



# Student Mobility Management System and Business Intelligence Solution for Higher Education Institutions

## Yükseköğretim Kurumları İçin Öğrenci Hareketlilik Yönetimi Sistemi ve İş Zekası Çözümü

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**Abstract:** Erasmus+ is a form of mobility supported by the European Union that provides education and internship opportunities at another contracted university abroad, subject to the agreements that university students and even faculty must adhere to. This way, international education opportunities are provided, and in addition to cultural exchange and integration, the goal is to increase international cooperation. This mobility is critical to its students' career development. While managing student mobility is straightforward for universities with a small number of programs, it can become complicated and time consuming for universities with a large number of faculties and institutes, and thus students. Our study proposes an information system for managing this complexity effectively. Prior to modeling, the developed information system was successfully run, with the goal of managing the process effectively. The study shares user experiences, critical points in the needs analysis process, developed processes and user roles, as well as screenshots of developed systems and their tasks. The findings indicated that administrators in universities welcomed such practices, and that effective management was provided for universities with intensive programs, particularly those with difficult-to-coordinate and dispersed campuses. By incorporating business intelligence technology into the developed system, it is ensured that educational technologies used in higher education institutions are up to date. No study has been identified in the literature that comprehensively evaluates the learning mobility process and connects the subject to current technologies.

**Keywords:** Erasmus, higher education, international student mobility, information system, business intelligence.

**Özet:** Erasmus+, Avrupa Birliği tarafından desteklenen, üniversite öğrencilerinin hatta personellerinin buldukları üniversitelerinin tabi olduğu anlaşmalar ile yurtdışındaki bir başka anlaşmalı üniversitede eğitim ve staj fırsatı sunan bir hareketlilik türüdür. Bu sayede uluslararası eğitim olanağı sağlanmakta, kültürel paylaşım ve entegrasyon yanında, ülkeler arası işbirliğinin artırılması hedeflenmektedir. Bu hareketlilik öğrencilerinin kariyer gelişiminde önemli bir yere sahiptir. Öğrencim hareketlilik sürecinin yönetimi az sayıda programa sahip üniversiteler için kolay olurken, çok sayıda fakülte ve enstitüye, dolayısı ile öğrenciye sahip üniversiteler için karmaşık ve yönetilmesi güç bir hal alabilmektedir. Çalışmamız bu karmaşıklığın etkin bir şekilde yönetimi için bir bilgi sistemi önermektedir. Geliştirilen bilgi sistemi, modelleme öncesi başarılı bir şekilde çalıştırılmış, sürecin etkin bir şekilde yönetilmesi amaçlanmıştır. Çalışmada, kullanıcı deneyimleri, ihtiyaç analizi sürecindeki kritik noktalar, geliştirilen süreç ve kullanıcı rolleri, geliştirilen sistemlerden ekran görüntüleri ve görevleri sistematik olarak paylaşılmaktadır. Bulgular, üniversitelerde bu tür uygulamaların yöneticiler tarafından olumlu karşılandığını, yoğun programlara sahip özellikle koordinasyonu zor ve dağınık kampüslere sahip üniversiteler için etkin bir yönetimin sağlandığını göstermiştir. İş zekası teknolojisinin geliştirilen sisteme entegrasyonu ile eğitim teknolojileri anlamında güncel bir teknolojinin yükseköğretim kurumlarında kullanılması sağlanmaktadır. Literatür incelendiğinde öğrenim hareketlilik sürecini, kapsamlı bir şekilde değerlendiren, güncel teknolojiler ile konuyu kapsamlı bir şekilde paylaşan bir çalışmaya rastlanmamıştır.

**Anahtar Kelimeler:** Erasmus, yükseköğretim, uluslararası öğrenci hareketliliği, bilgi sistemi, iş zekası.

## 1. Introduction

Due to the chances, they provide for students, exchange

programs, in which students meet classmates from different cultures and nations and learn in a different setting, are crucial in terms of gaining experience and building

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interpersonal skills. These programs, which go by various names like Erasmus, Mevlana, and dual diploma programs, are carried out under the auspices of bilateral agreements between institutions. Different program and department levels that offer curricula in various areas can be split down into agreements. These programs are in high demand, especially at large universities with a large number of programs and students, hence application and admission processes are quite difficult. In addition to the basic difficulties of managing applications, quota allocations, and student admissions, monitoring the efficiency and efficacy of both students and agreements is a critical administrative problem to overcome. Students, for example, expect to be able to take advantage of these chances in a fair and equal manner in the applicable institution for mobility.

The beginning conditions are maintained by national agencies of European Union (EU) countries, as well as the quotas and cash supplied to higher education institutions by these organizations. As a result, the institution's future stages of the process should proceed in the same manner, with the help of methodical approaches, processes, and a system to support them. The study's goal is to suggest a business intelligence (BI)-based monitoring system as a solution to the described challenge in this setting.

The dashboard components of the reporting system developed within the business intelligence platform include summary reports, performance indicators, and visuals to monitor the number of students participating in which program and student mobility based on faculty, program, or campus, as well as agreements and related statistics within the institution's relevant mobility period. We can now handle massive volumes of data and extract information in real time thanks to advancements in information and communication technologies. We can extract relevant and actionable information from databases using data mining technologies. Business intelligence technology employs a range of strategies for extracting data's information and making optimum use of it.

Instant situation evaluation, process management, and effective decision-making can all be accomplished by linking the core database directly to such a reporting platform. The study uses hypothetical data to demonstrate the applicability of the built system, providing a good practice example for the application of cutting-edge technology in higher education institutions. Despite the fact that the report components were created expressly for the problem, the tools and platforms used to create the reports are general-purpose and serve as a model for developing an effective monitoring mechanism for other processes in higher education institutions. Many procedures, including educational operations, have been carried out online and on digital platforms in recent years, making it easy to collect and store essential data. As a result, building databases, data warehouses, and business intelligence-based support systems to extract usable

information from these data has become quite simple. When study is assessed from this perspective, also offers a technical framework for monitoring other processes.

## 2. Importance of the Study

For years, numerous different institutions in European countries have participated in Erasmus student mobility. Although there is various research on Erasmus mobility in the literature (Mirici et al., 2009; Ersoy, 2013; Boya-ci, 2011), no study that completely assesses the learning mobility process and shares its application with current technology in this area has been found. The developed application allows users to analyze and evaluate the number of bilateral agreements as well as the diversity of students who benefit from mobility. In terms of educational technologies, it is clear that participation in studies in this area in the literature is advantageous to higher education institutions' efficacy.

There has been a rapid growth of digital technologies in today's knowledge society. In ways that were unimaginable even a few years ago, digital technology has become an integral part of contemporary education (Selwyn & Facer, 2014). The incorporation of ICT into teaching and learning, colloquially referred to as educational technology, has evolved into a critical component of general education, particularly in developed countries (Smeda et al., 2018). This change and transformation are becoming increasingly necessary for all societies on a daily basis (Pates Sumner, 2016). Higher education institutions are investing in a variety of educational innovation initiatives, many of which incorporate a variety of technologies (Gasevic et al., 2019). This occurs throughout the educational system, from kindergarten to higher education.

Furthermore, the use of current technology in higher education institutions in terms of educational technologies has been exposed to discussion thanks to this application realized through business intelligence technology. In terms of the language in which it was published, the study has a global significance. Simultaneously, it can be mentioned that it provides a valid evaluation not only for EU countries, but also for many networks that carry out international student mobility, as well as the rule makers and administrators in these networks.

## 3. Purpose of the Study

As of the 2021 academic year, 617 universities in France, 459 universities in Germany, 379 universities in Poland, 280 in United Kingdom, 266 universities in Spain, than there are more than two hundred higher education institutions operating in Turkey after Spain (Statista, 2021). Student mobility directly concerns many universities across Europe and many students who receive undergraduate, graduate and doctoral education in these universities. For this mobility, which is sustained by the national agencies funded by the EU and the quotas and funds provided by these agencies to higher education ins-

tutions, it is considered important that students benefit from these opportunities in a fair and equal manner in the relevant institution.

Mobility achieved through bilateral agreements is of critical importance for university students and students' individual career development. It is considered important that students benefit from these opportunities in a fair and equal manner in the relevant institution for this mobility, which is maintained thanks to the national agencies of the countries of the EU and the quotas and funds provided by these agencies to higher education institutions. With this fact, the research is able to monitor the agreements that students are entitled to during the relevant mobility period, to report information such as how many students go to which program, and enables the management of student mobility based on faculty, program or campus. With the support of database management and business intelligence technologies, this study attempts to address the basic research issue of how a reporting system could be developed to monitor and manage international mobility processes at higher education institutions.

#### 4. A Brief Evaluation of Erasmus Mobility and Turkey

The Erasmus Higher Education Program was established to support or develop higher education policies for EU members and applicants, to enable higher education institutions to engage in short-term student and personnel mobility, and to produce and implement cooperative projects with one another (Taylan, 2021).

In terms of education and culture, the Erasmus Program makes a significant contribution to Turkey's integration with the EU (Demirer, 2015). The Erasmus+ Program, which began in 1987-1988 with 11 countries and 3.244 students, was first intended exclusively for the mobility of higher education students, but it eventually expanded to include vocational education, adult education, school education, youth, and sports. The Erasmus+ Program, which has been in place for more than 30 years and funds approximately 10 million people to travel to another European country for activities such as education, internships, volunteer work, and professional development, has gone through several stages (Adanır & Susam, 2019).

Higher education students can study or train at a company, and higher education personnel can study or train overseas, thanks to this training. EU Member States, Iceland, Liechtenstein, Norway, North Macedonia, and Turkey are among the 34 Erasmus+ Program countries. All other countries in the globe are considered partner countries. Turkey, which has one of Europe's highest levels of student mobility in higher education, was first included in the process in 2004 under the Erasmus program, and the number of students engaging in the mobility has increased practically every year since then. By sponsoring education, training, youth, and sport, Eras-

mus+ promotes education and youth systems while also increasing employability. Between 2014 and 2020, Erasmus+ will provide opportunities for 3.7 percent of young people in the EU to study, volunteer, or acquire professional experience in another country. This program is managed by national agencies formed in each country (Turkish National Agency Website: <https://www.ua.gov.tr/>) (EU Commission, 2019).

The Erasmus Program was created to improve the quality of higher education while also expanding the European dimension. In four aspects, it can be classed as inbound or outbound: student mobility, internship mobility, teaching mobility, and staff training mobility. The transition will occur as institutions open up to the outside world, enhance their relationships with other universities, and ensure student and teaching staff mobility.

The Erasmus Program is said to be the first large European program in this field, with specific goals in higher education. Despite the fact that the Erasmus Program is part of the Socrates Program, it is a far older program. Since 1976, research to promote inter-university ties have been conducted, according to the report. Between 1976 and 1986, cooperative study programs were formed to promote university partnerships by allowing academic staff and students to exchange. These research set the foundation for the Erasmus Program to be established (Ağrı, 2006).

International student mobility, which is one of the most important issues of internationalization for higher education institutions, has become an area where countries and higher education institutions all over the world have focused and developed policies in the 1980s, according to Arkalı-Olcay & Nasır (2016). It was founded in 1987, they said, to facilitate the mobility of its employees and to stimulate the European higher education industry. They also claimed that the international student economy has grown rapidly in the previous 20 years, and international student admittance has become a global competitive field for governments and academic institutions seeking to enhance their share of the growth.

Kasalak (2013) found that while participants in the Erasmus staff mobility lecturer mobility program faced challenges in terms of foreign language, nutrition, transportation, and climate, they benefited in terms of foreign language development, learning about different cultures, and understanding the educational system. Furthermore, the reasons for Turkey's participation in this study include: building a network to develop joint projects, gaining experience abroad, learning about different countries, cultures, universities, teaching staff, and educational systems, and strengthening academic relations and professional development.

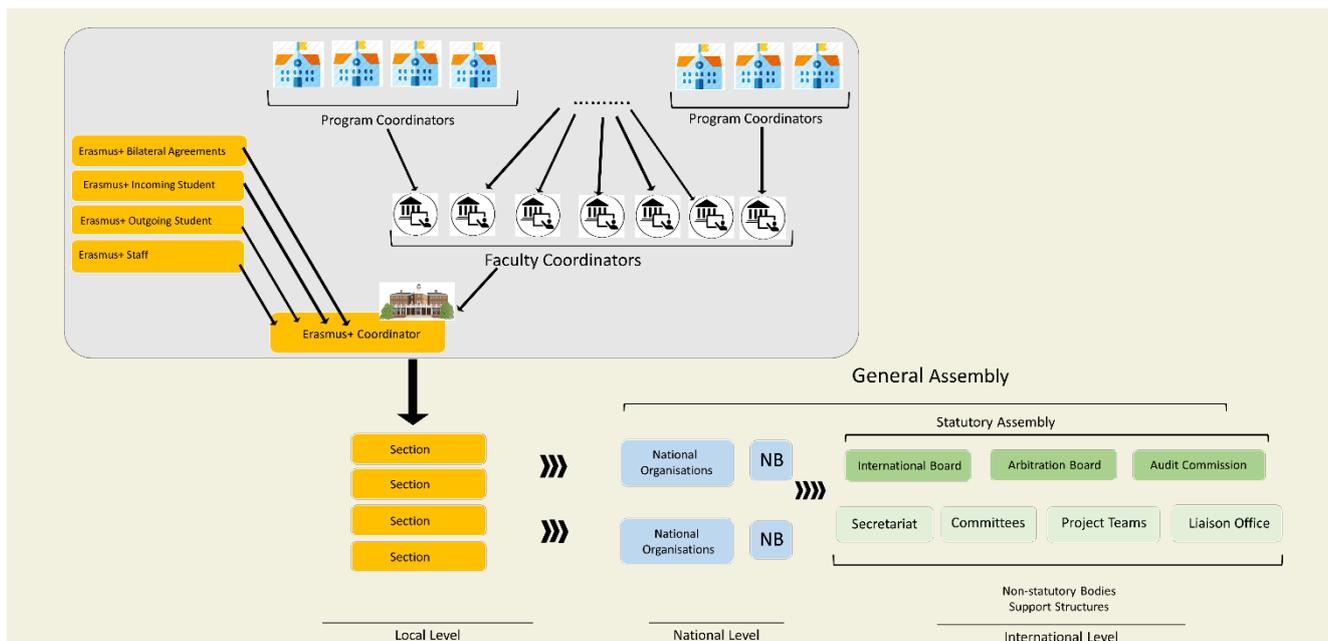
According to Baykara & Kuzulu (2021), students who will participate in the learning mobility program, which accounts for the majority of Erasmus mobility, can be

granted the right to benefit from mobility through an election made by the university where they are registered, as long as they meet certain military requirements. The first of these requirements is that the student is enrolled as a full-time undergraduate, graduate, or doctorate student. The second requirement is that the student have a cumulative grade point average of at least 2.20 on a 4-point scale at the undergraduate level and at least 2.50 on a 4-point scale at the graduate or doctorate level. The student must also have an appropriate European Credit Transfer and Accumulation System (ECTS) credit load for learning mobility, which is becoming increasingly crucial with the Bologna process (Özmen et al., 2015). Of course, depending on exceptional circumstances such as handicap or past involvement, the scoring and registration restrictions for entry may differ.

The following are the key concepts that the EU's education policy are based on (Duman, 2002; Ağrı, 2006). Multiculturalism, mobility, universal education, professional knowledge, global openness, interactive teaching methods, continuous education/lifelong education, education for a unified Europe, reciprocal experience sharing, learning society/information society. Figure 1 depicts an intra-university Erasmus mobility organizational structure for Turkey, as well as a holistic framework that involves foreign stakeholders in the process. The Erasmus Mobility program is coordinated by universities in Turkey's Foreign Relations Coordinatorship. To accommodate this worldwide student movement, many colleges have diverse organizational systems. In addition, not only Erasmus Mobility, but also the Foreign Relations Coordinatorships within our universities coordinate the Farabi student exchange program in Turkey and the Mevlana student exchange program around the world. Since this is the point we focus on in our Erasmus Mobi-

lity research here, the organizational structure for Erasmus Mobility is taken as a reference, leaving out other types of mobility. For the structure shown in Figure 1, Marmara University Foreign Relations Coordinatorship (MUUIAIO, 2021) was taken as reference, with the thought that it reflects the general structure in Turkey and the most appropriate structure that can meet the needs.

In 2019, Turkey received grants of 83 million Euros from mobility in the sectors of higher education, vocational education and training, school education, adult learning, and youth for 1,333 projects and 44,953 participants. In terms of outgoing students, Turkey's international mobility situation was evaluated in the following years: 2014-2015 (students:12.2006, trainees:2.672, students and trainees:0, total:14.678), 2015-2016 (students:12.964, trainees:3.111, students and trainees:104, total:16.179), 2016-2017 (students:13.303, trainees:3.586, students and trainees:119, total: 17.008), 2017-2018 (students:13.834, trainees:4.017, students and trainees:106, total:17.957), 2018-2019 (students:13.131, trainees:4.188, students and trainees:142, total:17.461). For students coming in for semesters as part of Erasmus mobility, the scenario is the same: 2014-2015 (students: 6.603, trainees:1.340, students and trainees:0, total:7.943), 2015-2016 (students:5.793, trainees:1.153, students and trainees:524, total:7.470), 2016-2017 (students:2.222, trainees:812, students and trainees:529, total:3.563), 2017-2018 (students:2.007, trainees:1.096, students and trainees: 418, total:3.521), 2018-2019 (students:2.721, trainees:1.450, students and trainees:408, total:4579). Staff mobility is a different sort of Erasmus mobility. The number of incoming and outgoing staff by years in Turkey can be expressed as follows: 2014-2015 (outgoing: 2.757, incoming: 2.206), 2015-2016 (outgoing: 2.772, incoming: 1.520), 2016-2017 (outgoing: 3.334, incoming: 1.199), 2017-2018 (outgoing: 3.244, inco-



**Figure 1.** Erasmus + Local, National and International Levels General Structure

**Reference.** Derived from the ESN Annual Report, 2020. The Internal Erasmus Mobility Organizational Structure and a Holistic Structure of a University for Turkey have been revealed.

ming: 1.958), and 2018-2019 (outgoing: 3.244, incoming: 1.958). While Marmara University, Anadolu University, and Yıldız Technical University are the institutions sending the most students, Poland, Germany, and Spain are the nations that accept the most students from Turkey, respectively (EU Commission, 2019).

According to data from ESN Annual Report (2020) data, in general, the income of Erasmus Student Network for 2019-2020 mobility is 1,193,147€ (membership fees: 57,920€, services: 269,895€, public funding: 684,031€, sponsorship: 79,736€, others: 101.565€), expenses (staff: 357.730€, headquarters: 237.093€, network services: 49.151€, events & meetings: 124.608€, projects: 317.416€, others: 17.490€) are 1.103.573€. Budget condition by year: 523 thousand in 2015, 882 thousand in 2016, 1.133 thousand in 2017, 980 thousand in 2018, and eventually 1.193 thousand in 2019, as previously announced. 1,000 higher education institutions across Europe that are partners in the Erasmus + program have involved 350,000 students in this process.

Higher education institutions were given 31,963,311 € in the 2021 application period by the Turkish Ministry of Foreign Affairs, Directorate for EU Affairs, Turkish National Agency, Higher Education Coordinator. This budget has a total of 20.000.000 € set out for Student Study Mobility. Higher education institutions received 40,079,502 € in funding for the 2020 application year, including 26,530,000 € set out for learning mobility (KA131, 2021). When the results of the Mobility in Higher Education Projects for the 2021 Application Period are analyzed, it is clear that there is a significant competition for education, internship, and training mobility of personnel among Turkey's more than 200 universities. Although there are substantial disparities between newly formed institutions and well-established universities in terms of sharing the resources defined on the National Agency's website (KA131, 2021 can be viewed).

In fact, in this case, the best and most efficient use of the given cash and learning mobility opportunity is required. As a result, the requirement for each university to employ this process effectively and efficiently inside its own institution occurs within the structure that demonstrates interaction from the international structure to the national structure. The research presented solves this gap by presenting a methodology and practice for internal dynamism and resource management that is applicable not only to Turkey but to other Erasmus+ mobility universities.

## 5. Business Intelligence (BI) and Higher Education

In the education industry, as in all other sectors, advances in information and communication technologies necessitate the adoption of cutting-edge technology tools. This situation can be attributed to both sector competitiveness and the desire of managers, who have now become

stakeholders in the sector, to perform a good job and continue their operations by making smart judgments based on information. This is not simply a factor that gives the educational system a competitive advantage. Managers who have authority over various aspects of education, including students, teachers, budgets, activities, resources, and processes, will guarantee that their operations are not only efficient and sustainable, but also that the service provided is integrated. Zulkefli et al. (2015) stated that due to the increasing amount of data collected and distributed from universities, internal and external sources, new technical and managerial approaches are constantly sought for better use of existing data and information. He stated that it enabled him to develop innovative tools to collect data. At this point, business intelligence technology emerges as a digital tool that is fed by many systems and can be used at different decision levels at the operational, tactical and strategic level.

Hasan et al. (2016) assessed Higher Education's readiness for business intelligence solutions across three dimensions: organizational (strategic alignment, information technology partnership, education requirements and policies, management and leadership), technological (technical readiness, data source and information), and social (decision process engineering, culture around use of information and analytics, continuous process improvement culture). BI has indicated that it has considerable potential to turn data from distributed and diverse sources into valuable information to help institutional decision making, management, and strategic planning, as it is a vital tool for higher education institutions.

According to Guster & Brown (2012), BI stands out as a very promising alternative for much-needed operational efficiency in higher education. According to León-Barraño et al. (2015), education management requires knowledge management in order to give a strategic and forward-looking perspective, as well as effective and efficient people and material resource management. It also encompasses other levels, according to them, such as marketing, particularly in administration, student monitoring, teacher monitoring, general budget and expenditure monitoring, and market opportunity evaluation.

According to Santi & Putra (2018), the future of business intelligence will necessitate the use of multiple technologies to realize the design, the first of which is the technique (Data Mining, Viable System Model, Learning Analytics), and the second is the tools or products derived from the technology. In addition, his contributions to higher education include resource sharing, evolve knowledge, quality improvement for managerial decisions, innovation in research and development, educational initiative improvement, prediction of behavior, resource efficiency and effectiveness, competitive improvement, consumption trends, and a new model of assessment.

When looking at the literature on business intelligence technology and higher education institutions, the fol-

lowing topics come up: its applications (Hamad, 2021), improve performance in higher education (Abduldaem & Gravell, 2021), model to evaluate some national higher education (Khatibi et al., 2020; Ülker & Coşkun, 2021), analyzing educational data (Villegas-Ch et al., 2020), data and information for student admission process (Mirwansyah & Sari, 2021), governance framework in a university (Niño et al., 2020), quality management of higher education institutions (Pérez -Pérez, et al., 2018), performance measurement (Vallurupalli & Bose, 2018), course management systems (Van Dyk & Conradie, 2007), providing a framework and component dedicated for university's management (Muntean et al., 2011). Higher education and business intelligence studies have been conducted in a variety of disciplines, as may be shown.

When it comes to the internationalization of today's higher education institutions and the need for graduating students to be compatible with international qualifications and skills, as well as international working conditions, the use of current technology, such as information systems and business intelligence, in a very popular mobility process, within the framework of the research questions created, contributes to the digital transformation of higher education. It might also be claimed that it will contribute significantly to improved adaptability.

## 6. Implementation and Methodology

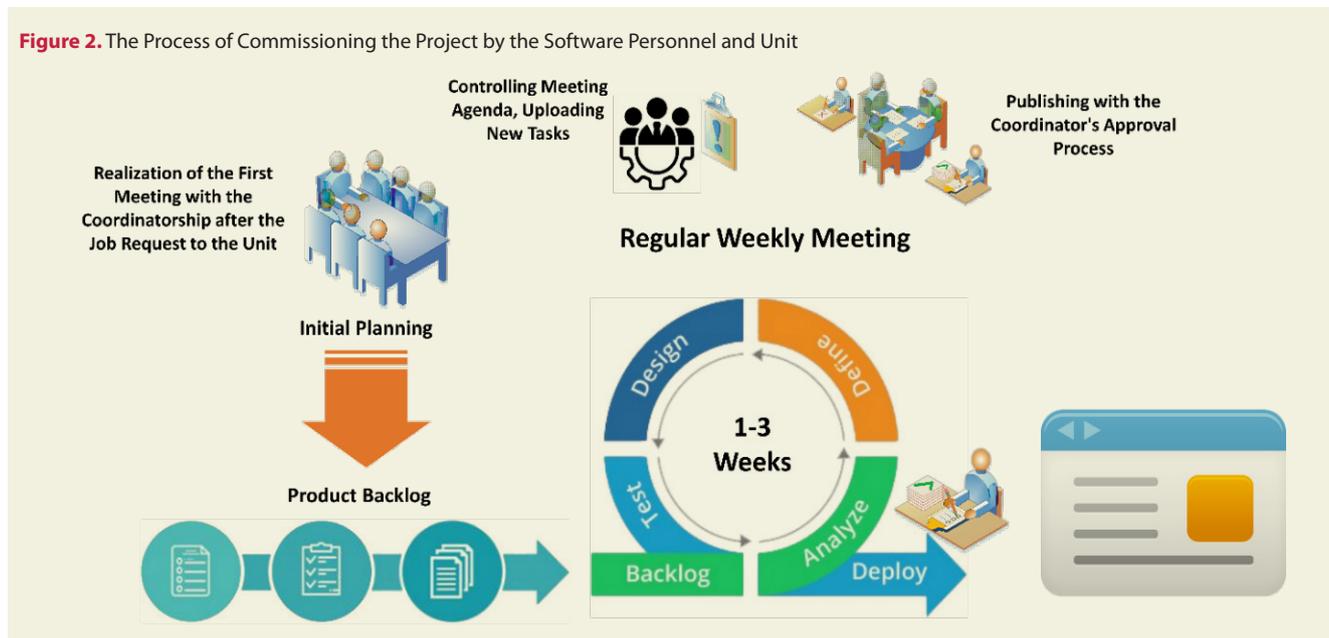
In the study, the modeling of the application, which has been successfully run in the Erasmus learning mobility process for the 2019-2020, 2020-2021 education period, in a university for bilateral agreements, and the process has been managed effectively, is discussed so that it can be applied to other universities.

The developed application provides the opportunity to analyze and evaluate the number of bilateral agreements and the texture of the students benefiting from the mobility. In addition, in the application to be modeled, Mic-

rosoft Power BI technology was used for the visualization and analysis of the data stored in the Oracle database, and it was requested to talk about the possibilities of this current technology for higher education institutions, especially for administrators and rule makers, and to discuss the subject. Demo data are used in the application process of the design and presentation of the study.

Although a random software methodology seems to have been applied in the management of the software process in the implementation, the project bears similarities with the scrum methodology at the macro level and considering the way the project is progressed. Scrum management is the most popular and current application development framework in software engineering. It is based on the assumption that many modern software projects are quite complex and it would be difficult to plan them all from the beginning (Cervone, 2011; Ma'arif et al., 2018; Moe et al., 2010). The most basic feature of the Scrum methodology is that it is observer, developer and iterative. Not all scrum functions and roles fit well due to being a small team. However, the program is similar to the methodology in terms of backing up the data, designing the screens around a round table with the users, revising them in line with possible feedback, completing the program through step-by-step feedbacks, finalizing it and publishing it. It can be stated below that the realization process of the project coincides with the principle of observation in terms of unit approval, testing and implementation process and its step-by-step implementation in small parts, and the principle of transparency by recording every meeting and process.

After each software delivery, the screens and the developed software were revised with user requests. In this respect, it coincides with the harmonization principle of the scrum software methodology. Of course, different people or people can be assigned for many different roles, such as in a professional software company, and people can specialize in certain subjects. In fact, this situation cons-





titutes the basic feature of a real scrum methodology. In public institutions, sometimes more than one role can be undertaken by a single person. The whole process can be developed by a software personnel, meetings, screen designs, commissioning of applications, recording of user feedback and management of all these processes can be carried out by a single person. In this respect, it coincides with the random expression. Although in principle such methodologies can be operated, in reality they are not

fully functional. This is a quality-enhancing feature for effective project output, it can prevent the desired quality perception from appearing as output at the end of the project.

In the study, a detailed and effective reporting process of an information system and the implementation of this process are explained in the methodology section, and the experience gained, the outputs of the application are

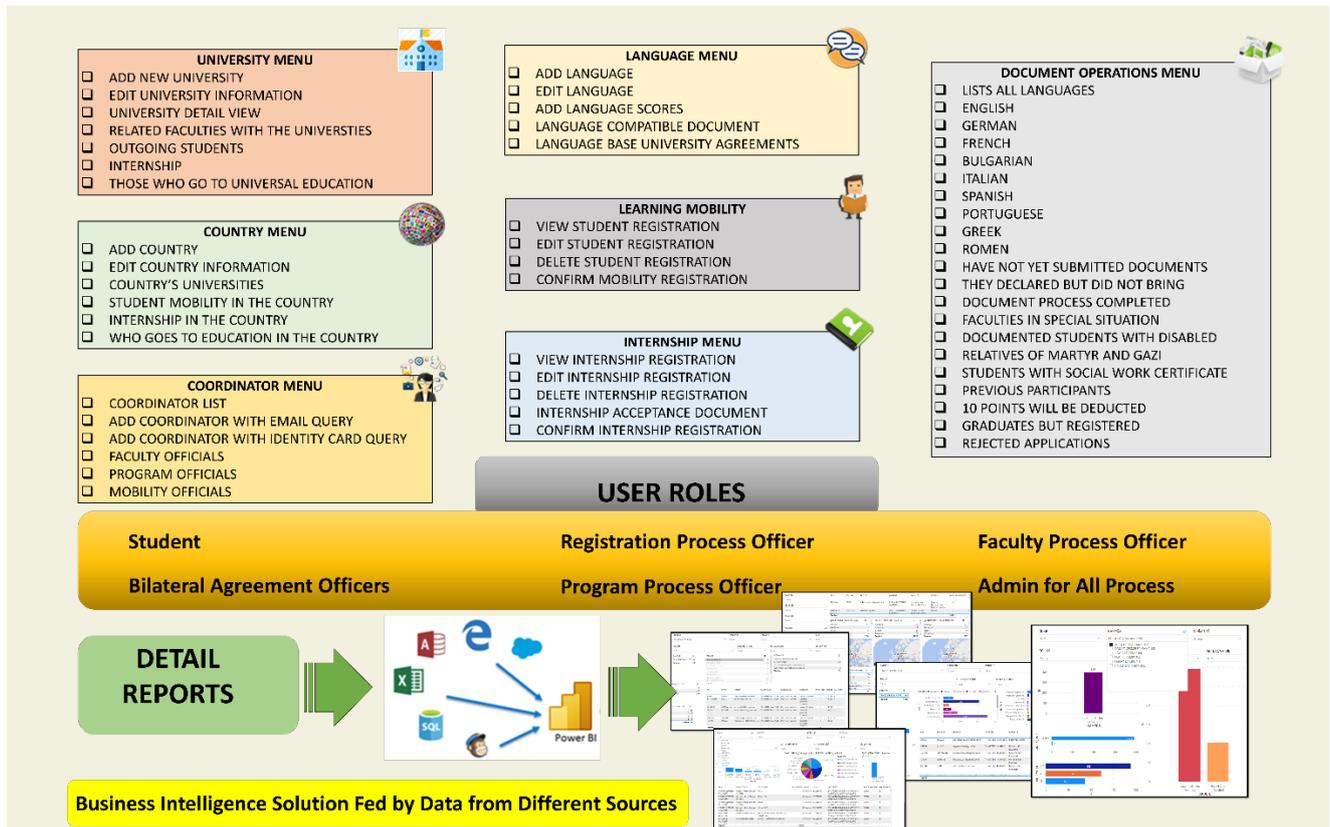


Figure 3. Program Menus and Business Intelligence Solution

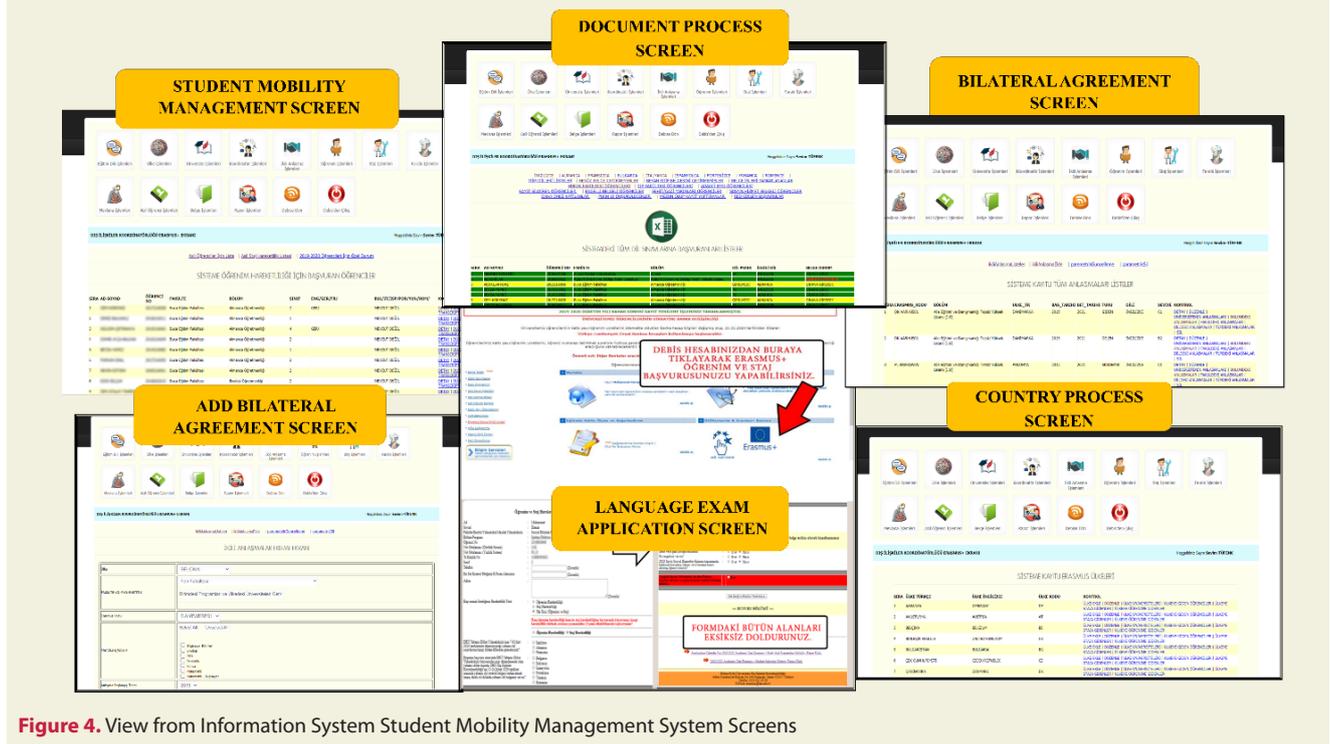


Figure 4. View from Information System Student Mobility Management System Screens

expressed in the conclusion section, the importance of the subject and the evaluation of its place in the literature are expressed in the discussion section.

## 7. Results

In the light of the findings, it provides an effective bilateral agreement management for institutions with dispersed campuses and universities with intensive programs and departments, where such practices in higher education institutions are very positive for administrators. The fact that bilateral agreements and student densities can be seen on a unit basis has led to the questioning of the qualifications of the faculty or department coordinators of the administrators in this job that they do with secondary or tertiary priority. The study reveals whether students who graduate from programs that provide foreign language education, such as English language literature, German teaching, and American culture, benefit more from mobility, and whether students benefit from student mobility in programs like medical school or engineering faculty, where they enter with high scores. It has also been noted how beneficial this mobility has been during the master's and doctoral programs. The produced application's and business intelligence solution's program menus are detailed below.

The general view of the developed application is shown in Figure 4 below from the bilateral agreement addition screen. Each menu has different tasks (such as adding bilateral agreements screen, country transactions, registered universities and country codes, coordinator transactions, agreement transactions, language exam management of applicants, student registration management screen.) and the purpose of these screens is to ensure a healthy education and internship mobility. The way it is operated is to ensure that the institution takes this process with minimum effort. As stated in the methodology section during the development process of the software, the screens were not delivered to the relevant unit as a whole. The screens are designed 2-3 times, step by step, taking into account user feedback and experience, even in some steps that may negatively affect the experience or reduce user performance. The most essential of these is the screen for adding bilateral agreements, which takes a long time for users. The fact that colleges have bilateral agreements with one another does not imply that all students would be able to move around. As a result, this scenario becomes inextricable and difficult, especially for institutions with many faculties or institutes.

As previously noted, the agreements include reference data not just for outgoing students but also for new students. Quotas based on agreements at the undergraduate, graduate, or doctorate level, as well as the expiration dates of these agreements, can be significant and helpful to institution administrators. As a result, it's worth noting that all of these aspects, from the periodicals through the project completion process, become an input that improves the project's quality by taking into account user

experiences.

Another element that senior management may want from the developed information system is an excellent reporting system that allows them to see the process efficiency and texture in general. This is only possible if the data gathered from diverse sources provides answers to some questions. These can be reclaimed in the following way:

- How many applications did the department submit?
- How many students applied for learning mobility from each department?
- How many students from which department have applied for internship mobility?
- How many students from which department have been successful in language exams?
- How many students from which department were denied the opportunity to study abroad owing to the quota despite satisfying all of the requirements?
- Which faculties/programs/departments provide the most intensive learning mobility to their students in terms of years?
- How many agreements does each department have with which universities?
- Is there a program or, if we go even further, a faculty or a institutions that does not have an international department agreement?
- What is the distribution of the Erasmus budget among the departments and faculties that benefit from it?
- Which countries or universities are the most popular among students?

These concerns can, of course, be raised further. For these questions to be answered, not only the data obtained from the information system data, but also the periodic screens presented by the National Agency to the foreign relations coordinator of the universities (See: Mobility Tool+) and the data that can be obtained from these screens can attract the attention of the administrators. For this reason, these data, which can be obtained in Excel, provide important information to units and unit managers, especially about corporate budget management. Figure 5 depicts the application that was created using the Microsoft Power BI tool.

The business intelligence solution built was used to get answers to all of these queries. The Microsoft Power BI application is used because data can be exported in multiple forms such as Excel or CSV from a variety of dif-

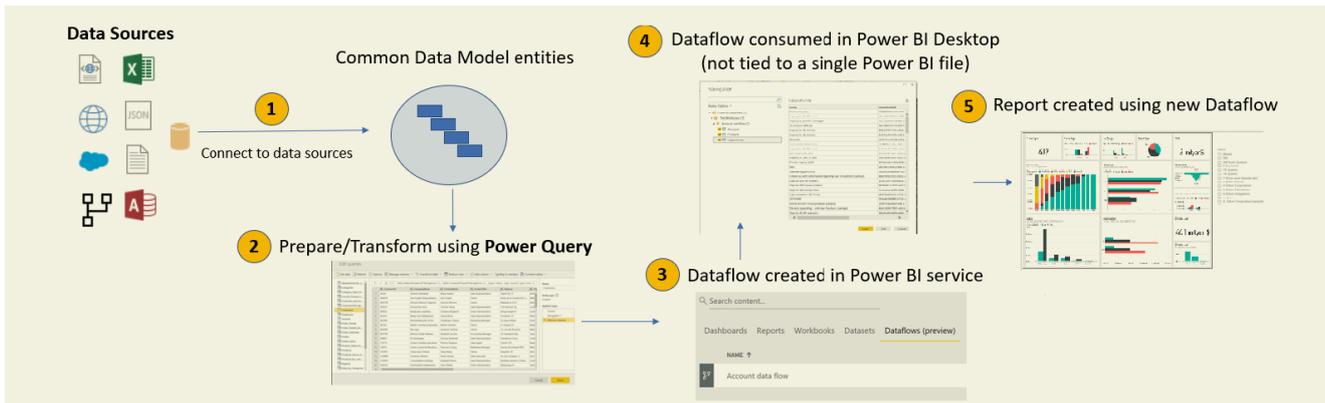


Figure 5. Microsoft Power BI Report Generation Process

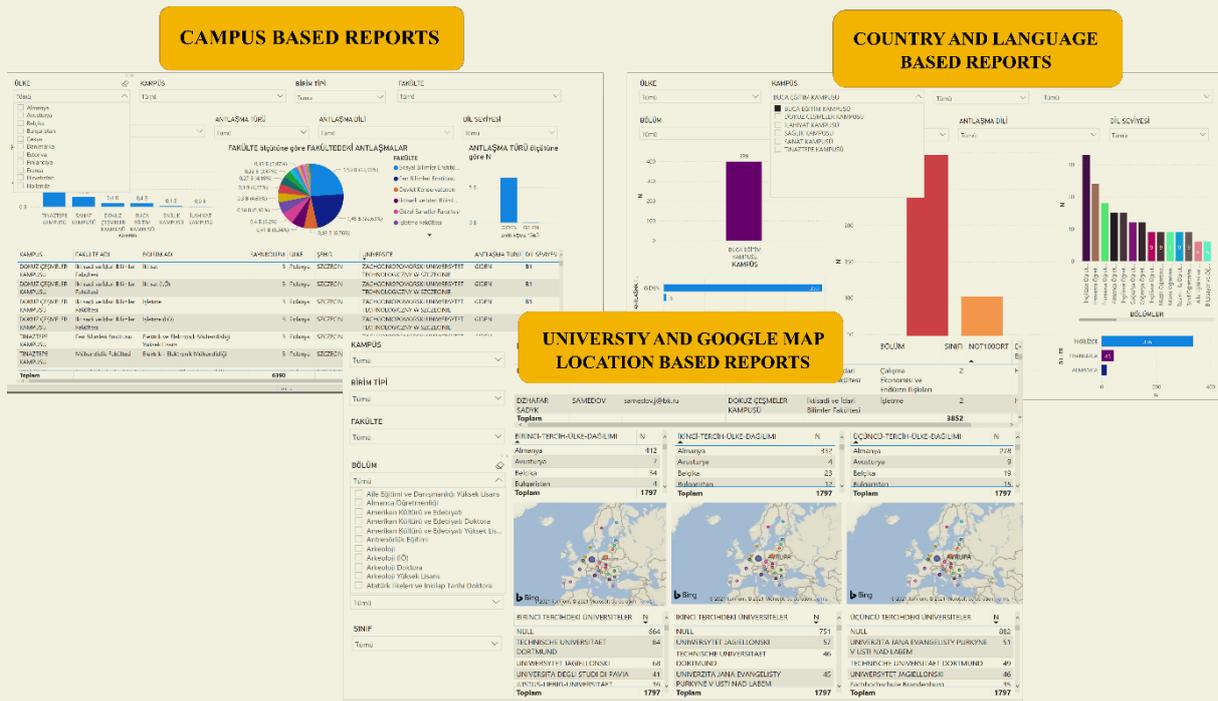


Figure 6. View from Business Intelligence Application Screens

ferent information systems (National Agency Mobility Tool + Application, University information systems) and processed with this technology. This is highly important for managers and officials at institutions, and it makes this technology even more helpful for better process management.

## 8. Discussion and Conclusions

According to Muntean et al. (2011), using business intelligence for decision support in university administration is one method to see business intelligence in the context of the educational environment in business operations carried out in higher education institutions. He underlined that while using business information in this manner, a set of relevant criteria should be employed, and that identifying and monitoring key performance criteria is critical for university management. Recognizing this fact for the completed project, the needs analysis process was overcome through interviews conducted at various times with the goal of determining which reports the manager

might request, as well as the implementation of an online registration and record management system application. After that, using business intelligence technologies, reports were made with the same reality and awareness.

Kasalak (2013) proposes that, within the scope of the general conclusions established based on the research findings, the conditions for academic personnel to benefit from this program be determined. Instructors said that assessments should be conducted in a fair, transparent, and impartial manner while participating in this program. He noted that the European Union Erasmus Offices of universities, in particular, have significant duties in this regard. The Student Mobility Management System and Business Intelligence model, which we introduced in our research, makes the Erasmus mobility process clear to students. Keeping numerous logs in the process of removing or changing records, or noting what action was performed by whom, for example, many improper paths are closed by users during this process. It highlights how such methods can result in more transparent and equi-

table student-staff mobility. The processes under control and control, as well as improvement and making strategic and tactical decisions, create a good foundation for effective resource management.

According to the findings of Özdemiş & Kafkas (2010) and Saban et al. (2019) explained. Students' understanding of the Erasmus student learning mobility program is insufficient even after ten years. There could be a variety of causes for the lack of student information. Poorly executed, tough, and complex application processes are one of them. Furthermore, it is possible to count not being able to obtain effective news or not making announcements for Erasmus mobility processes from many locations. Students can easily apply for student mobility and be informed about their processes thanks to this system and business strategy. During their daily learning lives, these stages were surmounted with a system configuration incorporated into the notes viewing screens and userfriendly panels. There is research in which processes are successfully operated, and computerized, students control their processes with simple 2-3 clicks and forms that they can quickly fill, and are handled with an effective announcement system in order to raise awareness. The quizzes, midterms, homework, and final exams that students enter the system with a single click using the same application or system are the subjects they check most successfully and frequently (Özdemiş & Kafkas, 2010; Saban et al.)

For all institutions, the ideal solution is believed to be the design and digitalization of processes using well-structured systems in conjunction with proper system and needs analysis. The research undertaken in this field indicates how all institutions, not just those in Turkey's higher education system, but also those in other European Union member nations that participate in the Erasmus mobility process, can handle the Erasmus mobility process most effectively. Both the sharing of information systems and the transfer of acquired expertise are significant outcomes of the study that are highly valued by the countries with which the network is connected.

It should not be forgotten that the overarching goal of student mobility is to foster a feeling of European identity and citizenship, to secure European integration, and to facilitate cross-cultural interaction within Europe (González et al., 2011). This achievement can be portrayed as a shared achievement for all countries, as a result of their membership in the European Union and their contribution to development through an educated young population. Erasmus learning mobility has a significant impact on the lives of students in a variety of ways. According to Cushner & Mahon (2002), students who participated in the program developed a more positive attitude toward various cultures and developed a sense of freedom and bravery. According to Önder & Balcı (2010), students contribute to their personal growth by being conscious of their own prejudices, improving their ability to make new acquaintances through improved communication,

and developing foreign language skills.

According to Özden (2013), the linguistic abilities of students who participated in the program improved significantly. According to Ünal (2011), students who participate in this mobility program have an easier time finding work. Orhan (2005) claimed that ensuring equal access to education throughout the country as part of the European Union process will benefit the country's development and progress, and that educating people is the most critical aspect in building the economy.

Ekmen (2017) may be engaged in certain individual career preparations while they are in the early stages of their careers or during their undergraduate years. The most critical of these preparations is on-the-job training for students who continue their education beyond high school. These on-the-job training opportunities, often known as internships, can provide insight into where students will begin their professional paths following graduation. This program, in addition to assisting students in gaining work experience in a multicultural business environment, enables students to acquire foreign activities relevant to their profession through applied work experience. Additionally, according to Bracht et al. (2006), it aids students in developing international abilities by placing them in international professional roles. According to Parey & Waldinger (2007), the participant increases the likelihood of working overseas later in life. Indeed, this way, the groundwork for an international workforce and workforce circulation oriented toward the European Union can be laid, as well as a foundation for recognition and adaptation (Parey & Waldinger, 2011).

According to Göksan et al. (2011), personnel exchange benefits include the opportunity to learn and acquire practical skills through knowledge and experience transfer, to develop necessary skills through exposure to the experience and best practices of another institution, to learn about different cultures, to introduce their own culture, and to provide self-confidence and motivation for self-renewal. The benefits of internship mobility include engagement in the business world, work and professional relationships made after graduation, the ability to find work in their own country or abroad, teamwork, and skill development. As a result, open and competent management of such a lucrative migration process is valued.

Considering the fact that Turkey is a developing country and the place of higher education institutions in Turkey in the world ranking systems (Damar et al., 2020; Damar et al., 2021), it is obvious that Turkey should get as much share as possible from the outgoing and incoming student pie. Breznik & Skrbinjek (2020), in their study on Erasmus learning mobility, study the countries where students roam (1) good receivers and senders (Spain, Italy, and Germany), (2) good receivers only (Finland, Sweden, the United Kingdom and Portugal) and (3) good senders only (Belgium and the Czech Republic).

Similar to the related study, Breznik et al. (2013), in his evaluations on student mobility in the 2007-2011 periods; Portugal was categorized as a good receiver and a good sender; Denmark and Ireland as good receivers only, whilst the Netherlands, Austria, and Poland were identified as good senders only. Turkey is not particularly notable among these countries. Benefiting fully and efficiently from this type of foreign mobility will enhance our students' knowledge and experience, as well as stimulate their international ties and interaction. Additionally, we are open to improving this type of mobility, which aspires to Europeanize and shape European culture through the activities of young people, and in which Turkey's population density cannot be compared to other nations (such as Netherlands, Austria, Denmark, Ireland).

Teichler (1996) stated that student mobility is not a new phenomenon, and experts have stated that it is a natural and ongoing situation since medieval universities. In the 20th century, talented, wealthy and adventurous students are also studying abroad for some or all of their education. Students from developing nations may wish to pursue studying in wealthier countries with superior tertiary education in order to improve their prospects. Given Turkey's status as a developing country, it's easy to see why our students fall into this category as well, and why the gap between students who applied for Erasmus student or internship mobility and outgoing students is so wide.

For these reasons, it is advised that higher education institutions improve their process management and more efficiently, transparently, and fairly allocate scarce resources in the areas of Erasmus learning, internships, and staff mobility. Due to the implementation and the model offered, institutions had access to supporting data for a variety of strategic decisions and identified opportunities for development. Appropriate actions in this regard can be listed as follows; making new agreements, extending the existing ones, replacing the coordinator who is inactive and unable to ensure the international

effectiveness of the department's program, making equal budgets between the programs as much as possible, etc.

In terms of educational technology, it can be claimed that include works in this area in the literature benefits higher education institutions by allowing them to profit more effectively from information technologies and raising awareness. Additionally, this program, which was developed using business intelligence technology, ensured that educational technologies utilized in higher education institutions were up to date. It has been feasible to obtain a wealth of information using the built application, such as whether there is a homogeneous distribution of programs in bilateral agreements and whether there are disparities across programs within the same faculty. Reports and dashboards, which are created using business intelligence technologies from unintelligible data flowing through normal operations in daily life, have long been seen as critical by users and management.

Higher education institutions in Turkey host small software teams, these teams mostly develop their software from scratch and continue their activities in the form of software maintenance, mostly by putting out the applications purchased from outside or with a long-term motivation for many years. This situation is probably considered to be the same in many European countries. In fact, it can be stated here that the Scrum methodology has a good infrastructure for higher education institutions to enable the projects carried out with the classical or arbitrary software methodology and to make the applications more user-oriented.

The global coronavirus pandemic has presented significant challenges to higher education institutions in both developing and developed nations (Waghid et.al., 2021). This developed system has also ensured that Erasmus Mobility mobility is minimally affected by the epidemic process, especially in the COVID19 process, by making many groping processes online-contactless.

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