

An Evaluation of the Spatial Repercussions of Student Mobility Policy in European Higher Education Area Using Network Analysis

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Abstract

The mobility of international students is a crucial tool for the European Union's goal of creating a unified European Higher Education Area. Despite the initial assumption that all European universities and students can benefit equally from cross-university study experiences, certain European regions have become disproportionately favored over time. This has resulted in specific geographical patterns, challenging the principles of equality and openness in the EU's higher education policy. To better understand these spatial effects and enhance the EU's mobility policy effectiveness, this research analyzes the network properties of Erasmus+, comparing it with traditional degree-seeking activities. Utilizing a modularity measure with data from the EU and UNESCO, the study reveals significant sub-regional variations in the Erasmus+ geographical network,

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posing challenges for policy implementation and limiting mobility alternatives.

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Introduction

Studying abroad is not new; even in the 20th century, talented, wealthy, and adventurous students often studied abroad for some courses (Teichler, 1996). For a long time, student mobility has been the best-known form of internationalization (Van Damme, 2001), and mobility is perceived as an indicator of quality (Mızıkacı, 2005). 1.3 million international students were undertaking tertiary-level studies across the European Union (EU) member countries in 2018 (Eurostat, 2020). However, international student mobility in higher education has become more than an individual endeavour in the last decades and has transformed into a common strategy for competing supra-national organizations, national governments, and higher education institutions. Yet, this raises questions about various dimensions and repercussions of policies to deal with mobility to meet this end, starting with geographical distribution and equal opportunities for all. It is also a matter of debate on what kind of theoretical and methodological approach can be taken in analyzing the implementation of mobility



policies by supranational and national institutions and how the big picture can be seen in the end (Watson, 2009).

It has been argued since Pressman and Wildaksky's (1984) long-ago article that the larger the scale at which policies determined by any institution are to be implemented, the more difficult it is to monitor how the principles underlying these policies are reflected in practice, and the more pronounced the effects of spatial dynamics on implementation become (Hupe, 2011). In the literature on policy implementation, such challenges are often associated with network governance and its spatial projections (Rhodes, 1997), and this theoretical approach is often utilized concerning education policies in particular. This is because, when analyzing the implementation of education policies, approaches based on seeing aggregate effects rather than isolating the effects based on the mobility and preferences of individuals and the structures of educational institutions may yield more substantive results (Ball, 2016).

Although there are various types of student mobility in tertiary education around the world, in terms of funding institutions, rules and regulations, and individual preferences, degree, and credit mobilities are the most widely recognized forms (Brooks & Waters, 2011; European Commission, 2018). “Degree mobility” or “diploma mobility” is the physical crossing of a national border to enroll in a higher education program to pursue the whole of an undergraduate or postgraduate degree. It requires a relatively long-term commitment to mobility, i.e., students are enrolled in a degree program to receive a diploma as regular students in the destination country. There are other types of short-term mobilities with relatively different expectations, such as credit mobility, a short-term circulation that typically emerges as part of an organized mobility program such as the Erasmus+



program. It is defined as a temporary education and a study-related internship abroad within the framework of enrollment in a higher education program to gain academic credits. The credits taken abroad are expected to be recognized at the home institution somehow, and the student will graduate from the home institution. If credit mobility is realized independently, out of a structured program via a student's application to a university abroad, these students are called "free movers." In general, although individuals may try these different types of mobility simultaneously or sequentially to take advantage of educational opportunities that come their way at different periods of their lives, the impact of structural conditions that enable or hinder their ability to take advantage of these opportunities is undeniable.

Although transnational and national authorities try to handle these different choices of mobilities via grant schemas, rules, and regulations for acceptance to accentuate their eminence in the world more effectively, there is mostly a complex decision-making process at work involving individual and institutional preferences and socioeconomic and cultural tendencies. Usually, this sophisticated dynamic interplay of movements among countries and universities results in the emergence of certain path dependencies of mobility between different actors, agencies, and geographies that can be elaborated upon using a social network analysis methodology, as there is a mutual relationship between sending and receiving students, academicians, and other types of degree seekers. Research on social networks purports the idea that, as can be seen in many other forms of international cultural, political, social, and spatial networks, the dynamics of networks are closely linked to institutional regulations, preferential attachments, and geographical components (Glückler, 2007; Ter Wal & Boschma, 2009). Moreover, the dynamics of an international social network and



its geographical reflections might have the potential to provide valuable insights for policy endeavors that are based on general trends of collaboration among agencies like universities (Cross, Borgatti, & Parker, 2002). Therefore, it can be inferred that social network analysis, taking different types of individual preferences for mobility and geographical dimensions of emerging sub-structures into account, has the potential to be instrumentalized as a policy analysis tool for the implementation of internationalization in higher education.

Hence, the main aim of the study is to elaborate upon the implementation of the EU's policy on mobility in higher education, taking differentiations of the existing degree and credit-seeking activities in Europe and looking into the networks and sub-networks created by these mobility activities on a European scale between different countries. Even though, as a result of the recent COVID-19 pandemic, virtual versions of higher education mobility have also become widespread, this study is limited to analyzing the physical mobility of students. Since the Erasmus+ Program, the main instrument of the European Union's mobility policy in higher education is essentially a credit-seeking activity, it is important to distinguish this policy from the degree-seeking opportunities that people usually choose to take advantage of in the absence of such a Program. Seeing the differences in spatial networking between Erasmus+ and other degree-seeking programs can help identify the main problematic areas in implementing the policy.

International Student Mobility in Europe

The EU is a significant policy-making supranational actor in the higher education sector. Aiming to become a powerful global player in higher education (Barkholt, 2005), the EU's general policy framework stands on the pillars of mobility and standardization to strategically create the



European Higher Education Area (EHEA). Bols and Nillson (2004) explain a sense of urgency recognized in the Bologna Process based on the fact that higher education is becoming increasingly globalized, and universities have started acting as an international hub of multi-sectoral development. Students from all over the world study everywhere, but mainly concentrated in North America, but not as much in Europe. It has been envisaged that with a more compatible system of higher education throughout Europe, more foreign students would choose Europe to study, and at the same time, students within Europe would become more “mobile.” In 2001, the European ministers congregated in Prague and reaffirmed that efforts to promote mobility must be continued to enable students, teachers, researchers, and administrative staff to benefit from the richness of the EHEA, including its democratic values, diversity of cultures and languages, and diversity of the higher education systems (Prague Communiqué, 2001). As a consequence of the two decades of EU policy interventions, Europe is now one of the leading destinations for higher education students from within and outside Europe, with one in every two students in circulation being European (Campus France, 2020; Eurostat, 2020).

Yet, there has always been a discussion about the way the European Commission (EC) aims to steer European educational activities with a “top-down” approach and the extent to which the beneficiaries have room for “bottom-up” action through the projects they design and request for support (Teichler, 2002). As Marginson & van der Vande (2007) explain, whereas the Bologna Process emerged bottom-up and the role of the European Commission (EC) in the process was initially limited but over time gradually developed into a leading one, the EC took the initiative for the Lisbon strategy at the supra-national level,



and in its implementation, it exhibits a more top-down character. He also explains that this strategy cannot be characterized entirely as top-down since the formal competencies of the EC in education policy have not been enlarged, and the instruments used are thus not legally binding EU directives but take the form of recommendations, communications, consultations, or other working documents. The difference between top-down and bottom-up approaches to determining mobility policy is felt most effectively in exchange programs such as Erasmus+. Although it is thought that these programs should cover all of Europe without any threshold, it is known that there are natural barriers and capacity problems (Souto-Otero et al., 2013).

As a result of this mobility policy, the Erasmus+ program became the most extensively used credit-seeking student exchange program in the EHEA. The program was launched first in the 1987–88 academic year and included member states of the European Union, members of the European Free Trade Association (EFTA) countries (Norway, Iceland, and Liechtenstein), and candidate countries (the Republic of North Macedonia, the Republic of Turkey, and the Republic of Serbia) to increase the quality of higher education in Europe and strengthen the European Dimension in Higher Education in Europe. It is funded by the EU to link universities in the EU member states via mobility grants. There are no country restrictions in the Program on sending or receiving students since Erasmus+ is seen as a means of unification under the EHEA and the Bologna Process, and EU mobility targets have been set with the expectation that all member states will accord similar priority to this policy area (Brooks, 2018).



Since Erasmus+ started, the European Commission has tried to identify and monitor the profiles emerging in the Program countries regarding policy implementation based on the expectation of conducting reciprocal exchange between the countries. According to the Bologna Process implementation report (European Commission, 2018), there are three types of countries identified: net importers, i.e., the countries that receive more students than they send; net exporters, i.e., the countries that send more students than they receive; and countries that have balanced mobility. As can be expected, net importers are mostly advanced Western or Central European countries (e.g., the United Kingdom, Denmark, the Netherlands, Austria, Switzerland, etc.); the top net exporting countries are situated in the Balkans or Eastern Europe (e.g., Croatia, Poland, etc.); and some countries have a balanced incoming/outgoing ratio of mobile students in Europe (e.g., Ireland).

As a priority of the mobility policy in the EU, the concept of “balanced mobility” was used in several policy documents and Bologna reports. In 2012, the EHEA Mobility Strategy document (EHEA, 2012) was published to draft the mobility strategy for 2020, and it stated that the member countries should be encouraged to strive for more and better-balanced mobility of the EHEA with countries in and outside the EHEA. This document mentions the imbalance in mobility in 2012 and states that mobility flows should be analyzed carefully and systematically. Yet, in this document, mobility imbalance is seen as a significant problem for only degree mobility:

Our demand for more balanced mobility is directed particularly at degree mobility since it can have a sustained effect on the host and home countries, facilitate capacity building and cooperation, and may lead to brain gain on the one side and brain drain on the other. In order to be able to better evaluate the development of degree mobility



in the EHEA and react in good time to possible negative consequences for certain countries and regions, we intend in the future to analyze the mobility flows systematically and regularly. If the findings show greater imbalances over longer periods, the governments concerned should jointly investigate the causes, consider carefully the advantages and disadvantages of the specific imbalance, and seek solutions if deemed necessary. (EHEA, 2012, p.2)

Eight years later, the Bologna Process implementation report put forward a broader sense of mobility regarding the different positions of the countries involved in the mobility programs in using degree and credit mobilities alike:

Although the balance was and still is sought in degree mobility, reciprocity is a characteristic of credit mobility, where the funding bodies have, through the amount of scholarships they provide, the financial means to control the flows. As most degree-mobile students are free movers, governments have very few positive means for intervention (apart from the not-so-positive courses of action such as imposing quotas). Third, although balanced mobility is endorsed as an objective, particular types of imbalances have been not only tolerated but also actively pursued by many EHEA and non-EHEA countries. Generally, most countries have aspired over time to become 'attractive systems' in degree mobility (heavily imbalanced towards inflows) rather than to be in the situation experienced by 'closed' (low rates of outgoing students and even lower incoming) or 'limited' (high outward mobility, with excess) (European Commission, 2020a, p.128)

When the change in the Commission's reports is followed, it can be seen that a clear concern has been expressed regarding the implementation of mobility policy on a European scale, and therefore, a call has been made to develop new analysis methods and



perspectives against unbalanced mobility. It can be said that, over the years of implementing the Erasmus+ program, specific mobility patterns emerged between countries that reciprocally exchange students based on the universities' inclinations to sign mobility agreements predominantly with other universities in certain regions of Europe. Under the auspices of the EU guidelines and the monitoring of the EU agencies, certain sub-networks emerged as a consequence, which can be taken as reminiscent of the pragmatic tendencies of individuals and the programmatic priorities of institutions that got involved in the mobility schemes. The effects of these sub-networks, whose existence can be felt even observationally, may cause serious doubts about the degree to which the European Higher Education Area is unified. Therefore, this research aims to address the network properties of the Erasmus+ credit mobilities while comparing them with the general scheme of degree mobilities in Europe, based on official statistics provided by the European Commission (2020b) and UNESCO (2022), to reveal the geopolitical structures and sub-regions concerning the EHEA.

Previous Studies Concerning Network Analysis of Student Mobility

As a part of the rising interest in internationalization in higher education, the dynamics and consequences of international student mobility in Europe and the world have become a popular inquiry in the last two decades. The relatively under-researched emerging “highly uneven geography” of mobility has been linked with various elements such as institutional changes, polarization, regionalization, and connectivity factors like language, spatial proximity, and established flows of labour, trade, and knowledge (Balaz, Williams & Chrancokova 2017). In this respect, various research methods and



social network analysis techniques were used to reveal relatively unexplored geographical and sectoral underpinning dimensions of mobility. For instance, Kondakci, Bedenlier & Zawachki-Richter (2018) conducted a social network analysis based on a worldwide dataset representing 229 countries. Their findings uncovered both the strong positions of traditional destinations for international students and the emerging regional hubs deviating from those in traditional destinations. Similarly, Shields (2013), Beine, Noël, and Ragot (2014), Macrander (2017), Yin and Yeakey (2019), and Hou and Du (2022) all tried to determine the main driving factor behind the mobility of students internationally, or what the pulling and pushing elements are behind their movement.

The European experience with mobility in higher education has also been occasionally addressed in several pieces of research using social network analysis since the Erasmus+ program provided an exchange program within a clearly defined administrative and transnational boundary. In some of these studies, Erasmus+ data is used as a mere statistical source to determine the mathematical properties of the network structure. For instance, Derzsi et al. (2011) analyzed Erasmus student mobility data in 2003 to reveal the network of professional connections between universities. Their analysis indicates that in a bipartite network of Erasmus connections, i.e., every country has some links with the majority of the other countries, there is an exponential degree distribution, a relatively high clustering coefficient, and a small radius, which denotes a high probability of the existence of clusters in the network.

While trying to test the hypotheses about different features of the Erasmus+ network and accompanying networks like Erasmus Mundus, some authors consider the influences of the departments,



university types, higher education quality, settlement types, etc., and experiment with different statistical and social network analysis tools. For example, Breznik and Gologranc (2014) used the advanced network analytic method—the island approach—to differentiate diverging groups of HE institutions in the Erasmus mobility program. Later, Breznik and Ragozini (2015) analyzed the Italian Erasmus agreements network through the multiplication of 2-mode networks and multiple correspondence analysis (MCA). Analyzing the Erasmus agreements helped classify different types of Italian universities in terms of their cooperation with other countries. In another study, Breznik (2017) analyzed the mobility of engineering students through social network analysis to identify more significant HE institutions in terms of departmental influence. According to the results, Spanish universities were shown to have the highest mobility regarding engineering departments. On the other hand, Marques et al. (2020) used social network analysis to research the Erasmus Mundus Program and used data from 561 participating universities. They identified some universities that actively facilitate the evolving Europeanization of higher education by strengthening inter-university networks through participation in this program at different cycles.

There are also some studies focusing on the geographical and spatial characteristics of the Erasmus+ network. For example, Van Mol and Ekamper (2016) analyzed the spatial distribution of Erasmus+ students in different European cities based on Erasmus+ student data from 2012 to 2013. The results reveal that the capital and second-tier metropolitan cities attract European exchange students. Breznik and Skrbinjek (2020), on the other hand, used the “R” software for statistical analysis and “Pajek” software for network analysis to handle Erasmus data from 2007–2008 to 2013–2014 and identified three groups of countries:



good receivers and senders, good receivers only, and good senders only. Gadar et al. (2020) delved deeper into the spatial characteristics, merged four different datasets on the Erasmus+ student mobility program, and investigated the flow of students, teachers, and staff between European higher education institutions between 2008 and 2014. All the institutional headquarters were geo-coded and characterized according to the attractiveness and quality of their contexts and environments. The interlinked datasets offered relevant information to increase the understanding of educational institutions' mobility patterns and attractiveness.

The recent literature on international student mobility in the world and Europe provided fruitful insights about the working of mobility networks regarding geographical location, spatial characteristics, institutional arrangements, educational process, etc., and has shown that social network analysis has significant potential in bringing out the implicit repercussions of mobility endeavours. Yet, most of these studies lack a public policy perspective in examining the repercussions of policy implementation and fail to bring together a multi-dimensional approach to address the comparative perspective, taking different types of mobilities into account. Although higher education mobility policies are based on assumptions about the behaviours of the individuals and institutions involved, social network analysis helps investigate whether or not the overall picture indicates achievements as a result of implementation in line with the intended policy objectives. For this reason, this study aims to focus on the spatial characteristics of higher education mobility networks and sub-networks in Europe by comparing Erasmus+ and other degree-seeking activities.



Methodology of the Study

In this study, social network analysis is used to analyze to what extent countries involved in the mobility programs are connected, the type of structure (homogeneous or heterogeneous), and sub-networks of the Erasmus+ credit mobility compared to degree-seeking mobility. While doing this, data presented in the Erasmus+ annual reports by the EC (European Commission, 2020b) is used to portray the credit mobility network of Erasmus+, and the UNESCO database (UIS, 2022) is used to obtain data about the flow of tertiary students between 33 EHEA countries and draw a degree-seeking mobility network. These databases cover the international flow of students at institutional and national levels in EHEA, including information about the country of origin and destination, and provide an opportunity to construct social networks to describe flow patterns and the strength of connections between different countries.

Like the Erasmus+ data, UNESCO data refers to all educational programs in tertiary education, which provides an opportunity to comparatively analyze the structures of two-way mobility between EHEA countries. It is assumed that both credit and degree mobility movements in the EHEA create unique and comparable patterns of network structures and sub-networks based on the interconnectedness of the sending and receiving countries. Therefore, the interconnectedness differences that emerged with the orientation of Erasmus+ and the usual degree-seeking regulations at the EHEA will be tested and revealed by modularity analysis. The network analysis was conducted using the modularity feature (Marcoux & Lussea, 2013; Newman, 2003; Reichardt & Bornholdt, 2007), which measures the structure of networks, measuring the strength of the division of a network into communities or clusters. As the main aim is to ascertain



whether or not geographical differences or unevenness emerge from the current mobility policies, analysis of the Erasmus+ and UNESCO data is utilized via trials of different modularity measures. This article represents a specific subset of student mobility, namely those involving only Erasmus+ Program countries, and thus differs from the general figures found in UNESCO's database. This selection was made to reflect the scope of our study and the specific nature of the student mobility being analyzed.

Both 2015 and 2019 data are available for Erasmus+ and in the UNESCO database, and in the analysis, Europe-wide mobility data were extracted from ERASMUS+ and UNESCO's general data on higher education student mobility. Yet, because a single set of highly representative data is sufficient to elaborate on the current structure of the networks, as a first step, the correlation between the 2015 and 2019 datasets is analyzed using the two-tailed Pearson test. As shown in Table 1, there is a high correlation between the distribution of the numbers of incoming and outgoing students in 2015 and 2019 to 33 countries in the EHEA in both databases; thus, more up-to-date 2019 data is preferred. Then, the mobility of both the credit-seeking and degree-seeking international students is analyzed using descriptive statistics and social network analysis tools. There were two critical issues to be concerned about in the analysis. First, the balance of incoming and outgoing students for each country in the EHEA should be considered to determine their weights in the network. Secondly, countries displaying similar behaviours of sending and receiving students to similar countries are classified under certain geographical sub-networks. After obtaining the necessary data sets to solve these problems, the obtained network structures were drawn on the map



with geo-coding, and the network structure characteristics were handled with modularity analysis.

Table 1.

Descriptive statistics and correlations of the data provided for Erasmus+ and degree-seeking students for the years 2015 and 2019

<i>Variable</i>	<i>n*</i>	<i>M</i>	<i>SD</i>	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>
1. ERASMUS+ (2015)	949	308.23	796.97	-			
2. ERASMUS+ (2019)	1056	317.53	882.75	.97**	-		
3. Degree-seeking (2015)	870	621.43	2072.31	.44**	.43**	-	
4. Degree-seeking (2019)	977	647.92	2056.64	.48**	.46**	.95**	-

** Correlation is significant at the 0.01 level (2-tailed)

* total number of connections between countries

Mobility Balance of Countries in the ERASMUS+ and Degree-Seeking Mobility

It is assumed that within the Erasmus+ Program and degree-seeking activities, there is a constant flow of students, and each country has a specific ratio of incoming and outgoing students from each of the 33 countries. Although in Table 1, the total number of students in mobility is used as a unit of analysis, in Table 2, since the position of each



country in the networks of mobility is needed for network analysis, the ratio of incoming and outgoing students is used instead. In this study, the ratio of the number of incoming students to the number of outgoing students is defined as 'the mobility balance factor,' showing whether a country's characteristics are more inclined toward an attraction point for students or a distribution center in the network (Table 2). This table analyzes the flow of students between European countries in the context of the Erasmus+ program and degree-seeking activities in 2019. The 'mobility balance' refers to the ratio of incoming students (those coming to a country for education) to outgoing students (those leaving a country for education elsewhere). It provides insights into whether a country is a net receiver of students, indicating a strong pull factor for international students, or a net sender of students, which might suggest a more outward-oriented educational engagement. The data in this table help to understand the patterns and preferences of student mobility in Europe, shedding light on the dynamics of international education and cultural exchange. Countries with a mobility balance value closer to 1 in both data sets have approximately closer numbers of incoming and outgoing credit-seeking and degree-seeking students. In addition, in countries with a value over 1–5, the number of incoming students is higher than that of outgoing students. Similarly, in countries with values below 1, the number of incoming students is higher than the number of outgoing ones. It has been determined that the countries that distort the balance in favor of incoming or outgoing students exhibit different characteristics in both data sets and act as an attraction point in the network. In the table and figure below, two-digit ISO country codes are used, and extreme values are shown in bold.



Table 2.

The Mobility Balance Data for Erasmus+ and Degree Seeking
Mobility for 2019

Country	Erasmus+_	Erasmus+		Degree_	Degree	
Codes	Erasmus+_	Outgoing #	Incoming/	Degree_	Outgoing #	Incoming/
(ISO)	Incoming		Outgoing	incoming		Outgoing
	#					
AT	8318	6954	1.20	54298	18837	2.88
BE	12534	9464	1.32	27050	13908	1.94
BG	1645	2665	0.62	12029	23214	0.52
CY	1465	743	1.97	4616	25554	0.18
CZ	10628	7240	1.47	17088	10216	1.67
DE	32855	42286	0.78	89666	97368	0.92
DK	5974	4107	1.45	25463	4144	6.14
EE	1881	1181	1.59	2169	2825	0.77
ES	49664	43678	1.14	26441	31320	0.84
FI	11980	5357	2.24	4626	9724	0.48



Şahin, Şahin & Söylemez (2024). An evaluation of the spatial repercussions of student mobility policy in European higher education area using network analysis.

FR	27971	48772	0.57	34310	61152	0.56
GB	29677	18099	1.64	152640	20598	7.41
GR	5246	5630	0.93	16222	35364	0.46
HR	2450	2151	1.14	2257	6052	0.37
HU	6569	4328	1.52	13775	11415	1.21
IE	8386	3952	2.12	6220	13516	0.46
IS	783	352	2.22	765	2141	0.36
IT	27668	40805	0.68	14393	61890	0.23
LI	87	60	1.45	576	292	1.97
LT	3544	4612	0.77	1657	9272	0.18
LU	1396	594	2.35	2483	11475	0.22
LV	1899	2385	0.80	2731	3949	0.69
MK	281	407	0.69	32	4357	0.01
MT	2873	570	5.04	822	1131	0.73
NL	15376	14790	1.04	59541	15350	3.88



NO	7575	2926	2.59	3457	13844	0.25
PL	17348	14716	1.18	8340	21700	0.38
PT	15957	10381	1.54	5330	13545	0.39
RO	3665	8381	0.44	9193	27318	0.34
SE	10353	4618	2.24	11159	11294	0.99
SI	2821	2123	1.33	2741	3938	0.70
SK	2270	3664	0.62	7344	21068	0.35
TR	4171	17319	0.24	13662	25325	0.54
Average			1.42			1.18

At first glance, in Table 2, there are two main findings when mobility balances are analyzed for both data sets. First, most countries have a more balanced flow of students in terms of credit and degree-seeking mobility, meaning that the ratio of incoming students over outgoing students is between 0.24 and 5.04. This ratio indicates whether a country is more of an attraction point for students or a distribution center within the student mobility network. A ratio close to 1 suggests a balanced exchange, with similar numbers of incoming and outgoing students. Conversely, ratios significantly greater than 1 indicate countries that attract more incoming students than they send out, while ratios less than 1 denote countries where the number of outgoing



students surpasses the number of incoming ones. This mobility balance factor, therefore, offers a quantitative measure to understand the dynamics of student flow between countries in the context of Erasmus+ and degree-seeking activities. Notably, the average balance value in the Erasmus+ network is higher than that in the degree-seeking network, suggesting a more uniform distribution in the latter. These patterns highlight the varying roles of countries within the European higher education landscape, either as destinations or sources of student mobility, thereby contributing to the central and outlier positions within the overall mobility network. However, the average balance value of Erasmus+ is higher than the degree-seeking balance, meaning that the degree-seeking network is more uniformly distributed than the Erasmus+ network. Secondly, some countries have exceedingly higher or lower mobility balance values. For instance, regarding credit-seeking mobility, Finland, Iceland, Luxembourg, Norway, Sweden, and Malta receive exceedingly more students than they send, whereas Turkey receives exceedingly fewer students. Similarly, in the degree-seeking network, Austria, Denmark, Great Britain, and the Netherlands receive significantly more students than they send. In contrast, Norway, Macedonia, Luxembourg, Lithuania, and Italy receive significantly fewer students than they send. Some countries are credit-seeking destinations, and others are degree-seeking ones, as pointed out in the previous literature. This feature carried them to a central and outlier position in the mobility network.

On the other hand, if the mobility balances of these 33 countries are compared, it can be seen that the mobility behaviours of these countries indicate different groups of countries (Figure 1). In the first group, there are natural degree-seeking destinations of the higher



education market in Europe, and Great Britain, the Netherlands, Denmark, and Austria are on this list. Although these countries still receive relatively more incoming students than outgoing ones, the difference between incoming and outgoing students is significantly higher in degree-seeking mobility. Unlike them, the second group of countries, including Malta, Norway, Iceland, Finland, Sweden, Luxembourg, Cyprus, and Ireland, are natural credit-seeking destinations, meaning that they receive significantly more incoming students than outgoing ones through Erasmus+. Thirdly, there is also a group of countries such as Hungary, Czechia, Belgium, Liechtenstein, Poland, Spain, Germany, Slovenia, and Estonia, where mobility balances are relatively close to 1 in both degree-seeking and credit-seeking mobilities, meaning that there is not a significant difference between the numbers of incoming and outgoing students. Lastly, countries like Turkey, Romania, Italy, Lithuania, Bulgaria, Macedonia, Slovakia, and Latvia are student-sending countries since they receive significantly fewer incoming students than outgoing ones in both credit-seeking and degree-seeking.

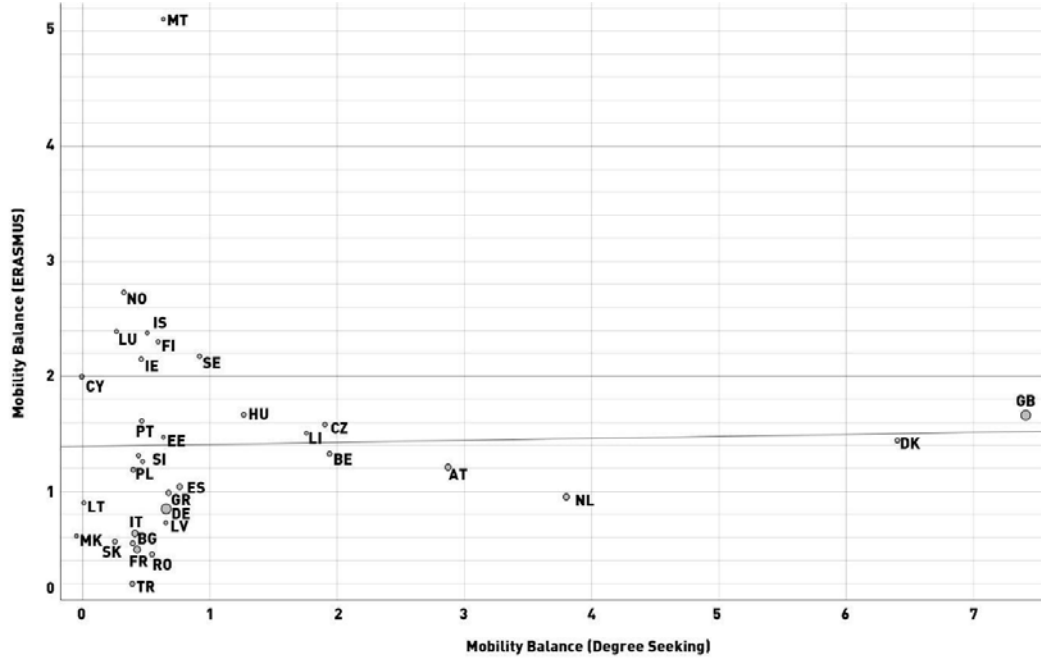


Figure 1. *Mobility balances of countries according to Erasmus+ and Degree-Seeking data*

This analysis shows that looking descriptively into the general number of student flows of degree-seeking and credit-seeking mobilities results, it can be said that each country has a specific behaviour both in the credit-seeking and degree-seeking networks. These behaviours may cause countries to create different sub-networks depending on which other countries they send students to and from which they receive students. Addressing the effects of geographical, cultural, and spatial elements in forming these sub-networks has the potential to provide important insights into the implementation of mobility policy. The next section uses modularity measures to determine significant



geographical sub-networks of countries in the Erasmus+ and degree-seeking networks.

Applying Modularity Measure to Explore Network Structures

In this study, network modularity proposed by Leicht and Newman (2008) is used to detect communities in a network using social network analysis. Network modularity divides the network into communities in which the number of edges within each community is greater than the number of edges that would be found by random chance. The modularity measure is computed as the number of links in each community minus the number of links in the same groups in a graph where the links were redistributed randomly (Newman, 2006). Consequently, each community is a subset of nodes more connected between them than with the rest of the nodes in the network. In this respect, modularity measures both represent more tightly-knit nodes of a network and nodes with similar types and quality of connections.

When the concept of modularity is adapted to real-life systems, it provides clues about the topological properties of a complex network, and it can also show clusters of similar nodes formed by the edges in the network. Finding communities in the geographic domain is a convenient algorithm for detecting interoperable clusters in the network. However, the analysis depends on the scale and number of countries involved. For instance, previous degree-seeking mobility research to investigate clusters at the global level with the modularity measure (Kondakci, et al., 2018) shows clusters different from this study as it included all countries in the analysis. Whereas, in this study, an algorithm provided by the Gephi Software is used to estimate the level of modularity and number of modules in the networks of Erasmus+ and degree-seeking.



The modularity algorithm is a pivotal tool in network analysis, particularly effective in discerning the overall structure of the network and identifying distinct subgroups or communities within it. In Gephi, the modularity value, which typically oscillates between -1 and 1, measures the network's division into modules. A higher modularity value indicates a network with well-defined and distinct modules, while a negative or low modularity value suggests that the modules within the network are either vague or poorly delineated.

Gephi's implementation of the Newman-Girvan modularity algorithm (Newman & Girvan, 2004) plays a critical role in our analysis. This algorithm focuses on identifying groups of nodes that exhibit denser connections among themselves compared to what would be expected in a randomly connected network. By seeking node partitions that accurately mirror the network's modular structure, the algorithm effectively unveils the community structure inherent in the network. Calculating a network's modularity score, or the Q value, is a crucial aspect of this analysis. The algorithm achieves this by contrasting the observed number of edges within the network against the expected number of such edges under a random connection scenario. The resulting modularity score, computed as the aggregate of these discrepancies, indicates the prominence and strength of the community structure within the network. The selection of the modularity algorithm for our study was guided by its ability to reveal complex community structures within networks. This capability is crucial for achieving these research objectives, as it allows for an in-depth understanding of our dataset's intricate relationships and subgroup dynamics. The modularity algorithm's effectiveness in identifying and characterizing these community structures makes it an



ideal tool for our network analysis, aligning seamlessly with the scope and needs of our study.

On the other hand, since the analysis scale is Europe, networking the clusters via geo-coded countries will allow us to see the effect of spatial proximity at the EU level. In addition to using the modularity measure, similar relationship patterns were found, and the geographic/spatial proximity was visualized on the map. Also, the density of the established ties was tested by including the weighted degree calculation on two different datasets. Thus, in the end, the more centralized countries of the student mobility networks and the structure of similar mobility patterns were detected. The analysis allowed the identification of the core and peripheral countries in the networks and helped to see countries with similar characteristics being included in a cluster according to different weighted modularity levels.

Student mobility within Europe was visualized with network diagrams produced using the Gephi software for both datasets. In the graphs drawn from the network analysis, the nodes in both networks show the countries that send and receive higher education students, and the node sizes are shown proportionally with the number of incoming students. Each node has a degree equal to the number of edges it creates with other nodes, and thus, the degrees are weighted according to the edge volume, which is the total number of students a country sends or receives. In Figure 2, Erasmus+ and degree-seeking mobility network structures can be seen concerning different numbers of sub-groups or communities. In general, in the Erasmus+ network, at all five levels of modularities or communities, there happen to emerge strong and coherent sub-groups, whereas, in the degree-seeking

network, the strong ties of the central countries in the network seem to be effective throughout all levels of the modularity measure.

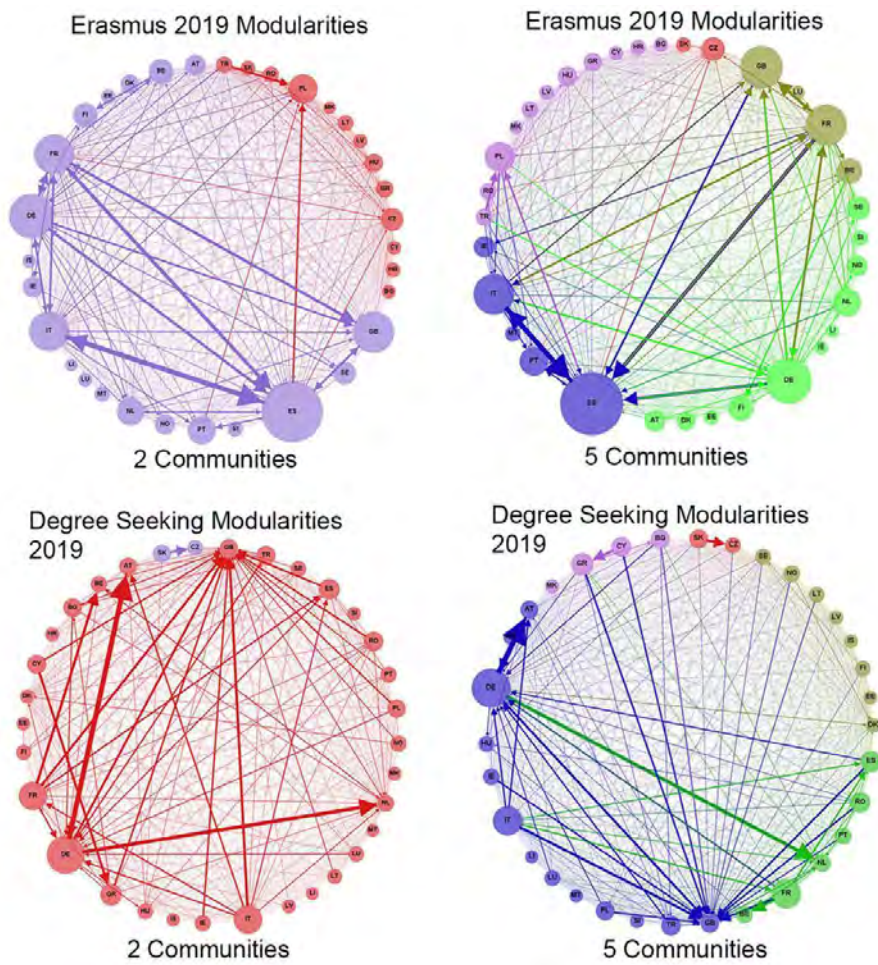


Figure 2. Network diagrams for EHEA student mobility structure in 2019



Modularity is also a topological attribute of spatial networks that refers to the degree to which modules dissociate from each other. The modularity of functional networks varies by country and is related to network connectivity patterns. Low modularity is associated with heterogeneous connectivity patterns in the network, which are more dissimilar from each other. Within the framework of the study, the modularity values of two different data sets were compared, and statistically significant classes were searched. The number of communities formed at different resolution values was evaluated using the community detection algorithm in Gephi software. In this context, low resolution means more communities, and high resolution means fewer communities. It can be said that the higher the resolution, the greater the number of communities. The significance of the divided community numbers is related to the modularity with resolution values higher than 0 in the network. Usually, there are many edges within a community; if the modularity with resolution value is close to 1, the differences between those clustering communities are also high. On the other hand, if a network partition is no better than random, the value is 0, and these communities cannot be topologically separated from each other.

Modularity compares the number of edges inside a cluster with the expected number of edges that one would find in the cluster if the network were a random network with the same number of nodes, where each node keeps its degree, but edges are otherwise randomly attached. In this context, it was assumed that values above about 0.30 would be a sign of modular structure (Newman & Girvan, 2004). Moreover, the definition of a good partition into communities should depend on the nature of the network and the dynamics taking place in it.



Thus, two clusters are used to extract two major distinctive connectivity bundles, and the connectivity patterns are compared within each network and among each other. To detect different clusters formed in the network at different modularity levels; 2, 3, 4, and 5 communities have been put forward for both data sets (Table 3). Communities with 2 and 5 classes that allow comparison are geocoded and shown on the map (Figure 3). Thus, an insight into the network structures was provided based on geographical proximity. Modularity resolution values were iterated to reach different community numbers, and sub-networks were created for both datasets. In Erasmus+ network modularity with a resolution value closest to 0.3, two distinct classes are formed, meaning that at the EU level, two different topologically optimum communities can occur in the Erasmus+ network. On the other hand, the divisions of 2, 3, 4, and 5 communities created by the degree of mobility show that different groups can be distinguished apart from the Erasmus+ network.

The resolution of different levels of modularity shows that, in the degree-seeking network, there is a very strong center of the network, together with diverse communities formed according to different levels of modularity. This indicated the existence of strong sub-groups within the network, working in a heterogeneous fashion. Whereas in the Erasmus+ network, at each level of modularity, the most meaningful community of countries emerges based on a two-level modularity scale, and on the 3-4-5 modularity levels, the distinction of sub-groups is not significant, and the network structure is relatively homogeneous. It can be inferred that although the centrality of certain countries and heterogeneity of the degree-seeking network is significant, the structural division of the EHEA is more striking in the Erasmus+ network.



Table 3.
Modularity metrics for Erasmus+ and UNESCO Networks

	Number of Communities	Modularity with Resolution
1. Erasmus +	2	0.228
	3	0.094
	4	0.003
	5	0.005
2. Degree-seeking Mobility	2	0.564
	3	0.519
	4	0.357
	5	0.249

After the Erasmus+ and degree mobility data were divided into modularity clusters, they were geo-coded (Figure 3). They are displayed on the European map to make sense of the geographical relations and reveal the flow patterns and strength of the connection between countries. While the colors represent different classes in the analysis, the sizes of the circles of the countries are visualized according to the size of the incoming students. The reason why incoming students were taken as the basis for the analysis was to see the core-periphery relationship of the network, and it allowed us to test whether the countries with high numbers of incoming students have the power to influence the EHEA space at the regional level.

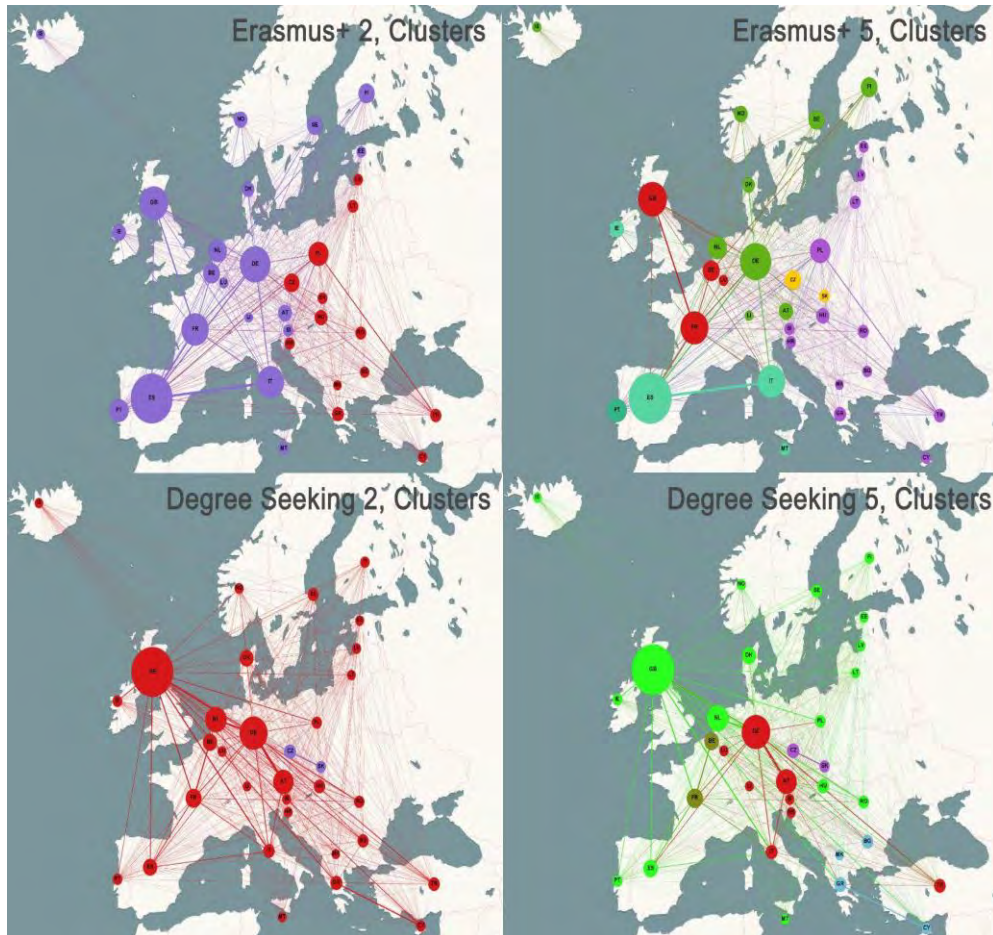


Figure 3. *Geo-coded Network diagrams for 2 and 5 clusters for Erasmus+ and Degree Seeking*

To make a geographical comparison, both networks are first divided into two clusters and analyzed regarding geographic/spatial proximity and connections. Thus, the existence of the communities that make up the basic distinction of both networks has been tested, assuming that the communities that will emerge regarding geographical context



provide important clues about the form and content of student mobility-based relationships. As a result of the analysis, it is seen that while the EHEA is divided into two sub-regions concerning the Erasmus+ Program due to geographical proximity, a predominantly single network emerges in the degree-seeking mobility network, with the only exception of the intense relationship between Slovakia and the Czech Republic, which can be seen as expected since they were the same country until recently. Later, both networks are divided into five modularity classes to reveal the intensity of regional relations in the EHEA geography and the operational characteristics of inter-country relations to further elaborate on lower-level regional geographical clustering in both networks. In the two modularity class evaluations, it was revealed that the clusters that emerged in the Erasmus mobility network were shaped in direct relation to geographical proximity, while the geographical character of the degree mobility network appears as a single network with a strong core group of countries, structured as a result of sectoral supremacy. In the Erasmus+ network, there is a clear distinction between Europe's Western and Eastern countries based on the incoming number of students due to credit-seeking mobility activities.

Thus, both the incoming centralities in the space are shown, and the connection structures are based on the regional proximity (neighborhood) in which these centers also appear. The relationship of the clusters with the spatial neighborhood pattern was tested by comparing the five classifications. In the Erasmus+ network, according to five cluster modalities, East and South European, Mediterranean, Scandinavian, Central European, and North European sub-regions can be seen, with a strong core of the UK and France countries (Figure 3). In 5 cluster modalities, in addition to proximity, it is easier to infer



other factors such as the influence of language, as in the cluster where Germany is located, or ease and expense of living costs, as can be seen in the clusters where Spain, Italy, and Poland are located. Unlike Erasmus+, in degree-seeking mobility, according to five cluster modalities, the influence of proximity looks negligible since, apart from a small cluster of Germany's hinterland, France and Belgium, and Hellenic-speaking Balkan Countries, the whole EHEA is under the heavy influence of the UK's higher education pull effect. It can be inferred that language, sectoral impact of countries, and long-term commitments are at work in the degree-seeking mobility network.

The geographical clustering of countries in degree and credit mobilities indicates intricate behaviours of individuals making decisions for their careers and universities, looking for suitable opportunities for their education and career. Regarding mobility principles of Erasmus+ and competitive sectoral conditions of degree-seeking, a short-term and more pragmatic mobility style can be distinguished from a long-term and more conformist one, which in turn causes a different network structure of countries involved in the exchange of students. Although there is the possibility of equal opportunity for all countries in higher education mobility by definition of EU policies, in the end, the use of these opportunities is based on the individual decisions of students and the institutional policies of the universities. The fact that a network analysis based on which countries within the EHEA send and receive students to which countries and for what purpose also points to the formation of differentiated geographical sub-networks is a situation that policy implementers in this field should consider.

Conclusion and Discussion

Policies developed by transnational organizations covering large geographical areas, such as the European Union, are expected to meet the needs of the entire geographical region and will be sufficient to overcome institutional and regional inequalities. This was the same purpose when creating student exchange policies in higher education. The European Union uses statements in the published reports (EHEA, 2012; European Commission, 2020a) showing no limits or restrictions within the scope of Erasmus+ Program cooperation and that it accepts that the Erasmus Program will be a policy tool for forming the European Higher Education Area. This program assumes that short-term student mobility will occur without restrictions for the European Union program and partner countries. This article investigates whether this is the case by examining official statistics (European Commission, 2020b; UIS, 2022).

In this study, statistics for both credit-seeking and degree-seeking students were included. Diploma mobility is a much more institutional type of mobility that dates back to the founding of universities, and some countries in the world have become centers of attraction in this mobility and expanded their sphere of influence by attracting more international students. Western English-speaking countries such as the UK, USA, etc. have maintained these positions for many years (Altbach, 2004; Altbach & de Wit, 2017; Buckner, 2019; Glass & Cruz, 2023; Kondakci et al., 2018). On the other hand, the Erasmus+ Program, which dates back to 1987 (European Commission, n.d.), is one of the most institutional and widespread programs of short-term mobility, and there is limited research (Breznik & Golgranc, 2014; Breznik & Ragozini, 2015; Derzsi et al., 2011; Gadar et al., 2020; Marques et al., 2020; Van Mol & Ekamper, 2016) on the student flows under this



program. Moreover, the previous research did not intend to find out the geographical clusters in Europe for the Erasmus Program. Therefore, in this study, research was conducted to compare the flow of the degree students with the Erasmus+ ones.

To make this comparison, a social network analysis was applied. This method of analysis is well-applicable to international student mobility research (Gadar et al., 2020; Glass & Cruz, 2023; Kondakci et al., 2018; Yin & Yeakey, 2019) to analyze the mobility patterns and flow of students between the countries and the push-pull factors of student mobility. The results of this study revealed that there is a significant geographical and structural difference between Erasmus+ and degree-seeking mobility in Europe.

In the Erasmus+ network, geographical proximity is significantly influential, causing it to be divided into western and eastern clusters, with some minor differentiation at a higher number of clusters. There are interesting similarities between countries such as Turkey and Poland regarding the number and origin of the students they receive. These findings are quite similar to the research (Stein, 2016) showing that the inequalities between different countries in terms of internationalization are also valid for the European continent (Bulut-Sahin & Brooks, 2023) against the periphery countries. Similarly, Van Mol and Ekamper (2016) also found out that some European capitals are more attractive for Erasmus+ students compared to other European cities.

Whereas in the degree-seeking network, the sectoral centrality of countries is more influential than their geographical positions, rendering the network more heterogeneous at a higher number of clusters. Apart from some minor sub-groups around France, Greece, and Germany, the whole network revolves around the significant



influence of the UK and Western European countries. The dominance of Western countries in international student mobility was also found by some other social network analysis (Glass & Cruz, 2023; Kondakci et al., 2018; Shields, 2013) and some other research using other methodologies (Altbach, 2004; Varghese, 2008; Wadhwa & Jha, 2014). Even the European Commission (2018) defined some Western or Central European countries (e.g., the UK, the Netherlands, Switzerland) as net importers and some Eastern European countries (e.g., Croatia, Poland) as net exporters in terms of degree-seeking mobility.

The analysis of this research showed that there are differing center and periphery country positions regarding different mobility frameworks, and geographical clusters exist for different types of mobility. The centrality of Western Europe is not new for degree-seeking mobility, since students prefer to study in these reputable countries for various reasons, like research capacities (Altbach, 2009). The network analysis for degree-seeking mobility can indicate that "the host university" might be more effective in students' decisions. In other words, degree-seeking students might have more career-oriented choices so that they can target universities located in countries with a central position in the network. It seems that quality and reputation considerations can be seen as reasons for their country preferences.

However, the findings of two clusters for the Erasmus+ mobility scheme are significant, which shows that the equity principle of European Union policy (EHEA, 2012; European Commission, 2020a) should be re-evaluated. Therefore, the results of the study show that policy-makers in the European Union should consider the reasons for these inequalities between different parts of Europe. Moreover, in terms of the Erasmus+ program, student mobility is based on



partnership agreements between the home and host universities (European Commission, n.a.). In other words, the students choose their host country among the signed partnership agreements. Recent research (Bulut-Sahin & Brooks, 2023) revealed that internationalization is nation-bounded, in other words, countries can only make partnership agreements with other countries, and the partnership choices are limited to their country' position. Similar to that, the flow and mobility patterns that were found in this study show that there are limitations for sending students.

This dual mobility pattern might pose some critical challenges for students by limiting study abroad destination choices and achievements. Therefore, there is a need for supra-national and national policy-makers, university leaders, and practitioners to develop new internationalization attitudes to go beyond the limitations of these networks. There are two important lessons to be drawn from this analysis. First, higher education mobility policies can lead to the emergence of unique geographical clustering, which can be revealed using social network analysis as a useful tool for policymaking. Secondly, an integrated policy approach takes both short-term pragmatic mobility preferences and longer-term degree-seeking mobility alternatives into account to allow flexible solutions that can eventually handle mobility inequalities and geographical clusters. This article opens up a new discussion on the current critical internationalization discourse (Critical Internationalization Studies Network, n.d.; De Wit, 2024; Jones et al., 2021; Stein, 2016), which emphasizes the inequalities in international student mobility, adding geographical cluster inequalities to the other inequality issues. As Crăciun & de Gayardon (2021) explain, the spatiality of knowledge



divides the countries as centers and peripheries, and more policies should be developed to de-center internationalization.

This research has some limitations since it only analyzes the patterns of mobility based on official statistics and does not include the voices of students or other stakeholders. Therefore, further research should be conducted to analyze the views of authorities and students to understand the reasons behind certain behaviours of mobility constituting these networks.

References

- Altbach, P. G. (2004). Globalization and the university myths and realities in an unequal world. *Tertiary Education and Management*, 10, 3–25.
<https://doi.org/10.1023/B:TEAM.0000012239.55136.4b>
- Altbach, P.G. (2009). Peripheries and centers: research universities in developing countries. *Asia Pacific Education Review*, 10, 15–27.
<https://doi.org/10.1007/s12564-009-9000-9>
- Altbach, P. G., & de Wit, H. (2017). Trump and the coming revolution in higher education internationalization. *International Higher Education*, 89, 3–5.
- Balaz, V., Williams, A.M. & Chrančoková, M. (2017). Connectivity as the facilitator of intra-European student migration, *Population, Space and Place*, 24, <https://doi.org/10.1002/psp.2101>
- Ball, S. J. (2016). Following policy: Networks, network ethnography, and education policy mobilities. *Journal of Education Policy*, 31(5), 549-566.



- Barkholt, K. (2005) The Bologna Process and integration theory: Convergence and autonomy, *Higher Education in Europe*, 30(1).
- Beine, M., Noël, R., & Ragot, L. (2014). Determinants of the international mobility of students. *Economics of Education Review*, 41, 40-54.
- Bols, A., Nillson, T., (2004), A Revolution at your university?, *Pharmacy Education*, 4(2) pp.103-105.
- Breznik, K. (2017). Institutional network of engineering students in the Erasmus Program, *Global Journal of Engineering Education*, 19 (1).
- Breznik, K., & Goligranc, G. (2014). Erasmus mobility on the institutional level. In *Proceedings for International Conference "Management, Knowledge and Learning"*, (pp. 1361-1366).
- Breznik, K., & Ragozini, G. (2015). Exploring the Italian Erasmus agreements by a network analysis perspective. In *Proceedings of the 2015 IEEE/ACM international conference on advances in social networks analysis and mining*, (pp. 837-838).
- Breznik, K. & Skrbinjek, V. (2020). Erasmus Student Mobility Flows, *European Journal of Education*, 55, 105-117.
- Brooks, R. (2018). Higher education mobilities: a cross-national European comparison, *Geoforum*, 93, 87-96.
- Brooks, R. & Waters, J. (2011). *Student Mobilities, Migration, and the Internationalization of Higher Education*: Springer.
- Buckner, E. (2019). The internationalization of higher education: National interpretations of a global model. *Comparative Education Review*, 63(3), 315-336.



- Bulut-Sahin, B., & Brooks, R. (2023). Nation-bounded internationalization of higher education: a comparative analysis of two periphery countries, *Higher Education Research & Development*, 42:5, 1071-1085, <https://doi.org/10.1080/07294360.2023.2193723>
- Campus France (2020). Major Trends in Student Mobility in Europe. <https://www.campusfrance.org/en/major-trends-in-student-mobility-in-europe>
- Crăciun, D. & de Gayardon, A. (2021). Internationalization in Isolation: COVID-19 Implications, *International Higher Education*, 108, <https://doi.org/10.36197/IHE.2021.108.04>
- Critical Internationalization Studies Network (CISN) (n.d.). <https://criticalinternationalization.net/>
- Cross, R., Borgatti, S. P., & Parker, A. (2002). Making invisible work visible: Using social network analysis to support strategic collaboration. *California Management Review*, 44(2), 25-46.
- Derzsi, A., Derzsy, N., Káptalan, E., & Néda, Z. (2011). Topology of the Erasmus student mobility network. *Physica A: Statistical Mechanics and its Applications*, 390(13), 2601-2610.
- de Wit, H. (2024). 'Everything That Quacks is Internationalization' - Critical Reflections on the Evolution of Higher Education Internationalization. *Journal of Studies in International Education*, 28(1), 3-14. <https://doi.org/10.1177/10283153231221655>
- European Commission (n.d.). About Erasmus+, <https://erasmus-plus.ec.europa.eu/>



European Commission (2018). The European Higher Education Area in 2018: Bologna Process Implementation Report.

https://eacea.ec.europa.eu/national-policies/eurydice/sites/default/files/bologna_internet_chapter_7_0.pdf (Accessed on 25 February 2022)

European Commission (EC) (2020a). The European Higher Education Area in 2020: Bologna Process Implementation Report.

https://eacea.ec.europa.eu/national-policies/eurydice/sites/default/files/ehea_bologna_2020_chapter_05_0.pdf (Accessed on 25 February 2022)

European Commission (EC) (2020b). *Prospective Report on the Future of Transnational Collaboration in European Higher Education*,

Luxembourg: Publications Office of the European Union,
<https://data.europa.eu/doi/10.2766/098140> (Accessed on 25 February 2022)

European Higher Education Area (EHEA) (2012). Mobility Strategy 2020 for the European Higher Education Area (EHEA)

http://www.ehea.info/media.ehea.info/file/2012_Bucharest/39/2/2012_EHEA_Mobility_Strategy_606392.pdf (Accessed on 25 February 2022)

Eurostat (2020). Learning mobility statistics.

https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Learning_mobility_statistics#Key_figures (Accessed on 25 February 2022)

- Gadar, L., Kosztyn, Z.T., Telcs, A. & Abonyi, J. (2020). A Multilayer and Spatial Description of the Erasmus Mobility Network, *Nature*, 7(41).
- Glass, C. R., & Cruz, N. I. (2023). Moving towards multipolarity: Shifts in the core-periphery structure of international student mobility and world rankings (2000–2019). *Higher Education*, 85(2), 415-435.
- Glückler, J. (2007). Economic geography and the evolution of networks. *Journal of Economic Geography*, 7(5), 619-634.
- Hou, C., & Du, D. (2022). The changing patterns of international student mobility: A network perspective. *Journal of Ethnic and Migration Studies*, 48(1), 248-272.
- Hupe, P. L. (2011). The thesis of incongruent implementation: Revisiting Pressman and Wildavsky. *Public Policy and Administration*, 26(1), 63-80.
- Jones, E., Leask, B., Brandenburg, U. & De Wit, H. (2021). Global social responsibility and the internationalization of higher education for society, *Journal of Studies in International Education*, 1-18, <https://doi.org/10.1177/10283153211031679>
- Kondakci, Y., Bedenlier, S. & Zawachki-Richter, O. (2018). Social network analysis of international student mobility: uncovering the rise of regional hubs, *Higher Education*, 75, 517-535.
- Macrander, A. (2017). Fractal inequality: A social network analysis of global and regional international student mobility. *Research in Comparative and International Education*, 12(2), 243-268.



- Marcoux, M. & Lusseau, D. (2013). "Network modularity promotes cooperation", *Journal of Theoretical Biology*, 324, 103–108
- Marginson, S. & van der Wende, M. (2007), "Globalisation and Higher Education", OECD Education Working Papers, No. 8, OECD Publishing. doi:10.1787/173831738240
- Marques, M., Zapp, M., & Powell, J.J.W. (2020). Europeanizing universities: Expanding and consolidating networks of the Erasmus Mundus Joint Master Degree Program, *Higher Education Policy*, <https://doi.org/10.1057/s41307-020-00192-z>
- Mızıkacı, F. (2005). Prospects for European integration: Turkish higher education. *Higher Education in Europe*, 30(1), 67-79.
- Newman, D. (2003). On borders and power: a theoretical framework, *Journal of Borderlands Studies*, 18(1), 13–25
- Newman, M., E., J., & Girvan, M., (2004). Finding and evaluating community structure in networks, *Physical Review E.*, 69, 026113
- Nizzolini, S. (2020). Teacher networking, professional development & motivation within EU platforms & Erasmus+ Program: Teacher network dynamics in the knowledge society. In Zahao, J. (Ed.), *Collaborative Convergence and Virtual Teamwork for Organizational Transformation*, 195-218.
- OECD (2021). Education at a glance 2021: OECD indicators. <https://www.oecd-ilibrary.org/sites/5a49e448-en/index.html?itemId=/content/component/5a49e448-en>
- OECD (2022). International student mobility (indicator). doi: 10.1787/4bcf6fc3-en (Accessed on 25 February 2022)



- Prague Communiqué (2001). Ministerial Conference.
<https://www.ehea.info/page-ministerial-conference-prague-2001>
- Pressman, J. L., & Wildavsky, A. (1984). Implementation: How great expectations in Washington are dashed in Oakland; Or, why it's amazing that federal programs work at all, this being a saga of the Economic Development Administration as told by two sympathetic observers who seek to build morals on a foundation (Vol. 708). Univ of California Press.
- Reichardt, J. & Bornholdt, S. (2008). "Market segmentation: the network approach: insights into a giant online market", *Understanding Complex Systems*, 19–36.
- Rhodes, R. A. (1997). *Understanding governance: Policy networks, governance, reflexivity and accountability*. Open University.
- Shields, R. (2013). Globalization and international student mobility: A network analysis. *Comparative Education Review*, 57(4), 609–636.
<https://doi.org/10.1086/671752>
- Stein, S. (2016). Rethinking the ethics of internationalization: Five challenges for higher education, *UCLA Journal of Education and Information Studies*, 12(2), 10.5070/D4122031205
- Souto-Otero, Manuel, Jeroen Huisman, Maarja Beerkens, Hans De Wit, and Sunčica Vujić (2013). "Barriers to international student mobility: Evidence from the Erasmus program." *Educational Researcher* 42, 2, 70-77.



- Teichler, U. (1996). Student Mobility in the Framework of ERASMUS: Findings of an Evaluation Study. *European Journal of Education*, 31(2), 153–179. <http://www.jstor.org/stable/1503594>
- Teichler, U. (2002). Erasmus in the Socrates programme. *Findings of an evaluation study*. Bonn, Lemmens.
- Ter Wal, A.L.J., & Boschma, R.A. (2009). Applying social network analysis in economic geography: framing some key analytic issues. *Annual Regional Science*, 43, 739–756
<https://doi.org/10.1007/s00168-008-0258-3>
- UNESCO Institute of Statistics (UIS) (2022, February 25). Glossary. <http://glossary.uis.unesco.org/glossary/en/home>
- Van Damme, D. (2001). Quality issues in the internationalisation of higher education. *Higher Education*, 41, 415–441.
<https://doi.org/10.1023/A:1017598422297>
- Van Mol, C. & Ekamper, P. (2016). Destination cities of European exchange students, *Geografisk Tidsskrift-Danish Journal of Geography*, 116:1, 85-91, DOI: 10.1080/00167223.2015.1136229
- Watson, P. (2009). Regional themes and global means in supra-national higher education policy. *Higher Education*, 58, 419-438.
- Yin, M., & Yeakey, C. C. (2019). The policy implications of the global flow of tertiary students: a social network analysis. *Oxford Review of Education*, 45(1), 50-69.

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