

# The Brain Drain of IT Professionals: Register Evidence of Non-Return Graduates from Türkiye

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## Abstract

In this paper, the brain drain of Information Technology (IT) graduates from Türkiye is examined on the basis of graduation departments by ISCED classification, country and gender. The register data sets belonging to a total of 63,787 IT graduates were obtained from the Ministry of Interior, the Council of Higher Education and the Directorate-General of Population and Citizenship Affairs. The brain drain ratio of Turkish IT graduates was determined as %11.4 through the data of 7,284 non-return IT graduates in the year 2020. To our knowledge, this paper is the first register evidence-based study that sheds light on the brain drain of IT graduates from Türkiye.

*Jel Codes: F22, J24, J61, O15*

*Keywords: Brain drain, human capital flight, higher education, IT professionals, Türkiye.*

## Bilişim Uzmanlarının Beyin Göçü: Türkiye'ye Geri Dönmeyen Mezunların Kayıt Bulguları

### Özet

Bu çalışmada; Türkiye'deki bilişim teknolojileri (BT) mezunlarının beyin göçü; ISCED sınıflandırmasına göre mezun olunan bölümler, ülke ve cinsiyet bazında incelenmiştir. Toplam 63.787 bilişim mezununa ait idari kayıt verileri İçişleri Bakanlığı'ndan ve Yükseköğretim Kurumu'ndan, yurt dışı ikamet bilgileri ise Nüfus ve Vatandaşlık İşleri Genel Müdürlüğü'nden temin edilmiştir. Türkiye'de lisans eğitimi aldıktan sonra yurt dışına giden ve Türkiye'ye geri dönmeyen 7.284 bilişim mezununa ait veriler analiz edilerek, beyin göçü oranı %11.4 olarak hesaplanmıştır. Bildiğimiz kadarıyla çalışmamız, Türkiye'de idari kayıtlara dayalı olarak yapılan, bilişim teknolojileri (BT) mezunlarının beyin göçü oranlarına ışık tutan ilk çalışmadır.

*Jel Sınıflandırması: F22, J24, J61, O15*

*Anahtar Kelimeler: Beyin göçü, insan sermayesi kaybı, bilişim uzmanları, eğitim, Türkiye.*

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## 1. Introduction

With recent improvements in Information Technologies (ITs) and the emergence of knowledge as a strategic production factor in information societies, IT professionals, who have theoretical and analytical knowledge and focus on brain power rather than manual skills and muscle power (Drucker, 1994), have become the main strategic contributors for countries. Therefore, the demand for skilled IT professionals in the intense competition of today's high-technology-driven global markets remains strong. Consequently, both talent attraction and retention strategies for IT professionals at the company and country level have been the subject of considerable research.

Meanwhile, since the end of the cold war, the freedom of movement of not only entrepreneurs, raw materials, capital, but also of labour and information has increased tremendously around the world. Together with the advantages of freedom of movement, an increasing number of IT professionals are working outside the traditional on-site work places. They prefer working from home or another location remotely connected to a central office through internet (Beno, 2018). Therefore, flexibility of location such as home/tele/remote working in the new digitalized business environment of today, allows IT professionals to find jobs from companies both in their own countries and abroad. In this regard, knowledge-based high-tech countries have been willing to accept an increasing number of foreign professionals and students through offering remote (in the home country) or hybrid (any place) work to fill their shortage of skilled manpower and thereby sustain their innovation-based economic growth (Tansel & Güngör, 2003).

**Purpose of the Study and Research Questions.** It is essential to provide well-equipped universities, academic staff, accommodation and financial support for the youth in tertiary education. No less significant than providing all these needs for university students is to provide decent work opportunities after their graduation in order to retain high-skilled youths in the country. Therefore, harmonizing higher education outcomes with the needs of the national labour markets is critical. At this point, it is also significant to determine which IT fields experience brain drain to which countries and to what extent.

Overall, this study based on registered records of IT graduates between 1993 and 2020 presents the findings of the emigration rates of IT graduates from Türkiye in terms of year, destination country, department and gender. IT departments are determined according to the International Classification for Organizing Education - Fields of Education and Training (ISCED-F 2013). Furthermore, since this paper focuses on the brain drain of recent IT graduates, work and workplace expectations of the youth and current working conditions in the Turkish IT sector are also discussed. In addition to these, to what extent gender affects the status of being abroad is also examined. The research questions of this study are listed below.

- 1) What are the working conditions of IT professionals in Türkiye?
- 2) Which countries are the most preferred destinations for Turkish IT graduates to immigrate to?
- 3) Which IT departments experience more brain drain in Türkiye?
- 4) Does the brain drain ratio of IT graduates differ according to gender?

## 2. Brain Drain

The term ‘brain drain’ was coined firstly within a report by the Royal Society of London in 1963 in the context of the immigration of British scientists to the United States and Canada in the early 1960s (Köser-Akçapar, 2006). The term of brain drain is every so often used to define emigration of physicians, healthcare professionals, scientists, engineers or financial professionals (Gibson & McKenzie, 2011). Beine, Docquier and Rapoport (2001) defined brain drain as not merely the migration of engineers, doctors, scientists or other highly skilled individuals, but simply, the emigration of a fraction of the population that is relatively highly educated as compared to the average.

McKenzie (2011) underlines that skilled labour migration has grown considerably, approaching unskilled immigration. Rapoport and Docquier (2006) stated the following in support of this view: the number of skilled migrants moving from developing countries to developed countries has increased dramatically over the past decades. This trend is likely to continue in the future, as a result of growing wage differentials and different demographics between the countries. Various common causes such as political instability, low quality of life, limited access to healthcare and lack of economic opportunity accelerate brain drain among new graduates (Gibson & McKenzie, 2011).

Brain drain, also known as human capital flight, is traditionally considered as the movement of high-skilled individuals from their home country to more developed countries with the purpose of having better work and life conditions. In general, brain drain has long been viewed as detrimental to the growth potential of developing countries. This is due to the fact that, expertise is lost with each emigrant, reducing the human capital and supply for the profession in the source country (Gibson & McKenzie, 2011). Apart from that, as opposed to the majority of migration types, brain drain is a kind of selective process. Skilled people without any necessity to migrate, do so because they perceive opportunities from abroad (Lee, 1966).

Brain drain could be classified into three dimensions: ‘brain export’, ‘hidden brain drain’ and ‘virtual brain drain’. Brain export, one of the most common types of brain drain, means exporting skilled and well-qualified brains to another country physically. Another dimension is the hidden brain drain, indicating the working of individuals in their home countries but for multinational enterprises. Lastly, virtual brain drain is a form of remote working of individuals without changing their country of residence (Yılmaz, 2020). This type of brain drain has gained popularity, particularly after the outburst of the Covid-19 pandemic. *Non-return students/graduates* who reside abroad after completing their bachelor or postgraduate studies can be considered a form of brain export (Tansel & Güngör, 2003).

As a large emerging economy, there have been a several number of studies about the brain drain from Türkiye (Aksoy, 2012; Atılğan, 1986; Atmaca, 2020; Aytaç & Aydın, 2019; Bakırtaş & Kandemir, 2010; Başaran, 1972; Erkal, 1980; Gülmez, 1974; İyi, 2020; Kaya, 2019; Köser-Akçapar, 2006; Rüzgar, 2020; Tanrısevdi, Durdu, & Tanrısevdi, 2019; Tansel & Güngör, 2003; Tezcan, 1971; Yılmaz, 2020). Nevertheless, some of these papers are lacking empirical data and more significantly none of these papers have used administrative data to evaluate brain drain from Türkiye. This paper is the first study which analyses the brain drain from Türkiye through register evidence of non-return bachelor degree IT graduates.

Indeed, having a better understanding of the new generations’ expectations about life, work, and workplace is essential to develop retention or attraction strategies for the youth. Furthermore, IT labour market conditions in the origin country are also significant determinants

for new IT graduates to consider migration. In this regard, current IT labour market conditions in Türkiye and the nature of recent IT graduates are discussed in the coming section.

### 3. IT Professionals and IT Labour Market Conditions

**New Generation IT Professionals.** Information Technologies (IT) is a comprehensive concept that includes technologies related to the management and processing of information in all aspects. IT was first introduced to world literature as a concept by *Harvard Business Review*. Harvard University has explained the concept of IT as programming general-purpose computer operations and performing various tasks including design, implementation, development and management of computer-based information systems, computer hardware and software applications. IT professionals are responsible for designing, developing, supporting and managing computer software and hardware and information networks, including the internet (Aksoy, 2012). An IT professional is a person who finds algorithmic processes that transform, create and define information and formulate them with appropriate abstract methods. In order to become an IT professional, it is expected to earn a bachelor's degree in a computer-related field such as information technology and information systems, computer science, information science, systems and network administration, software engineering, cybersecurity, electrical and electronics engineering, and industrial engineering (Kariyer.net, 2022).

Even though a bachelor's degree may be the most common level of education required to become an IT professional, it is not compulsory to complete an IT degree to become an IT professional. Some employers prefer to hire applicants who do not have a bachelor's degree in IT but those have earned master's degrees in computer science, information systems and software engineering or related areas. Additionally, it is also possible to gain experience in IT after graduating from some other degrees related to IT such as maths, physics, statistics etc. Apart from these, some individuals could gain expertise in IT through experience and receiving worldwide acceptable certificates without having a bachelor's degree. Consequently, IT professionals can be examined in two groups; those who have graduated from information technology degrees, and those who have graduated with different degrees and gained competence with a certificate (Fogle, 2020). Nevertheless, since the administrative data used in this paper covers merely bachelor's degree graduates, those who have become IT experts without having a university degree are out of the scope of this paper.

In terms of business life, generation Y consists of individuals who were born between 1982 and 1996, avoid routine work, have many different personal abilities, are more educated and give importance to flexibility (Güngör, 2013). It is essential to leave an area of initiative to these knowledge workers in matters such as the procedures and timing to be followed in order to carry out the duties assigned to them (Newell, Robertson, Scarborough, & Swan, 2002). Davenport, Jarvenpaa, and Beers (1996) argued that knowledge workers enjoy dealing with the complex and uncertain tasks rather than daily routine tasks. For these reasons, it is stated that knowledge workers demand autonomy in order to use their talents at the highest level due to the nature of their work. These individuals do not see the workplace as a breadwinner to work for a lifetime like previous generations. For the new generations, an employer is a knowledge tenant who rents out the knowledge workers' own knowledge. Generation Y IT professionals, as knowledge workers, perceive individual knowledge, skills and abilities as a kind of reason for existence. For these reasons, IT professionals tend to change their existing workplaces or migrate to other countries when they find an organization that values them and can use and increase their knowledge and experience better (Metin, 2020).

**IT Labour Market in Türkiye.** With the growth of the IT sector around the world, the investments made by countries and companies in the field of IT have reached significant dimensions. Considering the per capita IT expenditures of countries, Ireland ranks first with \$3,500, followed by the United States with \$3,400, England with \$3,000, Germany and Japan with \$2,500. In Türkiye, the share of IT based occupations is around 1.6 per cent among all occupational groups. While this rate is around 4 per cent in the USA, it is 3.5 per cent in Germany and 3.1 per cent in France (Ministry of Family, Labour and Social Services of Turkey, 2014). These rates draw attention to the need for highly a skilled workforce in the field of IT particularly in developed countries.

The IT sector is one of the fastest growing sectors in Türkiye (TurkStat, 2021a). Parallel to the growth of the IT sector, the number of people trained in IT in Türkiye increases every year. According to the Turkish Higher Education Council database the total number of people received education in the field of IT in Türkiye reached 135 thousand in 2020. The numbers draw attention to the growth in human capital in IT (Metin, 2021). Moreover, when the Annual Industry and Service Statistics data published by TURKSTAT is compared between 2017 (TurkStat, 2018) and 2020 (TurkStat, 2021a), the IT workforce increased from 201,829 to 218,527. The 10% increase in the number of people employed in the IT field in Türkiye within three years is noteworthy in a positive way.

Even though the number of IT graduates, the IT workforce and IT investments raised in Türkiye, there are several fundamental problems that exist in the Turkish IT sector. One of the most significant problems in the Turkish labour force market is *the high unemployment figures among the youth* between the ages of 15-24, which reached 25 per cent in April 2021. While the youth labour force participation rate is 43 per cent, the employment rate among them is 32 per cent. When all age groups are examined, the unemployment rate in Türkiye is 12.9%. The number of unemployed people increased by nearly half a million compared to the same month of the previous year and reached 4 million. In the same period, the employment rate was 44.2% and the number of employed people was 28 million. 54.2% of the total employment was realized in services, 21.3% in industry, 18.0% in agriculture and 6.4% in construction (TurkStat, 2021b). Considering these figures, it is obvious that one out of every four young people who were in transition from education to employment was unemployed. Double-digit unemployment figures in the Turkish labour market may especially lead the highly qualified young workforce to seek alternative job opportunities abroad.

A further key challenge in the Turkish IT sector that needs to be addressed in the shaping of a sustainable work future is the skills mismatch issue. *Skills mismatch* refers to a lack of matching between the skills that are in demand by employers and the skills that are available in the labour market. Despite the increasing number of trained youths in the field of IT, many graduates are challenged to find jobs due to over or under skilled graduates (vertical mismatch) or firms not attracting the right skills, or skill gaps situations where there is a lack of adequately skilled people (McGuinness, Pouliakas, & Redmond, 2017). A study conducted by the Informatics Industry Association of Türkiye (TUBİSAD) and DELOITTE, in which 168 employers participated from the Turkish IT sector, indicated that 59% of the employers stated that the most significant problem in the sector is the shortage of skilled IT labour (TUBİSAD; Deloitte, 2017).

On the other hand, a considerable number of highly qualified IT professionals in the Turkish public sector have the intention to quit their jobs due to lack of opportunities to further develop their knowledge and skills (Metin, 2021). In fact, high-skilled professionals consider non-financial characteristics of the job such as self-growth, self-actualisation and being able to take initiative while performing their duties as much as financial rewards (Albertsen et al.,

2010). Career development opportunities, flexible working conditions, managerial support, and team collaboration emerge as central considerations of knowledge workers regarding job satisfaction (Vinas-Bardolet et al., 2020). Therefore, IT professionals who do not receive the social support they expect from their organisations and/or managers, such as (a) feeling valued and appreciated, (b) acting with autonomy and initiative, (c) participating in training and development activities to enhance their skills, can easily have the intention to quit their current job (Metin, 2021). From a macro perspective, when there is a lack of highly qualified jobs in a country, a highly-skilled labour force struggles to find jobs equivalent to their skills. In this case, these individuals may consider leaving their home countries by taking advantage of the job opportunities abroad with the purpose of improving their skills and working and living conditions (Metin, 2020).

An additional problem in the Turkish IT sector is that *Turkish currency tumbled (Are the italics on purpose?)* as much as 350% against the dollar between January 2018 and January 2022. Despite the increase in salaries in Turkish lira, the annual wages of IT employees decreased from 22,000\$ (TurkStat, 2018), to 14.000\$ (TurkStat, 2021a) within four years. There has been a massive decrease of 8,000 dollars in average annual wages, which accounts for a 35 per cent loss. This situation may have triggered turnover intentions of IT professionals to seek available job opportunities abroad since 2018. Consequently, the IT labour market in Türkiye has become much 'cheaper' in terms of 'labour input costs' compared to Western European and North American countries. In 2018 and 2019, companies from Western Europe and North America began to make intensive job offers via LINKEDIN to qualified IT specialists employed in companies such as ASELSAN, HAVELSAN, TAI and TUBITAK, most of which operate in the defence industry. Following these job offers, the brain drain of qualified IT workers, in both public and private sectors, to western countries has accelerated. In order to slow down the brain drain, aggressive salary increases of up to 50% in Turkish lira were made to IT professionals particularly in the companies mentioned in 2018.

Despite the considerable efforts made by organizations and countries in different sectors to retain qualified IT workers, these employees continue to change workplaces or go abroad due to several reasons mentioned in the previous paragraphs. Meanwhile, the absence of alternative job opportunities is a further macro parameter influencing labour markets. Because world markets are digitizing with great momentum, this creates new employment opportunities in the field of IT. Therefore, the absence of alternative job opportunities, particularly abroad, is not considered a valid factor for IT professionals. Overall, the brain drain of IT professionals has been the subject of considerable research. In the next sections of this paper, the brain drain of IT graduates in Türkiye will be examined on the basis of country, gender, university department and years.

#### 4. Method

The administrative data sets in the current research are obtained from two public sector institutions of the Republic of Türkiye. Data on residence abroad is transferred from the Turkish Ministry of Interior, the Directorate General of Population and Citizenship Affairs. Data on higher education graduates is transferred from the Turkish Council of Higher Education. The target group for the analyses are individuals registered in the Registration System of Turkish Citizens Abroad, a database system under the Central Population Administration System (MERNIS). The education and residence data belonging to individuals who have graduated from IT departments in Türkiye between the years 1993 and 2020 are integrated in relational databases. Micro analyses are carried out on individual basis by matching anonymized versions of unique personal identification numbers (TC Identification number) in the two data sets.

Consequently, the final integrated dataset contains the graduation departments and dates of Turkish bachelor's degree graduates, as well as the time periods in countries they resided in.

A first and foremost limitation in the database is that the Registration System of Turkish Citizens Abroad is based upon the voluntary application of Turkish citizens living abroad. The citizens are not necessarily obliged to register in the system through Turkish embassies and consulates. Nevertheless, they do apply to be registered in the system so as to maintain citizenship affairs such as compulsory military service for male citizens, voting for the parliamentary and presidential elections, marriage and divorce transactions, etc.

The statistical unit of the analyses is bachelor's graduates (ISCED 6th level) from universities under the responsibility of the Turkish Higher Education Council. These higher education institutions include all 207 universities in Türkiye. ISCED is the reference international classification for organising education programmes and related qualifications by levels and fields. ISCED 2011 contains the levels of education and has been implemented since 2014 by European countries. ISCED-F 2013 contains the fields of education and training and has been implemented since 2016 (EUROSTAT, 2022).

Since this paper focuses on the brain drain, more precisely the "brain export" of highly skilled individuals, an assumption regarding non-returned student is made: a bachelor's degree graduate has been abroad more than seven years is considered as non-return. The assumption of seven years is made according to Table 1. ISCED 2011 Levels and Durations in Higher Education. As stated in Table 1, master's or equivalent level studies typically completed between 1-4 years when following ISCED level 6 is a bachelor's degree. Doctoral or equivalent level studies take between 4-7 years directly following a bachelor's degree (OECD, 2017). Therefore, the assumption of seven years covers both master and doctoral level studies after completing a bachelor's degree. It was assumed that a significant part of those who were abroad for a short period of time could be eliminated through the assumption of seven years. Consequently, Turkish citizens who have completed a bachelor's degree in Turkish universities and have been abroad more than seven years are considered non-returned graduates in this research.

For the year 2020, for instance, the denominator for the analyses are the number of 63,790 IT bachelor's graduates (ISCED level 6) of universities under the responsibility of CoHE between the years 2004-2013, except open and distant education graduates for the calculation of brain drain rates of IT graduates in the year 2020. The denominator for each year is calculated through taking the interval back one year. For instance, the brain drain rate for the year 2019 is calculated through considering 6,621 IT bachelor's degree graduates living abroad in 2019 among 57,518 individuals who graduated between 2003-2012.

**Table 1.** ISCED 2011 Levels and Durations in Higher Education

ISCED 2011 Levels		Typical (Most Common) Duration
6	Bachelor's or equivalent level	3-4 years directly following ISCED level 3
7	Master's or equivalent level	1-4 years following ISCED level 6
8	Doctoral or equivalent level	4-7 years directly following ISCED level 6

Source: (OECD, 2017)

After the identification of non-returned students according to ISCED 2011 levels, IT and IT-related bachelor's degree programmes are also identified according to ISCED-F 2013

classification. In this classification, bachelor's degree programmes starting with 06 codes are accepted as IT departments (Please see Table 2. ISCED-F Codes of IT Departments).

**Table 2.** ISCED-F Codes of IT Departments

ISCED-F Code	Description
06	Information and Communication Technologies
061	Information and Communication Technologies
0611	Use of Computer
0612	Database and Network Design and Administration
0613	Software and Applications Development and Analysis
0619	Information and Communication Technologies, not Elsewhere Classified
068	Inter-Disciplinary Programs and Qualifications Involving Information and Communication Technologies
0688	Inter-Disciplinary Programs and Qualifications Involving Information and Communication Technologies

After examining the Turkish Higher Education Council data, it is noticed that a number of graduations from 0611, 0612, 0619 and 068 ISCED-F coded programs are considerably limited. The total number of IT graduates from these programs stands for less than 1% among all 06 coded programs. Additionally, more than 99% of the IT students have graduated from only 0613 ISCED-F coded *Software and applications development and analysis* departments. Therefore, the programs under the ISCED-F codes of 0611, 0612, 0619 and 068 are ignored due to their significantly limited total share that is less than %1 among all IT graduates. Additionally, 0714 ISCED coded *Electronics and Automation* departments were included due to their relevance to informatics. This is due to the fact that some of the fundamental IT programs such as computer engineering, electric and/or electronic engineering departments are given 0714 ISCED-F codes in the Turkish Higher Education Council database. IT and IT Related Departments in the Turkish Higher Education Council database according to the ISCED-F classification are listed in Table 2.



**Table 3.** IT and IT Related Departments in the Turkish Higher Education Council Database

ISCED-F Code	Department
0613	Computer Sciences
0613	Computer Technologies and Information Systems
0613	Computer and Information Systems
0613	Computer and Informatics
0613	Software Engineering
0613	Management Information Systems
0714	Computer Sciences and Engineering
0714	Computer Engineering
0714	Informatics Systems Engineering
0714	Informatics Systems and Technologies
0714	Biomedical Engineering
0714	Electrical and Electronic Engineering
0714	Electronics Engineering
0714	Electronics and Communication Engineering
0714	Control Engineering
0714	Control and Automation Engineering
0714	Mechatronics Engineering
0714	Microelectronic Engineering
0714	Telecommunications Engineering

In the coming section the results of the brain drain of IT graduates from Türkiye are shared by years of migration, by departments of graduation, by countries of destination, and by gender breakdown.

## 5. Results

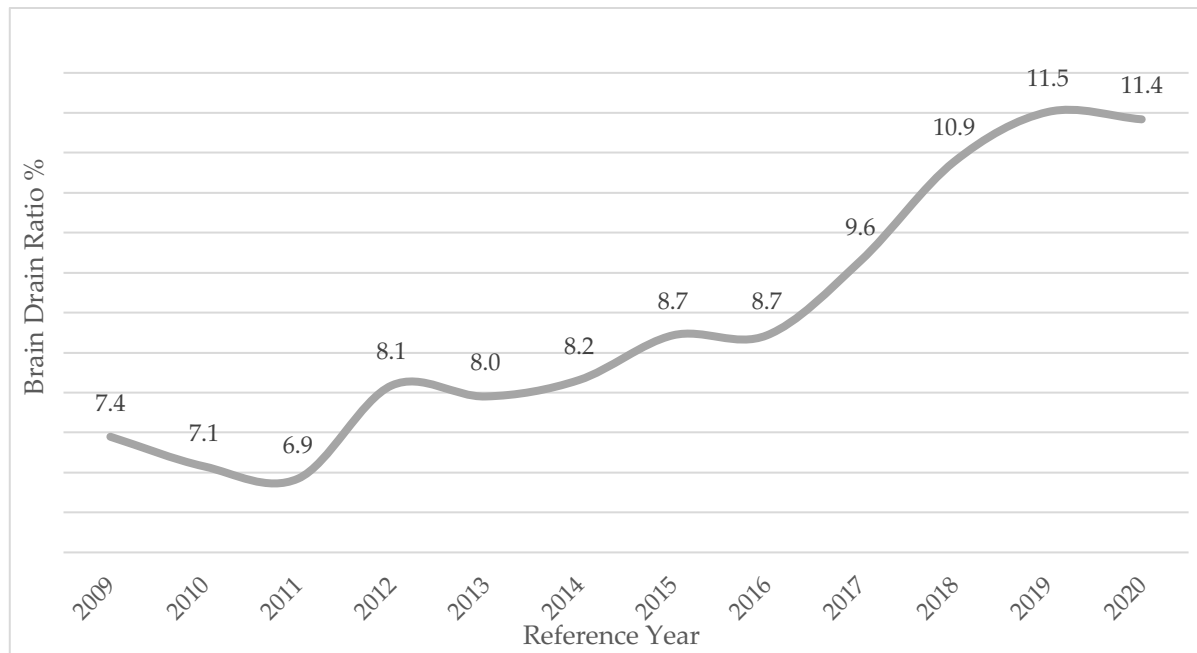
The IT departments are determined through ISCED-F classification in the previous section. Brain export rates among Turkish IT professionals on the basis of department, country of destination, gender and years are given in the coming sections.

### By Years of Migration

A total number of 63,787 individuals from universities in Türkiye have received their bachelor's degrees from IT departments between 2004 and 2013. As mentioned under the methodology section of this paper, the number of IT graduates abroad who have not returned to Türkiye yet after seven years upon graduation are subjected to “brain drain” status in this paper. In this regard, through considering 7,287 bachelor's degree graduates abroad, the brain drain rate of Türkiye in the field of IT is calculated as 11.4 per cent in the year 2020. Moreover, brain drain rates of IT graduates and its aggregated data set by years in Türkiye are displayed in Table 4 and Figure 1.

**Table 4.** Aggregated Data Set by Years

<b>Graduation Periods</b>	<b>Reference Year</b>	<b>Number of Graduates</b>	<b>Number of Abroad</b>	<b>Brain Drain Rate</b>
1993-2002	2009	15,012	1,118	<b>7,45</b>
1994-2003	2010	17,665	1,250	<b>7,08</b>
1995-2004	2011	20,889	1,446	<b>6,92</b>
1996-2005	2012	24,702	1,998	<b>8,09</b>
1997-2006	2013	28,537	2,269	<b>7,95</b>
1998-2007	2014	32,743	2,671	<b>8,16</b>
1999-2008	2015	37,412	3,261	<b>8,72</b>
2000-2009	2016	42,374	3,693	<b>8,72</b>
2001-2010	2017	47,548	4,587	<b>9,65</b>
2002-2011	2018	52,427	5,709	<b>10,89</b>
2003-2012	2019	57,518	6,621	<b>11,51</b>
2004-2013	2020	63,790	7,284	<b>11,42</b>



**Figure 1** Brain Drain Rates of IT Graduates for Türkiye for the years 2009-2020

The figure above indicates that, the brain drain of new IT graduates accelerated between 2016 and 2019. In 2020, the growth rate of brain drain decreased probably due to the impact of Covid-19.

#### By Departments of Graduation

Of the departments that are given in the previous section in Table 3 and do not exist in Table 5, there was no migration due to a considerably limited number of graduates including computer and informatics, computer and information systems control engineering.

**Table 5.** Brain Drain of IT Graduates by Departments, 2020

ISCED -F Code	Departments	Number of Graduates	Number of Non- returned Graduates	Brain Drain Rate (%)
(0613/ 0714)	Computer Sciences and Eng./ Telecommunications Eng./ Computer Sciences / Microelectronic Engineering	1,274	379	29.8
0714	Control and Automation Engineering	408	96	23.5
0714	Information Systems Engineering	483	104	21.5
0714	Mechatronics Engineering	1,342	210	15.6
0613	Software Engineering	601	89	14.8
0714	Computer Engineering	24,158	3,186	13.2
0714	Electronics Engineering	3,973	432	10.9
0613	Computer Technologies and Information Systems	1,010	108	10.7
0714	Electronics and Communication Engineering	3,722	343	9.2
0613	Management Information Systems	1,524	140	9.2
0714	Electrical and Electronic Engineering	24,332	2,127	8.7
0714	Information Systems and Technologies	382	28	7.3
0714	Biomedical Engineering	578	42	7.3
	<b>Total</b>	<b>63,787</b>	<b>7,284</b>	<b>11.4</b>

According to the Table 5, it is seen that 7,284 of 63,787 IT graduates have not returned to their home country. The brain drain ratio of Turkish IT graduates is determined as 11.4 per cent in the year 2020. When the column number of non-returned graduates is examined, it is seen that the departments where the most brain drain occurred are *computer engineering* and *electrical and electronic engineering* with 3,186 and 2,127 non-returned graduates respectively. These two departments account for 72.9 per cent of the total IT brain drain from Türkiye.

It is stated in the 13th article of the Turkish Statistical Law that, “In the case where the number of statistical units in the data table created by the aggregation of individual data is less than three, or the number of units is three or more, and one or two statistical units are dominant, the relevant data are considered confidential”. Therefore, the relevant departments such as *Computer Sciences and Eng./ Telecommunications Eng./ Computer Sciences / Microelectronic Engineering* have been aggregated and given in Table 5. These four departments have the highest brain drain rate with 29.8 per cent. They are followed by *Control and Automation Engineering* with 23.5 per cent and *Information Systems Engineering* with 21.5 per cent. Meanwhile the lowest brain drain occurs in both *Information Systems and Technologies* and *Biomedical Engineering* departments with 7.3 per cent.

### By Countries of Destination

Table 6 gives an overview of brain drain rates of Turkish IT graduates by country. The top fifteen countries preferred by the IT graduates who went abroad after their graduation between the years 2004 and 2013 and still have been residing there in 2020 are given below in Table 6 according to departments. It is observed that every two out of three IT graduates prefer to immigrate to the U.S.A., Germany, the U.K. and the Netherlands. Moreover, almost all of the countries are European countries, except Canada, the USA, and the United Arab Emirates.

**Table 6.** Brain Drain of IT Graduates by Country, 2020

<b>Emigrated Country</b>	<b>Number of Non-returned Graduates</b>	<b>Brain Drain Ratio (%)</b>
The United States of America	1,935	26.6
Germany	1,082	14.9
The United Kingdom	833	11.4
The Netherlands	819	11.2
Canada	282	3.9
Sweden	226	3.1
Switzerland	184	2.5
The United Arab Emirates	182	2.5
Ireland	149	2.0
Belgium	146	2.0
Australia	129	1.8
France	103	1.4
Poland	93	1.3
Spain	89	1.2
Austria	80	1.1
Finland	79	1.1

Indeed, quality of life is also one of the most significant factors that is considered by individuals to migrate. Nevertheless, almost all the countries listed in Table 6 are developed

countries with high quality of life conditions. Thus, we argue that even though quality of life in the destination country is a significant pull factor for brain drain, it falls short of explaining the high brain drain rates of IT professionals from Türkiye to these four countries including the United States of America, Germany, the United Kingdom, and the Netherlands.

In fact, countries with widely spoken languages or organisations using an international language and offering high wages are more likely to attract migrants compared to the countries with their own unique language and moderate wages (Chaloff & Lemaître, 2009). Apart from that, both the population size and labour force size of the destination country and the labour shortage in the target sector accordingly affect the target country's ability to attract qualified individuals from other countries. In addition, historical and colonial links and also geographic proximity are some other pull factors (Docquier et al., 2007).

To start with the USA is one of the leading countries in the IT sector around the world. The USA was ranked 2<sup>th</sup> in the 2022 IMD World Digital Competitiveness Index (IMD, 2022). The digital economy of the USA accounted for 7.1 per cent of the gross domestic product of the country. The country was ranked as 7<sup>th</sup> in the world in this category (OECD, 2011). Moreover, there were 39 IT companies from the United States in the top 100 digital companies list published by Forbes. Apple, Microsoft, Alphabet, AT&T, Amazon, Verizon Communications, Walt Disney, Meta, Intel and IBM are American companies in the top 15 worldwide (Forbes, 2022). In addition to the size of the IT sector, the high influence of American culture in Türkiye may have been influential in the preference of new graduates to migrate to the USA. Furthermore, foreign language education in Türkiye is mostly English. Thus, when including the language factor as well, it is not surprising that the USA appears the top migration destination country for young Turkish IT graduates.

Germany was ranked 19<sup>th</sup> in the 2022 IMD World Digital Competitiveness Index (IMD, 2022). In this respect, Germany is not among the top leading countries in the IT sector. Furthermore, German companies, except those using English as an organisational language, have a disadvantage compared to the other English speaking countries. Moreover, there were only two German IT companies listed in the top 100 digital companies by Forbes (Forbes, 2022). The digital economy of Germany accounted for 5.1 per cent of the gross domestic product of the country. The country was ranked as 15<sup>th</sup> in the world in this category (OECD, 2011). Nevertheless, according to the findings of this paper, Germany is the second most preferred country to migrate to for young Turkish IT graduates. Durmaz (2020) argued that the diaspora effect influences brain drain and reverse brain drain between Germany and Türkiye. In fact, nearly half of the Turkish diaspora live in Germany. One of the fundamental reasons behind this fact is the recruitment agreement signed between Germany and Türkiye in 1961. Overall, we also argue that diasporic networks may have a significant pull effect on young Turkish IT graduates to migrate to Germany.

The findings indicated that the United Kingdom (the UK) was the third most popular destinations for young Turkish IT graduates. The digital economy of the UK accounted for 7.4 per cent of the gross domestic product of the country. The country was ranked as 5<sup>th</sup> in the world in this category (OECD, 2011). Apart from that, the country was ranked 16<sup>th</sup> in the 2022 IMD World Digital Competitiveness Index (IMD, 2022). Besides these good indicators in the IT sector of the UK, the country has an advantage compared to the other non-English speaking countries in attracting highly-skilled individuals with good English language skills. Lastly, for a relatively small country, the Netherlands has a strong IT sector. More than 80.000 IT firms in

the Netherlands account for 4.3 per cent of total Dutch firms. Major IT companies such as Google, Microsoft, IBM and Oracle have established their European headquarters, customer service centres, research and development facilities in the Netherlands (Invest in Holland, 2022). Moreover, there were four Dutch IT companies listed in the top 100 digital companies by Forbes (Forbes, 2022), which is higher than both the UK and Germany. Furthermore, as with Germany, the digital economy of the Netherlands accounted for 5.1 per cent of gross domestic products of the country. The country was ranked as 15<sup>th</sup> in the world in this category (OECD, 2011). Similar to Germany, there is a large Turkish diaspora in the Netherlands as well. Nearly 10 per cent of the Turkish diaspora live in the country (Turkish Statistical Institute, 2019). Therefore, we argue that both strong IT sector and large Turkish diaspora in the Netherlands may play a significant role in attracting new Turkish IT graduates.

### **By Gender Breakdown**

The distribution of non-returned IT graduates by gender is given below in Table 7. When the total number of non-returned IT graduates is compared by gender, the number of males, with 5836 individuals, exceeds by far the number of females that consists of 1448 individuals. Approximately four out of five non-returned IT graduates are men. This is due to the fact that 80 per cent of the total number of IT graduates are male in Türkiye. Indeed, one of the most significant findings of this research is that average brain drain rates by gender are relatively close to each other. While the average rates for males is 11.3 per cent, it is 12 per cent for females. The brain drain percentages of females are noticeably higher than males in some IT fields such as in *control and automation engineering* where the rate difference reaches 10.9 per cent, in *mechatronics engineering* 6.0 per cent, in *electronics engineering* 5.6 per cent.

**Table 7.** Brain Drain of IT Graduates by Gender, 2020

ISCED-F Code	Departments	Male			Female			AVG.	
		Number of Graduates	Number of returned Graduates	Brain Drain Rate (%)	Number of Graduates	Number of returned Graduates	Brain Drain Rate (%)	Brain Drain Rate (%)	Brain Drain Rate (%)
0613 / 0714	Computer Sciences and Eng. Telecommunications Eng.	993	298	30.0	278	81	29.1	29.8	
0714	Computer Sciences Microelectronic Eng.								
0714	Control and Automation Eng.	361	81	22.4	45	15	33.3	23.6	
0714	Information Systems Eng.	334	72	21.6	148	32	21.6	21.6	
0613	Mechatronics Engineering	1,181	177	15.0	157	33	21.0	15.7	
0714	Software Engineering	446	74	16.6	155	15	9.7	14.8	
0714	Computer Engineering	18,289	2,458	13.4	5,814	728	12.5	13.2	
0613	Computer Technologies and Information Systems	772	82	10.6	238	26	10.9	10.7	
0613	Electronics Engineering	3,519	362	10.3	440	70	15.9	10.9	
0714	Electronics and Communication Eng.	3,009	271	9.0	707	72	10.2	9.2	
0714	Management Information Systems	907	91	10.0	615	49	8.0	9.2	
0714	Electrical and Electronic Eng.	21,182	1,835	8.7	3,072	292	9.5	8.8	
0613	Information Systems and Technologies	252	16	6.3	128	12	9.4	7.4	
0714	Biomedical Engineering	319	19	6.0	256	23	9.0	7.3	
	<b>Total</b>	<b>51,564</b>	<b>5,836</b>	<b>11.3</b>	<b>12,053</b>	<b>1,448</b>	<b>12.0</b>	<b>11.4</b>	

On the other hand, brain drain ratios of males remarkably exceed the ratios of females in several disciplines including *software engineering* at 6.9 per cent. For the rest of the IT fields the brain drain ratio by gender remains considerably close to each other. Additionally, the total number of graduates is given as 63,787 in Table 5, but the sum of male and female graduates is given as 63,617 in Table 7. *The reason for this difference is due to the absence of gender information of 170 people in administrative records.*

## 6. Discussion and Conclusions

The IT sector is one of the fastest growing sectors in Türkiye as in many other countries across the world. With the growth of the IT sector around the world, IT infrastructure, software application development and human resource investments of countries and companies has reached significant amounts. For the establishment of sustainable growth in the field of IT, it is critical to train and retain a qualified workforce that can keep up with the constant change in the IT world.

In this research, the brain drain of IT graduates from Türkiye is examined on the basis of graduation departments by ISCED classification, country, gender, and years. The results indicate a considerably high brain drain rate of 11,4 per cent of highly skilled IT graduates and appears to be a significant issue for policymakers in Türkiye due to its private and social costs to Turkish society. We argued that better quality of life conditions, size of IT sector, and diasporic networks in the destination country may play a significant role in attracting new Turkish IT graduates to migrate. The most popular country destinations for the IT brain drain from Türkiye are listed according to the percentage of non-return bachelor's degree graduates. The findings indicated that the United States of America is at the top with 1,935 graduates (26.6%); it is followed by Germany with 1,082 graduates (14.9%), the United Kingdom with 833 graduates (11.4%), the Netherlands with 819 graduates (11.2 %) and Canada with 282 graduates (3.9 %).

When considering the field of study according to ISCED-F classifications, 29.8% of Computer Sciences and Eng./ Telecommunications Eng./ Computer Sciences / Microelectronic Engineering graduates reside abroad, which is followed by Control and Automation Engineering with 23.5%, and Information Systems Engineering with 21.5%. When considering the number of graduates abroad, Computer Engineering is at the top with 3,186 graduates (13.2 %), followed by Electrical and Electronic Engineering with 2,127 graduates (8.7%) and thirdly Electronics Engineering with 432 graduates (10.9%). In fact, one of the most significant findings is that average brain drain ratios by gender are relatively close to each other. While the average rate for males is 11.3 per cent, it is 12.0 per cent for females.

Growing wage differentials between the Turkish IT labour market and abroad due to the depreciation of local currency, and increasing remote or hybrid job opportunities, particularly after the Covid-19 pandemic may accelerate “hidden brain drain” and “virtual brain drain” rates in emerging countries like Türkiye. Furthermore, this study explored the brain export rate of Türkiye in the field of IT. However, when adding hidden and virtual brain drain rates to brain export rate, the actual brain drain rate of Türkiye is almost certainly higher than the figures here.

The results of this research support data-based decision making for studies carried out to increase the harmonization between education and the labour market. Indeed, education policies are merely a single part of the brain drain solution. In fact, it is essential to provide well-equipped universities, academic staff, accommodation and financial support for the youth in the higher education to upgrade human capital. What is not less significant than providing all these indicated needs for university students is to provide decent work opportunities by generating highly qualified jobs and better working conditions after graduation in order to retain high-skilled youths.

Skills mismatching issues including over mismatching; double-digit unemployment figures as high as 25% among the young population aged 18-24; and depreciation of the Turkish Lira of up to 350% between January 2018 and January 2022, are some of the fundamental obstacles that need to be addressed in order to shape a sustainable future of work in Türkiye.



For these reasons, education policies should be well harmonized with labour market policies by policymakers to increase the human capital indicators of the country. The private and social rates of return to investments in education and training should be closely monitored with the purpose of increasing the learning capacity of both citizens and organisations (OECD, 1996). Firm level indicators regarding the requirements of human resources, employment, usage of technology and job-related mobility may help decrease skill mismatch problems in the Turkish IT labour market. Additionally, the behaviour patterns of a new generation of knowledge workers who have just completed their university education and their expectations of working life should be clearly understood by both states and organisations. Otherwise, it is not possible to obtain successful results in retaining IT graduates for any country.

The brain drain results of this research could be used as a guide by the Presidential Human Resources Office of Türkiye, the Higher Education Council Presidency and the Ministry of National Education, the Ministry of Labour and Social Security and other relevant institutions to develop policies that cover the needs of young people regarding living and working conditions after graduation. In this context, it is essential to take steps such as increasing cooperation between universities and employers, to help, for example in university quota planning, providing private sector incentives to create employment and using qualified workforce in qualified jobs, especially in IT areas where brain drain is high. It is thought that the results of this research can also contribute to the "TUBITAK International Leading Researchers Support Program", which is carried out by the Ministry of Industry and Technology in order to ensure reverse brain drain.

### **Limitations and Future Directions**

Administrative registration data that is used in this paper is based on the statements of Turkish IT graduates who reside abroad after completing their university programs. Therefore, the data on IT workers who migrated abroad are at least as much as the statistics given in this study; the actual number may be higher than the figures here. The results presented in the study are only numerical statistics and there are no results on the sociological causes of brain drain. Statistics on the sociological causes of brain drain can be obtained by conducting a survey on people who have migrated abroad.

### **Ethical Text**

All violations arising from this article are the responsibility of the author(s). Additionally, the comments regarding the findings obtained within the scope of this research belong only to the researcher(s) and do not bind the Turkish Statistical Institute."

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