations' Sustainable Development Goals (SDGs). Focusing on research, stewardship, outreach, and teaching pillars, it looks into university performance under all SDGs. Impact ranking is an outcome of a responsible ranking approach with a social duty perspective[23].

Therefore, there are critical limitations of the rankings and use of journal-based metrics in the research and researcher assessment. Thus, we should be careful while using these kinds of methods to set a target on science and scientific development of the country or institutions and planning the amount and use of resources of the country on science or the higher education system, which is critical in the scientific productivity and development of the countries.

2.4 Turkey's Approach to Scientific Productivity and Research Network Integration

Turkey also attaches utmost importance to science and increasing scientific productivity as a way of reaching its development-related aims and empowering its position in the world as an economic and political power. Turkey has been publishing five-year Development Plans since 1963. These plans convey the main aims of the country within the respective period by setting a common policy framework in which

[22] The higher citation, the higher JIF, and the higher the ranking while the ones with a better ranking and JIF have the potential to attract more citable authors or articles or got a higher citation.

[23] https://www.timeshighereducation.com/impactrankings

all the law and regulatory efforts would feed to reach those aims and serve as a roadmap.

Since 1963, Turkey published 11 Development Plans and these Plans also set the agenda of Turkey on science, research and development, and the related activities that facilitate scientific development such as higher education. Thus, it will be helpful to visit some of these plans to reflect Turkey's general policy framework on science policy. I believe particularly the last three Plans would be useful and meaningful to visit in this regard.

The 9th Development Plan was an exception in terms of its period which is longer than five years. The Plan covered 2007-2013 and had five main pillars: Increasing Competitiveness, Increasing Employment, Strengthening Human Development and Social Solidarity, Ensuring Regional Development, and Increasing Quality and Efficiency in Public Services.

Science and R&D were addressed under the pillar of increasing competitiveness. As such, the plan highlighted that in Turkey the R&D infrastructure was mostly located in universities and public research institutions, and most research activities were carried out there. The number of full-time equivalent research personnel per economically active person was well below the OECD averages as of 2002. In addition, in Turkey, 73.1% of the researchers were working in higher education institutions, and 70% of the researchers in developed countries were in the private sector. According to the plan, as a shortcoming of the previous plan period, the share of allocations from the EU Framework Programs was rather low due to the inadequacy of the connection with the EU research network, the R&D infrastructure, and the number of researchers was highlighted as the main reasons of failure.

The respective aims were stated as:

R&D activities would be market-oriented and designed in a way that would produce innovations. The share of R&D expenditures in GDP and the weight of the private sector in expenditures would be increased. (As of 2013, the private sector's share in

the total R&D expenditures of Turkey would be at least 60 percent.) Increasing the innovation capacity of the private sector was one of the main objectives of the science and technology policy. The human capital in the research would be strengthened in terms of quantity and quality, and researcher employment in the private sector would be encouraged. The transfer of Turkish researchers working abroad would be supported particularly in prioritized areas. In addition, the employment of foreign researchers in Turkey would be promoted if needed in a special field. The R&D activities carried out in universities would be designed in a way to contribute to the economic, social, and cultural development of the country, and the results of patents and similar results of these studies, apart from scientific publications, would be taken into account in academic promotion. University-industry cooperation would be developed and the use of infrastructure and R&D human capital of universities by the private sector would be supported. Cooperation activities for knowledge and technology transfer would be carried out with countries competent in the field of science and technology, especially EU countries.

In addition, under the "Strengthening Human Development and Social Solidarity" pillar, Plan stated that centralized structure and the deficiencies related to the quality of the higher education system continued to harm the competitiveness of higher education and its capacity to respond to the needs of society. To meet the needs of faculty of the recently established universities, domestic and international faculty training programs would be continued. The financial resources of higher education institutions would be increased and diversified. The Council of Higher Education would be restructured to be responsible for standard-setting, coordination, and planning. By ensuring higher education institutions have administrative and financial autonomy in line with the principles of transparency and accountability and specialize in accordance with local characteristics, the system would reach a competitive structure (*Dokuzuncu Kalkınma Planı*, 2006).

The 10th Development Plan covering the 2014-2018 period was designed under four main pillars: Qualified People and Strong Society, Innovative Production, Stable and High Growth, Livable Places and Sustainable Environment, and International

Cooperation for Development. "Science, Technology and Innovation" was covered under the Innovative Production, Stable and High Growth pillar. The plan indicated that during the previous plan implementation period the amount of resources allocated to R&D and the number of scientists, as well as the private sector's R&D activities, expenditure, and researcher employment increased, and research infrastructures had been expanded in universities, public institutions, and private sector. Although the ratio of R&D expenditures to GDP increased from 0.6 percent in 2006 to 0.86 percent in 2011, it remained under the 2 percent target in the 9th Development Plan. The number of full-time equivalents (FTE) researchers in our country, which was targeted at 80 thousand at the end of this period, reached 72 thousand as of 2011. Yet, it was still below EU averages. As of 2011, 43.2 percent of R&D expenditures were made by the private sector and 48.9 percent of FTE R&D personnel were employed by the private sector. To improve the research capacity of universities, central research laboratories were established in 20 universities. Turkey ranked 18th in the world in terms of the total number of scientific publications as of 2010. However, it was ranked 45th in terms of the ratio of these publications to the population and performed very poorly in comparison to EU countries in terms of average citations to publications.

The Plan underlined that conducting science, technology, and innovation policies in a complementary way to other policies, especially education, industry, and regional policies; was important for increasing added value in services and agriculture sectors, developing innovative entrepreneurship, and activating regional potential. Despite the progress made, the need to increase both the amount of resources allocated for R&D and innovation and their effectiveness to turn them into the desired benefit continues.

With that, the Plan's respective aims were:

Research centers within universities and public institutions would be transformed into sustainable structures that work in close cooperation with the private sector, had qualified human capital, provided uninterrupted service to all researchers, and were managed effectively. The structure and operation of technology development zones would be improved to maximize university-industry cooperation, joint R&D and innovation activities between enterprises, and innovative entrepreneurship. Measures

to facilitate and encourage university and private sector cooperation would be taken and interfaces would be created. In this framework, the restructuring of higher education, R&D, and entrepreneurial activities of academics and students would be encouraged.

The training of competent researchers in basic and social sciences would be supported, and the number, quality, and effectiveness of research in these fields would be increased within universities and public institutions. Regional and global cooperation would be strengthened in R&D in terms of activities, research infrastructures, and human capital.

Under the "Qualified People and Strong Society" pillar, the higher education-related diagnosis was provided, and respective aims were set. As such; it was aimed to reach a competitive higher education system on a global scale within the framework of the university model that was sensitive to the needs of the society and the economy, interacting with its stakeholders, transforming the knowledge produced into products, technology, and services, and was autonomous in terms of academic, administrative and financial aspects. The higher education system would be transformed into a quality-oriented competitive structure within the framework of the principles of autonomy, performance-oriented, specialization, and diversity based on accountability. Higher education institutions would be diversified, and the higher education system will become a center of attraction for international students and faculty members. Transforming higher education institutions into an output-oriented structure that attaches importance to technology production in cooperation with industry would be encouraged, and income sources would be diversified with entrepreneurial activities.

The 10th Development Plan also had several prioritized transformation plans and one of which is about "Improving International Cooperation Infrastructure for Development". This Transformation Plan had an action to launch academic programs

for students and academics from LDC countries in the process of economic and social transformation (*Onuncu Kalkınma Planı*, 2013).

The last Development Plan-11th- covers 2019-2023. 11th Development Plan has five pillars; Stable and Strong Economy, Competitive Production and Efficiency, Qualified People, Strong Society, Livable Cities, Sustainable Environment, State of Law, Democratization, and Good Governance. "Research and Innovation" in parallel to the previous plan are addressed in the "Competitive Production and Efficiency" pillar as an item of Industry Policy. The plan notes that progress was made and the share of R&D expenditures in GDP increased to 0.96 % in 2017. R&D and innovation support programs were diversified, private-sector R&D expenditures and the number of researchers increased, research infrastructures were expanded, and Law No. 6550 on Supporting Research Infrastructures came into force in 2014 to increase their effectiveness. However, the need for the development of information and technology transfer, entrepreneurship, and commercialization activities, which enable R&D results to be transformed into economic and social benefits, continues.

The main objective is to strengthen the R&D and innovation capability of the manufacturing industry to make value-added products and increase the innovative product development capacity and make it a structure based on innovation. R&D and innovation supports will focus on the intersection of priority sectors and critical technology areas in line with the technology roadmaps to be prepared.

The number and quality of researchers in the private sector will be increased. Qualified human resources with doctorate degrees needed in the industry will be trained through university-industry cooperation, and employment of researchers with doctorate degrees in the industry will be encouraged. In cooperation with universities and industry, graduate programs will be created to meet the needs of the industry, especially in priority sectors, and universities that open these programs will be encouraged. Cooperation between universities, research infrastructures, and the private sector will be improved, support mechanisms to increase knowledge and technology transfer, will be implemented, and the efficiency of interface structures will be enhanced by improving their institutional capacities. Research universities will

be matched with priority sectors, taking into account their competencies, business models based on projects created to achieve the determined goals will be put into practice, and these collaborations will be supported. Improvements will be made in the legislation on the commercialization of intellectual property registered on behalf of higher education institutions through TTOs with different statuses, return of income to university and payment to inventors, and ensuring the financial sustainability of TTOs.

The academic incentive system will be structured by adding criteria that take into account information and technology transfer activities. To obtain a higher value-added share in the global value chain, preliminary research will be carried out in our country. The R&D laboratories to be established in Turkey by national or international companies that produce pioneering scientific and technological knowledge in their fields will be supported. Share of Private Sector in R&D Expenditures will be 67% in 2023.

Under the "Human Capital" sub-pillar of Industry Policy, higher education and R&D-related other actions are underlined. To mention some of them:

Graduate programs will be established in cooperation with universities and industry to improve the human resources capacity of companies in priority sectors in R&D and innovation processes. The number and diversity of associate degree, undergraduate, and graduate programs for priority sectors will be increased and special attention will be given to R&D activities in this field by universities. A project pool will be created by the industry in the areas needed in priority sectors, and within the framework of the standards established by the Council of Higher Education (YÖK), students and thesis advisors will be supported with the contribution of relevant professional organizations and companies, if a doctorate and master's thesis topic is selected from this pool. Scholarship programs will be created to send postgraduate students to overseas education institutions with proven competency in critical technology fields, with varying amounts of support compared to other fields. Competent academics and

researchers from abroad will be encouraged to work part-time at universities with specialized programs in critical technologies.

Under "sectoral policies": The roles of universities in the R&D ecosystem will be strengthened. Budget resources allocated for strengthening the R&D infrastructures of universities and improving scientific research projects in terms of quantity and quality will be increased.

To ensure that the scientific research project budgets of universities are in harmony with the macro targets, to ensure that the projects are carried out effectively and efficiently, to increase coordination and cooperation among universities, and to strengthen the harmony between the Plan objectives and the projects, a coordination and support unit will be established within the YÖK, a policy regarding scientific research projects.

The Research University program will be strengthened so that universities can carry out R&D and innovation activities that will support high-value-added production, and the capacities of universities included in this program will be increased with special support. Employment of post-doctoral contract researchers will be increased in research universities.

The number and quality of R&D personnel will be increased. Qualified researchers carrying out high-level scientific and technological studies abroad will be supported to come to Turkey and train researchers within the scope of the International Leading Researchers Program. A mechanism will be established to provide laboratory infrastructure and research funds that allow leading Turkish scientists abroad to carry out part-time education and research activities.

Regional and global cooperation, especially with EU countries will be developed in terms of R&D activities, research infrastructures, and research. The ratio of R&D Expenditures to GDP (%) will increase to 1.8%. The number of R&D personnel (FTE)

will be 300000. The number of Ph.D. (or above Ph.D.) R&D Personnel per Million People will be 863.

Under the "Qualified People, Strong Society" pillar under the education sub-pillar higher education is also covered. Respective aims are:

The higher education system will have a globally competitive, quality-oriented, and dynamic structure; practices aiming at increasing the qualifications of higher education institutions will be continued. By 2023, at least 2 of our universities will be in the top 100 and at least 5 of our universities will be in the top 500 in the world academic success rankings. In the plan period, especially in priority sectors, the number of doctorate graduates will be increased to 15 thousand annually. The lower limit of the academic staff's appointment and promotion criteria will be raised centrally. The level of internationalization in the field of higher education in our country will be increased. The number of qualified international students in the higher education system will be increased. The share of qualified foreign academicians in the total employment rate will be increased.

Table 6 gives a brief summary of these plans' science and technology related pillars.

Table 6: Development Plans

	Diagnosis or Needs	**Targets and Intended Policies**
9th Plan (2007-2013)		
Competitiveness	• The Low level of R&D expenditures (%of GDP) • The low amount of researchers per economically active persons compared to OECD averages • Weak connections with EU research networks • Weak R&D infrastructure	• R&D expenditure share will increase to 2% of GDP • The Number of researchers will be 80000 (FTE) • The private sector's share in the total R&D expenditures of will be at least 60 %. • The transfer of Turkish researchers working abroad will be supported. • Recruitment of foreign researchers would be promoted if necessary.

Table 6 (cont'd)

	Diagnosis or Needs	Targets and Intended Policies
		• Patents and similar results of R&D efforts of academics will be considered in academic promotion.
Human Development and Social Solidarity	• Centralized structure and the deficiencies in the quality of the higher education system • Need for the additional number of academics, particularly for new universities	• Domestic and international faculty training programs will be supported. • The financial resources of higher education institutions will be increased and diversified. • Restructuring of Higher Education Council • The administrative and financial autonomy of universities will be improved.
10th Plan (2014-2018)		
Innovative Production, Stable and High Growth	• The ratio of R&D expenditures to GDP was under the 2% target and below EU averages • The number of researchers per 10000 employment was 30 in 2011, which was well below the EU average of 70.3. • Need to increase R&D expenditures and improve its effectiveness	• R&D expenditure share will increase to 1.8 % of GDP • The private sector's share in the total R&D expenditures will be at least 60 %. • The number of researchers will be 176.000 (FTE) • Improving the capacity and human capital of university research centers and their cooperation with the private sector to maintain uninterrupted service to all researchers. • The structure and operation of technology development zones would be improved • R&D and entrepreneurial activities of academics and students will be encouraged. • The number, quality, and effectiveness of research in basic and social sciences will be increased.

Table 6 (cont'd)

	Diagnosis or Needs	Targets and Intended Policies
Qualified People and Strong Society	• Centralized structure and the deficiencies in the quality of the higher education system and research • Low level of competitiveness	• Higher education institutions will be diversified, and the higher education system will become a center of attraction for international students and faculty members. • Transforming higher education institutions into an output-oriented structure that attaches importance to technology production in cooperation with industry will be encouraged, and income sources will be diversified with entrepreneurial activities. • Share of Turkey in servicing the International Student Pool in the World will reach 1.5% (which was 0.76% in 2013)
11th Development Plan- (2018-2022)		
Competitive Production and Efficiency (as a sub-component of Industrial Policy)	• The need for the development of information and technology transfer, entrepreneurship, and commercialization activities continues. • The share of R&D expenditures in GDP is 0.96. Far below the target and EU averages.	• The ratio of R&D Expenditures to GDP (%) will increase to 1.8% • The number of R&D personnel (FTE) will be 300000 • The number of Ph.D. and above R&D Personnel per Million People will be 863. • The Research University program will be strengthened so that universities can carry out R&D and innovation activities that will support high-value-added production
Qualified People, Strong Society	• Low level of competitiveness of higher education system	• The higher education system will have a globally competitive, quality-oriented, and dynamic structure • At least 2 universities will be in the top 100 and at least 5 of our universities will be in the top 500 in the world academic success rankings. • The level of internationalization in the field of higher education in our country will be increased. • The share of foreign qualified students and academics will be increased.

All in all, these three plans give a snapshot of the outlook and inform us of the progress of the general policy direction of Turkey on science and technology. In addition, these three plans have similarities and differences from each other. To briefly summarize and discuss:

- All of them admit the low share of R&D expenditures, emphasize the universities' central role in the R&D development of Turkey and aim to improve the private sector's contribution.
- R&D is seen as a way to improve competitiveness and is covered under a related pillar in all of the plans, and it is attached to prioritized areas or sectors. In the last one, all the efforts to support R&D are directly and strictly tied to the industry. I believe the value of R&D activities that do not currently create value for the industry is questionable.
- The need to improve human capital by both quantity and quality in R&D has been emphasized in all three plans. As such, to develop the higher education system, i) reforming the Higher Education Council and improving transparency, accountability, specialization, and autonomy of the universities, ii) cooperation with all domestic actors iii) improving international cooperation (internationalization) by making Turkey as a center of attraction for both researchers and international students have been referred in these Plans.
- Need to improve scientific productivity has been indicated in all of them. Yet, the most definite and solid target announced is the one related to the higher education system in the last development plan. That is having at least 2 universities in the top 100 and at least 5 universities in the top 500 according to world academic success rankings by 2023. It is not stated which universal ranking would be the anchor. In addition, the set of potential actions and respective stakeholders are not clearly stated. However, as I said in the previous section, although all these university rankings use different criteria for ranking in line with their aims, they generally cover the number of publications, citations, number of students per academic, and number of international students. This is broad coverage of the indicators used for

measuring scientific productivity by several academics that I mentioned in the related section.

- 11th Plan also makes a special reference to the Research University Program initiated in 2017 and states that the Program will be strengthened to support R&D and innovation activities facilitating high value-added production, and the capacities of universities included in this program will be improved with special support. With the specific importance attached to Research Universities, we can expect that the research universities are the ones expected to succeed first in the scientific productivity targets defined in terms of university rankings.
- As elaborated in the previous sections, research networks help to access new and additional resources, a set of capabilities, and new infrastructures. They are also helpful in training and gaining new skills for researchers. With that, they improve scientific productivity by increasing the publications and citations, and capacity. In other words, research network integration has a big potential to improve university rankings performances as well. As I mentioned above, the 9th Development Plan highlighted Turkey's inadequacy in the connection with the EU research network. Yet, the starting point of this emphasis was rather financial, with low allocations from the EU funds. The role of international cooperation and internationalization were also indicated in the last three development Plans. Encouraging the transfer of competent academics and researchers from abroad, launching new academic programs for students and academics from other countries, and introducing new scholarships for supporting overseas education of post-graduates were among the actions. However, they stayed rather limited to the transfer of academics and students from abroad, and other possible tools or mechanisms that could support research network integration were not covered. Although some of these Plans acknowledge the low connection with the networks, these plans do not have a special focus on research network integration. As such, I believe despite their huge potential to improve scientific productivity and university ranking

performances, research network integration potential has not been acknowledged appropriately in these Plans.

In conclusion, Turkey has been striving to improve its scientific productivity including actions related to improving human capital and strengthening international cooperation in the last fifteen years. Although it has several flaws in its structure or definition the most solid target is revealed in the 11th Development Plan of Turkey. Yet, the research network integration can be defined as the missing or underutilized aspect of these Plans.

Since Turkey's most solid scientific productivity-related target is defined in terms of university rankings, it is beneficial to look at Turkey's previous performance starting from the preparation period of the 11th Development Plan and its current outlook according to these rankings. Table 7 provides information on the universal ranking scores of Turkish universities. For each ranking classification, the scores of the best-performing universities were provided. THE rankings were provided for the first-five ones to present the rankings of the state universities within the entire timeline. As could be seen from Table 7, the ranking scores and university combinations are changing with respect to the selected criteria of the respective rankings. Similarly, in general, the ranking scores throughout these years are not stable as well. In addition, we can say that none of the Turkish universities has ever achieved to be ranked in the top 100 in none of the ranking systems. In addition, the number of Turkish universities within the top 500 has been always less than 5 since 2018. The closest year was 2018 and in 2018 according to THE rankings, 4 of the Turkish universities were ranked within the top 500 universities. According to the 2021 rankings, Turkey has two universities within top-500 according to THE rankings and none of them is close to being ranked within the top 100. Considering the limited time ahead of us, if Turkey wants to succeed in this target, it has to work hard and take specific and targeted measures, particularly on the rather neglected dimensions that could influence most of the ingredients of rankings such as research network integration.

Table 7: Global University Rankings of the Turkish Universities

Ranking System	2017	2018	2019	2020	2021
QS World	Bilkent 411-420 Sabanci 441-450 Koc 451-460 Bogazici 471-480	Bilkent 421-430 Koc 431-440 Sabanci 461-470 METU 471-480	Koc 448 Bilkent 456 Sabanci 501-510 METU 551-560	Koc 451 Bilkent 501-510 Sabanci 521-530 METU 591-600	Koc 465 Sabanci 521-530 Bilkent 551-560 METU 601-650
THE Ranking	Koc 251-300 Sabanci 301-350 Bilkent 351-400 Atilim 401-500 Bogazici 401-500	Koc 301-350 Sabanci 351-400 Bilkent 401-500 Bogazici 401-500 Atilim 601-800	Sabanci 351-400 Koc 401-500 Bilkent 501-600 Bogazici 501-600 Hacettepe 501-600	Cankaya 401-500 Sabanci 401-500 Bilkent 501-600 Hacettepe 501-600 Koc 501-600	Cankaya 401-500 Koc 401-500 Hacettepe 501-600 Sabanci 501-600 Bilkent 601-800
Shanghai Ranking	Istanbul 401-500 Erciyes 501-600 Hacettepe 501-600 Dokuz Eylul 601-700	Istanbul 401-500 Hacettepe 501-600 Bilkent 601-700 Erciyes 601-700	Istanbul 401-500 Akdeniz 701-800 Bilkent 701-800 Dokuz Eylul 701-800	Istanbul 401-500 Hacettepe 601-700 Dokuz Eylul 701-800 Ege 701-800	Istanbul 401-500 Dokuz Eylul 701-800 Hacettepe 701-800 Ankara 801-900
URAP Ranking	METU 532 Istanbul 540 Hacettepe 543 Istanbul Teknik 559	Hacettepe 527 Istanbul 579 ITU 619 METU 620	Hacettepe 534 Istanbul 582 ITU 698 METU 706	Hacettepe 500 Istanbul 632 ITU 725 METU 751	Hacettepe 524 Istanbul 626 ITU 753 Ankara 770
Leiden Ranking	Bilkent 460 Erciyes 594 ITU 694 METU 742	Bilkent 465 KTU 679 Erciyes 695 Selcuk 712	Erciyes 559 Bilkent 566 ITU 734 METU 762	Koc 679 Bilkent 701 Erciyes 731 Bogazici 812	Bilkent 652 Koc 795 Firat 890 Pamukkale 893

Source: https://www.universityrankings.ch/ https://urapcenter.org/Rankings/2021-2022/World_Ranking_2021-2022

2.5 Concluding Remarks

Careful assessment of the scientific publications covered by several databases has shown continued growth in these publications. Another prominent feature of these studies has been the tremendous increase in international collaboration either due to evolving nature of science or the advantages associated with these networks. There is no consensus on the definition of scientific productivity and the indicators for measuring it. Yet, a review of the studies focusing on scientific productivity and its relationship with research network integration has shown a tendency to use the number of publications for productivity, citations for quality, and co-authorship for integration. The literature also indicates that research networks stimulate an increase in the number of publications and their impact through citations. On the other hand, there are various efforts to improve more comprehensive scientific productivity indicators. They aim to reflect all aspects of science and scientific productivity such as increasing the capacity of human resources via education, and dissemination of scientific outcomes to the public through science communication and other realms of the life economy and production.

Due to their pivotal role, universities have been at the center of efforts regarding scientific productivity. The global university rankings have been the most common indicators used for measuring the improvements of universities. However, there are serious concerns about their capacity to measure scientific progress, their methodology, choice of indicators, and bias due to the coverage of the database and journals used. These deficiencies have been acknowledged by many stakeholders including the ranking institutions, universities, and academics. Thus, it is necessary to use them as a supplement and with great caution. The impressive and great thing about the research networks is their benefits to scientific productivity no matter what the basis of assessment is. They facilitate higher production and citations. Even in the case of using these disputable global university rankings as the main indicator, research

network integration will help through its positive effects on publications, citations, and international collaboration, of which most of these rankings consist of.

Against this background, Turkey is one of the countries using these questionable global university rankings as a tool for measuring the scientific productivity of universities. However, the actions included in the development plans of Turkey do not have an appropriate emphasis on research network integration, which is beneficial for scientific productivity no matter what the indicator is. Thinking about what scientific productivity is, better indicators, and the actions for improvement are essential.

CHAPTER 3

METHOD

This study aims to answer how should Turkish scholars be integrated into international research networks considering the scientific productivity targets defined in terms of global university ranking in the last development plan.

Based the on literature and in line with the aim of the study, I employed five sub-research questions. They are:

Sub-Research Question 1: What effect does research network integration have on scientific productivity in terms of publications?

Sub-Research Question 2: Does the level of integration with research networks differ from region to region?

Sub-Research Question 3: Is the tendency to integrate with research networks the same in different disciplines?

Sub-Research Question 4: What are the factors that motivate academicians to be a part of research networks?

Sub-Research Question 5: What are the factors that make the research network integration easier?

I have chosen METU as the focus of my study since METU is one of the oldest, integrated and most qualified universities in Turkey.

When choosing the university, first I thought it would be better to focus on a state university since I believe policy recommendations that I would provide within the

study would be more relevant and useful, particularly for state universities financed by public resources and whose employment policies are widely influenced by the government's regulations. [24]

In addition, working on the research collaboration, it would be meaningful to choose one of the research universities determined by the government. As such, YÖK's annual review in 2019 conveyed in 2020 has been guiding as well. YÖK has determined a three-pillar evaluation structure to assess the performance of the research universities. These pillars, their content, and their share in the overall assessment are briefly provided below.

1. Research capacity (25%): The number of scientific publications in the university, the number of citations, the number of national projects, the amount of funds obtained from national projects, the amount of international project funding, the number of national and international patent applications, the number of national patent documents, the number of international patent documents, the number of utility models / industrial design documents, number of doctoral graduates and number of doctoral students
2. Research quality (40%): Rate of scientific publications in 50% and 10% of Incites journal impact value, number of national science awards, number of faculty member companies, number of student/graduate companies, YÖK 100/2000 Doctoral Scholarship Program students, TÜBİTAK 2244 Industry Doctorate Program students, TÜBİTAK 1004 Technology Platform Project fund amount, open access percentage of scientific publications, open access percentage of theses, the top 500 in the world academic general success rankings and the number of accredited programs.
3. Collaboration and Cooperation (35%): University-university collaboration publication rate, university-industry collaboration publication rate, international collaborative publication rate, number of university-industry

[24] https://www.yok.gov.tr/Sayfalar/Haberler/2020/yok-ten-arastirma-ve-aday-arastirma-universiteleri-degerlendirilmesi.aspx

collaboration patent documents, international collaborative patent document number, the amount of funds received from university-industry collaborative R&D and innovation projects within the scope of public funds. the ratio of the number of projects to the number of projects, the ratio of the funds received from contracted university-industry cooperation R&D and innovation projects to the number of related projects, the ratio of international students, the ratio of international faculty members, and the number of lecturers/student in circulation.

Based on these criteria, the top three universities were respectively METU, Istanbul Technical University, and Bogazici University.

Furthermore, METU has a wide coverage of different fields from basic science to art and humanities, which prevents us from biased observations which may arise due to field-specific features.

Last but not the least, being my school, I believe, have limited the number of complexities, particularly in the qualitatively part, and eased the access to faculty more comfortably.

In this context, I used a mixed-method research design including quantitative analysis through bibliometric assessment and qualitative analysis via semi-structured interviews held with METU Professors. Before elaborating on the type of analysis used for these sub-questions, I see merit in giving general information on the data set employed in the bibliometric part and interview guide.

For determining the interviewees and set of academicians to be covered in the bibliometric analysis in a more detailed way along with a general assessment of the METU, I look through the METU Departments' list of staff provided on their webpages for the departments which are more prone to team science, which are resided in Turkey. While searching the web pages of departments and working on the shortlist, I focused on the early career academicians who start to work at METU from 2010 to 2017. Although there are several ongoing discussions on the need to revise the

definition of "early career academics", traditionally the ones *"in the five years following Ph.D. completion, with career progression from post-doctoral appointment to tenure, promotion, and beyond"* are called early career academics (Bosanquet et al., 2017). Being at the beginning of their career journey, early-career academics are under the pressure of "publish or perish" in the most severe way as they are the ones who need to establish a publication record and impact factor indicators for warranting a tenure, sustainable personal income stream and access to better opportunities for their future academic research. Thus, it is natural that they are the ones who need to and are volunteered to study and integrate more with other researchers. Therefore, it makes sense to work with a group of early-career academics to assess the general tendencies of the research network integration and the factors affecting these tendencies.

Moreover, research is a time-consuming process from the creation of the research question, data collection, and testing to publishing. Though the study and publishing cycle is different from discipline to discipline, I decided to end the period as of 2017 for allowing enough time to adapt to their new environment and responsibilities at METU including the internalization of rules and regulations which are necessary for their research endeavors. As a matter of fact, one interview has proven that ending the period at a later one would be misleading since it is too early to adapt to the environment and develop familiarity with the rules and regulations of the University.

In this context, I review the pages of the following departments and graduate schools provided in Table 8 below.

Table 8: List of Departments

	Department Name
1	Department of Aerospace Engineering
2	Department of Architecture
3	Department of Biological Sciences
4	Department of Chemical Engineering
5	Department of Chemistry
6	Department of City and Regional Planning
7	Department of Civil Engineering
8	Department of Computer Education and Instructional Technology
9	Department of Computer Engineering
10	Department of Educational Sciences
11	Department of Electrical and Electronics Engineering
12	Department of Elementary and Early Childhood Education
13	Department of Environmental Engineering
14	Department of Food Engineering
15	Department of Geological Engineering
16	Department of Industrial Design
17	Department of Industrial Engineering
18	Department of Mathematics and Science Education
19	Department of Mechanical Engineering
20	Department of Metallurgical and Materials Engineering
21	Department of Mining Engineering
22	Department of Petroleum and Natural Gas Engineering
23	Department of Physical Education and Sports
24	Department of Physics
25	Department of Psychology
26	Department of Statistics
27	Department of Sociology
28	Graduate School of Informatics
29	Graduate School of Marine Sciences
30	Graduate School of Social Sciences

To determine the beginning of academicians' tenure at METU and other possible network linkages that may have before their tenure here in METU via their Ph.D. education, post-docs, and other career activities, I have used open resources such as Avesis[25], Linkedin[26] and other possible research and career networks including public CVs of academics. Of course, the process used in finding the legally true and exact date is open to error as there are inconsistencies between the respective open resources due to their focus and aim, possible deficiencies of these registries such as not being under a legal responsibility, not requiring a full record, or the recklessness or negligence due to continuously changing legal academical registry systems, especially in Turkey. As such, I paid special attention to the verification of these dates, particularly for the interviewees by taking advantage of their volunteered participation and face-to-face communication, although it is online. As a result, I come up with a list containing 169 early career academics. I sent interview requests to the 59 names in this short-list and analyzed the data for this group in the bibliometric part in addition to the general publication of METU, to sub-research questions that I will elaborate on below.

There are various databases such as Web of Science (WoS), Scopus, and Google Scholar, which provide information on the scientific outputs. All of them have their peculiarities. Web of Science is the first comprehensive citation index developed in the pre-digital era and has greatly affected the lives of librarians and information scientists. Web of Science has been criticized due to its bias towards the USA books from major publishers and international journals. Scopus -the next generation developed by taking advantage of digital technologies- has a wider coverage of the

[25] Avesis is a software system that includes an academic performance management model developed to take an inventory of academic activities, measure and evaluate the performances of institutions, units, departments, and individuals, and create a sustainable quality assurance system. https://avesis.metu.edu.tr/hakkinda

[26] LinkedIn is one of the largest professional networks that aims to strengthen professional relationships and connections. It is also helpful in recruitment and learning about the skills needed to succeed in your career. https://www.linkedin.com/help/linkedin/answer/a548441/what-is-linkedin-and-how-can-i-use-it-?lang=en#:~:text=LinkedIn%20is%20the%20world's%20largest,to%20succeed%20in%20your%20career.

non-English academic literature and domestic content. Google Scholar is another database with a larger coverage, though it is less transparent in the collection of data and more difficult to curate raw data for information scientists (Sugimoto & Larivière, 2018). Despite it is limitations, I used the Web of Science to attain the respective publication data since the Higher Education Board of Turkey reports that the criteria used by METU based on the "Journal Citation Report (JCR)" of the Web of Science[27].

For a healthy analysis, data retrieved from the Web of Science for both METU in general and the data on specific academicians in the aforementioned list should be carefully curated and cleaned. WoS claims that it provides unified and combined data for the institutions, and it does so up to a certain extent. Yet individual search efforts indicate that it should be developed further for capturing all alternative written forms of the institution name in both English and Turkish. Similarly, for academicians' alternative written forms and combinations for both family names, names, and initials, and name and name initial combinations for the ones having more than one name and family names should be determined and combined and name similarities should be eliminated one by one.

For the visualization and determining the extent of network integration, I used Vosviewer[28] and Biblioshiny[29] packages of RStudio. I believe Vosviewer is good at graphical representation and instrumental in displaying large bibliometric maps in an easy-to-interpret way. Biblioshiny is preferred as it allows the single country and multiple country collaboration mapping. Vosviewer requires "tab.delimited" files while we need plain text data for Biblioshiny. Thus, name clearing was carried out for both data formats.

The qualitative part was handled during the Covid-19 Pandemic. Though the effects of the Pandemic on academic life would be studied further in the future, the respective

[27] https://www.yok.gov.tr/akademik/atanma-kriterleri

[28] https://www.vosviewer.com/

[29] https://www.bibliometrix.org/Biblioshiny.html

process in this research suffered from the negative effects of the Pandemic on both academic life and possible other reflections in the personal lives of the interviewees and me. All had to adapt to new and additional responsibilities and deal with new sources of stress including the adaptation to online working practices in the university, maintaining the continuity of the education during the Pandemic at the University -particularly for the ones having administrative responsibilities-, lack of some support mechanisms ranging from childcare to housekeeping, additional disruptions in the supply chain of the materials for research and stress of being infected, living the disease and losing the loved ones. Thus, on the qualitative part carried out via semi-structured interviews, in the first step, I contacted academicians in the aforementioned list via e-mail, initially based on previous acquaintances to eliminate the additional possible discomfort and increase the possibility of positive replies (Lotito et al., 2015). In progress, taking faculty, discipline, gender, and geographical representation into consideration, the additional invitations were sent. Positive replies and the availability of the interviewees had been limiting factors. Some of the invitations were unanswered, some of them were kindly rejected, while some of them were confirmed and a possible time slot arranged for interviews, yet the participants never show up. All in all, 15 interviews were held and 14 of them were coded. The 15th interview held with an academic who started her tenure at METU in 2018 confirmed the relevance of the selected period and at cutting the short list of early-career academics as of 2017 is appropriate. In addition, one respondent rejected the interview request and preferred to provide data in writing.

Due to the Pandemic, all the interviews were done via online meeting tools (Zoom and Skype) from September 2020 to March 2021. With the respective approval of the interviewees, the recording function of these online meeting tools allowed me to focus on the interview rather than keeping more detailed notes to capture each detail which could be commended as a hesitation or validation of an emotional response or reaction. Yet, right after the interviews, I prepared participant observation notes to lead the way during the coding. The shortest interview lasted 45 minutes while the longest took 2 hours and 5 minutes. The average time for an interview was 1 hour and 25 minutes. The interviews were transcribed and line-by-lined coded via QDA Miner 6th version.

Half of the interviewees are women. The regional representation was 4 from EU, 7 from non-EU, and 3 Mixed. Faculty representation was 4 Engineering, 2 Arts and Science, 1 Architecture, 1 Marine Sciences, 2 Social Sciences, 3 Education and 1 Informatics. Bounded by positive responses of the academics, this representation is somehow in line with the distribution of departments at METU, which is more based on engineering and arts and science as being structured as a technical university, and regional representation of the list of early-career academics referred above.

The interview guide is provided in Annex I. In addition, to warm up questions and questions to confirm the collated information on the CV of the interviewee, the guide is mainly composed of three sections.

- The first section aims to capture the latest trends in the area of interest of the interviewee by the topics studied, respective team combinations, methods of study, and type of scientific outputs. Moreover, the questions also aim to understand the effects of these trends in the long run on the scientific environment in general. This section also consists of questions on a recently completed study of the interviewee such as how the study was done (via the team or an individual one), how the team was established if it is a team study, division of responsibility among team members, methods and tools used during the study including online tools, advantages or disadvantages of the methods employed and any difficulties experienced in the study both technical and due to team members. In this section, the general network preferences of the interviewee observed via the WoS data were also questioned to confirm and understand the factors leading to these research network preferences. Future plans for interaction with a new network were also visited through the questions in this section. Finally, this section also includes questions to learn the interviewee's thoughts on Turkey's aims for scientific productivity in the 11th National Development Plan. As it could be remembered, though it is relatively indirect, the most solid scientific productivity target is framed with international university rankings. As such, the approach to the idea of ranking, the procedure of target setting, roles and responsibilities of the university, and

the effect of research network integration in succeeding these aims were also discussed.

- The second section includes questions on a specific study of the interviewee from scratch to the publishing of the output. I chose these specific studies based on the research network preferences' difference with respect to interviewees' general preferences, via group, country, or theme combinations. This part allowed me to test and verify the information that I gathered in the first section via my preference and to cover up any additional factors leading to a different set of preferences, including financial resources, human resources, working structures, etc.
- The final section is on the general needs and requirements which are necessary to improve the productivity of the researchers and to transform a better environment for science. The differences between Turkey and abroad in terms of scientific opportunities, working practices, and forms of assessments on productivity were also captured via the questions in this section.

To provide brief information on the progress of the interviews in general, as the interviews were held during the Pandemic, the preferences on network choices and working practices for a planned study were affected and further questions were necessary to understand the non-Covid environment and factors in the study and network choices. Similarly, there were a lot of discussions on the METU's promotion criteria planned to be revised and draft criteria. Though it is not unrelated to the scientific productivity assessment and had the potential to affect the success of respective targets on ranking, the use of similar target-making and communication strategies, necessitated a further deep dive to disaggregate these issues in a structured way. Furthermore, tension around these discussions on the promotion criteria induced a reluctance to join or continue the interview and made it a little difficult to open a candid interaction. Some of the interviewees openly stated their hesitation to further elaborate on the issue. On a separate note, the set of interviewees was also handy to observe the influence of these discussions and draft rules on the future preferences on research network integration in eyes of the recently promoted ones and the ones under tenure pressure in the upcoming period. The set of interviewees also includes the

academicians having administrative duties and own laboratories. This helped me to capture the effect of rules and regulations, the way they were taken care of, feedback provided in the administrative decision-making processes, and to observe some chicken-egg dilemmas.

Before moving into specific details of the analysis with respect to research question, I believe describing the flow of process with a visual would be helpful.

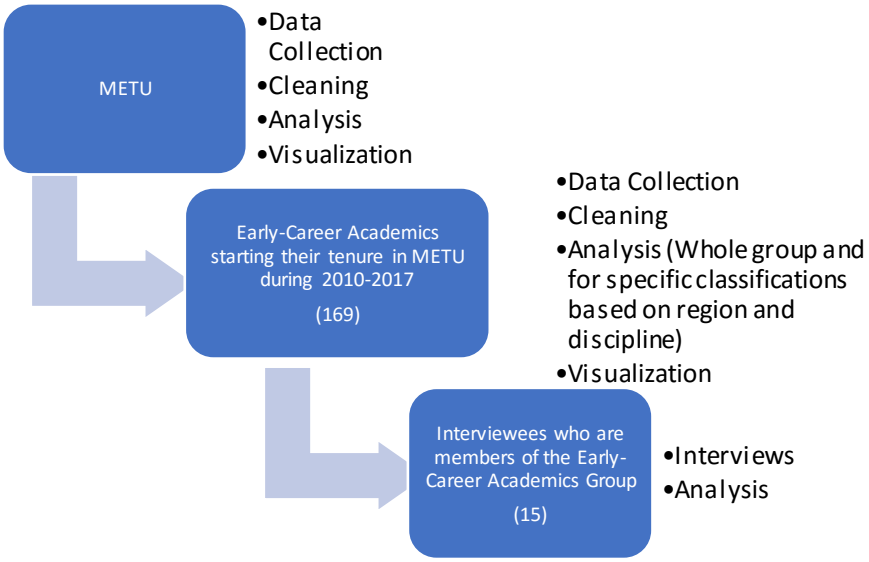


Figure 9: Stages of the Study

Source: Author's own work

To move on to the type of analysis used for the aforementioned sub-research questions and hypothesis:

Sub-Research Question 1: What effect does research network integration have on scientific productivity in terms of publications?

For the quantitative assessment of the performance of research activities, publications, licenses, citations, and patents are among the most commonly used indicators (Fernandes et al., 2017). Similarly, there is a tendency to use co-authorship as an indicator of collaboration (Fagan et al., 2018; Newman, 2004). Moreover,

Leydersdorff and others (2013) indicated that "*No researcher unnecessarily shares authorship and thus collaborative publication can be considered as an indicator of esteem and shared intellectual contributions*" (p.3). Therefore, I used co-authorship data as a network integration indicator. I analyzed overall data for the METU for the given period and the group of early-career academics.

I see merit in sharing some of the works that I carried out in the implementation process.

Before cleaning, raw data include 16474 citable documents which were authored or co-authored by 41549 authors, and the number of single-authored documents was 1285 (8%). Table 9 represents the respective information attained from Biblioshiny on the raw data, while Table 10 is showing the respective one via Vosviewer. Biblioshiny produces "The Co-Authors per Articles Index" and "The Collaboration Index (CI)". The first one is the average number of co-authors per document as indicated by its name while the latter is measured as Total Authors of Multi-Authored Articles/Total Multi-Authored. The first index considers the author's appearances while the latter only focuses on the co-authored articles and shows the collaboration in the set of co-authored articles[30]. On the other hand, Vosviewer provides information on the links and total links strength. "The Links" shows the number of co-authorship links of a given researcher with other researchers while "The Total Link Strength" indicates the total strength of the co-authorship links of a given researcher with other researchers by counting the additional works made by the same researchers[31].

[30] *Biblioshiny Manual 2021,* https://www.bibliometrix.org/vignettes/Introduction_to_bibliometrix.html

[31] *Vosviewer Manual 2020,* https://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.15.pdf

Table 9: Scientific Outputs and Trend of Integration of METU (2010-2020) via Raw Data (Biblioshiny)

Year	# of Publications	# of Authors	Co-authors per Doc[32]	Collaboration Index
2010	1259	5605	63	4.86
2011	1288	9136	182	7.75
2012	1391	12278	416	9.47
2013	1476	11474	288	8.43
2014	1427	10754	152	8.11
2015	1436	11040	129	8.24
2016	1741	12075	135	7.52
2017	1642	8727	161	5.6
2018	1678	11194	199	7.17
2019	1597	11870	181	7.88
2020	1361	10128	159	7.98
2021	112	350	3.45	3.25
2020-2021	1473	10334	147	7.51

Source: Author's own work

[32] "It is calculated as the average number of co-authors per article, counts the author appearances. https://www.bibliometrix.org/vignettes/Introduction_to_bibliometrix.html

Table 10: Scientific Outputs and Trend of Integration of METU (2010-2020) via Raw Data (Vosviewer)

Year	# of Publications	# of Authors	# of Links[33]	# of Total Link Strength	Av. Links/Author	# of Clusters
2010	1259	6111	4611118	85933156	14062.04	500
2011	1288	8926	27592	29060	3.26	394
2012	1391	11633	104561	134850	11.59	415
2013	1456	10919	88068	112765	10.33	436
2014	1427	10503	155405	264549	25.19	423
2015	1435	10345	90235	155066	14.99	446
2016	1740	11753	424823	535842	45.59	488
2017	1641	8864	161997	164682	18.58	460
2018	1677	11143	174319	302917	27.18	478
2019	1596	11884	330229	503196	42.34	490
2020	1361	10210	110443	162778	15.94	414
2021	112[34]	355	690	703	1.98	88
2020-2021	1473	10435	499500	44455810	4260.26	1000

Source: Author's own work

These tables do not indicate a smooth trend in terms of both publications and respective link indicators, which is understandable up to a certain point as the scientific production process is not a linear, smooth, and always predictable one. In addition,

[33] "In the case of co-authorship links between researchers, the Links attribute indicates the number of co-authorship links of a given researcher with other researchers. The Total link strength attribute indicates the total strength of the co-authorship links of a given researcher with other researchers."(Vosviewer Manual 2021, p. 6)

[34] 112 of the respective papers were opened to early access in 2020 but published in 2021.

both tables indicate a similar trend of co-authorship. This allows me to use the results of both packages interchangeably.

During the cleaning of the raw data, due to the specific functioning of the Vosviewer and to overcome the errors met in the cleaning process, 20 of the records were not included in the data set. The share of these records was very limited. Comparing above mentioned two tables, I can also say that the missing 20 articles belong to 2013, though it is still not possible to determine which articles are the missing ones. I was not able to determine those specific articles and could not insert them manually into the analysis. Yet, as I emphasized, the share is very limited and would not lead to a diversion in the general direction of the analysis, I continued with this new set excluding those 20 articles.

I chose the limit as 2500 for the maximum number of authors per document selection of the Vosviewer. That would include a material portion of the huge-big science projects on space, marine science, and geology without increasing the number of authors astronomically (by including the ones only included among authors for the data-producing process) and for operational easiness. Once cleaning the overall data of the METU between 2010 and 2020 with a 2500 limit for both formats -utf8 and plain text., Vosviewer the number of authors became 25421 for 16454 documents.

Table 11 represents information on the amount of scientific output produced by METU staff for the 2010-2020 period and their integration with research networks through the average number of links per author. As I said before both Biblioshiny and Vosviewer packages indicate the same direction and trend in general.

Table 11: Scientific Outputs and Trend of Integration of METU (2010-2020) (Vosviewer- Cleaned Data)

Year	# of Publications	# of Authors	#of Links	# of Total Link Strength	Av. Links/ Author	# of Clusters
2010	1259	3028	80208	96545	31.88	376
2011	1288	2822	27592	29060	10.30	394
2012	1391	3381	104561	134850	39.88	415
2013	1456	3451	88068	112765	32.68	436
2014	1427	4150	155405	264549	63.75	423
2015	1435	3852	90235	155066	40.26	446
2016	1740	5751	424823	535842	93.17	488
2017	1641	4691	161997	164682	35.11	460
2018	1677	4917	174319	302917	61.61	478
2019	1596	5857	330229	503196	85.91	490
2020	1361	4195	110443	162778	38.80	414
2021	112	351	689	703	2.00	85
2020-21	1473	4532	112214	164837	36.37	493

Source: Author's own work

To deep dive into the data comparing Table 10 and Table 11, first, we can see the importance of using a single and common identity representation for authors. The number of authors and number of links and total link strength seriously changes between cleaned and raw data, which affects the measure of integration, the average number of links per author in this case. Thus, we can highlight the importance of the initiatives such as ORCID and Web of Science Researcher ID, and others. In addition, 2500 for the maximum number of authors per document selection of the Vosviewer has also a share in this reduction.

On a separate note, the respective finding section also provides citations and the number of academics. Citation data is provided from WoS which are downloaded and calculated on a study basis until the end of 2020. Data on the number of academics are collected from the annual action plans of METU.

A similar data cleaning procedure is applied for the early group of academics as well.

The interviews provided data on the effects of research network integration and association between integration and productivity based on interviewees experience and observations.

Sub-Research Question 2: Does the level of integration with research networks differ from region to region?

Studies on the facilitators and challenges to the networks' efforts indicate the role of institutional and individual commitment, joint activities among members, alignment between funding and network cycles, shared goals among network members, clear governance structures, strong leadership, sustained resources, and effective communications (WHO, 2016), which could be associated with the detailed description of the Ph.D. and a post-doctorate program. In the same vein, *"the effects of temporary mobility during doctoral education may be similar to doing PhDs abroad in terms of networking and exposure to new knowledge."* (Horta et al., 2020, p. 130). Furthermore, the role of language, regional proximity/closeness, and transportation costs are also elaborated on in different studies about research collaboration (Shin et al., 2013; Catalini et al., 2020). Therefore, to observe whether there is any association between region and network integration preferences, I also classified these academicians under four main groups: EU, Non-EU, Mixed, and Other according to the location of their graduate education(s), post-docs, and any early-career engagements. Europe corresponds to the European continent, other countries are classified under Non-EU, while mixed refers to engagement with both EU and Non-EU regions. Other refers to the ones with a background only in Turkey, including the ones with only a METU background. In conclusion, 44 of them have EU origin or are

EU-connected, 19 are mixed, 96 are of Non-EU origin, and 10 are classified under Other (including METU and other Turkey).

In this regard, I look to the co-authorship networks and links of these groups via Vosviewer. I also used interviews to verify the effects of academic background and regionality based on these backgrounds.

Sub-Research Question 3: Is the tendency to integrate with research networks the same in different discipline?

Literature also indicates that there are differences in the choice of integration by disciplines. Lee (1996) argued that physical scientists and engineers are more prone to research collaboration than social scientists. The venue, format, or aim of the cooperation is also different among disciplines and based on the type of research activity, e.g., theoretical or applied. Social scientists engaging more in applied research have more interdisciplinary collaborators (Woolley et al., 2015). Similarly, Lewis (2018) also indicates that social scientists are more reluctant to cooperate or do more invisible terms. The publishing periods and team compositions are different for social sciences and engineering. In addition, positioned as a technical university in academia, social scientists' representation in the METUs and their representation among interviewees-which is aligned with METU composition, is limited. Thus, only comparing the information provided via respective packages could be misleading. As such, I tried to test the validity of this argument by using the interview data as well.

For the quantitative part, I used the data produced by Incites for METU for various disciplines. In addition, I tried to produce data on the composition of works by a group of early-career academics. In this context, I used WoS' main groups provided on its website[35]. I grouped early career academics with respect to WoS grouping. Some of them such as the ones in architecture, mining, or city and regional planning required further attention as their studies could fit in different classifications than direct

[35] https://images.webofknowledge.com/images/help/WOS/hp_research_areas_easca.html

connotations of the departments' name with respect to the specialization of the academics.

Sub-Research Question 4: What are the factors that motivate academicians to be a part of research networks?

Sub-Research Question 5: What are the factors that make the research network integration easier?

The questions that scientists are interested in finding answers to are bigger and more complex than ever, which requires the collaboration of more researchers and disciplines. The set of factors leading to the cooperation includes physical capacity, human capital, data availability, funding, culture, and regulatory requirements among many others (Abbasi & Altmann, 2011; Fagan et al., 2018; Paraskevopoulos et al., 2021; Wu et al., 2019) In addition, the type of network, composition of teams, and tendencies of academics are also crucial to understanding the nature, dynamic, and effect of the integration for policy making. These two questions would be studied through the interview data.

CHAPTER 4

FINDINGS

To elaborate on how Turkey's integration with research networks should be structured regarding Turkey's recent aims on scientific productivity, I employed a mixed-method research design to represent current outlook and to enlighten the connections and reasoning lay the ground for the outlook. As such, this section will follow a similar flow with the method section and represent findings in the same order and both quantitative and qualitative ones will be combined. Each sub-research questions will complete a part of the picture and will feed into our main research question.

4.0 Sub-Research Question 0: What is scientific productivity?

As seen from the interview guide, the guide does not include any specific questions on the definition of scientific productivity. The questions directly focus on the studies of academics based on their publications. Thus, before focusing on the scientific productivity and research network integration relation, I see merit in elaborating on a few critical issues raised in the interviews which are directly related to the framework.

First, one of the interviewees specifically shared her views on scientific productivity at the beginning of the interview and said:

> *I find scientific productivity both important and unimportant. Scientific productivity requires being scientific. Then the question of "what is science?" emerges. Scientists can find a concept or a notion in their entire life, then they put a lot of examples surrounding this notion or they elaborate on another notion developed by others. You derive hundreds and thousands of examples using the same notion and you end up with*

> *hundreds of articles. Yet, do you have any contribution to science?... Is this scientific productivity? The scientific productivity in Turkey is very low. Don't look at the thousands of people having papers or the others. I think none of them has developed something new…Think of a sculpture. What is more important? The thing she had created in her mind or the whittles or chippings? I believe this is important to define being scientific and scientific productivity*. (Interviewee, 11)

Though several attributes of science (continuity, critical mass, quality vs. quantity, etc.) were highlighted and scientific productivity focus including the design of the related targets, etc. was criticized during the interviews, this was the only question raised by interviewees related to the framework of the study. Thus, I believe there is a consensus on the definition of scientific productivity and associating it with publications widely accepted.

Furthermore, the other roles and responsibilities of the scientists/academics are another prominent topic emphasized in the interviews concerning scientific productivity. In this respect, interviewees also conveyed their ideas on what a university is or how a university should be. Education function of university (educating labor force), social responsibility of the university to society (public duties assigned to academics and distance to social problems), and relation with several actors in the society and how to balance them are the issues highlighted due to their effects on scientific publication, time, or resource-wise. Most interviewees believe that while assessing the performance of academics all these aspects should be taken into account.

4.1 Sub-Research Question 1: What effect does research network integration have on scientific productivity in terms of publications?

As I stated in the method section co-authorship is one of the most used indicators for presenting collaboration or network integration of scientists. Thus, I analyzed overall data for METU for the period between 2010-2020 and the group of early career

academics collating the data for their tenure at METU with the help of Vosviewer. Vosviewer helps us in producing information on the number of links, total links strength, and authors[36] and in visualization. Table 12 provides detailed information for citable publications of the METU between 2010 and 2020. Table 12 includes the number of publications, citations, links, total link strength, and the number of links per author and per academic. Similarly, Table 13 also gives information on publication per academic, citation per publication, and average link per academic at the same time. Table 13 gives this information separately for operational easiness. Figure 10 also visualizes the publication, average links per author, and average links per academic.

As seen in Table 12, the number of documents produced in a year increased and it is not following a smooth trend in the entire period, which is understandable as the scientific publication procedure is not a linear one. First of all, the first jump was seen in 2012 though the number of academics working at METU shows a limited change (just 1 with respect to 2011). Then the publication value could be defined as rather stable. The second large jump in the overall publication (though it is the largest by volume) was in 2016. The highest number of scientific outputs was observed in 2016 and reached 1740. Since then, there has been a decreasing trend with a slight increase in 2018. This trend change could be associated with several factors such as the changes in the number of academics, attributes of leaving/current academics (their discipline, studies carried out by the academics), and other factors including the ones related to the general confidence and freedom environment of the academia in Turkey raised during the interviews. The trend change is also indicated by the trend of publication per academic. Respective value has shown an increasing trend until 2013 and then another big jump was recorded in 2016. The value is decreasing since 2016 and in 2020 it came back to the 2011 level.

[36] "The Links" is the number of co-authorship links of a given researcher with other researchers. "The Total Link Strength" is the total strength of the co-authorship links of a given researcher with other researchers by considering additional works made by same researchers. (Vosviewer Manual 2020) https://www.vosviewer.com/documentation/Manual_VOSviewer_1.6.15.pdf

The increase in 2012 followed the participation of Dr. Demirköz who is working on experimental particle physics, participating in CERN-based studies and is a partner of huge-research networks such as AMS or Atlas Collaborations. The increase could be due to her participation or the collective influence of the ones joining in 2011 or it is just a simple completion of previous research efforts of the entire academics working at the university. Looking into the studies of Dr. Demirköz, we can say that the respective studies reached a saturation thorough time there were more studies between 2012-2014 and the number of studies via this collaborations decreased after that. Of course, this should be confirmed by looking into the trends of the studies by these collaborations or via information by Dr. Demirköz. On a separate note, with a quick and simple review of the early career academics set and their overall publication data, most of the ones having at least 10 or more than 10 publications during their tenure at METU are the ones joining in 2011 and half of this group have more than 10 publications. 2014, 2015, and 2017 are also other years that attract may attention during this quick review. At this point, I also need to be cautious and should not compare the incomparable disciplines with each other and different duration of tenures each other. In addition, it is also necessary to keep in mind that it is not always easy to publish with a new affiliation in a short time, particularly right after joining an institution. Academics would need time to adapt to new working conditions and opportunities provided by the university as confirmed by the 15th interview.

The overall citations followed a decreasing trend except in 2012. This could be meaningful up to a certain point as the citations of a publication has a life cycle, it is possible to be cited more as time passes with a critical reflection point that the citations do not increase by the time either the publication gets older, confuted by others or losing the relevance. Trends and the number of citations are also changing among disciplines[37] (Slyder et al., 2011; Hyland & Jiang, 2019). The citations received by the publications in 2012 have been exceptional and the highest. The trend of citations does

[37] https://www.behind-the-enemy-lines.com/2018/11/distribution-of-paper-citations-over.html#:~:text=The%20vast%20majority%20of%20papers,declining%20after%205%2D10%20years.

not provide any additional input about the integration other than marking the exceptionality of the works in 2012. Integration is expected to derive more citation but testing these require a further econometric analysis which is beyond our scope.

The integration level looks a little more complicated to analyze. The level of integration increased overall by the end-2020 compared to 2010. Yet, the level of integration decreased abruptly in 2011. The average number of links per author fell to 10.30 in 2011, from 31.88 in 2010. With up and downs during the period, the highest level of average links per author was observed in 2016 and reached 93.17, like the number of publications. The value became 38.80 as of end-2020. The movement of the number looks rather dramatic and sudden, particularly between 2013-2020.

The value of links per academic mimics this trend with higher values. The number of links per academic fell to 25.69 in 2011, from 86.12 in 2010. With up and downs during the period, the highest level of the average number of authors per document was observed in 2016 and reached 481.87, like the number of publications and average link per author. The value became 136.44 as of end-2020.

In addition, the year 2016 has been also an exceptional year with its average link per author and average link per academic value. These values reached their highest values in 2016. Though they in general show a kinky outlook with ups and downs, it is noticeable that there is an increasing trend until 2016. If the value is below the previous year it continued to stay above the previous down. The average link per academics' value in 2020 is not only below the 2019 level but also less than the values recorded in the last 5 years and below the 2015 level.

However, it is not easy to comprehend the motivation behind this volatile movement, especially when I take into account that the teams for potential future studies are in general shaped based on experience and networks derived from the current ones.

Looking into both trend of publications and the trend of average link strength per academic, I could rather suspect a divergence particularly due to movements in 2019.

In this respect, the reasons for the divergence of the trends of the publication and level of integration should also be visited carefully.

Finally, 2020 was an exceptional year in which the entire world struggled with the Pandemic, which could affect both personal resources and the capabilities of academics and the effect was not the same for all. For instance, in the entire world, more financial resources were available for the ones working on pandemic-related issues. The ones working in a lab have less access to these opportunities and the access was also asymmetric around the world. Some countries have defined scientists as a priority group while others do not. This could have motivated academics to work alone or focus on the issues not related to the fieldwork. However, it is not easy to predict which effect surpassed and what has been the main driver of the changes in the publications or level of integration.

Furthermore, data produced by Incites indicate that international collaboration has increased its prominence in the scientific production of METU during the period. The share of documents was produced via international collaboration was 29.9% in 2010 and reached 41.97% in 2020[38].

[38] https://incites.clarivate.com/#/analysis/0/organization

Table 12: Scientific Outputs and Trend of Integration of METU (2010-2020) (Vosviewer- Cleaned Data-Detailed)

Year	# of Academics	# of Publications	# of Citations	%of Cited Documents	# of Authors	#of Links	# of Total Link Strength	Av. Links/ Author	Av.Links/ Academic	# of Clusters
2010	1121	1259	26821	86.13	3028	80208	96545	31.88	86.12	376
2011	1131	1288	26889	88.06	2822	27592	29060	10.30	25.69	394
2012	1130	1391	44091	88.61	3381	104561	134850	39.88	119.34	415
2013	1113	1456	29260	84.01	3451	88068	112765	32.68	101.32	436
2014	1129	1427	23052	85.97	4150	155405	264549	63.75	234.32	423
2015	1133	1435	21359	83.3	3852	90235	155066	40.26	136.86	446
2016	1112	1740	17477	80.21	5751	424823	535842	93.17	481.87	488
2017	1117	1641	15097	80.83	4691	161997	164682	35.11	147.43	460
2018	1201	1677	10846	81.4	4917	174319	302917	61.61	252.22	478
2019	1165	1596	12066	79.09	5857	330229	503196	85.91	431.93	490
2020	1193	1361	5385	73.29	4195	110443	162778	38.80	136.44	414

Source: Author's own work

Table 13: Selected Productivity and Integration Indicators METU (2010-2020)

Year	Publications/Academics	Citations/Paper	Av. Link/Academics
2010	1.12	21.30	86.12
2011	1.14	20.88	25.69
2012	1.23	31.70	119.34
2013	1.31	20.10	101.32
2014	1.26	16.15	234.32
2015	1.27	14.88	136.86
2016	1.56	10.04	481.87
2017	1.47	9.20	147.43
2018	1.40	6.47	252.22
2019	1.37	7.56	431.93
2020	1.14	3.96	136.44

Source: Author's own work

Figure 10: Scientific Outputs and Trend of Integration of METU (2010-2020)

Source: Author's own work

Thus, I think looking at the level of integration for the selected early career academics at METU would also contribute to making a deeper analysis. Table 14 presents information on the number of publications by this focused group of academics and respective links while Table 15 shows the publication per academic, citation per publication, and links per academic. Figure 11 visualizes the same information for the early career academics.

The number of publications by early career academics increased, and the increase resulted from both the increased production of these academics and the increase in the number of academics within the group. The increase after 2017 was mainly due to an increase in production of the entire group. The highest number of publications by the group was in 2019. Thus, the publication per academics followed a similar trend to the trend of publications of this group. The citations also decreased through time, yet 2011 and 2012 are the exceptional years for this group. As a quick reminder, 2012 is the exceptional for METU. Looking into the studies in 2012 and the comments on the ones joining METU 2011 could be relevant. Yet, the value of average link per academic in 2012 is interesting as the total link was less than previous year considering the group include these exceptional names. Data for the early career academics group indicates a higher strengthening of the integration during the entire process, particularly in comparison to the beginning of the period. The average link per author and average link per academic have followed a similar path as in the METU case, yet the latter is more abrupt. For this group, the highest values were recorded in 2014, instead of 2016. The most sudden reduction was in 2017, since 2018 a decreasing trend is observed.

Table 14: Trend of Publications, Degree of Integration (co-authorship links) for Early Career Academics Group

Selected Group	# of Academics	# of Publications	% of Cited Publications	# of Citations	# of Authors	#of Links	# of Total Link Strength	Av. Links/ Author	Av. Links/ Academics	# of Clusters
2010	20	19	84.21	491	39	90	135	3.46	6.75	7
2011	45	79	78.18	4486	160	481	565	3.53	12.56	27
2012	68	171	89.80	13639	130	259	299	2.30	4.40	32
2013	83	151	67.90	7223	584	61154	61245	104.87	737.89	38
2014	107	160	64.38	5269	767	48211	126462	164.88	1181.89	63
2015	128	144	47.22	2880	723	48692	88756	122.76	693.41	67
2016	145	194	73.85	2662	1257	118087	150695	119.88	1039.28	90
2017	169	298	61.74	2277	1037	35727	36169	34.88	214.02	99
2018	169	304	54.61	1728	1221	58761	168567	138.06	997.44	100
2019	169	336	51.49	965	1401	60381	105899	75.59	626.62	111
2020	169	225	29.33	219	887	27683	28165	31.75	166.66	98

Source: Author's own work

Table 15: Selected Productivity and Integration Indicators of Early Career Academics (2010-2020)

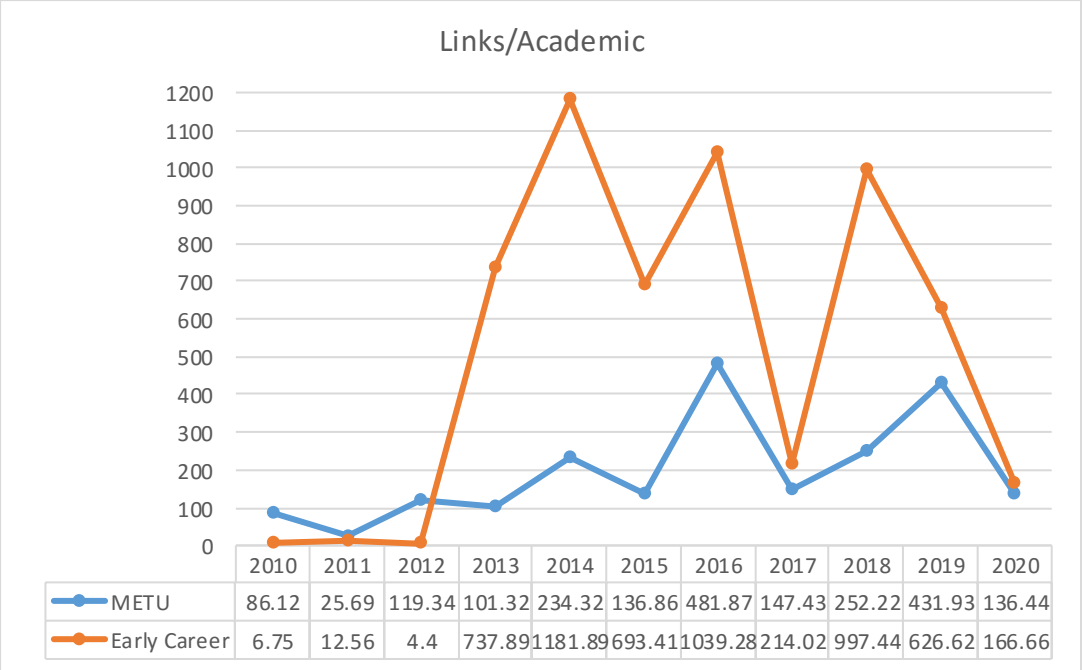
Year	Publication/ Academic	Citation/Paper	Av. Links/Academic
2010	0.95	25.84	6.75
2011	1.76	56.78	12.56
2012	2.51	79.76	4.4
2013	1.82	47.83	737.89
2014	1.5	32.93	1181.89
2015	1.13	20	693.41
2016	1.34	13.72	1039.28
2017	1.76	7.64	214.02
2018	1.8	5.68	997.44
2019	1.99	2.87	626.62
2020	1.33	0.97	166.66

Source: Author's own work

Figure 11: Trend of Publications, Degree of Integration (co-authorship links) for Early Career Academics Group (2010-2020)

Source: Author's own work

Figure 12 compares the integration for the entire METU and selected focus group. As seen early careers' integration has outweighed the METU's integration. 2020 has been the year where the values are the closest. The movements of integration levels are more or less aligned for the period of 2013-2018 while moving in opposite directions for the period of 2010-2013. Movements in the value of the early career group are more volatile, which could be due to higher integration of the members of this group, a reduction/increase in the study of a group member would be more powerful. In addition, comparing the values of publications per academics' values in Table 13 and Table 15, the early career academics group performed better than the entire METU since 2017. Moreover, the values of the early career group were also higher than those of METU in general.



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
METU	86.12	25.69	119.34	101.32	234.32	136.86	481.87	147.43	252.22	431.93	136.44
Early Career	6.75	12.56	4.4	737.89	1181.89	693.41	1039.28	214.02	997.44	626.62	166.66

Figure 12: Trend of Integration for METU and Early Career Academics Group (2010-2020)

Source: Author's own work

All in all, the scientific productivity increased within the respective period 2010-2020, and so the level of integration through their trend was not always aligned with each other, and both showed their highest values in the period rather than the end.

Therefore, based on the numerical outlook of the production and integration of METU and early career group, the interviews would be more valuable to observe the association between research network integration and productivity.

The interviews provided data on the effects of research network integration and the association between integration and productivity based on interviewees' experiences and observations.

All the interviewees believe collaboration is advantageous for higher quality and more scientific output. More importantly, some of them believe it is beyond a preference and is a requirement. *"Collaboration is a must. You cannot do anything without collaboration."* (Interviewee, 9)

> *Collaboration is necessary for our field. If we don't cooperate this would lead to a huge time loss and financial inefficiency for us and our country. For example, I have a lab equipped with several sets of machines to carry out specific experiments that focus on certain issues. On the other hand, we sometimes need other experiments which do not have the necessary technical setup. By collaboration, I can overcome these deficiencies easily. Otherwise, I must allocate money and time for the setup, and I need to wait for the experiment until the students and (our partners) gain experience in the area*. (Interviewee, 8)

All the interviewees elaborated on why they tend to cooperate with others and the advantages of being in a research network which I will mention in the following sections.

4.2 Sub-Research Question 2: Does the level of integration with research networks differ from region to region?

Abramo, D'Angelo, and Costa (2009) argued that scientific productivity can be classified into three groups, which are personal, institutional, and departmental and environmental attributes. They also stated that personal attributes cover education, age, sex, and other factors related to the researcher and highlighted the role of proximity effect on scientific productivity though it decreased a little with the development of information and communication technologies. In line with that and the literature review, observing the validity of the proximity including both regional and cultural proximity is meaningful. Thus, I will visit the role of proximity both quantitatively and qualitatively.

In this respect, I would like to present the general outlook of cooperation for METU's entire scientific production in the period 2010-2020. Academics at METU were involved in international collaboration with 122 countries in 11692 of the studies within the respective period.

According to Table 16, the USA has been the leading partner with 3036 studies. Yet, we can also say that European countries are among the important stakeholders and nearly half of them are European ones. Moreover, the number of publications produced in collaboration with EU-28 countries is 3568. This can be due to regional proximity and cultural and historical connections with Europe.

Table 16: Scientific Outputs with International Collaboration (2010-2020)

Rank	Country	WoS Documents	% of Documents
1	USA	3036	25.97
2	UK	1913	16.36
3	Germany	1857	15.88
5	Italy	1641	14.04
6	France	1576	13.48
7	China	1541	13.18
8	Spain	1539	13.16
9	Russia	1469	12.56
10	Switzerland	1456	12.45

Table 16 (cont'd)

Rank	Country	WoS Documents	% of Documents
11	Greece	1391	11.90
12	Poland	1390	11.89
13	Austria	1387	11.86
14	Portugal	1380	11.80
15	Brazil	1333	11.40
16	Taiwan	1327	11.35
17	Czech Repub.	1300	11.12
18	Hungary	1297	11.09
19	Serbia	1297	11.09
20	Georgia	1273	10.89
21	Colombia	1272	10.88
22	Belarus	1269	10.85
23	Armenia	1267	10.84
24	Iran	1209	10.34
25	India	1187	10.15
26	Belgium	1148	9.82
27	Mexico	1142	9.77
28	South Korea	1134	9.70
29	Finland	1126	9.63
30	Ukraine	1092	9.34
31	Pakistan	1072	9.17
32	Croatia	1070	9.15
33	Estonia	1060	9.07
34	Bulgaria	1059	9.06
35	Cyprus	1058	9.05
36	Egypt	1051	8.99
37	New Zealand	1046	8.95
38	Lithuania	1042	8.91
39	Ireland	841	7.19
40	Thailand	834	7.13
41	Australia	803	6.87
42	Malaysia	757	6.47
43	Qatar	735	6.29
44	Sri Lanka	663	5.67
45	Netherlands	575	4.92
46	Saudi Arabia	518	4.43
47	Ecuador	494	4.23
48	Latvia	493	4.22
49	Canada	479	4.10
50	Denmark	427	3.65

Source: Incites (Exported on February 14th, 2022)

To assess the effects of educational ties on research network integration and its scientific productivity reflections, explained in the Method section, I studied the early career academics data under four groups: EU, Non-EU, Mixed and Other. Table 17 represents information on the number of scientific outputs produced by the early career academics classified under these four groups. (For the Mixed group with two different assumptions, by including or excluding Dr. Demirköz, who can be called a potential source of an anomaly with her CERN-based studies in physics.)

In addition, Figure 13 shows the regional integration for the academics with EU origin while following Figures 14, 15 and 16 do the same for the Non-Eu, Mixed and Other respectively.

Table 17: Publications and Degree of Integration (co-authorship links by regions) for Early Career Group (2010-2020)

Region	Academics	# of Authors	# of Articles	# of Citations	# of Links	#of Total Link Strength	Av Links/ Author	Av. Links/ Academics	# of Clusters
EU	44	1354	516	2689	102524	122554	90.51	2785.32	44
Non-EU	96	2161	949	9587	54110	74742	34.59	778.56	83
Mixed	19	4520	544	29031	4761377	67956115	15034.54	3576637.63	31
Mixed-without Dr. Demirkoz	18	681	283	4169	4020	5303	7.79	294.61	40
Other	10	158	89	530	511	653	4.13	65.30	22

Source: Author's own work

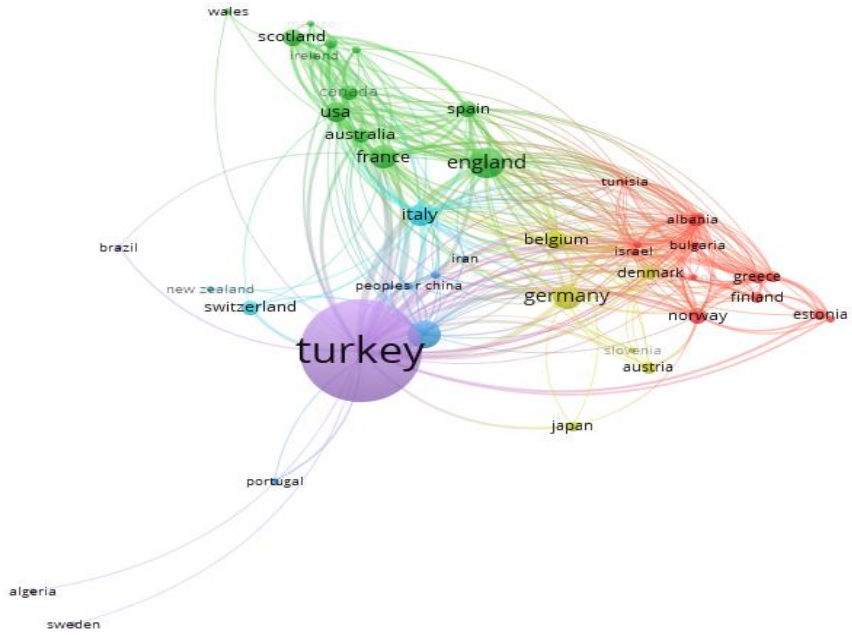


Figure 13: Co-authorship links of Early Career Academics by EU Origin

Source: Author's own work. Accessible via https://tinyurl.com/2qcuopg9

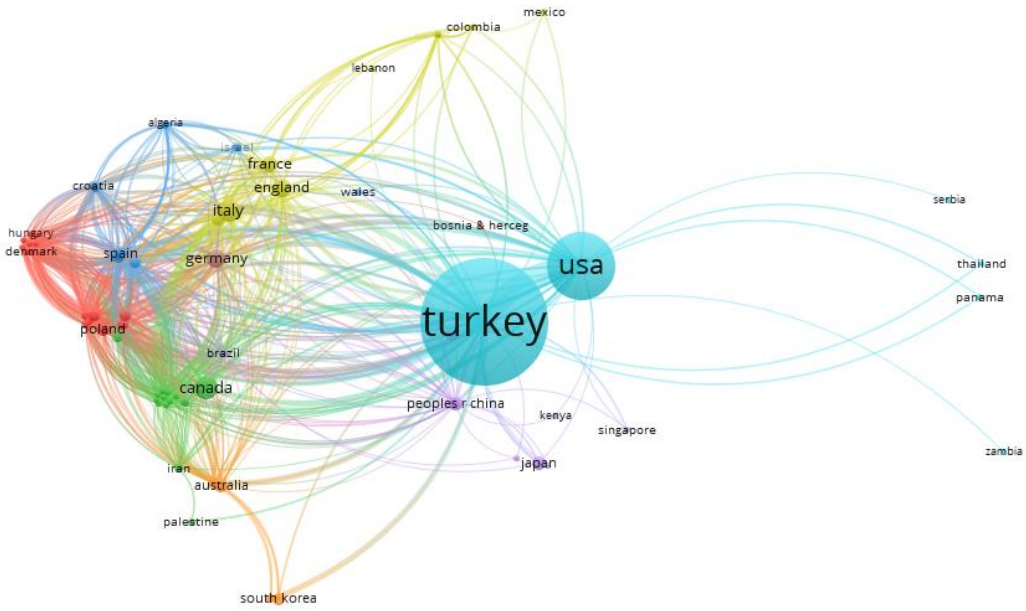


Figure 14: Co-authorship links of Early Career Academics by Non-EU Origin

Source: Author's own work. Accessible via https://tinyurl.com/2pcgv9po

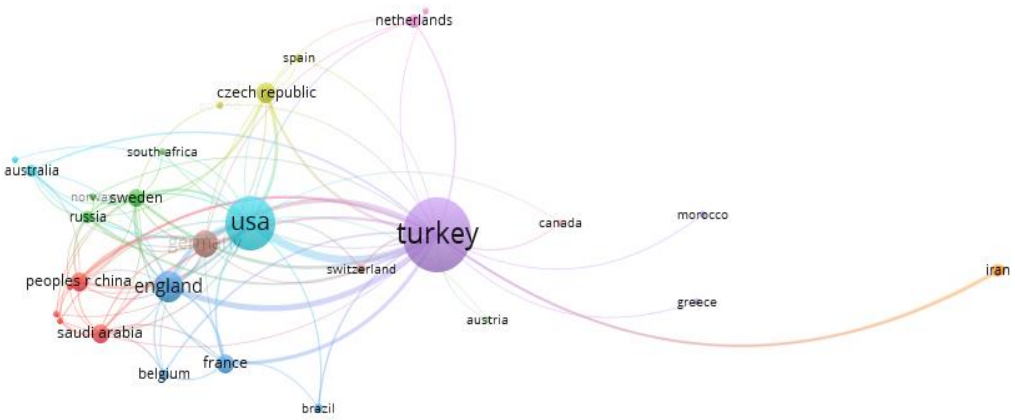


Figure 15: Co-authorship links of Early Career Academics by Mixed Origin

Source: Author's own work. Accessible via https://tinyurl.com/2gmgw9ql

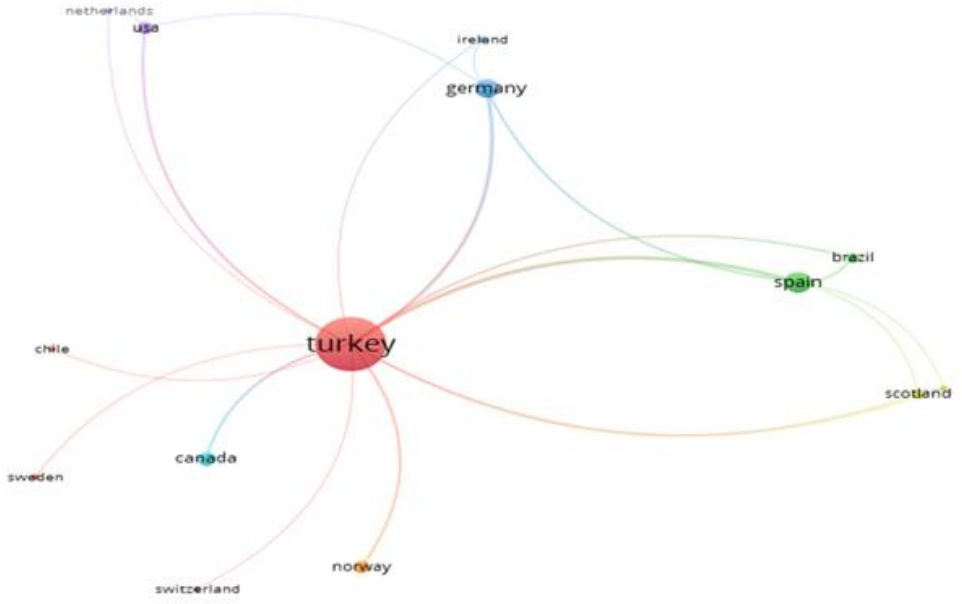


Figure 16: Co-authorship links of Early Career Academics by Other Origin

Source: Author's own work. Accessible via https://tinyurl.com/2lklq6b5

According to Table 17, the Non-EU group has the highest production by volume, and it is the largest group of academics with 96 people. However, the EU Group has produced more links. The average link per academic for EU, Non-EU, Mixed

(excluding Dr. Demirköz), and others are 2785.32; 778.56; 294.61, and 65.30 respectively for the period of 2010-2020. Thus, the EU has the highest integration namely average link per academic and this value is lowest for the group including academics of Turkey origin. The average link per author has a similar outlook for these groups.

Table 18 presents information on the publication per academic, citation per publication, and average link per academic for these groups.

Table 18: Selected Productivity and Integration Indicators of the Regional Groups

Region	Publication/ Academic	Citation/ Publication	Av. Link/ Academic
EU	11.73	5.21	2785.32
Non-EU	9.89	10.1	778.56
Mixed	28.63	87.18	3576637.63
Mixed without Dr. Demirköz	15.72	14.73	294.61
Other	8.9	5.96	65.3

Source: Author's own work

According to Table 18, the EU has the highest integration. The mixed group has the highest publication per academic value and the highest citation per publication value. The EU group surpassed the Non-EU and Other groups by publication per academic. On the other hand, publication per academic values of Non-EU and Other groups was rather close to each other but the citation and average link values of the Other Group were way behind Non-EU.

Figure 13 shows co-authorship links of early career academics by EU Origin. This group of academics is in connection with a group of 49 countries (Total link strength is 1025). Table 19 represents information on the first 15 leading partners with respect to total link strength. Both figure and the table show that integration is higher with EU countries.

Table 19: Leading Country Composition for EU Group

Country	Documents	Total Link Strength
England	40	145
Italy	22	112
France	23	108
Spain	11	91
Belgium	14	89
Australia	10	77
Canada	10	74
Germany	25	73
USA	17	73
Scotland	13	70
Netherlands	35	67
Norway	12	58
South Africa	6	58
Greece	7	56
Russia	6	46

Source: Author's own work

Similarly, Figure 14 and Table 20 represent the co-authorship links of the Non-EU group. The non-EU group is in interaction with 71 countries (Total link strength is 2055) and the USA which is a non-EU country is the leading partner and both the number of documents and total link strength are a long way from others in the USA case.

On the other hand, Figure 15, and Table 21 give the respective information for the Mixed group. This group is linked with 30 countries (Total link strength is 354.) and the USA again is the first one and nearly doubled the closest one (England). As the 16

of the academics also have a USA background, this ranking is not surprising, which is also in line with our hypothesis arguing a regional tendency and assuming a positive role for educational background on the composition/direction of integration.

Table 20: Leading Country Composition for Non-EU Group

Country	Documents	Total Link Strength
USA	247	360
Italy	27	162
Germany	18	131
France	15	113
Spain	10	113
Switzerland	8	108
Greece	7	107
Netherlands	5	102
Poland	11	102
Slovenia	4	101
Sweden	7	97
England	20	95
Scotland	7	95
Brazil	5	92
Portugal	7	92

Source: Author's own work

Table 21: Leading Country Composition for Mixed

Country	Documents	Total Link Strength
USA	94	137
England	33	77
Germany	25	47
China	15	32
Sweden	10	35
France	12	28
Czech Repub.	14	27
Saudi Arabia	12	22
Russia	5	19
Australia	5	12
Belgium	4	10
Denmark	2	9
Iran	5	8
Netherlands	7	8
Brazil	3	6

Source: Author's own work

The last one, the Other group is visualized and summarized in Figure 16 and Table 22. This group is integrated with 14 countries and its country-wise total link strength is 62. The outscoring partner is Spain and 9 of the countries are European countries. This is in line with the proximity hypothesis.

Table 22: Leading Country Composition for Others

Country	Document	Total Link Strength
Spain	14	22
Germany	10	15
USA	5	7
Brazil	3	6
Canada	6	6
Scotland	3	5
Norway	5	4
Italy	1	3
Ireland	1	2
Netherlands	1	2
Chile	1	1
Sweden	1	1
Switzerland	1	1

Source: Author's own work

All in all, the EU has the highest level of integration with respect to others and the composition of integration of these groups can be commended as the educational background is an important determinant of the group of countries cooperating. Similarly, the Other group is in close cooperation with again EU countries, which could be connected to physical proximity or funding opportunities. Analysis of data produced via interviews may help us to confirm these conclusions.

During interviews, I learned and confirmed the research network preferences of the interviewees via the questions on both their recent studies and previous studies starting from the establishment of the respective teams and the way they worked together to the publication of the study.

As I emphasized in the Methods section, the classification for regional groups was mainly based on the educational and professional background of the academics in the group of selected early career academics. As such, looking into the role of the advisors, colleagues met in the past during education life and the common physical and cultural ties attached to the region or educational background and these people mentioned in the previous sections would be beneficial in discussing the integration outlook revealed above.

Indeed, the interviews provide important input on this front. In this regard, the role of educational background, and the advisors, colleagues studied there are significant factors highlighted in the interviews (Interviewee 3, 4, 5, 11).

> *My advisor was very supportive. The respective projects were developed through his connections, and he also provided a perspective… He is very famous and open to collaborations…He also facilitated my access to networks that are in other geographical regions that I had not interacted with…During my dissertation studies, he recommended to consult with a Professor at Harvard and present my thesis to him. This became another integration route*. (Interviewee, 3)
>
> *Your education determines a lot. Your undergraduate education, master's, and Ph.D. degree or if you attended a sabbatical program and stayed there for a year and established certain connections and if you were able to maintain those connections somehow...That is not easy to set these networks online*. (Interviewee, 1)

As a reflection of the role of education on the network extension, though it is also related to recruitment:

> *Now, we have applied for the recruitment of a foreign faculty member, 'she is very linked' and we paid attention to this when choosing her, the friend is included in research networks that we do not have and that have pathways… For example, her Ph.D. is from another country and doctorate from different countries means networking with different countries.* (Interviewee, 4)

In the same vein, the feedback of academics on their studies carried out in cooperation with their former students also provide information on the role of educational background from the other way around. In this regard, Interviewee 5 conveyed that

"Another student of mine worked on the same subject and finished her master's degree. Now I can say 'Look, X did the following, let's talk on what we can do more? ".

> *As I said, X is one of our Ph.D. graduates. She first worked at Y University and then transferred to Z University. She said that she was interested in a project application on W issues that I had worked on previously and asked me to work together.* (Interviewee, 1)

Funding opportunities of the advisor is another prominent factor emphasized in the interviews concerning network integration though some of them are raised in connection to conference attendance.

> *We really went to many conferences and all of them were covered by my advisor's projects and the University's fund that I attended, and I did not come empty-handed from any of them, so I brought a link.* (Interviewee, 5)

Cultural ties established during Ph.D. life is another channel of integration or research network access gate.

> *When it comes to the connections in America… I've worked on a lot of projects in the USA…There are people I know and met there. One partner has now become a Professor in another place. I should have used the network better but now when I turn and say to those people that I want to work with them again, no one objects because we have developed a common language. Although they had not turned into an academic product before, Thankfully I have developed a language that has the potential to turn into research…Well, I guess those projects in America and the perspective of my teacher helped me in this regard.* (Interviewee, 3)

Similarly, physical proximity and having a chance for face-to-face communication are also important, which are also directly related to the educational background as well.

> *The main determinant is distance. I think distance is still important. The second is acquaintance, whether you have a social relationship before.* (Interviewee, 1)
>
> *Unless you are there, in those relations, "Once you don't reside, you don't live there", knowing exactly what will come out, what special issue will come up, etc. It becomes much more difficult for you to know.* (Interviewee, 4)

> *For the projects, you do not have to be together, but it is important not to be too far away for being able to work continuously. I work with my students. Our colleagues in the Project also work with their students, but we hold synchronization meetings periodically. It is better to have those meetings physically though we do it online due to Pandemic*. (Interviewee, 7)

On the other hand, on the role of proximity, I have observed cases in that academics preferred to find a side way to attain necessary skills in the study instead of collaborating with other colleagues within METU or others. The approach of the academics, protectionist reflexes of the disciplines, or the perception of a cooperative environment within the University is the leading factors. The following examples could be commended as irrelevant, but I believe they are helpful to show the delicacy of the integration, which requires sincere and continuous effort and there is a necessity to facilitate actions also for using existing networks to the best possible extent.

> *But if I tell you why I don't work with the ones from X department at METU, now if I go to the XY guys working there, they will humiliate and say, "what the hell and he doesn't understand", "we know that", "we write the code" or something like that, long story*. (Interviewee, 9)
>
> *I have never seen such an inviting approach towards it…Therefore, what I feel here is that the faculty of X at METU has an experience of being left out.* (Interviewee, 10)

In conclusion, building on the quantitative examination of regions that indicates that Academics from EU are more connected or more integrated to research networks, interviews indicate to existence of a regional tendency. Academics tend to cooperate more with the ones from the countries within the same region. Interviews confirms this and educational background, cultural ties, qualities and networks attained during this educational and professional background and physical proximity are associated with this integration outlook.

4.3 Sub-Research Question 3: Is the tendency to integrate with research networks same in different disciplines?

Historical trends and the number of publications are changing from discipline to discipline. [39] In addition, the number and distribution of publications by fields of science also change concerning countries' research agenda and their capabilities and needs of the time as we observed in the Covid-19 Pandemic. The government agenda could also affect their tendency to motivate cooperation and lead to limitations on the partners of cooperation, though it is generally independent of the field and generally technology specific. Table 23 shows the distribution of scientific output for 2010 and 2018 based on the data provided by the National Science Board of the USA by fields and regions.

Table 23 gives information on the composition of the world scientific outlook by areas in 2010 and 2018 and countries. This I believe hints us at the priorities of those countries. First of all, health is at the center of world scientific efforts in 2010 by volume/share and preserved this position. The case has been the same in all countries except China and the leading position of health in India has changed in 2018 and replaced with computer and information technologies and engineering. The countries' top three research areas stayed the same. Social science's share increased in the entire world and countries except for India and Turkey. While psychology gained importance all over the world.

[39] https://ncses.nsf.gov/pubs/nsb20206/data#table-block

Table 23: Distribution of Scientific Output by Field and Region (2010 and 2018) (Share of the field in the region)

	2010							2018						
Field	World	USA	EU	China	Japan	India	Turkey	World	USA	EU	China	Japan	India	Turkey
All articles(n)	1948805	486363	645838	338291	124144	69237	29421	2555959	422808	622125	528263	98793	135788	39449
Agricultural	1.93	1.27	1.75	1.29	1.13	4.68	2.82	2.16	1.20	1.89	2.38	1.03	2.42	3.13
Astronomy Astrophy.	0.64	1.22	1.13	0.25	0.70	0.60	0.25	0.54	0.85	0.86	0.20	0.56	0.30	0.26
Biological & biomedical	12.37	15.47	13.04	7.82	12.60	15.41	10.79	11.97	14.03	12.05	9.85	12.15	10.37	10.62
Chemistry	5.73	3.74	5.28	7.45	6.70	10.69	5.77	6.20	3.56	5.33	9.61	7.36	8.46	5.72
Computer	12.14	7.68	10.51	22.44	8.74	12.53	6.84	10.70	7.66	9.60	13.24	9.36	18.41	8.79
Engineering	16.23	13.60	13.15	26.06	16.37	12.50	12.37	16.96	12.84	14.43	25.47	15.13	17.56	13.76
Geosci.	3.05	3.67	3.57	2.37	2.72	2.04	1.53	3.07	3.54	3.17	2.93	2.32	1.50	1.95
Health	24.87	30.40	27.26	11.70	26.24	19.14	37.74	23.64	33.91	27.05	13.10	30.41	14.04	30.59
Materials	2.92	1.53	1.89	6.00	4.14	3.82	2.74	4.19	1.30	2.56	6.48	3.18	9.32	2.98
Math.S.	2.31	2.06	2.66	2.15	1.48	2.02	3.13	2.39	2.03	2.53	2.08	1.66	3.45	3.64
Natural Res.	1.53	1.33	1.42	1.59	1.16	2.58	2.58	2.42	1.47	2.44	3.18	1.44	1.82	2.49
Physics	10.22	8.85	11.28	9.89	16.12	11.82	5.67	9.12	6.46	8.39	10.07	12.87	10.59	8.90
Psychology	1.75	3.19	2.14	0.20	0.70	0.21	0.61	1.91	3.81	2.84	0.38	1.08	0.29	1.28
Social Sci.	4.31	6.00	4.92	0.77	1.20	1.96	7.15	4.74	7.34	6.86	1.04	1.45	1.48	5.88

Source: National Science Board (2019)

The Incites, a reporting system of WoS, provides METU data by topics. Figure 17 presents this information under six main areas. According to Figure 17, 38% of the articles were produced on engineering and technology issues. The share of articles on Arts and Humanities and Social Sciences is 4% and 12%, respectively, which is in line with the departments' representation/composition at METU[40]. The reader should keep in mind that the given classification does not provide information on the share or interdisciplinary works.

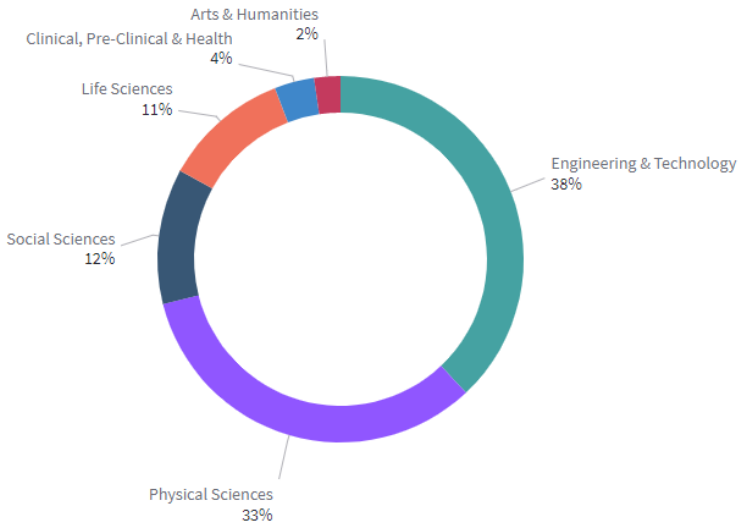


Figure 17: Composition of Documents Produced by Academics at METU by Research Area (2010-2020)

Source: Incites (Exported on February 15, 2022)

With that and considering the relative representation of the social science and arts and humanities departments at METU, disaggregating the studies produced by the early career academics and looking into their link may not produce meaningful and comparable results always. As such, in this section, our main input would mainly come from the Interviews.

[40] List of Departments at https://www.metu.edu.tr/faculties-institutes-schools and the information about the the number of faculties by departments provided in the Action Plans of METU (https://sgdb.metu.edu.tr/tr/idare-faaliyet-raporlari)provides the outlook of METU.

Yet again, I employed a quantitative model as well following the procedure that I told at the Method section. With that, I produced a version of Figure 17 for early career academics. Figure 18 provides information on the number of scientific outputs by selected group with respect to areas.

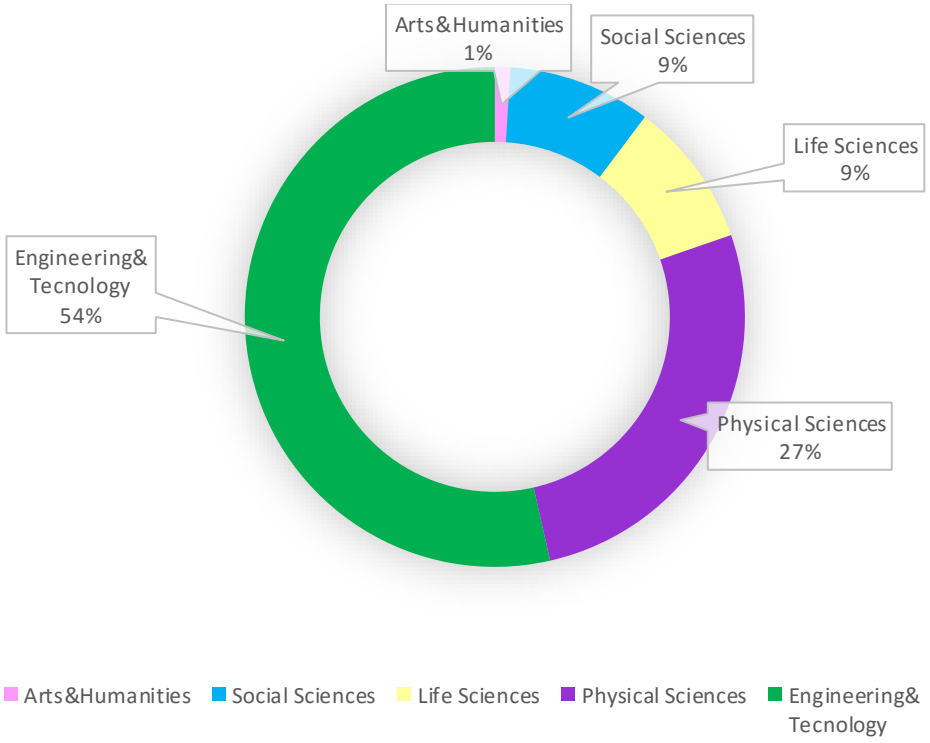


Figure 18: Composition of Documents Produced by Selected Academics at METU by Research Area (%) (2010-2020)

Source: Author's own work

The outlook of articles by the early career academics is similar to the one at METU. Yet, the share of social science (9.32 %) is lower than METU. Though engineering and technology have the largest share again, the gap between engineering and physical sciences is larger in the selected group. Arts and Humanities have the lowest share as is the case at entire METU and its lower than the share of it at entire METU.

In addition, replicating the method in regions I looked at the average length strength for these groups of authors. Table 24 represent information on the integration of these academics by area. On a separate note, with a quick review of the respective data used

in the Vosviewer, the teams are larger in the engineering and physical science studies and studies in Arts and Humanities and Social Sciences are carried out by smaller teams. For several topics such as sociology or international relations or regional studies, working alone is like an exercised general rule of thumb. In the same vein, according to Table 24 Arts and Humanities has the lowest average link strength. Social science follows the Arts and Humanities. The integration is way beyond them in Life Sciences, Physical Sciences Engineering, and Technology.

In addition, by looking at some of the numbers of articles in these fields which is nearly equal to the sum of articles made by the selected group, I can also argue that any cooperation among these academics is carried out within the same group/discipline.

Interviews provide information on the integration differentiation of disciplines and issues which are associated with the disciplines' features. They indicate in-built differences in the disciplines and research agenda and policy priorities of governments which is directly reflected in the budget affects the tendency to cooperate.

As I highlighted in the first sub-research question, though all the interviewees highlight the positive role of collaboration in their studies, in some disciplines, it is easier and naturally driven or required while in others further effort is needed to work in cooperation. In general, natural sciences and basic sciences tend to cooperate more. Tendency to cooperation is lower, particularly in social sciences. The critical difference between physical science and social science is their main area of interest, which also differentiates the methods and tools used by them. Physical sciences are the knowledge of the physically existing aspects of the world, its phenomena, and applications through general laws, research, and observations. On the other hand, social science dealing with human society and behavior explains its political, social, psychological, and economic aspects, which is by nature more inclined to change by the perceptions of the researcher. Thus, it in general requires a common approach of the researchers in the team, which may lead to smaller teams due to difficulty in consensus building. Working on human nature and its reflections could also complicate the working procedures of social science. It also makes the study and its

outputs more attached to region. The existence of the material or tools is the main difficulty in the physical science while it is analysis or the collection of the data on humans in social science. This could also lead to differences in the periodicity of the publications.

Table 24: Publications and Degree of Integration (co-authorship links by areas) for Selected Group (2010-2020)

Topics	Academics	# of Authors	# of Articles	# of Citation	# of Links	#of Total Link Strength	Av Links/Author	Av Links/ Academics	# of Clusters
Arts & Humanities	9	15	21	37	11	13	0.87	1.44	7
Social Sciences	36	242	194	681	631	1384	5.72	38.44	40
Life Sciences	18	922	198	2873	31566	51074	55.39	2837.44	18
Physical Sciences	22	4654	561	28676	4780962	67975758	14605.88	3089807.18	33
Physical Sciences (without Dr. Demirkoz)	21	815	300	8655	23605	24946	30.61	1187.90	26
Engineering& Technology	84	2098	1123	9185	83613	85720	40.86	1020.48	60

Source: Author’s own work

In the same vein, as I briefly touch upon before, cooperation helps in better use of time and resources. This efficiency gains and contribution of each partner or group within the network is more easily observable in engineering, physical, and life sciences while it is rather vague in social sciences. Similarly, the emphasis on trust is more in the interviews carried out with academics working on social sciences, though it is important in all disciplines, particularly for the sake of responsible and timely delivery of the output.

In this regard, Interviewees who are social scientists highlight the role of cooperation and differences in the cooperation tendency of their area.

> *Social science is a social phenomenon and a collective effort. The more society invests, the more social science develops. The more social scientists become socialized, the more social science develops. This is not a job that will be done alone... The culture of cooperation is very limited in social sciences… because there is not a culture of working together in social sciences, because there is little interphase*. (Interviewee, 4)
>
> *Unfortunately, it is not a good thing to have many authors in our field. Having many authors means including many perspectives, and a richer interpretation, but even working with 5 academics seems too much...When you were involved in such a study, people would ask which part you do.* (Interviewee, 3)

One of the issues raised while discussing the cooperation within the disciplines is the protectionist attitudes of the scientists working on that specific field in interacting with other disciplines. As an example:

> *About the restructuring of the field, when a field begins to form over time, reflexes to protect this field also arise. For example, when the field of X comes into contact with Y, we say XY. For example, it does not accept the dominance of Y, it does not allow it to be too dominant, especially something like X. However, there may be a relational development situation, but that language is not being tried to be established… and I observe that there is an effort to advance in a very controlled way about what information we will get from other disciplines and with which disciplines we will get in touch…Of course, this makes the field more closed, and causes it to develop a production and charisma focused on certain issues, and of course, to develop relations in line with this production mechanism*. (Interviewee, 10)

In other words, the Interviewee 10 highlights that academics refrain from interacting with other disciplines to protect their dominance and share in the area. This could lead to rather restricted works even when it is possible to expand realm of the work. This behavior does not only function in the interaction of physical and social sciences but also within the subfields of these main disciplines. Indeed, the masked information provided by the Interviewee 10 gives an example of this situation.

Similarly, an engineer highlighting the necessity of network integration also argues that the role of journals has been questionable in science communication for a while.

> *If I speak for the field, the works have gained a terrible speed… It has gained a lot of speed because of the amazingly successful studies, especially in the last few years, as a result of the developments in big data and big computing power. If you don't look at the literature for a month, you're far behind. A new record is broken every day, something new and something that was thought impossible before is being done every day. Therefore, the dynamics of publication and scientific work have also changed a lot…There is something called Arxiv, a public server, without waiting for the conference. You put your work there with a timestamp. Interaction and publication dynamic are in this way. If you don't want to be left behind, you must be included in these networks, you must catch up quickly. No one is interested in journals and are reading them, those who come later will already be garbage.* (Interviewee, 5)

Thus, in engineering, science communication channel is in transformation and the main channel to catch up is not the journals or conference proceedings any more. Therefore, the regulations related to access to finance or promotion built up on these so-called relatively outdated channels could lead to the use of resources in a less efficient way, moving with the dynamics of these and motivating the integration with a limited group. In addition, the open platforms are generally highlighted by the interviewees from engineering, life sciences, and physical sciences. There is only one exception in the social sciences, and she underlines the difference between the subfields in social sciences in using these new tools and indicates that only a few sub-fields use these new tools.

The government's priorities and its policy reflections also affect the integration level and whom to cooperate with through budget and other tools, which is more determinant in social sciences.

> *Networking is always expected to be westward, either within ourselves or to the west. If I work in Z, you go to the east to the south but there is no sabbatical for them, it is an important opportunity for networking… I will learn a lot of things, methods, etc.… but the funding is always directed towards the west…In my opinion, this hinders Turkey a lot in the field of X… You can use TÜBİTAK funds for networking, but their focus is too narrow, too small, nothing about the social sciences, it says, policy-oriented only, you have to invent something for the Turkish state that will increase its interests here and there and it rarely comes out.* (Interviewee, 4)

> *Receiving these projects has a certain project establishment. Certain conditions of receiving it, there is a project format that it demands from you, and there is an output… In short, there are also issues that your geography demands from you and wants you to think about and find solutions for. I find these understandable, but I find it problematic that the research processes of the academy, more precisely, in universities, are structured to meet the needs there and are shaped by that demand… You can't get this project if you don't include it, then there will be a situation where I think that you are also limited in an intellectual sense.* (Interviewee, 10)

In other words, social scientists are expected to study the issues serving the direct interests of the state and shape their integration in line with the priorities of the Turkish state. This limits the integration ability and integration channels of the academics. Though the examples are limited, a similar example in physical sciences is provided below and in another country.

> *When I was in America, a man from Harvard said at the seminar, "I submitted this project to NSF, it was rejected twice and finally, I put the phrase "nanotechnology" and I put a sentence and it was funded without any objections*. (Interviewee, 11)

Thus, governments priorities are leading less integration with research networks in socials sciences.

Academics working on social sciences are expected to satisfy the similar expectations of physical science, which is in contradiction with the nature of social sciences in general.

> *TÜBİTAK wants you to write the project as if you have almost done the project, researched it, and it also asks for such a detail. If you know a research project that well in advance, it does not worth asking and studying, it does not do much scientifically, you write the question, you write the research method, you predict the research outcome, and there is no element of surprise*. (Interviewee, 4)

None of the engineers or physical scientists raise such a concern about the language of these forms. Thus, this nonconformity of these forms with social sciences affects the access of socials scientist to resources that could support their integration with research networks.

Another difference between social and physical sciences that catches my attention is the emphasis on personal feelings affecting collaboration. One interviewee conveys her observation on the collaboration tendency of her colleagues even in obligatory works.

> *Of course, there may be problems, personal problems, but there is a job, and we all have a responsibility towards this job, but here it is organized from such intimate, personal approach that we don't work together or not. Cooperation seems unlikely with this style*. (Interviewee, 10)

Thus, I expect less cooperation for research which is a voluntary effort of the academics though she must do it up to a certain level. Another interviewee shares her unfortunate experience in cooperative work at METU.

> *For example, a congress which I contributed for a long time in cooperation with my department, at one point I was completely excluded from work. There may be issues and differences of opinion but reflecting this to such structures is not acceptable.* (Interviewee, 11)

Although it is a case observed at METU, I believe this is valuable to represent the role and tendency of personal feelings and approaches in social sciences. It is easier to

overcome disagreements due to personality differences in the physical sciences as they are more based on numbers and experiments.

All in all, there is a difference between disciplines in terms of their tendency to cooperate among academics. This difference could result from the in-built differences of these disciplines, government agenda, and its reflections or personal approaches which could find more room to function in social sciences.

4.4 Sub-Research Question 4: What are the factors that motivate academicians to be a part of research networks?

The question of "Why to collaborate?" has been one of the important pillars of the work on scientific collaboration and collaboration's facilitating and more importantly enabling role have been the most straightforward answer to this question (Shrum et al., 2019) regardless of the type, size or focus of cooperation. As such, it is natural to expect that collaboration improves productivity and several studies indicate this positive association between collaboration and productivity (Abbasi & Altmann, 2011). Katz and Martin (1997) summarized the factors that lead academics to cooperate as the level of funding, rationalization of human capital, visibility, and recognition, access to complex instrumentation, specialization of science, and gaining experience and training. Scientific collaborations are mainly based on the share or use of technology or equipment (Shrum et al., 2019). On the other hand, Ynalvez and Shrum (2011) argued that scientists may choose to collaborate on research projects without any measurable impact on their productivity and acquiring professional opportunities and extrinsic rewards such as additional income in the form of honoraria, and travel opportunities are determinant in such cooperation.

Technology or infrastructure of the partners' organization or skills or competency of the partners or the academics himself/herself is the prominent factor highlighted in the interviews.

As I conveyed before on views of academics about cooperation, collaboration is useful for efficient use of resources and helps to overcome the lack of resources, including skills and perspectives. Nearly half of the interviewees provided input here (Interviewee 1, 7, 8, 10, 13, 14).

> *In that study, the strong points of both groups are the knowledge and capabilities that the other is not able to do. We both came together, we created something better, and we continue to do so. We progress by writing a project every 2 years and there is a complementary situation there. We cannot research without their material, and they cannot do it without our know-how. This is a need-based and complementary process.* (Interviewee, 13)
>
> *I couldn't do the whole experiment alone because my skills were not the same and they were different. In other words, this is how it goes in America and collaborations are based on skills.* (Interviewee, 14)

Collaboration is also conducive to widening the realms of research venues in several fields.

> *So frankly, joint work here gives more productive results. In one of the fields, the depth that can be reached has been reached, and the opportunities to work here have started to decrease. Therefore, there is a need to open new horizons in such interdisciplinary fields. Now it seems like new horizons are opening with integrations in other branches.* (Interviewee, 14)
>
> *I think it is very useful and important for the application. In my previous works, I was working more alone, but they were more academic examples. In our academic collaborative studies, we try to find an answer to a more serious problem. X, Y, Z give us numerical data, detailed necessary system information about the system. I transform them into a model that I know, I solve a problem that I know…With that we introduce new methods… I think it's an example that I cannot think of and put forward a solution alone and by working together, we come up with something together and find a solution.* (Interviewee, 7)

At this point, I see merit in highlighting that these two interviewees are engineers, and the protectionist reflexes of the several disciplines that I touched upon in the previous section are not observed.

In addition, with integration to research networks, several departments have access to other regions and extend their capacity on them as well.

> *Increasing collaborations cause us to get to know other regions. In other words, it is now much easier to go and take an input from another country's and look at a parameter, when it was impossible or very difficult before*. (Interviewee, 6)

Highlighting the role of complementarity of the skills in the collaborations, one interviewee also indicates connections of the partner as a crucial factor in Turkey, though with an ethical criticism in this case. The interviewee conveys her observations and highlights that some people could be involved in the studies due to their political connections that could help in accessing incentives rather than their scientific contributions.

> *I say I'll do something. You tell me how much and what you can do. Then we can collaborate from there. It starts by asking questions, but in the Turkish environment… It is not based on questions, but on interests. In other words, I could make a few publications with X who was politically connected, and I could receive incentives thorough X. It's just like that.* (Interviewee, 14)

Although it has been mentioned in a different context and I will elaborate on the issue in the next section, in the same vein, one academic also mentioned the tendency to add celebrities or well-connected academics to several studies without even real connections. Interviewee, 8 said that "*Craftiness…So, once in a while, everyone was trying to write Aziz Sancar's*[41] *name on their projects as a consultant or something."*

On a separate note, honorary and extrinsic rewards emphasized by Ynalvez and Shrum (2011) were not detected in the METU case most probably due to limited resources. On the contrary, all academics indicated that due to limited resources they had to

[41] Aziz Sancar is the first Turkish scientist awarded the Nobel Prize and got the Nobel in Chemistry in 2015 for his studies on DNA repair.

choose their research endeavors very carefully and maintaining funds even for the publishing-wise productive ones is challenging.

In conclusion, building up the cooperation's positive role in academic studies, interviewees' experiences indicate that they prefer and need to cooperate to manage their both physical and intellectual resources more efficiently. This has been the greatest value added to the cooperation.

4.5 Sub-Research Question 5: What are the factors that make the research network integration easier?

Building on the positive role of being connected with research networks on scientific productivity and based on the experiences of the academics in their research efforts at METU and their previous professional experiences, the environment with its attached physical, regulatory, and ethical features is an important factor facilitating or complicating integration to research networks. This is also parallel with Abramo et al. (2009)'s findings on scientific productivity and its relation to personal, institutional, departmental, and environmental attributes and yet it is more detailed.

As such, based on the codes produced from the analysis of interviews, I believe the factors making research network integration easier could be categorized under six main groups. They are regulation, financial, infrastructure, human resources, ethical issues, and democracy. Naturally, in some sections, we could observe the intersection or interaction of these fundamental issues via some sub-themes. In addition, "Demotivation" as a side effect though it is serious has been a prominent observation in the interviews. These codes were provided in Annex II.

4.5.1 Regulation

Schmandt et al. (2016) elaborates on the development of regulations and the role of science in policy making via regulations that is to provide an analysis for prescription and justification of that prescription. Yet there is a bi-directional relation between

science and regulation. The power of regulation over science is beyond the repercussions of its simple control over the products and services of science-based or high technology industries. The regulation also affects the environment and resources for new scientific discoveries, their use, and dissemination including the release of scientific outputs either directly or indirectly. The scientific studies and their collaboration aspect namely integration with research networks is not immune from this effect.

Regulation or policy-making -or how they are structured- influences integration with research networks through its effect on finance, human resource policies, and issues related to policy making in general, and the implementation process of these policies is proven to be critical in the interviews. Interviews also provide input on the time dimension of regulations and logistical processes. Policy making based on the ranking of the higher education institutions is also a step forth as a serious pressure source-challenge in this case- on the integration of research networks.

4.5.1.1 Policy Making-General Framework

As I touched upon in Chapter 2, the aims, direction, and functioning of the higher education system of Turkey had been structured via the laws mainly focused on universities till the 1990s, and then the changes have been made with plans and laws that do not aim at full transformation and approach higher education as a tool such as development plans and laws on R&D and technology development. They all had reflections on the scientific studies of academics and academicians' roles and responsibilities. As I mentioned above with reference to Schmandt et al. (2016), science is used as a base and tool for justification of the policy in the USA. Yet, the case in Turkey is not exactly the same. Interviewees have indicated that the general policy framework set on these plans and laws does not always support their integration with the research networks. On the contrary, it is not easy to understand how they are structured and there are flaws in the general policy framework.

To be specific and start from the beginning, these policies define several priority areas and set specific targets to channel the resources to the respective areas. Yet, it is not

always clear how these areas are chosen, or the targets are set. In addition, whether directing the resources to these priorities in each discipline is logical is questionable.

One interviewee shared her experience with such a plan preparation process.

> *There were many sub-commissions in the preparation of the 11th Development Plan, even I was included, for example, my X team had a Y goal, I guess, to produce 2 Ys by 2023. But why 2? No one knows. In fact, all of the goals are set in this way, no one questions how realistic or unrealistic they are.* (Interviewee, 1)

Interviewees say that the target is not set in the right way and has deficiencies such as the dangers of reverse engineering and lack of scientific basis.

> *This thing is not a target once, it becomes a result, you can set your target by saying "I will develop Turkey scientifically", you do it, then you will enter the top 100 anyway… If you call this as a target, it goes like this; you start looking at how that ranking is done, you don't look at how science is done… Everything is reversed, causality is completely reversed. Who is in the top 100, there is Stanford, what is Stanford doing? There is no problem in this either, but again, you see, there is such a thing as Journal, there are 5 in Stanford, I don't know why there are 5. Well but you don't look at the thing so why does it appear so much in Stanford, how does it write? How much does he give his staff? How does he evaluate the men he has put into the system, what does he give them?* (Interviewee, 5)
>
> *Of course, we want our institution to be a world-class one. I wish both our research, our scientific quality, and our human quality were at this level, but is there a study that shows that this can be achieved by only increasing promotion criteria?* (Interviewee, 6)

Working on specific regions and areas, interviewees (Interviewee 3, 4, 10, 11) argue that these priority specifications directly affect the resources for their studies and limit their capacity to cooperate.

> *TÜBİTAK does not allow any field, it does not allow any field outside of Turkey…There is such a clear geographical barrier. In my opinion, this hinders Turkey a lot in our field.* (Interviewee, 4)

Quality vs. quantity discussion is another dimension of the criticisms directed at the general policy-making framework. Focusing on the numbers, though it looks straightforward due to the difficulty of measuring the quality, is problematic.

> *The problems stem from the measurement and evaluation of our academic life. If you focus on the output, since these can be measured, a lot of time and money is spent and wasted there. The quality of the work that comes out at the end. The evaluation does not go there much because it is difficult to measure the quality of the work and what is searched… The others are interested in the results but here we look at how the budgets are spent, but then the result is not looked at. I think it consumes our energy a little.* (Interviewee, 14)
>
> *Is the focus publication? You understood something, you announced it to the world, if there are still questions about it and there are missing parts, if you can't answer those questions, it is not proper. It is just scoring. Ok, it is a score but what its contribution is*. (Interviewee, 11)
>
> *If we see it as such long-term investments, our efforts for research will be fruitful when we think much more broadly. I think it will be fruitful, in fact, more publications will come out at the end, but these funded things are always expect direct links and no one has such patience. I don't have to publish a publication at the end of the workshop, it's not good when I do a workshop with that pressure, but maybe if you don't do it with that pressure, maybe if I do three workshops and maybe a huge book will come out at the end.* (Interviewee, 4)

Thus, academics are motivated to focus their time and energy to works that are more guaranteed and publishable in a short time instead of more qualified works and long-term contributions that is more than sum of individual results of shorter periods. These would limit aspiration and opportunities to integrate. Indeed, this is a contradiction with the ultimate target of being in the top 100 considering research networks' advantages referred in the literature review section.

Inclusion of the respective stakeholders and experts in the policy processes is another flaw. Interviewee 12 said that *"In other words, when developing policies on these issues, how much expertise and people's opinions are included?"* to underline the opinion about not being appropriately included in the policy works in their field.

Time constraints or frames set by the regulations or plans look like a cliché and are not aligned with the nature and realities of the targeted field or area or the study. Interviewee 5 highlighted this issue by saying "*You are doing a two-year project. He says to do it in a year and a half. How can I do?".* Similarly, Interviewee 12 noted that "*we are expected to include more partners and to cover a larger field and to develop a model and it gives a period of 1 year. These expectations are not very realistic*."

Moreover, the implementation process of regulations is not clearly shared with the stakeholders and does not provide information on how long it will take or how the progress could be checked. Interviewee 6 mentioned that she doesn't know how the process will continue and how they will decide and reflected in the system.

The regulations are continuously changing which is baffling and time-consuming and should be streamlined.

> *It takes a lot of time, even in BAPs in METU since I started, BAP's regulations, rules of things, etc. have changed a few times and each time a new learning process takes a lot of time. This is a general problem in Turkey*. (Interviewee, 12)
>
> *Even the transfer of the samples that we are getting from abroad. There is no standard for it either. One year it is stacked in the customs while we have no problem in getting the material exactly in the same conditions in another year*. (Interviewee, 6)

In conclusion, there should be improvements in the general regulatory framework, which should be science-based, considering specific needs or realities of the targeted sector, more inclusive and clearer and more informative on the process and supportive mechanisms should be established.

4.5.1.2 Policy Design in Finance

This section will focus on the regulations about obtaining and usage of financial resources and the way they are implemented. Very specific conditions defined in the fund applications, inflexibilities in the use of funds, bureaucratic difficulties attached to application and usage of funds, lack of clear communication channels in funding

processes, the sufficiency of the mechanisms at METU (PDO) structurally, and problems faced in the panels for designation of funds are main issues raised.

First, funds' calls usually include very specific conditions which hinder the access of several disciplines or several activities to funds and also shape the way you think or contact them (Interviewee 4, 5, 10).

> *I saw the cases that you had to complete the project application with a lot of details as if you had done it, but then they criticize you because you have already done it.* (Interviewee, 5)
>
> *In other words, it turns into something that determines many things about what you read and who you communicate with, how much and with whom you cooperate… I think it leads us to monopolization of research processes and production processes in universities*. (Interviewee, 10)

On the other hand, the ones arguing the expectations, or the conditions are clear, and they have no issues with the way they are structured (Interviewees 8 and 11) and they are generally working on basic sciences.

Second, obtaining funds is a critical and complicated task. Each fund has its own rules and special application procedures which require study in detail in advance. In addition, filling the application forms appropriately and clearly reflecting the project aims in a way aligned with the expectations of the funder for warranting the acceptance of the project is challenging. A special language is sometimes needed to be mastered. Furthermore, collecting the requested documents and providing them in the correct format is also time-consuming. More than half of the interviewees indicated that these are big investments for academics, particularly for such uncertain and vague processes. In this regard, the academics argued that though its efforts are appreciated, the Office of Sponsored Projects of METU has limited capacity to meet the demands of every department. In addition, the Office only provides information or consultancy on the application procedure of several funds and does not help in the writing of the project proposal.

> *Much of your time goes into these things, dealing with administrative affairs, and communicating with TÜBİTAK and other institutions in*

> *Turkey… There is a lot of drudgeries and unproductive work even when we write an ordinary TÜBİTAK 1001 project.* (Interviewee, 6)

> *There is the Office of Sponsored Projects at the university, a unit that serves the whole university, where three people work. They are doing a very good job, that is a separate issue, but those three people are not enough for the entire university anyway. Also, they do not write the project, they only provide support during the project writing process, they have some information that we do not have, and we consult with them. For example, in my previous institution, there was a unit working only on the applications of my department… It was an incredible thing, something facilitating, indeed.* (Interviewee, 3)

Similarly, spending the funds is not easy either. Very tight and complicated rules on the use of funds and respective documentation are problematic and sometimes it is like a full-time job for academics. Using the funds exactly as is foreseen, changing the allocation of funds, and completing the documentation and financial statements all have their complexities. The problems are more or less the same for applications for project funds, execution of the projects, and attending a conference or a seminar. Almost all the interviewees touched upon these issues. They all obstruct the scientific studies of academics, delay the working schedules and their integration with research networks due to procedural difficulties and cause inefficient use of financial resources as well. Though some of them stated these are probably due to misuse of funds in the past, the solution should not be more burdensome than necessary. Interviewee 7 said that "*I also know that it is not spent that easily because you have to deal with standard procedures and bureaucracy."* While others emphasized the following:

> *I think financially, our biggest problem is not money, money is somehow found, but it is very difficult to spend the money, it is very difficult, and you tolerate it for a while, but then you get upset, you can choose not to do as there was so much burden… If you have your own team like administrative staff, these things can work better. If you look at the teams that make very good projects at the university, all of them in METU are centers and they have their own administrative teams.* (Interviewee, 1)

> *When you will get a glassware for your laboratory, believe me, you have been dealing with these correspondences and documents for days. I mean, these really tire you out after a while.* (Interviewee, 6)

In the same vein, budgets or capacities of the funding programs are not conformed to specific fields and are defined in broader limits which makes the application more burdensome than necessary and deters the applications.

> *For example, when I look at my work… I do not need that much money, but the mechanisms could be improved. We have either small or very large amounts of funds. With BAPs, you cannot do anything for 8-10 thousand liras. On the other hand, we have large funds, but it is very difficult to apply to them and it is very difficult to spend money. More flexible mechanisms are needed. We do not have these flexible mechanisms.* (Interviewee, 1)

Thus, having limited funding options by the amount and complicated application procedures in return would limit the financial opportunities of the academics and their research and integration endeavors. Even distributing the existing amount of funds in different tranches and associated easier application and spending rules could make an improvement.

Lack of communication in the fund applications and delays in the communication process in the use of funds is a common experience of academics. Interviewee 9 complained about not getting an answer for months even for a simple contract.

> *You apply for a project, you come to the last stage, then you get no news. All of a sudden, it's like it never happened. There is such a thing as Y in the Z industry, we made offers there, we made presentations and completed all of them, such an enormous amount of time was spent, then nothing happened again. I'm so bored with this*. (Interviewee, 5)

Repeated experience of these uncertainties, time losses in these procedures, and not having any feedback on the results and reasons for rejection will decrease the motivation of the academics to be part of such applications and the possibility of learning by experience through feedback. In the end, academics will have less time, motivation, and resource for research and integration.

Additionally, specific mandatory procedures on spending funds may also lead to other financial inefficiencies due to intermediaries, logistics, or customs procedures attached.

> *When I go online, I see the price of it is 100 dollars, but I cannot buy it directly. TÜBİTAK project does not allow this, we must buy it with an intermediary company. The intermediary company will take it and pass it through customs, sometimes they bring a product of 100 dollars for 500 dollars, and we must buy it… I don't know how many days they will stay in customs, mostly some things come broken …Somehow there is such a system that intermediary firms make good money by wasting our own money and forcing our researchers…This is accepted as a very normal routine, this should not be the case.* (Interviewee, 8)

> *I wrote a TÜBİTAK project in 2013 and it was rejected. A year later, the project I wrote was published by the Americans in one of the most important journals in the world. If I had approval for that project, I would not have been able to compete with those guys because I am saying this as while I was working in America, one day you order your equipment, in two days you have them and you are doing your experiment. You order it here, it will arrive two months later, so you somehow start two months behind, that's the thing.* (Interviewee, 13)

Because of these inefficiencies, academics will have fewer resources for research. They will have less or low-quality infrastructure or have to spend their money on these inefficiencies instead of using them in other beneficial actions such as supporting a post-doc expenditure or attending a conference or membership to a leading association, etc. Waste of time will cause falling behind your rivals, which would limit the preferability by the potential partners in the research networks.

Last but not the least, the selection panel is an important step to be passed in. Though the issues related to the working of these panels, or the competency of the panelist could be commended as ethical, or human resources related, they are also directly related to access to finance as there are regulatory preferences that do not seem duly structured or functioning, it would be meaningful to address them here. Nearly half of the interviewees took part in such kinds of panels as a panelist and shared their experiences. Two of them have no negative observations yet they conveyed that they also heard rumors about the discrimination in such panels and decisions which were out of logic. Interviewees pointed out that panelists are not always competent enough to understand the project under evaluation. Some of them have no experience in project application or execution and some of them display hostile attitudes or show favoritism incomprehensibly.

> *At a panel, one of them was very good, they rejected it because they didn't understand it… Well, these project forms are already ridiculous. It is a form taken from somewhere, translated into Turkish, and it is unclear what to expect in its full content. You complete the application one way or another but you are not sure whether they read it or not and whether they understand or they don't...Unfortunately, the evaluators are very bad. (Interviewee, 5)*
>
> *In a 6-person panel, the woman from X University received a Ph.D.., she sits there, she even does not understand your project. After that, it gets rejected. If you're lucky, they get a good jury, they understand, at least when they criticize, you can either say it's a really good critique and use it to improve your next project, but most of them are given with a sense of jealousy. (Interviewee, 11)*
>
> *Due to the instruction given to TÜBİTAK, it wants to spread the panelists across Turkey as much as possible, but then a problem arises. Spreading it to people in Turkey and it does not want to invite the same person to the panel two or three times, at most once or twice. This is understandable, when you summon the same people, a group dominates …On the other hand, there are people who have never written a project, people who have no project experience are selected as panelists, these people do not understand the project, they do not understand its content, because they do not have the capacity to understand it. (Interviewee, 13)*

Thus, these problems faced in the selection panels directly influence academics' access to resources for their studies and the production of a concrete output by the research network established for this study. I believe repeated unsuccessful attempts at providing funding for intended studies will also have a downgrading effect on research network connections.

In conclusion, based on the feedback of interviewees, providing more administrative support, the establishment of open and swift communication channels, reducing the red tape, usage of an integrated information system and improvement of the panelist selection in a way guaranteeing the participation of qualified and objective ones could improve the system.

4.5.1.3 Policy Design Based on Rankings

The recent policy documents including strategic plans or development plans include targets or aims based on universal rankings of the higher education institutions. They

lead the way in the regulatory changes related to higher education institutions, especially through communique of the individual universities. Yet, the process has several flaws in the design of respective policies including defining these ultimate targets. These flaws challenge the research network integration by creating uncertainty, discrediting the actions of the authorities and inefficient use of resources.

First, how the target of having at least two universities in the top 100 universities of the world is set is criticized as it is uncertain how the two is chosen as the threshold, whether there is a logic behind it and whether it is reachable. Moreover, as I quoted above some academics argued that this kind of statement could not be called a target. Additionally, whether having two universities in the top 100 would guarantee an improvement in the overall quality of the higher education system is uncertain or how the continuity of these "successes" would be maintained is unknown. Moreover, the target is vague as to who is responsible to fulfill this target, what are the individual universities' responsibilities aligned with this target, and which are the sub-steps to reach this target are unexplained. Several quotes were provided in the previous sections. These policies are also criticized as the respective target is not reachable with the current capacity of the universities including financial resources, human resources, and the operational procedures of the system and within the given time frame. The current version of this target could be reached by tricking the numbers or steering some of the resources to fulfill this target, though these activities would not warrant a continued presence within the top 100.

This lack of knowledge on the target setting affects authorities' ability to steer the academics actively participate in these efforts. Lack of knowledge creates concerns about the judgments and intentions of the authorities and the system. Even if the academics were able to overcome the adverse effects of these communication problems and act to support these aims, they would face the sub-regulations and requirements argued to be structured to reach those aims but most probably in contradiction with them. The scene becomes more complicated when there is no additional resource to support the actions for these aims. Thus, it is natural that academics focus on their individual agendas within the limits of given resources and

sub-regulations. Namely, they become more introverted and less integrated with the networks.

All interviewees emphasized that they also wish to be a part of a better and high-qualified education system, yet this could not be achieved through such questionable targets and "questionable" bases. The current efforts would not capture the realities of scientific studies and disciplines and mostly motivates efforts on quick and introverted studies, which are generally with low impact and limited contribution to science.

On a separate note, the interviews were conducted while METU's administration was working on the revision of its promotion criteria intending to improve METU's universal higher education ranking. Thus, the interviews provide important feedback and critique on the draft versions of this regulatory work.

On the appropriateness of the ranking oriented efforts:

> *I am fully against the idea of ranking, but on the other hand, everything started to go with these rankings. That's why, you can set such a goal, but when you set a goal, you have to move in a way harmonized with it. (Interviewee, 1)*

Interviewee 1 underlines the lack of necessary structure, particularly the deficiencies in the budget system, to support the actions to reach those aims and maintain the continuity of these rankings.

Interviewee 11 notes that current target does not warrant the improvement of the entire system.

> *We need a reform in the entire system, not to waste money on one or two of them… but you need to do something for all of them… I will raise a tree and it will become 100 meters. Others are at 2 meters in the METU forest, that tree does not make that place green, that's what I think*. (Interviewee, 11)

Improving the entire system in sustainable way will attract more financial resource to the country for research and increases the preferability of the country by qualified

human capital. In other words, this will improve the research network integration. Thus, current targets not supporting whole system will make research network integration harder.

In addition, the aims are not aligned with the current conditions of the universities or current planning. Below given quote refers to unsustainability of the current planning.

> *There is nothing wrong in wishing for your country's universities to be in the top 200. What I don't find right is that this is not something that will happen because it is wanted or tried, so it is a long-term thing, not something that will happen in a very short time ... Due to my background, I can say that you will fall as fast as you go, so if you enter a place in three years, you will leave in three years. In other words, doing this step by step in the long term and then staying there for many years is real success. If you find a way and you're in the top 100 all of a sudden, the next year, you will be in the top 500, and you will fall as fast as you started.* (Interviewee, 14)

Another one underlines the need for improvement in the students per academic ratio for better ranking performance.

> *We need to set high goals for ourselves and make improvements in that direction, but I don't think these processes will end in a short time. Especially the number of students per teacher, which is the most difficult part of good universities in Turkey, for example, this is not a problem that can be solved immediately ... I find it right to raise the target, and I cannot predict whether such a target can be reached in 2023.* (Interviewee, 2)

Above given quote is also important to present that academics' workload on the training side. This means they have less time for their research endeavors and integration with others.

Another one directly refers to integration with research networks through internationalization and openly states current system does not support integration.

> *Let me tell you very briefly, setting a target is a good thing, but activities to be carried to reach that has not been defined yet...If it becomes clear what to do to enter the top 100 first, it will be very clear that this cannot be done with the current system, with the continuation of this. In other words, you cannot increase the number of publications or increase*

> *citations without increasing international integration and building and strengthening know-how in Turkey... Internationalization should be maintained. Why can't international people come to Turkey, why can't people in Turkey be active enough in international cooperation? I think it is necessary to evaluate this and these problems should be addressed.* (Interviewee, 13)

On the other hand, there are missed opportunities due to rankings-oriented efforts. Academics note that focusing on the efforts supporting only rankings and in such short time periods might cause neglecting of other important pillars of science such as education and communication of the science. This may produce other deficiencies in the long run.

> *You know there are too many factors, when you try to rank, I start to see that everything seems to be progressing through certain criteria. I think it might cause problems after a while, so if we all focus on a single but very narrow purpose, do we miss other things. Because there is a science side, there is education, there is a science communication side, does it only go through certain parameters in the long run, will it create new problems? I think this should also be considered.* (Interviewee, 2)

The deficiencies in the education side could lower human capacity which is a challenge for integration. Lack of appropriate communication or lower levels of communication with the scientific community would also hamper the research network integration.

In this vein, several academics argue that the draft promotion criteria are not aligned with the nature of their field and could block their current and promising studies and their integration with several networks. Interviewee 12 stated: *"Whether adhering to these rankings has a positive or negative effect on scientific productivity is something to be discussed."* The following is additional comment on integration:

> *I think it reduces productivity. There are very good journals in my field. I even have a research meeting tonight with our professors at X University in the USA. When they say to send it to one of these journals -they are good journals in the field- you say that they don't meet my criteria ...It is embarrassing to go to your study partners in the field with such an argument... Based on the current averages of the department, the*

> *publication potential of our department is very high, but you limit it. The possibility of contributing to our field is very high, but if you limit it to this journal.* (Interviewee, 3)

Thus, with these criteria, academics are under the dilemma of satisfying the promotion criteria for keeping their positions or being more integrated with networks and being part of the studies, which could produce more output but not help their promotion.

As I explained in the literature review, rankings are based on several criteria including the number of articles in a group of journals and the number of citations. Yet, some academics criticized the objectivity of these journals and prejudice against the studies with affiliations in the universities or institutions in several regions.

> *We don't get a lot of citations, but we do not know whether it will improve if we do better studies because there is the hegemony of the west in many fields. So, even if someone from here does something to do, how is it perceived? is it published? There may also be things like not being published just because it is from Turkey. The same person sends it with foreign affiliation, there may be another result…if there is a foreign partner in that study, it is published and if not, it is rejected*. (Interviewee, 12)

This quote is crucial to show the facilitating role of integration with research networks. Having an additional affiliation makes the publication easier.

Finally, the 11th Development Plan was approved in the Parliament in 2019 July [42] though its time frame is 2019-2023. The Plan itself has been time wise late. In addition, the universities' Strategic Plans which include the strategic aims, respective benchmarks, and budget planning are expected to be aligned with this Development Plan. Yet, when we look into METU's last and recent strategic plan, it has been approved by the University Senate and University Administration common meeting on 19th September 2017 covers the 2018-2022 period. Thus, these plans are not synchronized. At this point, I think the Strategic Plan of METU is more successful to

[42] https://www.aa.com.tr/tr/ekonomi/11-kalkinma-plani-tbmmye-sunuldu/1526250

meet the expectations of the interviewees, since there is an emphasis on the internationalization of the academics and supporting interdisciplinarity and cooperation. Full compliance of the new promotion criteria with these aims is questionable. Therefore, better time planning, and synchronicity of the steps are necessary.

In conclusion, the academics believe the current target stated in the 11th Development Plan is rather vague. It neither warrants the improvement in scientific productivity or the development of the entire higher education system nor is aligned with the current system and doable with given regulations and resources. They also provide feedback on how the system could be developed, which I will refer to in the following sections.

4.5.1.4 Policy Design in Human Resources Policies

This section will contribute to the role of human resources policies that could affect research network integration to improve scientific productivity by looking at the experiences of the academics, particularly on how they accessed networks. The general labor policies such as tenure and increasing the capacity (both increasing the number of personnel and giving more room for scientific studies) would be covered in the Human resources pillar (4.7.4). In this regard, I will focus on the channels of the network and other factors or tools that have reflections on the network integration tendency through human resources such as human resources policies of the METU including the promotion and employment criteria and their implementation.

First, I asked all interviewees when they applied for the position, the progress of their application and when their tenure started to confirm their position as "early career academics". Yet, though my intention was different, the answers given to this question provided an important observation on the efficiency of employment policies' implementation. In this regard, I could say that the entire employment procedure takes too long and generally takes longer than one year, which is perceived as a routine practice by academics though some of them had to find alternative resources to manage their life. For some of them, the process took about three years. Most of them continued their previous jobs or worked part-time at METU or other universities.

Unfortunately, all of them have similar experiences. Whether there will be a positive response though the positive feedback were provided by the commission or when the process will end are important sources of uncertainty. Completing the allocation of tenure and completing the respective security clearance procedures are out of the control of the university which requires improvement in the general higher education system and general human resource policy framework and better communication of the process with the candidates. I will not include a specific quote on this issue for the sake of anonymity.

Second, as I elaborated on in section 4.1 proximity both physical and cultural proximity which could be associated with educational background comes forward as an important factor in network integration. As a quick reminder, educational background (through peers, advisors in the Ph.D. education, or the opportunities that the university had provided such as intellectual environment, resources, or requirements to complete the program or the financial resources) could affect the network integration. Moreover, previous students, post-docs, and recruitment preferences of the departments are also important.

In addition, the orientation program of METU for academics named as Academical Improvement Program (AGEP) has also functioned as a channel for new collaborations though it is within METU, and they also have the potential to link the initial networks of these new staff. This program is referred to as a nice way to be informed about the process and regulatory environment of the university. As such, some of the interviewees argued that this program has been the only tool they know of METU to bring them together with different people for interdisciplinary works and new cooperation and highlighted the potential of having a similar Program for mid-career academics as well. In a similar vein, the fund calls in Turkey do not lead academics to cooperate with different institutions or regions. Although this could be seen as related to finance, this is a matter of making the fund more inclusive in other words more cooperative among the participants. Moreover, in some of the fields the academics are open to communication, but they prefer not to cooperate as they have seen no value-added on the information built up front for themselves. Thus, having

fund calls requiring the cooperation of different regions and institutions is more critical if the administration wants to empower knowledge circulation. This is particularly critical given the limited resources of the institutions both financially and human capital front and cooperation should be supported.

Draft promotion criteria, which could be commended as one of the pillars of METU's strategy to increase its ranking[43], is another important headline discussed in the interviews. Interviewees criticized the draft criteria by arguing it motivated the more guaranteed and narrow works (not supporting the interdisciplinary works, limiting the cooperated regions or the issues to be studied) as I mentioned in the previous section. Concerns are more or less similar for every discipline, yet the outlook is more difficult for the ones working in social sciences and interdisciplinary studies.

> *This makes you more introverted and weakens the connection. For example, I received a request from Spain, to write to us. I will say I can't write because I need to write articles in Turkish and in Turkish-indexed journals. However, it would be nice if we made a connection, there are many academics in Spain, working in our field, and it would be relevant for me.* (Interviewee, 4)
>
> *I do the math. A study with Brazilians means 3 points. If I write with my colleague X, send it to the journal by chance in q1 and it is accepted, it is 32 points. The difference is 10 times. This is much more, we became X and Y. What happened? We isolated ourselves from the world.* (Interviewee, 5)
>
> *In our field, studies are interdisciplinary in general with large teams, it is a natural thing, but these works evaluated with regard to promotion criteria, this contributes very little to me, even if I work alone, I get a better result. In other words, it is officially punished*. (Interviewee, 6)
>
> *If the study is good, does it matter whether it is in a TR-indexed journal or not? I don't know…. Someone needs a Turkish article, someone needs to do a project, and someone else needs to publish in a TR indexed journal. However, it should not be the case… If these things do not exist, everyone will work to ensure that the output is good. It will focus on the quality of*

[43] https://www.aa.com.tr/tr/egitim/rektor-prof-dr-kok-odtunun-dunya-universiteler-ligindeki-yeni-hedeflerini-acikladi/2461196#:~:text=ODT%C3%9C'n%C3%BCn%202021'de%20ulusal,aras%C4%B1nda%20ilk%20s%C4%B1rada%20yer%20almay%C4%B1

> *the final output, not whether it is a Turkish or TR indexed journal or a Web of Science indexed journal.* (Interviewee, 14)

Thus, the participants inform us about attributes of the draft promotion criteria that lead to less integration and make cooperation more difficult. Giving a lower coefficient to the more integrated works and requiring specific types of publication by creating an additional restriction on the academics, they direct academics to more introverted studies instead of integration.

Another critical issue is the time dimension. As could be seen via the interview guide, interviewees were asked to share the entire working process of their specific studies. Research and release of the research output via publications is a long process taking years and with several backs and forths in the process. As such, though the entire duration would change from discipline to discipline, I believe the criteria should also take into account the time needed in this respect and the differences between the disciplines.

4.5.2 Financial Resources

Financial resources are used to acquire appropriate equipment, services, and supplies that are needed to carry out the research activities. Thus, it is a critical ingredient in scientific studies. Thus, beyond its simple role in individual scientific studies, the financial resource also affects the research network integration. First, as I elaborated in section 4.4, the technology or infrastructure of the partners' organization and the complementarity of the skills are among the factors that motivate academicians to be a part of research networks, which are also related to finance. In addition, financial resources are also necessary to bring the potential partners together and maintain the continuity of the collaboration. *"Sustained financial resources, infrastructure and human resources are among the enabling factors for effective and sustained networks."* (WHO, 2016). Thus, this section touches upon the effects of financial resources on the research network integration mostly through network facilitating activities or opportunities such as conferences, workshops, and others and sufficiency

of financial resources (access to finance), general economic conditions, or lack of budget issues raised in the interviews.

On the access to finance and sufficiency of the financial resources, the most important issue is access to finance is subject to strict and definite project applications. Scientific Research Projects (BAPs), the EU Funds, and TÜBİTAK Funds are the main financial resources used by the interviewees. In addition, government institutions/ministries or publicly owned companies are other sources of finance. The private companies' role in providing finance is very limited, observed in only one official case in the interviews. While one of the interviewees indicated the difference in the interest of the private sector in supporting academic interest between Ankara and Istanbul and another one emphasized that the private sector sees academia as a potential customer for their product. Three interviewees said their departments could provide resources for some of their research activities though they were limited.

On the project side, both the application procedures and the use of these funds require the completion of complicated and time-consuming procedures, which I mentioned in 4.5.1.2 and I will not repeat here. Moreover, the respective institutions or units' internal working procedures and decisions also have reflections on access to finance. These funds have different conditionalities or operating procedures and some of them provide more flexibility of use while the others do not allow the transfer of the funds to other research-related activities (or among sub-expenditure items) and expect to use the funds as exactly described in the manuals or communique. In this respect, EU funds are the most preferable due to their flexibility and the amount they provide but they are more competitive. Along the same lines, BAPs are among the most limited ones and a group of interviewees indicated recent reductions in the BAPs. Furthermore, due to complicated procedures attached to these funds, from time to time, some academics also referred to their tendency to use their resources, though it may not be sustainable in the long run (Interviewee, 1, 3, 4, 9, 10, 13 and the control interview). Non-governmental organizations including the foundations supported by foreign embassies residing in Turkey are another resource providing funds and one of the interviewees particularly highlighted the effectiveness of these funds particularly

in the networking events as the others do not support such events or their field adequately and they are easier to apply. On a separate note, other academics' experience with these and other possible funds have functioned as a facilitator to extending financial resources. Two interviewees (5 and 12) specifically noted this issue and said that colleagues or advisors who already attained enough funds or these funds by completing the project application and approval procedures were quite informative and useful.

> *If you want to do large-scale works in Turkey, you need to apply big EU projects so that you can continue your fieldwork appropriately… There was a travel expense item in my BAP project, and I couldn't use it due to the Pandemic. As the dollar increased, the price of consumables increased a lot. I wanted to use that travel part to be transferred to these materials. I spent days for this to happen and, it is not clear whether it will be approved or not. Probably, it would not be approved, and I will try again*. (Interviewee, 6)
>
> *In this regard, European Union projects, especially my project, were more comfortable, I had research money, I could use it as I deem appropriate, but that's not the case at TÜBİTAK, you cannot mix travel and other money, you have to use them within much stricter rules*. (Interviewee, 7)
>
> *I wrote a BAP 1.5 years ago by including a conference in Europe, not in America. I wrote the project for 5000 liras… It fell to 3500 and you can guess that it is impossible to go somewhere with 3500 liras…That's why the conference part is a problem. If you are willing to use your own budget, it may not be a problem, but of course it is not something that can continue for a long time.* (Interviewee, 10)

The above-given quotes help us compare the EU funds and BAPs in amount and flexibility. They are important for accessing sufficient resources for studies and integration with research networks.

Regarding the role of private sector in financing research and related activities including collaboration:

> *Cooperation with companies is not in a very good condition in our country, but in other countries this is in a very positive and very good condition. For example, if you look at Stanford's campus, it can be very difficult to distinguish faculties' buildings and the companies, they are all next to each other and in interaction…The companies that we interact with*

> *are much more limited. Rather companies try to communicate and try to sell their goods.* (Interviewee, 8)

In addition, three interviewees (Interviewee 1, 6, 7) specifically emphasized that it is necessary to create new and various funds both in amount and target group which directly affect the efforts to write articles and join conferences. Uncertainty of the continuance of several funding projects in the future including the EU Horizon for several disciplines particularly social sciences has been a source of pressure, which I quoted before.

On the sufficiency of the resources, all the interviewees agree that there is a need to increase financial resources. Only one of the interviewees (13) said her field was relatively in a good position to attract international funding. Yet, she also emphasized the lack of resources is an important problem for their collaborative research efforts, though the most critical one is the integration of know-how circulation. I think this factor is also related to financial opportunities, particularly through the potential to attract post-docs, which she believes Turkey could switch its focus to closer and neighboring regions. Financial resources affect the quality of the infrastructure and material worked with, which causes a fallback in their competitive power, particularly for lab-based research or fields.

On the financial side, another issue that affects the scope and capacity of research endeavors is having enough human capacity, namely having full-time research staff. Though I will touch upon the amount of personnel in the following section, the financial opportunities are also relevant, and two interviewees noted that they were not able to attract qualified research staff with the given level of salaries of research assistants or scholarships and if they had done, they had not able to get their full attention or time as the research assistants were doing extra jobs. On the other hand, two of them strongly disagree, that the level was too high, and the level had to be regulated to correct this outlook and to motivate them to be productive. Interviewee 5 also mentioned the insufficiency of the salaries in the interview.

> *Working for 3,000 lira is not a big deal in an environment where even new graduates can earn very high salaries. My current full-time students are assistants. I couldn't fill the positions in the projects that also had those resources. After all, there is a serious difference*. (Interviewee, 7)

On research network integration through conferences and other academic physical interactions aside, all of the interviewees highlighted the role of conferences to establish new networks and strengthen the existing ones, particularly in their early careers. Moreover, they also indicated they also believe the conferences are also an important tool for improving their research assistants' capacity and experience and supporting their research endeavors (Interviewees 6, 7, 9, 14). Additionally, some of them, particularly the ones working on social sciences emphasized that the more focused conferences that target closer interaction and are preferably organized in isolation are better than the larger ones. However, one interviewee said that the draft promotion criteria do not value these small but more efficient conferences. Workshops are also valuable opportunities for network integration. Yet, strict article expectation at the end of each workshop is argued to limit the potential of scientific productivity. Beyond the distinct benefits of conferences on information sharing and communication, they also increase the possibility of serendipitous introductions, in which almost half of the interviewees shared their experiences of studies developed through such encounters.

> *I'll have to decrease the number of conference papers- because I won't be able to go to all three of them or I'll have to pay out of my pocket. There isn't such a fund around…From this point of view, the reshaping of the budget by TÜBİTAK in this regard, the discussion of limits, the changing of the limits of METU are important*. (Interviewee, 7)

> *The third issue is to be a member of these associations… but even the membership fee of these associations is not something that one can join without thinking, they are not at the level, especially for an academic who is a civil servant. Therefore, it is not impossible to maintain these relations or to be involved in this network, but it requires a lot of effort and resources*. (Interviewee, 4)

> *While I was at the University of X, the students had to attend 2-3 conferences a year and the university was paying for it. It was a great blessing; I see it now. For example, I do not have such a budget.* (Interviewee, 2)

Post-doctoral researchers are another channel to establish to research network as well as provide human resources and extend knowledge base. Yet, having a post-doc is an exceptional experience, which none of the interviewees had. Interviewee 10 emphasized that "*...when I talk to my friends working at Koç, they always work with a post-doc. So, it's something that I'm so far from, I don't witness it much here."*

Some of them said the financial conditions proposed were not preferable while others argued it could be desirable with EU Projects, especially considering life expenses in Turkey were relatively cheaper yet again Turkey is not preferred. As an example, Interviewee 7 said that "*When we look at it financially, nowadays with an EU project fund, living in Turkey looks very advantageous financially. but I don't know whether it is possible."* Similarly, Interviewee 13 said that "*Currently, I cannot get someone from Europe as a post-doc in Turkey or as a doctoral student. In other words, if I come to the man and say I will pay you 500 euros, it will do nothing."*.

I think a comparison of the past and the present also deserves our close attention which is covered in general economic conditions of the country including the effects of the exchange rate. Almost half of the interviewees argued that financial resources decreased with respect to their first years at METU significantly. The change in the exchange rate is emphasized as an important dimension of the financial concerns. Considering the interviews were completed as of the first half of 2021, I believe the fluctuations in the exchange rate since September 2021 have exacerbated the situation more. One of the interviewees specifically noted that during the Pandemic due to excess demand for disposable lab equipment, which is also used for hygiene purposes, they had experienced an additional price fluctuation in their lab materials.

> *I remember that I had no difficulties in terms of resources for the first three years…When we were interested in doing something in cooperation and thought about where to apply, a few channels were emerging but now most of those channels are inaccessible. (Interviewee, 10)*

Finally, we also discussed financial resources in relation to rankings of the university and respective targets. As such, the comparison with different universities which are already in the targeted range was made for the level of funding provided, the way

funding is used, and their ability to attract new funds. First, the financial opportunity of METU is far away from these universities. Also, these universities provide support to academics in advance and give room and flexibility to academics to mature their studies. Moreover, in addition to inflexibilities or bureaucratic difficulties attached to these funds that I touched upon before, other rules of the funds are not in line with the necessities of the time. To be specific, open access journals and online conferences are among the trendy academic interaction platforms or science communication tools. Though they seem less costly for the organizers or so-called "publishers" than the traditional ones, taking part in such occasions is not free in general and the publication or attendance fee is beyond what Turkish academics can cover. The current rules do not support these kinds of expenses as well. All interviewees, even the ones against the idea of ranking, believe that METU can do more, yet this requires more resources and better resource management (all kinds of resources). Two-thirds of the interviewees specifically refer to a mismatch between the current budget and the needed one for the targeted rankings.

> *There is a new agenda, very good Open Access journals, they also charge a fee to make them open-access…There is no law to ensure the payments of these fees. This is our current situation, frankly, you will do it out of your own pocket, and then I think that not everyone would prefer it because it may not be very realistic anyway.* (Interviewee, 12)

In conclusion, the level of financial resources and the procedures through which these resources are allocated and used has been another important pillar of concern in access to research networks. As such, all the interviews are striving to find other ways to overcome the lack of resources. For some it is adjusting its focus, for others switching their networking activities to more online ones, while for others adapting the use of the departments' resources and finding ways to support the most optimal ones including the withdrawal of some of the applications or leveraging his/her connections to attract sponsors. They indicate the need for different adaptations at the policy level to support the academics in their studies including their integration with different networks.

4.5.3 Infrastructure

TÜBİTAK on its website has defined research infrastructures as *"the facilities, resources, and services that are used by the research communities to conduct research and foster innovation in their fields."*[44] In addition, TÜBİTAK exampled them as major scientific equipment (or sets of instruments); knowledge-based resources such as collections, archives, or scientific data; e-infrastructures, such as data and computing systems and communication networks; and any other infrastructure of a unique nature essential to achieve excellence in research and innovation. No doubt that these facilities or software would increase the scientific productivity of the researchers and ease the integration with other researchers with higher capacities. Indeed, section 4.4 also refers to the role of infrastructure in network integration, particularly through the complementarity of the scientific facilities or capacities, which I will not repeat here.

> *We have a very serious shortage of materials to compete with abroad. So let's think like this; naturally, there will be a difference between making a device when you have a very old and useless model of the device, versus making it in a device that can provide much more detailed and more information*. (Interviewee, 8)

Building on this, although it has not been indicated I believe it is also logical to expect that better infrastructure will attract better or more partners either with technical capacity or human capital.

The environment where academic activities are carried out has the potential to stimulate cooperation and collaboration of the academics. Yet, in some cases, it is not only a facilitator but also an obstacle. This does not only include the lack of complicated lab facilities but also the existence of simple study areas. Though it could

[44] https://ufukavrupa.org.tr/en/thematic-areas/research-infrastructures#:~:text=By%20offering%20high%20quality%20research,efficient%20research%20and%20innovation%20environment.

sound unrelated to research network integration, I think it is important as it could be seen as an indicator of tendency to cooperate and support cooperation.

> *I always say that METU does not want people to work together…Now, for example, if we want eight academics to come together…there is no such idea as a field of collective work. So, I think space and having space designed to work together is important*. (Interviewee, 4)

4.5.4 Human Resources

All scientific studies start with a question that arises in the mind of one and is shaped by the perception, knowledge, and skills of that specific person or the ones who interact with, before the physical conditions or opportunities she had. As such, human capital is the key critical component of all scientific efforts. In addition, human capital does not only shape the environment but also has the in-built capacity to modify itself. Thus, it cannot be isolated from the 'life-long' and 'society-wide' processes in which it is formed and it formed. It is also related to individual and systemic competencies such as creativity, flexibility, leadership, problem-solving, relationship building and entrepreneurship, and learning how to learn (Menzies, 2003). Therefore, research networks are important to empower the productivity of the scientist by both extending her environment and providing more opportunities than we touched on above. On the other hand, more human capital is also necessary to interact with these networks as well.

In this respect, I will elaborate on the factors that make the research network integration easier concerning human resources. All factors allowing more time for academics for their studies would be included in this section. These include the ones both having more partners in their studies and the ones for reducing their burden on other issues.

First, the interviewees' main partners in their studies are their students including research assistants (RAs). Especially, the ones working on basic sciences employing laboratory applications and the engineering ones specifically highlighted that they are mainly working in cooperation with their students and otherwise it would be really

hard to carry out all the work at the same time. It is also a tool of education as their field progresses in a master-apprenticeship relationship. As such, most interviewees prefer students whom they already interact with during class, they are pretty selective and motivate them to work intensively. Two of the interviewees (10, 12) said that they had opportunities to work in cooperation with students from other departments, and one noted the establishment of the Graduate Level Academic Support Office (ÖGEM) as a benchmark (12).

> *I work with my students, we have a difference in perspective with social sciences…We mostly go in a master-apprentice relationship, I explain the idea to the children, after all, I do the planning and give it to the students... Then we teach them how to make the experiment, then we interpret together, we do things together, that's how they learn. Therefore, I do it with my students; in our field, a job that is not done together with the students would be difficult. I can't handle a single thing.* (Interviewee, 11)

On the position of research assistants, one interviewee (1) emphasized the difference between the abroad and Turkey on the use of research assistants. In foreign universities, RAs are seen as a factor to attract more funds by having more human capital to study within the projects. They are also employed in the new project application process, which is a mutually beneficial process for both academics and RAs. Another two also noted this as a deficiency with reference to her experience as a RA and their observations (5, 12). A large share of the interviewees (1,6,7,8,10,14) said that the lack of enough research assistants is a serious problem although one of them also noted that METU was relatively in a good condition. Another one highlighted the low level of RAs per academics and emphasized that the outlook is different abroad (1). On the other hand, one interviewee strongly disagreed with the idea of a lack of enough RAs and believes the problem is an inefficient use of RAs and that with half of the existing ones more production could be done (9). During interviews, we have also discussed the roles and responsibilities of the RAs and the perception of society on RAs. The interviewees see RAs as colleagues and staff with scholarships. One of them particularly noted that this is not a permanent position to be ended by the end of a Ph.D. program and the RAs should not see this position as a warranty for tenure. On the other hand, some of them observed that they are sometimes

perceived as only for doing paperwork. Yet, I see merit in reminding the difficulty of having full-time students and capturing their full attention as I touched upon in the 4.5.2 due to low level of financial support or the payments and others disagreeing with these claims. On a separate note, one of the interviewees, highlighted the benefits of the Academics Trainee Program to overcome several financial obstacles the research assistants faced by allowing more room to extend their networks via several conferences and other similar supports.

> *If you look at universities in the X, they use the doctoral student in different ways, giving a doctorate degree, which is a good thing for the university. If training is required, it is used in training. In terms of funding, it sometimes forces students to apply to funds together. This is good for the student, being able to observe the processes and good for the institution because you bring money to the institution while you are still a student…If there are 3-4 professors, there should be 7-8 research assistants. We do not have such a system, and since there is no such system, we try to do everything ourselves, both administratively and academically.* (Interviewee, 1)

> *Assistants are our colleagues; it may sound so cliché but assistants are not people who have to be busy with paperwork. There is such a thing in the Turkish academy, there is a task that he attaches to assistants. You know, such a thing is not only for assistants but also for assistant professors.* (Interviewee, 10)

Another dimension emphasized in the interviews has been the relation between scientific productivity related to ranking-based targets and human resources. In this respect, the first deficiency is the high number of students per academic or the time attached to education facilities. Five interviewees (2, 7, 12, 13, 14), some of whom also have administrative responsibilities, have noted the number of students per academic for METU is behind its peers/competitors in the targeted range and it has to be developed yet it is not easy to progress. For instance, Interviewee 2 has noted that *"Our general shortcoming is the number of teachers, and in other issues, I think we are quite competitive and in a good situation."* Another aspect of discussion has been the brain drain observed both in academics and student-wise.

> *As many universities have been opened, there is a serious shortage of academics. ÖYP was actually a very good idea for overcoming these*

> *deficiencies, but it was changed later, now there are different approaches 102-1000, for example, there is something for priority areas now, but it is also considered by some to be very inadequate because there is a limited budget at work and it's like you can live on that budget and complete your doctorate*. (Interviewee, 12)
>
> *I would like to discuss the fact that METU is a research university in this sense. In other words, since the day we became a research university, our thing has been increasing, and our undergraduate student load has been increasing while our number of faculty is decreasing. So now, without looking at these, it is not logical to say let's get into the top 100, let's get into the top 200*. (Interviewee, 14)
>
> *At the same time, of course, it is necessary to reach and attract people who will work in this direction to our country. In other words, our very successful students are trying to go abroad for their master's doctorate, and they are going. It's okay, it's for their career ...on the other hand, the fact that it seems to be the only way makes academic studies here a bit difficult.* (Interviewee, 7)

Moreover, though emphasized by only one interviewee, the existence of critical mass and continuity of this mass are critical to reaching respective targets. In the case of having a system dependent on certain individuals, it is unsustainable. Unsustainability and lack of adequate human capital affect the research network integration as no one will be willing to use their limited time and resources for cooperating with unsustainable and uncertain structures and groups.

> *Of course, we cannot ensure the continuity of human resources here. There has to be a "center of mass" mass so that it is permanent, if it is based on one person, the system collapses when that person leaves, but if there are ten people, it would stand and continue with newcomers, it collapses when eight gone, so there must be such a continuous human resource*. (Interviewee, 5)

Time spent on teaching and other additional roles and responsibilities including the administrative ones which are necessary for the timely and effective operation of the facilities at the university and the ones assigned by public authority is important to provide more room to academics for their scientific studies. Half of the interviewees (2, 4, 5, 9, 10, 13, 14) touched upon the effects of these responsibilities on their studies through their experiences and sometimes in comparison to their experience abroad or

at another university. Interviewee 4 stated: *"After that, the burden of administrative duties and the difficulty of finding funds demotivated me a lot."* One of them argues that teaching is not a source of concern for his/her studies, and this could be only challenging in educational sciences.

> *The leader of the team which I worked with indeed spent more than 50 percent of her time traveling. She didn't have a teaching responsibility; she was a researcher, and she was always traveling for networking. You can open and see her CV. If the publication is a benchmark she has it, if it's a project, she also has them and there's everything. It doesn't happen without traveling to that degree, so we will never do that thing as in Turkey.* (Interviewee, 5)

In conclusion, human resource is a crucial factor affecting network integration. Having more human capacity provides more opportunity for new studies and attracts new partners and funds. Due to the important role of financial opportunities for both new studies and access to new networks, having more administrative support-administrative staff is necessary as well. As such, increasing the number of positions at both the academic level and administrative personnel level, having more qualified and specialized ones, and organizing the roles and responsibilities of academics and research assistants in a way to give them more time for their academic studies would be beneficial to support integration. In this regard, programs like the previous ÖYP program could be revitalized.

4.5.5 Ethical Issues

Ethics is moral principles that control or influence people's actions behavior (de Lazari-Radek & Singer, 2014). In line with this definition, ethics has gone beyond being an area of interest in philosophy. Its relation and integration with science have also been studied thoroughly. The interaction between science and ethics is perceived as the relation of science with values and there are many schools of thought elaborating on these issues such as expansionists, restrictionists, continuity theorists, and discontinuity theorists (Pigliucci, 2003; Sharma, 2015; Graham, 1979). Though they all provide good and interesting discussions on ethics and science interaction, I will mainly focus on the role of ethics in science concerning research integration. I believe

Resnik (2014) provides a good basis for the issues which could have reflections on the research network integration. Resnik (2014) defines ethics as *"norms for conduct that distinguish between acceptable and unacceptable behavior"* and *"a method, procedure, or perspective for deciding how to act and for analyzing complex problems and issues"*. He highlights that ethical norms promote the aims of the research, such as knowledge, truth, and avoidance of error, and refers to prohibitions against fabricating, falsifying, or misrepresenting research data. In addition, he noted that in the research carried out with the cooperation and coordination among many different people in different disciplines and institutions, ethics provide the values that are essential to collaborative work, such as trust, accountability, mutual respect, and fairness. He summarized the common ethical principles of several codes or standards as honesty, objectivity, integrity, carefulness, openness, transparency, accountability, competence and legality, social responsibility, and others. Interviews provide inputs on some of them.

The first and the most intensely referred issue in the interviews is the ethical criticism of the project selection panels. Four interviewees conveyed their experiences or observations (Interviewees 8, 9, 10, 11). At this point, I would like to emphasize that these interviewees are eye-catching with their project and article performances and find a way to overcome these challenges, but it is not an easy task for everyone and is demotivating, and the system should protect the academics from such kinds of violations. To be specific, the abuse of the panelists, the role of popular subjects, and misinformation in the project applications are the issues that grab my attention. Interviewees said that there were efforts to manipulate their ideas within the panels or stop their progress and their additional project applications. Furthermore, they met the cases in the Panels in which applicants include other academics or partner institutions though they would not actively take part in the project with different arguments. The interviewees also shared their observations on the role of injection of some popular issues into the project document/content though they are not aimed at within the study to increase the possibility of selection. One can argue that these issues are not related to cooperation or integration yet as I said before projects are important for accessing the funds. In other words, it is one of the initial requirements for integration efforts in

most of the disciplines or studies on which the integration was built for the sake of. In addition, I think these issues also affect trust negatively.

> *An academic that I met in the panel was a consultant for that company, I was not very positive about the project. After we evaluated the project, she said 'Never mind and look at the money you get*. (Interviewee, 11)
>
> *I take part in many things as a referee. Some of the things I saw really surprised me…An academic took a project through another one since his academic title was not enough. That academic the one his name used has no contribution to the project…After that, he wants to leave the project. They apply to TÜBİTAK. It does not accept it rightly. These things that shouldn't happen, that is nonsense, to say the least*. (Interviewee, 8)

Another issue that I met in the interviews is the invisible barriers faced by academics and the system also tends to reproduce such kinds of barriers via education. These barriers are critical as they influence access to resources which are necessary for research and integration. These barriers have also effect on the motivation of academics. In this regard, the interviewees emphasized that they could not understand the reasons for project rejection or certain administrative actions including promotion and recruitment decisions as well. I believe having a solid feedback mechanism would be beneficial both to prevent the existence of such barriers and perceptions and other negative effects attached to these barriers including demotivation that I observed.

> *We do not know what it is and what is going on since they are all very closed systems, of course. On the other hand, you hear, there are rumors here and there, of course, there are also cauldrons*. (Interviewee, 5)
>
> *In my opinion, some political situations in universities and institutions, approaches that discourage researchers little, mobbing-like attitudes from co-workers or the management, I think these are preventing these network events. If certain people are at certain points and you would either get along well with those people or stay silent. Sometimes you even cannot understand that it is the case…I think almost everyone experiences these things at some level…I think such things are also learned*. (Interviewee, 12)

In addition, one academic who rejected to participate in the interview said that "professors who were not dismissed after signing "The Academics for Peace" petition/declaration were blacklisted by TÜBİTAK and were not able to enter several

systems such as ARBIS[45]. This obstacle was lifted about a year ago. Therefore, for 5 years, they could not apply to anything that goes through Tübitak including cooperation programs. She also added that the prioritized areas determined by the TÜBİTAK have already functioned as a restraining factor in their studies whether it's an individual or cooperative one. I believe rule of law is a must and precondition for preventing the abuses and arbitrary acts of all the parties.

Inbreeding is the following issue discussed from an ethical perspective though they all have different and conflicting approaches to the issue. One interviewee shares her observation that has existed at METU due to problems faced during the recruitment process. Two of them have intensively criticized inbreeding and emphasized its negative influences on academic productivity while one of them believes that this does not exist at METU while it is, unfortunately, the case at METU too.

> *In other universities, if you obey your professor well, you will eventually become one, you help her for nine years, you will do whatever she wants, you will not write an article or something. They open an associate professorship, or they write your name in 4-5 studies they do so that this poor person becomes an associate professor, and then you become an associate professor, you don't add properly anything academic.* (Interviewee, 9)

Opaque recruitment process or lack of merit-based recruitment process is the next theme that I attach importance to. The three interviewees (9, 11, 13) have referred to the cases where they observed or experienced a lack of merit-based decisions and their negative effects in Turkey or at METU. They have addressed that competence and qualification-based evaluation systems are an important requirement and if the more qualified and proper ones are chosen and the system is designed accordingly then all the intended targets would be succeeded easily and without no additional effort.

Differences in the approaches of academics to the conferences are another dimension of the ethical criticisms of the interviewees. Two interviewees though they find the

[45] Researcher Information System of TÜBİTAK. https://arbis.tubitak.gov.tr/

conferences very crucial in network establishment and determining new research questions argued that conferences are mostly seen as a trip opportunity or additional financial gain resources for some colleagues.

Interviewees also provided input on the personal behavioral issues having ethical reflections such as arrogance, jealousy, or negligent attitudes of the academics which could be dangerous at the existence of invisible barriers. They argued that they felt jealousy of their peers due to their potential or when the most successful students preferred to study with them or when their students are successful. The negligent approach or arrogance is also the attitude that hinders cooperation and collaboration.

In conclusion, the network integration is also affected by the ethical concerns of the academics or ethical deficiencies of the system via the misuse of resources and lack of trust. The project selection panels, merit-based decision-making process, and procedures deserve further attention to support academic productivity including cooperation and collaboration.

4.5.6 Democratic Issues

The relationship between science and democracy is as complex as it is in the ethics case, and it also has a very long history and a lot of thinkers contributed to the discussions of this relation. Though the direction and motivation of the relation are argumentative, they generally agreed that it is an important linkage to think of. For example, Edel (1944) focused on three separate but related meanings of Science and Democracy. He defined science as *"i) method plus established knowledge, ii) the continuous search for extended truth, and iii) the vanguard of the systematic pursuit of human goals"* (p. 702) while defining democracy as *"i) goals and ideals, ii) principles of government and iii) character-traits and attitudes"* (p. 703) and investigated their relation via the interaction of science and democracy by using different combinations of these meanings. He argued that there could be instrumentality, the similarity of attitudes, and direct positive association with respect to the definition used. All in all, he said that *"there is a clear interrelation between them. The former provides a basis and a method for the latter; the latter is best*

achieved by reliance on the former" (p. 710). Additionally, Brown (2013) providing a concise and compact summary of the literature on this relationship indicated that the use of science as a basis or source of recommendation or solution to problems, and the role of the public in science particularly in sociotechnical discussions are among the dimensions of this relation. Although I believe that democracy is the most appropriate method of governance, in the study I do not particularly prefer democracy or autocracy or other ways of governance over others and I only observe the way of governance and its interaction with scientific productivity, particularly for its reflections on research network integration. This segment is also related to section 4.5.1 on Regulation but in this section, I would rather focus on the method of governance and preferences (source and use of power, power dynamics) on this front while the former section concentrates on the procedural functioning. In this regard, I believe the set of values and principles of democratic governance adopted or aimed by the UN such as greater participation, equality, security, and human development is a good starting point. In this regard, I would visit the elements of democracy associated with them, freedom of association, freedom of expression and opinion, access to power and its exercise under the rule of law, a pluralistic system of parties and organizations, the separation of powers, the independence of the judiciary, transparency and accountability in public administration, free, independent, and pluralistic media[46].

Effective and clear communication is an important aspect of democracy and a tool of democratic governance. Interviewees indicate the lack of communication or clear communication as a problem in both policy-making procedures and their daily academic activities including project applications or executions and others (Interviewee 1, 3, 5, 6). Unfortunately, this has been observed both at METU and in the entire country. I touched upon communication problems in previous sections with respect to other main pillars of the integration as well, thus I do not repeat all the issues highlighted above.

[46] https://www.un.org/en/global-issues/democracy

I believe these kinds of issues would affect formation of better and appropriate targets, the ownership of the targets by the respective community, so the success of the target. Considering facilitating role of research network integration in scientific productivity and consensus of the interviewees, through effective and clear communication the system can be more successful. Along the same line, the following case also reflects an ownership aspect of the action and its results even at the administrative level.

> *An e-mail comes from the rectorate congratulating the Professor due to acceptance of the Project, which I believe he doesn't know about, that is not a big deal on our side. No one says, "Come on, let's start". Everyone is trying to push something against each other. We are trying to integrate with the nation, the world, we cannot integrate within ourselves yet.* (Interviewee, 5)

Communication is also related to the inclusivity of the respective parties and participation of the academics in policy-making and target setting is also crucial.

> *For example, we say that today's management approaches and effective management approaches should be participatory. Then, we need to proceed with an approach that includes everyone involved in all issues, but for example, it is very difficult, sometimes decisions can be made without even the knowledge of the university. In that context, the issues of autonomy and freedom are important.* (Interviewee, 12)
>
> *I cannot see the quality of the university in the criteria made by those rankings. To attract good students, to produce quality lectures, to produce a stable and regular publication in which more researchers work together. A university where the capacity to publish is more evenly distributed, rather than an environment where two researchers produce a lot of publications and the others do nothing, seems to grow better and better, for example. So, I want stability and justice and equality in the distribution of this research infrastructure.* (Interviewee, 4)

Rule of law is another cornerstone of democracy and supports the equality of all citizens. The law secures a non-arbitrary form of government, and more generally prevents the arbitrary use of power. In this respect, I think interviews provide input on the level of trust in the system including rule of law and the negative effects of its violation (Interviews, 4, 5, 8, 9, 10, 11, 12). I can say that there is a lack of trust in the

system and it is easy to be unethical and escape without penalty for some privileged groups that we have no idea how are shaped.

> *There is such a situation in Turkey, so you know, if you do your job to a minimum, when you don't make an effort, no one will decrease or increase your salary, and no one will reward you when you make an extra effort. On the contrary, you may be criticized in many places, and you are harmed*. (Interviewee, 8)
>
> *On the one hand, it automatically turns into something that produces many inequality mechanisms when you do not use that network or stay out of it. It means that there is a process going on that you do not know of the resources, so you may be left out systematically*. (Interviewee, 10)
>
> *People know how to be "politically correct" a little better abroad. I don't think it's needed here. It's thought that they don't need it. Even if I do this, there would be no consequence of it. I think there is such an inconvenience in Turkey*. (Interviewee, 12)

Freedom is another dimension of democracy that I find reference to it in the interviews as a factor affecting the academics' working environment, productivity, and ability to integrate with other academics. They referred to this issue as a factor to attract new human capital to the country or to maintain the existing ones, either post-doc or as colleagues.

> *Those years were very good, people were coming to Turkey as a post-doc…What happened next? Post-doc ran away…They didn't renew the contract of the foreign colleague because she signed The Academics for Peace petition. (Interviewee, 5)*
>
> *In other words, since the field I work in is very sensitive to politics, I have started to feel such extra pressure in the last few years. Let's not, let's not write in that magazine, let's not get into that cluster, they said from politics, they said that. We, as Turkish academics, have to shrink a lot to keep ourselves politically safe, we try to be small and invisible, instead of making the opposite noise…For scientific efforts it is not good.* (Interviewee, 4)
>
> *For the post-doc, TÜBİTAK had a co-fund call in agreement with the EU, it was paying an incredible amount, around 1500 Euros. The number of European applications is close to 0 there, the incident is not just financial, it's about the image of Turkey, that part is like that.* (Interviewee, 13)
>
> *When such criteria are involved, you don't have such freedom. It comes with something like at least you are not free until you become an associate*

> *professor. In other words, from that point of view, I find it contrary to the spirit of academic freedom.* (Interviewee, 7)

Though they could be commended as irrelevant to research network integration and scientific productivity they have a role in scientific productivity and integration. First, participation in policy-making would reflect the needs of scientists, improve resource allocation and efficient use of resources, maintain the ownership of the government policies and reduce the frictions within the system. In addition, trust in the system, equality, and rule of law will prevent violations in the system and build trust within the system and among the partners. This would facilitate the research network integration via more resources, due to the possibility to create frictions or alignment with the policy aim and the needs of scientific studies. All in all, we can say that academics feel that they are not included appropriately in the related policy efforts, or even if they were included what they shared would not be reflected in the policies. In addition, they were not given enough flexibility and freedom to choose what and how to study specific issues and whom to cooperate with and they carry career concerns due to political sensitivities and political sensitivities of the government also affect both financial and human resources.

CHAPTER 5

DISCUSSION AND RECOMMENDATIONS

Price (1963) in his influential book on the trend of scientific publication highlighted that scientific outputs would continue to increase by following an S-shape curve, its exponential growth reaching a saturation point, and collaboration was increasing constantly. Though the shape of this increasing trend has been challenged by others such as Wagner and Joong Kim (2014), the data and studies indicate that scientific publications around the world have continued to increase in the last twenty years as expected. Similarly, due to its advantages and changes in science the collaboration has expanded (National Science Board, 2019; Incites, WoS). With its continuously internationalizing nature and being a tool for development and protecting national interests, governments need to track the improvement of science and establish more efficient policies to promote the scientific development of their countries. Thus, evaluation of scientific productivity has gained critical importance. There is a historical tendency to measure scientific productivity in terms of the number of publications. However, there have been efforts to improve the assessment of scientific productivity by including the quality aspect through citations and other dimensions such as education, human capital, and development of solid outputs other than publications. All have their complexities particularly due to the difficulty of measuring on a comparable basis. Universities or higher education systems due to their critical role in scientific production have been the focus of attention for measuring scientific productivity. Although their use is criticized widely, university rankings that capture both quantities, quality, and education dimensions of the scientific production have been commonly used to measure and compare the universities by governments,

funders, academics, and students. Due to their increasing role in scientific studies and their advantages indicated in the literature such as increasing the number of outputs, citations and increasing technical opportunities, and intellectual capacity, and extending the network of the participants, research networks are also instrumental to improve university rankings that are used as an indicator of scientific productivity.

Turkey is also interested in improving its scientific capacity and in line with the world outlook universities have a focal position on that front. Turkey has been implementing several policies to improve its scientific productivity whose general direction and content are conveyed through its development plans. As such, review of policies related to scientific productivity in the last three development plans, the most recent and solid scientific productivity target is declared in the 11th Development Plan. That is having at least two universities with top 100 universities according to the international university rankings. Turkey's development plans included several actions that could support research network integration. However, though its instrumentality on the improvement of science and global rankings, the emphasis on research network integration has been very limited and only covered or addressed its transfer of human capital perspective, and no specific diagnosis or methodology is indicated in the Plans.

With that, I believe there is merit in looking into how Turkish scholars should be integrated into international research networks considering the scientific productivity targets defined in terms of global university ranking in the last development plan. In this regard, as being defined as a research university and with its outstanding performance in the assessment of research universities in 2019, I have chosen METU as the research venue. Looking into the scientific performance of the METU and a group of early career academics who are under severe pressure of publication, I studied the integration and productivity relation in the period 2010-2020 and the role of several factors such as region and discipline. Moreover, via the interviews carried out with 15 early career academics, I collected information on the role of research network integration, factors motivating integration, and facilitators or challenges on the road to research network integration.

The results of the quantitative and qualitative analysis carried out in the study are summarized below:

- METU's scientific publication has increased in the period of 2010-2020. However, the trend of output has fluctuated within the period. In general, the trend was increasing until 2016 and the general direction was downward since then.
- Research network integration of METU represented by average links per academic has increased between 2010 and 2020. Starting from 86.12 in 2010, it became 136.44 in 2020. With ups and downs during the period, the highest level of average links per academic was observed in 2016 reaching 481.87. Although the movement is not stable, there is an increasing trend until 2016. The average link per academics' value in 2020 is critical as it is the lowest of the last five years and below the 2015 level.
- Assessment of the data of the early career academics group also indicates an increase in the output some of which is due to the expansion of the group. The increase after 2017 was mainly due to an increase in production of the entire group. Data for the early career academics group indicates a higher strengthening of the integration during the entire process as well. However, the integration has been stronger in this case. For this group, the highest values were recorded in 2014, instead of 2016, yet again 2016 is the second best in terms of value. The most sudden reduction was in 2017, and since 2018 a decreasing trend is observed.
- The movements of integration levels of METU and early career groups are more or less aligned between 2013 and 2018 while moving in opposite directions from 2010 to 2013. The value of the early career group is more volatile, which could be due to the higher integration of the members of this group, a reduction/increase in the study of a group member would be more powerful.
- In addition, the publication per academic value has been higher than METU for this group in general.

- All in all, the scientific productivity increased within the respective period 2010-2020, and so the level of integration through their trend was not always aligned with each other.
- All interviewees highlighted that collaboration's positive role in their studies, namely the positive association between collaboration and productivity.
- Interviews indicate the positive role of proximity in the integration. Proximity includes physical, social, and cultural aspects. As such, educational background through the role of advisors, facilitating role of networks developed abroad and common languages established during education has eased the integration and affected the direction and strength of integration.
- Indeed, the quantitative analysis of the publications of METU and early career academics in terms of countries that collaborated verifies the role of proximity. The volume of publications of METU produced in cooperation with European countries is the largest. Similarly, early career academics tend to integrate with the ones in their associated regional group.
- The average link per academic for EU, Non-EU, Mixed (excluding Dr. Demirköz), and others are 2785.32; 778.56; 294.61, and 65.30 respectively for the period of 2010-2020. The EU has the highest integration with the largest average links per academic.
- Interviewees underlined that the technology or infrastructure of the partners' organization or skills or competency of the partners or the academics himself/herself is the main reason for their collaborative efforts. Collaborations help to overcome the lack of equipment and infrastructure for their studies and save time and increase efficiency. They are generally formed in a complementary way.
- The qualitative assessment of interviews presented that factors that make the research network integration easier could be classified under 6 main groups. Table 25 provides the main headlines of these facilitating factors.

Table 25: Main Findings on the Factors Facilitating Research Network Integration

- **Regulation**
  - General Policy Framework
  - Policy Design in Finance
  - Policy Design Based on Rankings
  - Policy Desing in Human Resource Policies
- **Financial Resources**
- **Infrastructure**
- **Human Resources**
- **Ethical Issues**
- **Democratic Issues**

Source: Author's own work

5.1 Recommendations to Improve Research Network Integration

The study has three important conclusions. The first one is the positive association between scientific productivity and research network integration. Second, the integration is closely related to proximity and educational background is an important determinant of integration tendency and route. Finally, financial resources and actions of governments can facilitate or challenge the integration with research networks. Building on these, it is possible to make dozens of recommendations in each of the pillars touched upon in section 4.5. Some of these recommendations would need to address very complicated issues such as ethics and democracy. These actions would require the full transformation of the system and a whole mindset and understanding of the higher education system. Having said that, higher political level resolution and unified actions of all the respective institutions including the ones not directly working on the higher education system would be essential for these possible actions. Thus, this comprehensive set of actions and consensus and participation of a very large group of actors would complicate and have the potential to stall the efforts. As such, to focus on quick fixes, I would prefer to attract attention to actions by individual institutions

or the ones requiring the cooperation of a rather limited number of stakeholders and the emergent ones. In addition, I would focus on the ones that are most directly related to research networks. Table 26 presents the main pillars of the recommendations and responsible authorities. These actions are also expressed in a more detailed way. The recommendations would increase the research network integration either by providing more resources for research and making the academics preferable in the networks and giving them more opportunities to access these networks. In the end, the scientific productivity of the university and the ranking score of the university will increase.

Table 26: Actions for Improving Research Network Integration

Pillar	**Actions**
General Policy Framework	Reduction of bureaucracy and establishment of a one-stop shop for applications
Financial Resources	Extension of the budgets for attending conferences and launching new support for membership fees of the several associations by YÖK and TÜBİTAK
	Increasing the amount of financial resources by the Government
	Develop the capacity of units (such as the Office of Sponsored Projects) assisting in the attraction of new resources and establish similar units under the roof of faculties by METU
	Revise the methodology of assigning panelists for project selection panels by TÜBİTAK
Human Resources	Implementation of a motivation-oriented approach for academics rather than a punishment approach by YÖK, Interuniversity Board of Turkey (ÜAK) and METU
	Having more flexible and swift recruitment mechanisms
	Use of new positions to improve integration by METU
	Facilitation of academic interaction events or programs by METU
Logistics	Resolving the logistical difficulties and delays in the customs

Source: Author's own work

The details of the recommended actions by Table 26 are provided below:

1. **Implementation of a motivation-oriented approach for academics rather than a punishment approach by YÖK, ÜAK and METU**

YÖK, the Interuniversity Board of Turkey (ÜAK), and METU should review their existing policies and applications to adopt a motivation-oriented approach in three months. While doing it, they should also fine-tune their regulations in a way that motivates the research network integration/international collaboration. As such, an immediate review of promotion criteria in a way to support research network integration and maintain harmony with the needs of each discipline and their publication dynamics by METU is critical. In this context, a more inclusive consultation period should be carried out through digital tools and the participation of all academics. The regulations punishing cooperation should be amended in line with the dynamics of disciplines.

2. **Extension of the budgets for attending conferences and launching new supports for membership fees of the several associations to support research network integration**

Based on the role of proximity including physical, social, and cultural factors, improving the opportunities for closer communication is necessary. Thus, an extension of the budgets for attending conferences to support research network integration by YÖK and TÜBİTAK is a must, especially with recent changes in the exchange rate and inflation. These updated amounts should consider all the mandatory expenses for conference participation including the attendance fee, and all the travel and accommodation expenses should be covered. Considering the fluctuations in the world economy and Turkey, a periodical review should be made.

On providing support for membership fees of the several associations, for determining the amount to be provided for the association fee, the authorities should collect the views of academics through a digital questionnaire. I believe having a limit to the number of associations would be more productive than introducing a monetary limit.

3. **Reduction of bureaucracy and establishment of a one-stop shop for applications**

Accepting fund applications through a unified system and directing them to the relevant authority through digitally interacting systems would save academics from preparing and getting approval for the same documents over and over. For launching a one-stop, first, a memorandum of understanding among the relevant institutions should be prepared. Then, integration among the digital infrastructures of the systems should be maintained. I believe mandating the TÜBİTAK with its experience in the management of several funds by volume and variety of applicants pool, its interaction with the EU and foreign partners, and its capacity the information and communication technologies are appropriate. A memorandum of understanding should be completed in three months with a timetable to complete the relevant actions. As such, improving the interaction among the systems of Government, TÜBİTAK, and Universities for information exchange is a dimension of the work to be completed. These efforts should include the use of funds including conference budgets and eliminate the recollection of already existing information and documents.

4. **Increasing the amount and flexibility of financial resources by the Government**

Ministry of Treasury and Finance, TÜBİTAK, and YÖK should consult on the possible ways of attracting new funds from other resources. In this regard, motivating and developing more flexible mechanisms for universities to attract more resources from the industry by reviewing the laws and communique on the budgetary procedures by Government, YÖK and METU would be helpful. These authorities should review the relevant laws and regulations and determine the actions to be taken in three months and these changes should be completed at most in a year, including the Parliamentary approvals. In addition, revising the amounts of funds periodically according to the changes in the general economic conditions and needs of the studies or project should be a part of these regular consultations. This revision exercise should benefit both open information and the feedback of the project coordinators. Interphase in the project tracking mechanisms can address whether there is a need for upward budget revision,

why it is needed, and the amount of needed revision. Introducing such interphase can be completed quickly at most three months yet this information should also be accessible to the Ministry of Treasury and Finance so that it can track potential needs. Though the ultimate decision should be the call of the relevant fund authority.

In addition, streamlining the mechanisms/tools used by the government agencies including YÖK, TÜBİTAK, and other Ministries for fund applications would make the efforts easier and also help the academics in their applications and save them from mastering the special requirements of these various funds. In this context, the IT teams of these institutions should work in cooperation to determine the steps for streamlining these systems in six months and the possible largest extent for alignment and the calendar for alignment activities. These teams also should cooperate with their staff using these applications and tracking systems.

Authorities should also aim to improve the flexibility in the use of these funds and allow easier transfer of funds between expense items within a project. This can be completed swiftly. Transfer among the sub-items of the projects should be allowed as long as proof of expenditure is provided and should not be subject to approval. All public funders particularly TÜBİTAK and METU should review their limitations in the transfer of funds among different expense items as quickly as possible and remove the restrictions, simultaneously with the ones mentioned above.

5. **Develop the capacity of units (such as the Office of Sponsored Projects) assisting in the attraction of new resources by METU**

For increasing the access of academics to existing and new funds, METU should develop the capacity of units (such as the Office of Sponsored Projects) assisting in the attraction of new resources and establishing similar units under the roof of faculties. In this context, a face-to-face consultation should be carried out with departments to detect which ones need the establishment of a new unit in the Faculty or for which of them have an assigned official would be enough. Then, whether there is a potential staff to be mobilized to work in these new units should be determined. The outcome would inform us of additional staff needed. Encharging these units to

find new ones and assist the project application process including the writing of the project by METU and periodic update of the academics on the possible resources should be taken into account while making these plans. The current staff of SPO should educate the new staff on the processes and project writing and guide them when it is needed. The new staff should be fluent in English and familiar with the terminology of the fields. The new restructuring should be completed within one year. SPO and new staff responsible for project assistance should meet twice a year regularly and exchange information. The performance of these new units or staff should be reviewed regularly.

6. **Revising the methodology of assigning panelists for project selection panels by TÜBİTAK**

Another critical issue in access to funds is the allocation of the existing funds to the best projects. Thus, revising the methodology of assigning panelists for project selection panels by TÜBİTAK is a must. First, TÜBİTAK should introduce a new regulation on the selection of Panelists. These criteria should provide the participation of the experts that are qualified on the specific issue of the Project and the ones who are experienced in the execution of the projects, and who took part in the projects previously. To improve the qualifications of the pool of academics to be applied a limit should be there as well such as academics can participate in at most two panels in three-year times or a version of this one decided in consultation with stakeholders. TÜBİTAK should also establish a registry of potential academics to track these.

7. **Having more flexible and swift recruitment mechanisms**

YÖK, METU, and the Ministry of Labor and Social Security should review the employment tools and positions (including tenure-track positions, post-docs, research assistantships, and part-time ones) that are used in the recruitment of academics including the recruitment of foreigners. YÖK in advance of the respective consultation should also consult with universities. These authorities should complete these works in three months and list the necessary changes and the timetable for the amendments in the sub-regulations. Related acceleration of the recruitment process by YÖK and

METU (from allocation of tenure-track positions to use of these positions) is also crucial. In this regard, YÖK and METU should sign a protocol with the respective authorities for prompt security clearance. These studies should be completed in one year.

In addition, YÖK should assess opening new positions (including tenure-track positions, post-docs, research assistantships, administrative staff, and part-time ones) in line with the needs of universities. In the meantime, salaries and necessary funds should be reviewed to guarantee the preferability of these positions by considering the current market conditions. Furthermore, the authorities should convey a plan to improve the "students per academic" and "RAs per academic" values of the universities in line with their needs in a comprehensive way. Universities should be motivated to be open in expressing their needs instead of framing more acceptable position requests for a realistic assessment of the needs.

8. Recruiting the more integrated Academics by METU

METU should motivate the recruitment of more integrated academics in line with the specific needs of departments and launch post-doc programs, particularly in a way to expand integration. METU should also improve the "RA/academic" value for each department and graduate school by METU in an equal way. Thus, METU should prepare a plan for itself for how it will increase these values over time.

9. Facilitation of academic interaction events or programs by METU

Facilitating further academic interaction events or programs could strengthen trust among academics and increase the access of academics to each other's networks and stimulate new studies. In this regard, METU should consult with departments on their needs and the specific types of events that could serve best their needs. Based on the feedback of the departments, the budget office of METU could make a provisional expenditure list, and based on the feedback and hierarchy of the needs a sequencing can be done among activities or each department could be provided a specific budget for their needs. They can also be allowed to have sponsors from the private sector

based on the regulatory changes in the budget practices of the university recommended above. In this regard, the organization of seminars similar to AGEP for senior-level academics can also be considered.

10. Resolving the logistical difficulties and delays in the customs

Resolving the logistical difficulties and delays in the customs, YÖK, TÜBİTAK should sign a protocol with the Ministry of Trade for introducing exemptions to university research equipment from the (extra) customs control or having a fast-track for clearance. Reviewing the exemption list periodically in line with the needs of time is critical to swiftly respond to the needs of universities. Giving authority to the university administration for fast-track approval in the Protocol could be another alternative to fasten the process. The Protocol should address the chosen alternative and inform about the review of the list and how the transfer would be with the maximum time limits to complete the clearance by the customs. Furthermore, these authorities should be open to communication through the execution of the Protocol. Periodical update by the authorities on the functioning of the fast-track or exemption applications is also critical.

5.2 Conclusion to Thesis

This study aims to fulfill a gap in the research network integration of Turkey with respect to its scientific productivity targets defined in terms of universal university rankings in the 11th Development Plan. The studies looking into the integration of Turkey's research networks are limited in number and existing ones focus on specific disciplines. The study is also unique in its method by employing a mixed method research design combining both quantitative and qualitative tools. The study focusing on the experience of the specific works of the interviewees provides information on the entire process from initiation of the project or publication idea, funding, and execution to publication. The Study indicates that research network integration helps academics overcome the deficiencies met in the research process such as lack of

physical and intellectual capacity and help to stimulate more and richer studies and better quality. On the other hand, integration with research networks requires the existence of some qualifications or features such as human capacity, infrastructure, unique set of capabilities, and proximity. With all these associated benefits, integration with the research network is a rather neglected aspect of the Turkish higher education system and has not been addressed appropriately and has only been captured through the transfer of human capital without a framework. Designing a better research network integration framework has the potential to improve the scientific productivity and carry Turkey to upper positions in the universal rankings.

With that in mind, the thesis showed that in the case of METU scientific productivity and integration with research networks are generally positively associated with each other during some exceptional periods. In addition, some disciplines by nature tend to be more integrated and some of which could make use of better integration yet there is a need for changes in the structure of the higher education system and university procedures and these changes would support the productivity of all disciplines. Moreover, the study reviewed the direction of the research network integration of the METU by focusing on early career academics based on their educational and professional background. Academics of EU origin have the highest level of integration, and a review of countries collaborated for each regional group indicates that each group has a higher integration within the same group. Educational background largely affects the integration level and whom to integrate with. Considering the European countries' position in the rankings of the countries, physical proximity can be addressed as the second factor. Integration with Eu countries could be also related to the structure of the EU funds requiring better integration with neighboring countries/regions.

The thesis shows that Government, YÖK, TÜBİTAK, and METU could stimulate further scientific productivity and lead to better rankings in the universal lists by some quick actions related to the general policy framework, financial resources, human resources, and logistical issues. These actions aim to increase resources and better the allocation and use of resources.

5.3 Limitations of the Study and Suggestions for Future Research

The main limitation of the study is the use of open resources for determining early career academics starting their tenure between the period of 2010 and 2017. The cut-off date for checking the departments' webpages for their academic staff is August 2020 and I had no information on the staff working and leaving within this period. In addition, open resources on the bio of the academics may not always provide the right information and there could be information gaps on the tenure start date and other potential connections including post-docs, etc. Thus, I may not be able to capture the full CVs of the early career academics and geographical classification may have some errors. However, the interviews clearly addressed these deficiencies of using open resources and I checked the tenure dates for the interviewees. The study also suffers from the deficiencies of the scientific databases to capture all sets of publications emphasized in Section 2. Last but not the least, the study was carried out during the Pandemic. Thus, both interviews and the quantitative data on studies in 2020 reflect the effects of the Pandemic and associated changes in the funding and execution of the respective studies and some of which are asymmetric by nature.

Though I believe the number and departmental, regional and positional variety of the interviewees are good enough to capture several deficiencies and mimic the METU's current composition, to capture the whole stance, future studies could cover a larger group of academics at all levels in METU. Furthermore, seeing the research network integration from the eyes of the respective counterparts abroad and having more information on the factors leading to their cooperation with Turkish academics, the challenges they faced, and the unsuccessful networking attempts would be valuable. Moreover, how other universities abroad particularly the ones placed in the top positions of the universal rankings structure their network integration is another aspect that can be studied for the scientific productivity of Turkey. The study can also be extended by the inclusion of other Turkish universities' research network integration with a public-private comparison. In addition, the use of econometric methods to study the integration and productivity relations with an application of time-series or panel data can be considered.

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APPENDICES

A. APPROVAL OF THE METU HUMAN SUBJECTS ETHICS COMMITTEE

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
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29 Eylül 2020

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi: İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Dr.Öğretim Üyesi Arsev Umur AYDINOĞLU

Danışmanlığını yaptığınız Ayşe IŞILAK'ın *"Türkiye'nin Araştırma Ağlarına Entegrasyonu ve Araştırma Ağlarının Bilimsel Çalışmalara Etkisi: ODTÜ İncelemesi"* başlıklı araştırmanız İnsan Araştırmaları Etik Kurulu tarafından uygun görülmüş ve **266-ODTU-2020** protokol numarası ile onaylanmıştır.

Saygılarımızla bilgilerinize sunarız.

Prof. Dr. Mine MISIRLISOY
İAEK Başkanı

B. INTERVIEW GUIDE

A. QUESTIONS ON THE BACKGROUND OF THE INTERVIEWEE

1. Please briefly introduce yourself and inform me on your educational and professional background.
2. When and how did you join METU?

B. GENERAL QUESTIONS

1. What are the recent changes in the scientific studies in your field (in terms of subject, method, tools used, working process, output type, etc.)?
2. What kind of long-term effects will these changes have in the context of scientific studies?
3. What do you think about Big science and research networks?
4. Could you tell us about a study you are currently working on?
   - Do you carry out your work independently? Or in a team/collaboration?
   - Could you give information about the reasons that led you to work in this way?

   <u>If it is collaborative work:</u>

   - How did you establish the cooperation? How did the team come together?
   - In which areas and in what way do team members contribute?
   - What are the tools you use in communication? What are the advantages and disadvantages of this communication method?
   - What can be done to improve communication and cooperation and increase the effectiveness of teamwork?

5. We see that you are involved in (Network/Networks of …… or research networks related to ……). Can you share why you are involved in this network(s)?
6. How did you come into contact with these network(s)?
7. What are the difficulties you faced, if any, during the process of being involved in the Research Network(s) or the factors that facilitated your participation?
8. Is there a different research network that you plan/want to take part in and to communicate with in the upcoming period?

   <u>If Yes:</u>

   - Why this network?
   - What are the issues that you need support during the implementation of your plans?
9. In Turkey's 11th Development Plan, it is stated that "Higher education system will have a global competitive power, quality-oriented and dynamic structure; It was stated that practices aimed at increasing the qualifications of higher education institutions will continue. In this context, the Plan also states that "As of 2023, at least 2 of our universities will be in the top 100 and at least 5 of our universities will be in the top 500 in the world academic success rankings." What are your thoughts on these and similar goals?
10. To what extent do you see the research networks as effective in line with Turkey's latest scientific research goals?
11. Are there any changes that need to be made in the context of research networks in line with these goals?

C. QUESTIONS ABOUT A PARTICULAR STUDY OF THE RESEARCHER

1. We see that you preferred a different research network interaction in your (name of study) study than your other studies? Can you share with us the reason for this change?
2. I am curious about your research environment in this work. (If any) How did you meet with the other researcher? What were the factors that brought you

together in this study? If yes, what were the problems encountered during the working process?

3. Can you share your achievements from this study?
4. If you choose to work in a similar way in the future, what would you like to shape differently and in what dimensions would you like to be supported?

D. QUESTIONS ABOUT RESOURCES

1. Can you give information about your needs in your working processes?
2. What(s) do you benefit from in order to meet these needs?
3. Can you tell me how you accessed these resources?
4. Why did you choose to use this resource?
5. In terms of access to physical and/or human resources, are there any differences between the work(s) you have carried out in Turkey and abroad(…(country/countries)? If so, can you give some information about them?
6. In this context, what are the facilitating and complicating factors for you?
7. What would you like/what kind of environments, situations, resources would you like to have in your future work, such as resources, access, collaboration?

C. CODES FOR RESEARCH QUESTION 5

Regulation

- Policy Making-General Framework
  - Inflexibility/Flexibility in the Fund Program-design
  - Prioritized areas of the Funds/Plans-narrow focus
  - Non-standardization-among pro and in-time
  - Regional limitations in the Fund
  - Problems in assessment (proficiency, promotion and others, quality vs quant)
  - Time constraints not in line with the project
  - Logical background in the Target Design
  - Focusing on only western oriented networks
  - Freedom as a stimulator
- Policy Design in Finance
  - very specific cond. in the fund applications
  - bureaucratic difficulties in the fund applications
  - Project application form's complications
  - bureaucratic difficulties in use of Fund
  - Back-forths in project applications
  - Lack of sufficient and clear comm. in the fund app. Process
  - Inflexibility/Flexibility in the Fund Program-Execution
  - Competency of panelist-Project selection Panels
  - Problems in the Project Selection Panels
  - Office of Sponsored Projects
- Policy Design Based on Rankings
  - Capacity constraints-For Ranking
  - Time constraints For Ranking
  - Criticism on ranking-strategies
  - Criticism on Ranking-Internationalization
  - Criticism on Ranking- Collaboration
  - Criticism on Ranking-western hegemony and prejudge
  - Criticism on Ranking-conflict with the area's nature
  - Not aligned with the current system-For Ranking
  - Missed opportunities due to ranking oriented efforts

- Critical mass-human capital-ranking
- Criticism on Ranking-Bureaucratic difficulties
- Budget structure design-ranking-ideas

➢ Policy Design in Human Resources Policies
- AGEP as a facilitator for network
- Education as a Factor for Network Connections
- Advisor as a resource for network
- Missed opportunities due to narrow scopes-promo
- Missed opportunities due to promotion related efforts-promo
- Promotion criteria as factor for narrow work-promo
- Promotion criteria- not aligned with the area dynamics
- Promotion criteria-quality vs quantity and indices
- Lack of communication among peers
- Time to tenure at the beginning
- Beating the numbers-ranking
- Motivating Cooperation-ranking
- Time to publishing of the output-not logical
- Common friends as a network facilitator
- Former Students as a partner-network access
- New colleagues-appointments as network opportunities

Financial

➢ Existing Resources
- BAPs as a financing tool
- EU Funds as financial resource
- Tübitak as study Financer and intermediary for new resources
- Government entities as financial resource (and partner)
- Financial support of the Department
- Private companies and NGOs as financial resource (and partner)
- Individual financial resources
- TTO as a fund gate
- Nish contribution to access to new funds

➢ Sufficiency of Financial Resources
- Financial resource needs
- Reductions in the BAPs
- Variety in financial resources
- Uncertainty

➢ Research Network Integration and Finance
- Conferences to establish network
- More events on academic issues as a stimulus
- More focused and closer academic interaction
- Workshops as a tool to establish new networks and new studies

- Post-docs as a channel for new network
- Serendipitous (natural introductions)
- Financial resources-other-including colleagues' experiences
- Possibility of organizing as a company
- Adequacy of Salary for research assistants/for students
- Role of conferences to support RAs/students
- Criticism on Ranking-Lack of Budget
- Exchange rate
- General economic conditions

Infrastructure

- Physical proximity for establishing new network
- Face-to-face communication's role in network establishment
- Physical conditions as a stimulus to work together

Human Resource

- Capital
  - Human capital-students
  - Ras as colleagues-students-their responsibilities
  - Research Assistant as a tool in new study endeavors
  - ÖYP as a financial source for RA's development, new network opportunities and new academicians
  - Research Assistant Positions
- Fund-Project
  - How to search for new calls or resources
  - Focused administrative staff
  - Lack of sufficient administrative staff with English language
  - More administrative support needed for fund applications
  - Expert of the Tübitak-Tübitak as financer
- Ranking perspective
  - Criticism on ranking-Student per academic
  - Criticism on ranking-need to stop brain drain
  - Critical mass-human capital/science
- Responsibilities
  - Teaching and administrative responsibilities
  - Other responsibilities

Ethical Issues

- Project selection panels
    - Role of the popular subjects in the acceptance of popular
    - Ethical issues related to panelists
    - Misinformation in project selection panels
- Invisible barriers
    - Reproduction of invisible barriers via education
    - Demotivation due to invisible barriers
- Inbreeding
- Merit-based recruitment
- Approach to conferences as a trip opportunity and additional financial gain
- Arrogance/Jealousy
- Criticism on the negligent approach of peers

Democratic Issues

- Communication
    - Planning and communication problems in project execution
    - Communication in Target Design
    - Criticism on Ranking (lack of inclusive approach)
- Trust
    - (Dis)believe in authorities and system in general
    - Injustice and its effects
- Freedom
    - Political freedom-Country
    - Balance between freedom and control-ranking

D. TURKISH SUMMARY / TÜRKÇE ÖZET

TÜRKİYE'NİN ARAŞTIRMA AĞLARINA ENTEGRASYONU VE ARAŞTIRMA AĞLARININ BİLİMSEL ÇALIŞMALARA ETKİSİ: ODTÜ İNCELEMESİ

Çalışmanın Amacı ve Önemi

Bilim, sınırlı kaynaklar ve sınırsız ihtiyaçlar ikilemini aşmanın bir yoludur. Devletler hem kaynak yetersizliklerini aşarak daha müreffeh bir geleceğe kavuşmak hem de ülkeler arası güç mücadelesinde öne çıkmak amacıyla bilimsel çalışmalara destek vermektedirler. Bu bağlamda özellikle İkinci Dünya Savaşı sonrasında bilimin küresel güç mücadelesinde bir araç olarak öne çıktığı görülmektedir (Gomory, 1992). Öte yandan bilim adamları ve bilimsel çalışmalar; teknik, düzenleyici ve hatta etik engeller dahil olmak üzere kaynak eksikliğinin üstesinden gelmek için devletlerin desteğine de ihtiyaç duyar. Devletler, örneğin, temel araştırmalarda, mali kaynak eksikliğinin (Cockcroft, 1962) veya yetersiz yatırımın üstesinden gelinmesi (Simon, 1999), piyasa aksaklıklarının aşılması ve nihai ürünlerini kamu yararına kullanımının sağlanması (Bookshelf vd., 1930) gibi alanlarda rol üstlendiler. Devletlerce yapılan düzenlemeler, bilim adamlarının faaliyet gösterdiği ortamı şekillendirmede rol oynar ve etkisi düşündüğümüzden daha büyüktür.

Solla Derek Price "Küçük Bilim, Büyük Bilim (1963)" çalışmasında bilimsel çalışmaların üstel bir şekilde artışı ile 20. yüzyılın başından beri yapılan bilimsel çalışmalarda ortak çalışmanın artan önemine dikkat çekerek, bu işbirliklerinin verimliliğini artırdığını vurguladı. Günümüzde, Wagner'in (2008) belirttiği gibi, "modern bilim yoğun bir şekilde sosyaldir" ve işbirliği, fiziksel sermaye, bilgi ve yetenekler dahil olmak üzere gerekli kaynakları sağlamanın iyi bir yoludur. Buna paralel olarak, araştırma ağlarının artan rolü ve bilimin küreselleşmesi, son eğilimler

arasındadır. Sadece bilim adamlarının bireysel tercihleri değil, devletlerin adımları da bu eğilimi desteklemektedir. Ülkeler bilimsel üretkenliği artırmak için bilimsel sistemlerinde "uluslararasılaşmayı" teşvik etmektedir. Bu eğilime paralel olarak, bu politikaların etkinliği ve işbirlikçi ortamın nasıl iyileştirilebileceği konusunda günden güne gelişen bir literatür bulunmaktadır. var (Lee ve Bozeman, 2005; Catalini ve diğerleri, 2020; Abbasi ve diğerleri, 2011). Genel olarak ilgili literatür, üretkenliği makale ve patent sayısı ve ortak yazarlık yoluyla işbirliğini ölçer (Newman, 2004; Fagan ve diğerleri, 2018).

Bilimsel çalışmalar devlet kurumları, araştırma merkezleri, üniversiteler ve özel şirketler tarafından yürütülmektedir. Bilimsel üretkenliği artırmak, birçok aktör için stratejik bir amaçtır. Diğer taraftan, bilimsel üretkenliğin tanımında farklılıklar görülmektedir. Üniversiteler bilimsel çalışmalarda kilit bir öneme sahiptir ve birçok ülkede bilimsel üretimin kaynağıdır. İşgücünün mesleki gelişimi, toplumsal işlevler vb. gibi farklı işlev ve sorumlulukları olsa da yükseköğretim sistemi ve üniversiteler, özellikle yükseköğretim politikaları yoluyla bilimsel verimliliği artırmak için dikkatle izlenmekte ve yapılandırılmaktadır. Bilimsel yayınlar ve daha pek çok faktörün bileşiminden oluşan üniversite sıralamaları, bilimsel üretkenliğe dair kaydedilen gelişmenin izlenmesinde ölçüt olarak kullanılmaktadır. Nitekim, Türkiye 11. Kalkınma Planı'nda (On Birinci Kalkınma Planı, 2019) bilimsel üretkenliğin artırılması bağlamında, 2023 itibarıyla uluslararası akademik sıralamalarda ilk 100 üniversite arasında en az iki üniversiteye sahip olmayı hedeflemektedir.

Bu çalışma, anılan hedef göz önünde bulundurularak, Türk akademisyenlerin uluslararası araştırma ağlarına entegrasyonunun nasıl yapılandırılması gerektiği sorusuna yanıt aramaktadır.

Bu kapsamda; araştırma ağlarına entegrasyon ile bilimsel üretkenlik arasında bir ilişki, araştırma ağlarına entegrasyonda bölgesel farklılıkların varlığı, farklı disiplinlerin araştırma ağlarıyla entegrasyon eğilimlerinin farklılığı, akademisyenleri araştırma

ağlarının bir parçası olmaya yönelten faktörler ile araştırma ağlarına entegrasyonunu kolaylaştıran/güçleştiren faktörler irdelenmiştir.

Çalışmada, bibliyometrik değerlendirme ve yarı yapılandırılmış görüşmelerin birleşiminden oluşan karma bir yöntem kullanılarak, Orta Doğu Teknik Üniversitesi (ODTÜ) örneğinden hareketle, Türkiye'nin araştırma ağlarına entegrasyonuna, ağ seçimlerini etkileyen faktörlere ve araştırma ağlarına entegrasyonun bilimsel çalışmalar üzerindeki etkilerine ilişkin bir değerlendirme sunulmuştur. Yükseköğretim Kurulu'nun (YÖK) 2020 yılında açıkladığı araştırma üniversitelerine ilişkin değerlendirmesinde ilk sırada yer alması, teknik kapasitesi ve geniş bir yelpazede eğitim vermesi sebebiyle inceleme alanı olarak ODTÜ seçilmiştir.

Bu çalışma, Türkiye'nin 11. Kalkınma Planı'nda uluslararası üniversite sıralamalarına göre tanımlanan bilimsel üretkenlik hedefleri açısından göz ardı edilen bir alana dikkat çekmeyi ve katkıda bulunmayı amaçlamaktadır. Türkiye'nin araştırma ağlarına entegrasyonunu inceleyen çalışmaların sayısı sınırlıdır ve mevcut olanlar belirli disiplinlere odaklanmaktadır. Çalışma aynı zamanda hem nicel hem de nitel araçları birleştiren bir karma yöntem araştırma tasarımı kullanması itibarıyla da diğer çalışmalardan ayrışmaktadır.

Tezde; öncelikle bilimsel yayınların trendi, bilimsel üretkenlik tanımı, araştırma ağlarının tanımı ve neden tercih edildiği, bilimsel üretkenlik ve araştırma ağları ilişkisi, uluslararası üniversite sıralamaları ve Türkiye'nin bilimsel üretkenlik ve araştırma ağlarına yaklaşımı hakkında genel bir bilgi sunulmuştur. Devamında ise, ülkemizde araştırma ağları ve bilimsel üretkenlik ilişkisi, araştırma ağlarına entegrasyonda farklılık yaratan faktörler, çalışmanın hem nicel hem de nitel temellerine ait bulgular sunulmaktadır. Son bölüm ise bilimsel üretkenliği artırmak için Türkiye'nin araştırma ağlarına entegrasyonunu geliştirmek için neler yapılabileceğine dair tavsiyeleri içermektedir.

Yöntem

Çalışma kapsamında ele alınan verilerin toplanmasında üç aşamalı bir yöntem kullanılmıştır. İlk aşamada; ODTÜ kimliği ile 2010-2020 yılları döneminde yayımlanan çalışmalara ilişkin Web of Sciences (WoS) verileri indirilerek anılan verilere ilişkin veri temizleme işlemleri gerçekleştirilmiş ve Vosviewer adlı bir bibliyometrik paket aracılığıyla bu çalışmalara ilişkin eş yazarlık üzerinden tanımlanmış işbirliği düzeyleri yıllık olarak belirlenmiştir. 2. Aşamada; kariyerlerinin nispeten başında olan ve "yayınla ya da yok ol" baskısını en derinden hisseden bu nedenle araştırma ağlarıyla entegrasyona en çok ihtiyaç duyan ve bundan en çok faydalanabilecek erken kariyer aşamasındaki akademisyenlere odaklanılmıştır. Bu akademisyenlerin tespiti için, ODTÜ'de eğitim veren bölümlerin web sayfalarında yer verilen akademik kadro bilgileri Avesis, Linkedin, akademisyenlerin kendi web-sitelerinde yer verilen öz geçmişleri vb. açık kaynaklar aracılığıyla taranarak, 2010-2017 yılları arasında ODTÜ'de çalışmaya başlayan isimler tespit edilmiş ve böylece Erken Kariyer Aşamasındaki Akademisyenler kümesi oluşturulmuştur. Bu akademisyenler, ayrıca öz geçmişleri üzerinden Avrupa, Avrupa-Dışı, Karma ve Diğer olmak üzere dört bölgesel gruba ayrılmıştır. Anılan akademisyenlere ilişkin yine WoS verileri toplanmış, veri temizleme işlemlerinin ardından ODTÜ'de olduğu gibi Vosviewer aracılığıyla entegrasyon düzeyleri yıllık olarak ortaya koyulmuştur. 3. Aşamada ise; erken kariyer aşamasındaki akademisyenlerle yapılan yarı-yapılandırılmış mülakatlar yer almaktadır. Bu kapsamda, görüşme talebimize olumlu dönüş sağlayan 14 akademisyenle görüşme gerçekleştirilmiştir. İlaveten bir akademisyen de yazılı olarak çeşitli hususlarda görüş ve düşüncelerini aktarmıştır. Mülakatlarda, akademisyenlerin kendi çalışmalarından hareketle, çalışma, proje veya yayın fikrinin doğuşundan, finansmanı ve yürütülmesinden yayınlanmasına kadar olan tüm bilimsel çalışma süreci hakkında bilgi toplanmıştır. Bu süreçte, kimlerle, neden ve nasıl işbirliği kurdukları, çalışma şekilleri ve yaşadıkları zorluk ve kolaylıklar gözlemlenmiştir. Görüşmelerin yazıya dökülmesinin ardından, ilgili içerik QDA Miner isimli program aracılığıyla analiz edilmiştir.

Bulgular

Anılan çalışmalar sonucunda ortaya çıkarılan bulgular özetle aşağıda aktarılmaktadır:

- 2010-2020 döneminde ODTÜ'de yapılan bilimsel yayınlar artmıştır. Ancak, toplam çalışma sayısı dalgalı bir seyir izlemiştir. Genel olarak, yayın sayısının eğilim 2016 yılına kadar artan ve o devamında ise aşağı yönlü bir trend izlediği söylenebilir.
- Akademisyen başına ortalama bağlantı sayısı ile temsil edilen ODTÜ'nün araştırma ağı entegrasyonu 2010-2020 yılları arasında artmıştır. Akademisyen başına eş-yazarlık üzerinden tanımlanmış bağlantı sayısı 2010 yılında 86.12 iken, 2020 yılında 136.44 olmuştur. Dönem içindeki iniş ve çıkışlarla, akademisyen başına ortalama bağlantıların en yüksek düzeyi, 2016'da gözlenmiş ve bu sayı 481,87'ye ulaşmıştır. Hareket istikrarlı olmasa da 2016 yılına kadar artan bir trend görülmüştür. 2020 yılında akademisyen başına ortalama bağlantı, son beş yılın en düşüğü ve 2015 seviyesinin altında olması nedeniyle kritik önem taşımaktadır.
- Erken kariyer akademisyenleri grubunun verilerinin değerlendirilmesi de çıktıda bir artışa işaret etmektedir. Bu artışın bir kısmı grubun genişlemesinden kaynaklanmaktadır. 2017'den sonraki artış, esas olarak tüm grubun üretimindeki artıştan kaynaklanmıştır. Erken kariyer akademisyenleri grubuna ilişkin veriler, entegrasyon düzeyinde artışa işaret etmektedir. Bu grup için en yüksek değerler 2014 yılında kaydedilmiştir, 2016 yılında en yüksek ikinci değer görülmüştür. Entegrasyon verisinde en ani düşüş 2017 yılında olmuştur ve 2018 yılından itibaren düşüş trendi gözlenmektedir.
- ODTÜ ve erken kariyer gruplarının entegrasyon seviyelerinin hareketleri, 2010 ile 2013 arasında zıt yönlerde hareket ederken, 2013 ve 2018 arasında benzer şekilde hareket etmiştir. Erken kariyer grubuna ait trendi daha hareketlidir. Bunda, anılan grup üyelerinin daha yüksek düzeyde entegre olmaları nedeniyle bir grup üyesinin çalışmasındaki azalma/artış daha güçlü bir etki doğurmasının etkili olduğu düşünülmektedir.

- Sonuç olarak, bilimsel üretkenlik ve entegrasyon düzeyi 2010-2020 döneminde artmıştır ancak bu ikisinin trendi her zaman birbiriyle uyumlu hareket etmemiştir.
- Mülakatların tamamında, bilimsel çalışmalarda işbirliğinin olumlu rolü ile işbirliği ve üretkenlik arasındaki pozitif ilişkinin altı çizilmiştir.
- Görüşmeler, yakınlığın entegrasyondaki olumlu rolüne işaret etmektedir. Yakınlık, fiziksel, sosyal ve kültürel yönleri içerir. Nitekim eğitim geçmişi, yurt dışı doktora çalışmalarında akademisyenlerin danışmanlığını üstlenen isimler ile yurtdışında geliştirilen ilişkiler ve eğitim sırasında kazanılan ortak dil ve yaklaşım entegrasyonu kolaylaştırmış, entegrasyonun yönünü ve gücünü etkilemiştir.
- ODTÜ yayınlarının işbirliği yapılan ülkeler açısından nicel analizi, ülke bazında ABD'nin lider ülke olduğunu, işbirliğinde bulunulan ülkelerin önemli bir bölümünün Avrupa ülkeleri olduğunu ve Avrupa ülkeleriyle işbirliği içinde üretilen yayın hacminin en büyük olduğunu göstermektedir.
- Erken kariyer akademisyen gruplarının eğitim geçmişlerine göre bölgesel sınıflandırması üzerinden yapılan nicel analiz ise, yayın sayısı açısından AB dışı grubun en büyük üretime sahip olduğunu göstermektedir. Akademisyen başına yayın ve yayın başına atıf değeri en yüksek grup Karma gruptur. AB grubu, akademisyen başına yayın sayısında, AB dışı ve Diğer gruplarını geride bırakmıştır.
- AB, AB-dışı, Karma (Dr. Demirköz hariç) ve Diğer grupları için akademisyen başına ortalama bağlantı sayısı 2010-2020 döneminde sırasıyla 2785.32; 778.56; 294,61 ve 65,30 olmuştur. AB Grubu, akademisyen başına en büyük ortalama bağlantıya yani en yüksek entegrasyona sahiptir.
- İşbirliği yapılan ülkelerin ülke kompozisyonu da yakınlığın rolünün altını çizmektedir. AB grubunun AB ülkeleri ile entegrasyonu daha yüksektir. Benzer şekilde, AB dışı grubun en önemli işbirliği partneri, belge sayısı ve toplam bağlantı gücü açısından diğerlerinden oldukça önde olan ABD'dir. Karma grup için, yine ABD önde gelmektedir ancak akademisyenlerin 16'sının ABD'de eğitim aldığı düşünüldüğünde, bu durum şaşırtıcı değildir ve

yakınlığın entegrasyondaki rolünü desteklemektedir. Diğer grubu için İspanya en önemli ortak iken, işbirliği yapılan ülkelerin çoğu Avrupalıdır. Bu da yakınlık ve bölgesellik hipotezi ile uyumludur.

- Mülakatlarda ayrıca, işbirliği yapılan partnerlerin teknolojik donanım ve araştırma altyapıları veya akademisyenlerin becerileri veya yetkinliğinin araştırma ağları ie işbirliğine teşvik eden ana nedenler olduğunun altı çizilmiştir. İşbirlikleri, bilimsel çalışmalar için ekipman ve altyapı eksikliğinin giderilmesine yardımcı olur, zamandan tasarruf sağlar ve verimliliği artırır. İşbirlikleri genellikle tamamlayıcı bir şekilde oluşturulurlar.
- Mülakatların analizi sonucunda araştırma ağları ile entegrasyonu kolaylaştıran ya da güçleştiren faktörler; Düzenlemeler, Finansal Kaynaklar, Altyapı, İnsan Kaynakları, Etik Sorunlar ve Demokratik Koşullar olmak üzere altı ana alanda gruplandırılmıştır.

Düzenleme:

a. Genel politika çerçevesi de araştırma ağı entegrasyonunu zorlayan veya kolaylaştıran faktörler arasındadır. Hedeflerin belirlenmesi ve zaman planlamasındaki sorunlar, bilimsel temelin zayıf olması, çalışmalarda yeterince kapsayıcı olunmaması, belirlenen önceliklerin veya hedeflerin disiplinlerin dinamikleri ve gereksinimleriyle çelişmesi gibi açılardan eleştirilmektedir. Uygulama takvimi ve sorumlu aktörlerin net bir şekilde iletilmemesi, nitelikten çok niceliğe odaklanılması, düzenlemelerin hedeflerle ve zaman içinde tutarsızlığı görüşmelerde dikkat çeken diğer hususlardır.
b. Fonlara erişime ve fonların kullanımına ilişkin düzenlemeler de bir diğer önemli boyuttur. Fon başvurularında aranan özel koşullar, fonların kullanımında esneklik olmaması, fonların başvuru ve kullanımına ilişkin bürokratik güçlükler, fonlama süreçlerinde açık iletişim kanallarının olmaması, Proje Destek Ofisi dahil fon başvuruları ile ilgili destek yapılarının yeterliliği, fon sağlanacak proje seçim panellerinde yaşanan sorunlar, özellikle panelistlerin yetkinliği, öne çıkan diğer konulardır.

c. Sıralamalara dayalı hedef belirleme, tersine mühendisliğe yol açarak, bilimsel verimlilikten ve tedrici ilerlemeden sapmaya ve diğer muhtemel gelişim fırsatlarının kaçırılmasına neden olma ihtimali nedeniyle sorgulanmaktadır. Bilimsel temelin zayıflığı, yükseköğretim sisteminin mevcut koşulları/kapasitesi ile uyumsuzluğu ve bu hedeflere bağlı alt düzenlemelerin çeşitli alanların doğası ile uyumsuzluğu ve işbirliği çabalarını engellemesi ve dolayısıyla nihai hedefle tutarsızlık yaratması diğer sorunlardır. Uluslararası sıralamalar yayın sayısı ve atıf verilerinden yararlanmaktadır ve bu verilere temel teşkil eden yayınların/dergilerin tarafsızlığı şüpheli olduğundan sıralamaların temel alınması ayrıca sorgulanmalıdır.
d. İnsan Kaynakları alanındaki politika tasarımı, araştırma ağı entegrasyonunu etkileyen düzenleyici faktörlerin bir diğer ayağıdır. İşe alım sürecinin uzunluğu (pozisyonun tahsisinden güvenlik izninin tamamlanmasına kadar), akademisyenler için düzenlenen uyum programlarının rolü, kapsayıcı ve işbirlikçi fon çağrılarının eksikliği, atama-yükseltme yönetmeliğinin işbirliğini caydırıcı yapısı görüşmelerde öne çıkan başlıklardır.

Finansal Kaynaklar:

a. Fonların (AB, TÜBİTAK, ODTÜ, bakanlıklar ve özel sektör) başvuru usullerinde/gereksinimlerinde farklılıklar olması, bu fonlardan bazılarının özellikle kullanımdaki esnekliklerinin kolaylaştırıcı rolü, BAP'lerde son zamanlarda yapılan kesintilere bağlı zorluklar, fon imkanlarının yetersizliği veya sürekliliğine yönelik endişeler ve bunların altyapı, doktora sonrası araştırmacı ve tam zamanlı araştırma elemanı temini veya konferanslar yoluyla araştırma ağlarıyla entegrasyona etkileri görüşmelerde bahsedilen konulardır.
b. Ülkenin genel ekonomik koşulları, fon seviyesindeki genel azalmalar, enflasyon veya döviz kuru dalgalanmaları nedeniyle artan maliyetler ve çeşitli ağlara yönelik üyelik aidatlarını ödemeye yardımcı olacak ve açık dergilerde yayın yapmak için ödenecek ücretleri desteklemeye yardımcı

olacak mekanizmalarının bulunmaması, araştırma ağı entegrasyonunu etkileyen diğer finansal açıdan kritik konulardır.

c. Öte yandan, halihazırda uluslararası sıralamalarda ilk 100'de yer alan üniversitelerin kaynakları ile ODTÜ'nün finansal kaynakları arasında ciddi düzeyde bir uyumsuzluk bulunmaktadır. Bu da finansal açıdan önemli bir diğer unsurdur.

Altyapı:

a. Gerekli ve kaliteli altyapı eksikliği araştırma ağları ile entegrasyon olanaklarını etkileyen faktörlerdendir.

İnsan Kaynakları:

a. Akademisyen başına öğrenci sayısını azaltma gereği, tam zamanlı araştırma personeli ve araştırma görevlisi ihtiyacı ve beyin göçü kritik konulardır ve bunların ağlara entegrasyon ve bilimsel üretkenlik üzerinde yansımaları vardır.
b. Araştırma görevliliğinin, kalıcı bir görevden ziyade bir burs olarak kabul edilmesi ve bu pozisyonun içe dönüşü önleyecek şekilde oluşturulması gerekliliği vurgulanan diğer konulardır.
c. Bir konu üzerinde çalışan beşeri sermayede kritik bir insan kapasitesine ulaşılması ve bunun korunması ihtiyacı, çalışmalarda başarıyı sürdürmek ve bu başarının devamlılığı için de zorunludur.

Etik Sorunlar:

a. Proje seçim panellerine yönelik eleştiriler bu bağlamda en öne hususdur. Panelistlerin yetersizliği, panelistlerin etik dışı davranışları ve yanlış bilgilendirme bu kapsamda dile getirilen önemli sorunlar olmuştur.
b. Akademisyenlerin proje seçiminde veya terfi ve işe alım kararları da dahil olmak üzere diğer idari işlemlerde karşılaştıkları görünmez engellere değinildi. İçe dönük eleman istihdamı ve akademisyenlerin konferanslara yaklaşımlarındaki farklılıklar da not edilmiştir. Bu sorunlar, hem bilimsel çalışmalar için kritik olan finansmana erişimi hem de ağ oluşturma

fırsatlarını ve hem de sisteme güvensizlik yaratarak araştırma yapma motivasyonunu etkilemektedir.

Demokratik Konular:

a. Proje başvurularına ve yürütülmesine ilişkin olanlar dahil olmak üzere politika oluşturmada ve akademik faaliyetlerde iletişim eksikliği, bu çalışmaların kapsayıcılığını ve hukukun üstünlüğü anlayışını geliştirme ihtiyacı, araştırma ağlarına entegrasyonu etkileyen önemli faktörlerdir.
b. Özgürlüğün temini, hem ülkede mevcut olan insan kaynağının korunması hem de doktora sonrası araştırmacı veya akademisyen olarak ülkeye yeni beşeri sermaye kazandırmak için önemli bir faktördür.

Tavsiyeler

Yukarıda aktarılan bulgulardan hareketle, 4.5. bölümde değinilen alt başlıkların her birinde onlarca öneride bulunmak mümkündür. Bu tavsiyelerden bazılarının etik ve demokrasi gibi çok karmaşık konuları ele alması gerekecektir. Öte yandan, bu eylemler, sistemin tam dönüşümünü ve yükseköğretim sisteminin bütünsel bir zihniyetini ve anlaşılmasını gerektirecektir. Bununla birlikte, bu olası eylemler için doğrudan yükseköğretim sistemi üzerinde çalışmayanlar da dahil olmak üzere ilgili tüm kurumların sürece dahil olması ve yüksek düzeyde siyasi bir kararlılık gerekecektir. Bu kapsamlı eylemler dizisi, oldukça fazla sayıda kurumun mutabakatı ve katılımını gerektirmesi nedeniyle süreci karmaşıklaşırma ve yavaşlatma ihtimalini gündeme getirmektedir. Bu nedenle çalışmada, söz konusu komplikasyonları ortadan kaldırmak ve hızlıca ve kolayca sonuç verecek adımlara odaklanmak için, kurumların müstakil çabalarıyla ya da nispeten az sayıda paydaşın işbirliğini gerektiren ve araştırma ağlarıyla entegrasyona etkisi daha direkt olan eylemlere odaklanılması tercih edilmiştir. Tablo 26, tavsiyelerin ana başlıklarını ve sorumlu makamları sunmaktadır. Devamında bu eylemler daha ayrıntılı bir şekilde aktarılmıştır. Bu adımlar, daha fazla kaynak sağlayarak ve akademisyenleri ağlarda daha tercih edilir hale getirerek ve araştırma ağları ile entegrasyonu kolaylaştıracaktır. Sonuçta hem üniversitenin bilimsel üretkenliği artacak hem de üniversitenin sıralama puanı artacaktır.

Tavsiyelerin ana hatları aşağıdaki tabloda sunulmaktadır.

Tavsiye Alanı	**Adımlar**
Genel Politika Çerçevesi	Bürokrasinin azaltılması ve başvuruların tek merkezden alınması
Finansal Kaynaklar	Araştırma ağı entegrasyonunu desteklemek ve geliştirmek için YÖK ve TÜBİTAK tarafından konferanslara katılım bütçelerinin genişletilmesi ve çeşitli ağlara üyelik aidatları için yeni desteklerin sağlanması
	Finansal kaynak miktarının artırılması
	Yeni kaynakların yaratılmasına yardımcı olacak birimlerin (PDO gibi) kapasitesinin geliştirilmesi ve fakülteler altında da benzer birimlerin kurulması
	TÜBİTAK tarafından proje seçim panelleri için panelist atama metodolojisinin gözden geçirilmesi
İnsan kaynakları	İnsan kaynakları yönetiminde, ceza yerine motivasyon odaklı bir yaklaşımın benimsenmesi
	Daha esnek ve hızlı işe alım mekanizmalarının geliştirilmesi
	Yeni pozisyonların ODTÜ'nün araştırma ağları ile entegrasyonunu geliştirecek şekilde kullanımı
	Akademisyenler arasında güveni güçlendirecek ve akademisyenlerin birbirlerinin bağlantılarına erişimini artıracak ve yeni çalışmaları teşvik edebilecek akademik etkinlikler düzenlenmesi
Lojistik	Gümrüklerde yaşanan lojistik güçlüklerin ve gecikmelerin giderilmesi için Ticaret Bakanlığı ile protokol imzalanması ve üniversite araştırma ekipmanlarına (ekstra) gümrük kontrolünden muafiyet getirilmesi veya bu tür araştırma ile ilgili materyallerin hızlı bir şekilde gümrük süreçlerinin tamamlanması

Tabloda önerilen eylemlerin ayrıntıları aşağıda verilmiştir:

1. YÖK, ÜAK ve ODTÜ tarafından cezalandırma yaklaşımı yerine akademisyenlere yönelik motivasyon odaklı yaklaşımın uygulanması

YÖK, Üniversitelerarası Kurul (ÜAK) ve ODTÜ, üç ay içinde motivasyon odaklı bir yaklaşım benimseyerek, araştırma ağları ile entegrasyonu güçlendirecek şekilde, mevcut politika ve uygulamalarını gözden geçirmelidir. Bu kapsamda, ODTÜ tarafından atama yükseltme kriterlerinin ivedilikle araştırma ağı entegrasyonu destekleyecek ve her disiplinin ihtiyaçlarına ve yayın dinamiklerine uyum sağlayacak

şekilde bir an önce gözden geçirilmesi kritik önem taşımaktadır. Bu bağlamda dijital araçlarla ve tüm akademisyenlerin katılımıyla daha kapsayıcı bir istişare süreci yürütülmelidir. İşbirliğini cezalandıran düzenlemeler kaldırılmalıdır.

2. **Araştırma ağı entegrasyonunu desteklemek ve geliştirmek için YÖK ve TÜBİTAK tarafından konferanslara katılım bütçelerinin genişletilmesi ve çeşitli ağlara üyelik aidatları için yeni desteklerin sağlanması**

Fiziksel, sosyal ve kültürel faktörleri içeren yakınlığın rolüne bağlı olarak, daha yakın iletişim fırsatlarını geliştirmek faydalı olacaktır. Bu kapsamda, YÖK ve TÜBİTAK'ın araştırma ağlarına entegrasyonu desteklemek için konferanslara katılım bütçelerinin, özellikle döviz kuru ve enflasyondaki son değişikliklerle birlikte gözden geçirilerek artırılması bir zorunluluktur. Bu güncel tutarlar, katılım ücreti dahil olmak üzere konferans katılımı için zorunlu olan tüm masrafları dikkate almalı ve tüm seyahat ve konaklama masrafları karşılanmalıdır. İlaveten, Dünya ekonomisindeki ve Türkiye'deki dalgalanmalar göz önünde bulundurularak periyodik bir gözden geçirme yapılmalıdır.

Benzer şekilde, üyelik mekanizması bulunan ağlarla entegrasyonun desteklenmesi kapsamında üyelik aidatlarını karşılamaya yardımcı olacak yeni bir destek hayata geçirilmelidir. Dernek aidatına verilecek miktarın belirlenmesi konusunda yetkililer, akademisyenlerin görüşlerini dijital bir anket aracılığıyla almalıdır. Bu kapsamda, dernek sayısına bir sınır koymanın parasal bir sınır getirmekten daha verimli olacağına inanıyorum.

3. **Bürokrasinin azaltılması ve başvuruların tek merkezden alınması**

Fon başvurularının tek bir sistem üzerinden kabul edilmesi ve dijital etkileşimli sistemler aracılığıyla ilgili mercilere yönlendirilmesi akademisyenleri tekrar tekrar aynı belgeleri hazırlayıp onay alma külfetinden kurtaracaktır. Tek elden başvuru için öncelikle ilgili kurumlar arasında bir mutabakat zaptı hazırlanmalıdır. Ardından sistemlerin dijital altyapıları arasında entegrasyon sağlanmalıdır. Bu kapsamda ilgili çalışmaların koordinasyonu için hacim ve başvuru havuzu çeşitliliğine göre çeşitli

fonların yönetimindeki tecrübesi, AB ve yabancı ortaklarla olan etkileşimi, bilgi ve iletişim teknolojileri kapasitesi ile TÜBİTAK'ı görevlendirmenin uygun olduğuna inanıyorum. Mutabakat zaptı ile ilgili eylemlere yönelik bir zaman çizelgesinin hazırlanması üç ay içerisinde tamamlanmalıdır. Bu kapsamda, Hükümet, TÜBİTAK ve Üniversiteler arasındaki bilgi alışverişi sistemleri arasındaki etkileşimin geliştirilmesi, bu çalışmanın diğer önemli boyutudur.

4. Finansal kaynak miktarının artırılması

Hazine ve Maliye Bakanlığı, SBB, TÜBİTAK ve YÖK ile diğer kaynaklardan yeni fon temininde izlenebilecek yöntemler hakkında istişare etmelidir. Bu bağlamda, Hükümet ile YÖK ve ODTÜ tarafından bütçe prosedürlerine ilişkin yasa ve tebliğlerin gözden geçirilerek, üniversitelerin özel sektörden daha fazla kaynak çekmeleri için daha esnek mekanizmaların geliştirilmesi yararlı olacaktır. Bu merciler ilgili yasa ve yönetmelikleri inceleyerek yapılması gerekenleri üç ay içinde belirlemeli ve bu değişiklikler Meclis onayları dahil en fazla bir yıl içinde tamamlanmalıdır. Ayrıca, genel ekonomik koşullardaki değişikliklere ve çalışmaların veya projenin ihtiyaçlarına göre fon miktarlarının periyodik olarak revize edilmesi de bu düzenli istişarelerin bir parçası olmalıdır. Bu revizyon çalışmasında hem açık bilgi kaynaklarından hem de proje koordinatörlerinin geri bildirimlerinden faydalanılmalıdır. Proje izleme mekanizmalarındaki elektronik ara yüzlerde, bütçe revizyonuna ihtiyaç olup olmadığı, neden gerekli olduğu ve gerekli revizyon miktarına ilişkin bilgi toplanabilir. Bu yeni ara yüzlerin devreye alınması en fazla üç ayda hızlı bir şekilde tamamlanabilir. Öte yandan, her ne kadar nihai karar ilgili otoritenin uhdesinde olsa da, bu bilgilerin potansiyel ihtiyaçları takip edebilmesi için Hazine ve Maliye Bakanlığı'nın da erişimine açık olması gereklidir.

Ayrıca, YÖK, TÜBİTAK ve diğer devlet kurumlarının fon başvurularında kullandıkları mekanizmaların/araçların uyumunun sağlanması akademisyenlerin başvuru süreçlerini kolaylaştıracak ve onları çeşitli fonların özel başvuru koşullarına adapte olmak için harcadıkları zaman kaybını azaltacaktır. Bu bağlamda, bu kurumların bilgi işlem birimleri, bu sistemlerin uyumunun artırılmasına yönelik

adımları ve bu faaliyetlere ilişkin takvimini işbirliği içinde çalışarak altı ay içinde belirlemelidir. Bilgi işlem birimleri, bu uygulamaları ve takip sistemlerini kullanan personel ile iletişim halinde olmalıdır.

Yetkililer ayrıca bu fonların kullanımındaki esnekliği artırmayı ve bir proje içindeki gider kalemleri arasında fonların daha kolay transferini sağlamayı amaçlamalıdır. Projelerin alt kalemleri arasında kaynak aktarımına, harcama belgesi sağlandığı sürece izin verilmeli ve bu aktarım herhangi bir ön onaya tabi olmamalıdır. TÜBİTAK ve ODTÜ başta olmak üzere tüm kamu fon sağlayıcıları, yukarıda belirtilenlerle eş zamanlı olarak, farklı gider kalemleri arasında kaynak aktarımı konusundaki sınırlamalarını mümkün olan en kısa sürede gözden geçirmeli ve bu kısıtlamaları kaldırmalıdır.

5. **Yeni kaynakların yaratılmasına yardımcı olacak birimlerin (PDO gibi) kapasitesinin geliştirilmesi ve fakülteler altında da benzer birimlerin kurulması**

Akademisyenlerin mevcut ve yeni kaynaklara erişimini artırmak için ODTÜ, bu alanda faaliyet gösteren Proje Destek Ofisi'nin kapasitesini geliştirmeli ve fakülteler altında da benzer birimler kurulmasını teşvik etmelidir. Bu kapsamda, yeni bir birim kurulmasına ihtiyaç duyan yada bu konuda bir görevlinin temininin yeterli olacağının belirlenmesi için bölümlerle yüz yüze istişarelerde bulunulmalıdır. Daha sonra ODTÜ çatısı altında bu yeni birimlerde görevlendirilecek potansiyel personel belirlenmelidir. Bu yeni birimler, yeni fon kaynakları bulmak, projenin yazım süreçlerinde destek olmak ve akademisyenlerin olası kaynaklar hakkında periyodik olarak güncellenmesi ile görevlendirilmeli ve söz konusu birimlerin personel ihtiyaçları belirlenirken bu yükümlülükler de dikkate alınmalıdır. PDO'nun mevcut personeli, yeni personeli süreçler ve proje yazımı konusunda eğitmeli ve gerektiğinde onlara rehberlik etmelidir. Yeni personel, iyi derecede İngilizce bilen ve alanların profesyonel terminolojisine aşina kişiler arasından seçilmeli ya da seçilen personel bu konularda da eğitime tabi tutulmalıdır. Yeni yapılanma bir yıl içinde tamamlanmalıdır. PDO mevcut personeli ve yeni birimlerin personeli yılda iki kez düzenli olarak toplanmalı

ve bilgi alışverişinde bulunmalıdır. Bu yeni birimlerin veya personelin performansı düzenli olarak gözden geçirilmelidir.

6. TÜBİTAK tarafından proje seçim panelleri için panelist atama metodolojisinin gözden geçirilmesi

Fonlara erişimde bir diğer kritik konu da mevcut fonların en verimli projelere tahsis edilmesidir. Bu nedenle, proje seçim panellerine panelist atama metodolojisinin TÜBİTAK tarafından revize edilmesi şarttır. Öncelikle TÜBİTAK, Panelistlerin seçimi konusunda dikkate aldığı kriterleri gözden geçirmelidir. Bu kriterler, Proje özelinde kalifiye, projelerin yürütülmesinde deneyimli ve daha önce projelerde görev almış uzmanların katılımını sağlamalıdır. Akademisyen havuzunun niteliklerini iyileştirmek için, akademisyenlerin üç yılda en fazla iki panele katılabileceği gibi bir sınırlama da bulunmalıdır veya bunun paydaşlarla istişare edilerek kararlaştırılan bir versiyonu değerlendirilmelidir. TÜBİTAK ayrıca hem bu kirterlerin takip etmek ve değerlendirmede TÜBİTAK hem kriterlere uyumu izlemek hem de potansiyel panelistleri belirlemek için bir sicil oluşturmalıdır.

7. Daha esnek ve hızlı işe alım mekanizmalarına sahip olmak

YÖK, ODTÜ ve Çalışma ve Sosyal Güvenlik Bakanlığı, akademisyenlerin işe alımlarında kullanılan istihdam araçları ve pozisyonları (kıdemli pozisyonlar, doktora sonrası pozisyonlar, araştırma görevlileri ve yarı zamanlı olanlar dahil) gözden geçirmelidir. YÖK'ün ilgili istişarelerden önce üniversitelerin görüşlerine başvurmasında fayda bulunmaktadır. Bu kurumlar, ilgili çalışmaları üç ay içinde tamamlamalı ve gerekli değişiklikleri ve alt yönetmelik değişikliklerinde izlenecek bir eylem planını ortaya koymalıdır. İşe alım sürecinin YÖK ve ODTÜ tarafından buna bağlı olarak hızlandırılması (pozisyonlarının tahsisinden bu pozisyonların kullanımına kadar) da çok önemlidir. Bu bağlamda, YÖK ve ODTÜ, ilgili makamlarla bir an önce güvenlik soruşturmalarının tamamlanması için bir protokol imzalamalıdır. Bu çalışmalar bir yılda tamamlanmalıdır.

Ayrıca YÖK, üniversitelerin ihtiyaçları doğrultusunda yeni pozisyonlar (kıdemli pozisyonlar, doktora sonrası pozisyonlar, araştırma görevlileri, idari personel ve yarı

zamanlı olanlar dahil) açmayı değerlendirmelidir. Bu arada, mevcut piyasa koşulları dikkate alınarak bu pozisyonların tercih edilebilirliğini garanti altına almak için maaşlar ve diğer kaynaklar gözden geçirilmelidir. Ayrıca yetkililer, üniversitelerin ihtiyaçları doğrultusunda "akademisyen başına öğrenci" ve "akademisyen başına araştırma görevlisi" değerlerinin iyileştirilmesine yönelik bir plan hazırlamalıdır. Üniversiteler, ihtiyaçların gerçekçi bir şekilde değerlendirilmesi için daha kabul edilebilir pozisyon talepleri oluşturmak yerine, ihtiyaçlarını açıkça ortaya koyma konusunda teşvik edilmelidir.

8. **Yeni pozisyonların ODTÜ'nün araştırma ağları ile entegrasyonunu geliştirecek şekilde kullanımı**

ODTÜ, bölümlerin özel ihtiyaçları doğrultusunda araştırma ağları ile entegrasyon düzeyi daha yüksek entegre akademisyenlerin istihdamını teşvik etmeli ve özellikle entegrasyonu genişletecek şekilde doktora sonrası araştırmacıların istihdamına yönelik programlar başlatmalıdır. ODTÜ, her bölüm ve enstitü için "Araştırma görevlisi/akademistyen" değerini geliştirmeyi amaçlamalıdır. Konuya ilişkin bir eylem planı hazırlanması yararlı olacaktır.

9. **Akademisyenler arasında güveni güçlendirecek ve yeni çalışmaları teşvik edebilecek akademik etkinlikler düzenlenmesi**

Akademisyenler arasında etkileşimi artıracak programların desteklenmesi akademisyenler arasındaki güveni güçlendirebilir ve akademisyenlerin birbirlerinin ağlarına erişimini artırabilir ve yeni çalışmaları teşvik edebilir. Bu bağlamda, ODTÜ, bölümlerin ihtiyaçları ve bu ihtiyaçlara en iyi şekilde hizmet edebilecek belirli etkinlik türleri konusunda bölümlerle görüş aışverişinde bulunmalıdır. ODTÜ Bütçe Birimi, departmanların geri bildirimlerine göre taslak bir plan yapabilir, geri bildirim ve ihtiyaçlara önem ve aciliyetine binaen faaliyetler arasında bir sıralama yapılabilir veya her bölüme kendi ihtiyaçlarına özel bir bütçe sunulabilir. Ayrıca, yukarıda önerilen üniversitenin bütçe uygulamalarındaki düzenleyici değişikliklere dayalı olarak özel sektörden sponsor bulmalarına imkan sağlanabilir. Bu bağlamda kıdemli akademisyenler için AGEP benzeri seminerlerin düzenlenmesi de düşünülebilir.

10. Gümrüklerde yaşanan lojistik sorun ve gecikmelerin giderilmesi

Gümrüklerdeki lojistik güçlükleri ve gecikmeleri çözmek amacıyla, üniversite araştırma ekipmanlarına (ekstra) gümrük kontrolünden muafiyet getirilmesi veya bu ekipmanların hızlı geçişinin sağlanması için, YÖK, TÜBİTAK tarafından Ticaret Bakanlığı ile bir protokol imzalamalıdır. Muafiyet listesinin zamanın ihtiyaçları doğrultusunda periyodik olarak gözden geçirilmesi, üniversitelerin ihtiyaçlarına hızlı bir şekilde cevap verilebilmesi için kritik öneme sahiptir. Protokolde hızlı onay için üniversite yönetimine yetki verilmesi süreci hızlandırmak için bir alternatif olarak değerlendirilebilir. Protokol, seçilen alternatifi açıkça ortaya koymalı ve listenin gözden geçirilmesi ve gümrükten geçişin tamamlanması için azami süre sınırları da dahil olmak üzere transferin süreci hakkında bilgi vermelidir. Ayrıca, bu kurumlar Protokolün uygulanması sürecinde de iletişime halinde olmalıdır.

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Bölümü / Department : Bilim ve Teknoloji Politikası Çalışmaları / Science and Technology Policy Studies

TEZİN ADI / TITLE OF THE THESIS (**İngilizce** / English): Turkey's Integration to Research Networks and Research Networks' Effects on Scientific Studies: The Case of METU

TEZİN TÜRÜ / DEGREE: **Yüksek Lisans** / Master ☒ **Doktora** / PhD ☐

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