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Human Capital Dimension of Digitalization: A Comparative Study for Turkey and Russia

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Abstract

In this study, the Human Capital dimension of I-DESI digitalization index is focused for comparing the level of digitalization of Turkey and Russia. The index scores are listed for four sub-dimensions of the human capital dimension. Some descriptive statistics are presented and some figures are showed for the years studied. The variations for some period are determined if enough data exists. Within the framework of the findings, policy recommendations are put forward for leveraging digital transformation. It is seen that the recommendations vary for Turkey and Russia.

Keywords: Human capital digitalization index, basic skills and internet ssage, advanced skills and development, I-DESİ, Turkey, Russia.

Jel codes: D83, L86.

Dijitalleşmenin İnsan Kaynağı Boyutu: Türkiye ve Rusya için Karşılaştırmalı Bir Çalışma

Öz

Bu çalışmada, I-DESI dijitalleşme indeksinin İnsan Kaynağı boyutuna odaklanılmış, Türkiye'nin, Rusya'nın dijitalleşme düzeyleri diğer ülkeler ve birliklerin düzeyleri ile karşılaştırılmıştır. Dijitalleşme indeksinin insan kaynağı boyutunun dört alt grubu için değerler listelenmiştir. İncelenen zaman dönemleri için bazı tanımlayıcı istatistikler ve grafikler verilmiştir. Yeterli verinin olduğu bazı dönemler için değişimler belirlenmiştir. Elde edilen bulgular çerçevesinde, farklı alt gruplardaki dijitalleşme düzeylerine bağlı olarak, dijital dönüşümden yararlanma ve dönüşümü hızlandırmaya dönük her iki ülke için ayrı ayrı politika önerileri ortaya konulmuştur.

Anahtar kelimeler: İnsan kaynağı dijitalleşme indeksi, temel beceriler ve internet kullanımı, ileri beceriler ve gelişme, I-DESİ, Türkiye, Rusya.

Jel kodları: D83, L86.

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1. Introduction

Digitalization is the process of shifting a company's resources into new sources of revenue, growth and other operational results that add value to the company by leveraging opportunities offered by digital technologies. In other words, digitalization means developing new business models, creating unique customer experiences, building new products and services and utilizing a company's resources much more efficiently through new combinations of information, human capital and technological assets (TBF, 2017).

Digital technologies enable innovative business models such as the platform-based models of well-known companies including Airbnb, Uber, or Facebook, or decentral models enabled by blockchain and 3D printing (Techrunch, 2015). Digitalization also changes industry structures (Hosseini, 2018): reduced entry barriers, make technology-savvy start-ups flourish and digital giants such as Google or Apple push forward to manifold sectors. Regarding the IoT, for example, 50 billion smart devices are expected to be connected to the Internet by 2020 (Google, 2020), having an economic impact of $7 trillion (Urbach, 2019).

Digitalization increases country competitiveness via sectors and an ecosystem. Global economy is going through drastic adjustments, created by both the changes in the economic cycle and digital transformation. What differentiates the current transformation from the previous transformation periods, including the industrial revolution, is the ability of countries/ companies to combine their area expertise competitive advantage with digitalization and innovative processes. Yet, this period also necessitates that countries learn to use digital transformation as leverage in economic development and create their own individual recipes (TURKONFED, 2018).

The digitization rate of companies or countries can be expressed through the digitization index (a discussion of a defined and used digitalization metrics; Kotarba, 2017). The Digital Economy and Society Index (EU-DESI) was introduced by European Commission as a performance measure, to assess the development of the digital economy and society in the EU countries, is based for this study. The DESI is made up of five dimensions: connectivity, human capital, use of Internet services in households, integration of digital technology in companies and digital public services. The five dimensions is comprised of 24 indicators, (IDESI, 2018), (HCDI, 2019)

The International Digital Economy and Society Index (I-DESİ) is structured around the same 5 dimensions as the original European DESİ. Together they compose the key elements of the Digital Economy: Connectivity and Human capital (digital skills of users and practitioners) can be considered as the enablers of the digital economy and society, of which citizens ("Use of Internet") and businesses ("Integration of Digital Technology") an governments ("Digital public services") can and should benefit. (IDESİ, 2018), (DESBC, 2018)

The **connectivity** dimension measures the deployment of broadband infrastructure and its quality. The **use of internet** accounts for the variety of activities performed by citizens already online. Such activities range from consumption of online content (videos, music, games, etc.) to modern communication activities or online shopping and banking. The **integration of digital technology** dimension measures the digitization of businesses and their exploitation of the online sales channel. By adopting digital technology businesses can enhance efficiency, reduce costs and better engage customers, collaborators and business partners. Furthermore, the Internet as a sales outlet offers access to wider markets and potential for growth. The d**igital public services** dimension measures the digitization of public services, and focuses in particular on eGovernment. Modernization and digitization of public services can lead to efficiency (IDESI, 2018).

Our paper is centered on **human capital dimension** of digitalization. A physical infrastructure is not the only prerequisite for a digital society. Having a connection to the internet is not sufficient; It needs to be complemented by the appropriate knowledge and skills to take advantage of the myriad of possibilities offered by the internet and the digital society, develop and consume new digital goods and services. For increasing productivity and economic growth, digital skills are also a necessary part of the digital transformation of economy and society. (IDESI, 2018), (IDSIFR, 2019)

The Human Capital dimension includes two sub-dimensions. The basic skills and internet usage, the advanced skills and development [for more detail. (HCDI, 2019) Both sub-dimensions measure the digital skills of citizens in general as well as those of the labor force.

The Basic Skills and Internet usage sub-dimension captures the digital skills level of the general population. In particular, it assesses whether citizens are able to use the internet and use it on a regular and frequent basis (Daily Internet Users indicator, Frequent Internet Users indicator). (IDSIFR, 2019) The Basic Skills and Internet usage sub-dimension refers to the ability of citizens to use digital products and services.

The Advanced skills and development sub-dimension concerns the workforce and its potential to maintain and grow the digital economy It takes into account the percentage of people in the workforce with ICT specialist skills (ICT Specialist indicators) and the share of the graduates with STEM education (Science, Technology, Engineering and Mathematics, STEM graduates indicator). The Advanced skills and development sub-dimension is related to the capability to produce such goods and services.

The following sections provides the level of digitization of the human capital dimension and each of its four sub dimensions of Turkey and Russia amongst 2013-2016. To make a comparison among countries it is needed normalized data. The studied years have been chosen depending on the availability of the data for comparison in that period.

The current Covid-19 crisis is having an important impact on key societal indicators, relating to the use of internet services by citizens in countries. It would not be wrong to think that this epidemic has leveraged digital transformation all over the world. This means a particular attention to the indicators relevant for a stronger and more resilient digital transformation and economic recovery, notably very high capacity networks (VHCNs), digital skills, advanced digital technologies for businesses and digital public services. Turkey has taken a large number of targeted measures in health, education, communication industries and some in digital to deal with the Covid-19 crisis.

2. The composite I-desi scores

It is essential to point out IDESİ and Human Capital are composite scores. The formula of the overall I-DESI score across all dimensions for a country is below. (IDSIFR, 2019) Scores range from 0 (worst) to 1 (best). The methodological changes for the index could be affected scores of the dimensions over time.

> **I-DESI *Country X*** = Connectivity *Country X* x 0.25 + Human Capital *Country X* x 0.25 + Use of Internet *Country X* x 0.15 + Integration of Digital Technology *Country X* x 0.2 + Digital Public Services *Country X* x 0.15

Figure 1 shows composite normalized scores (IDESI, 2018) for all selected of 45 non-EU and EU countries in 2016. It presents the main ranking or an overview of the performance scores of countries across all dimensions. The length of each bar in the chart corresponds to the score achieved by the corresponding country.

According to the indicator, the leading or best performing country was Denmark, with a score of 75.9 (within EU Top 4). The leading Non-EU country, which came second of all 45 countries studied, was South Korea (75.2). In third place was Finland (73.8), which was the second best performing of EU28 member states. The average performance of EU28 was 58.9. In particular Brazil (39,7) did score the lowest in the overall ranking (See: 14) on this index.

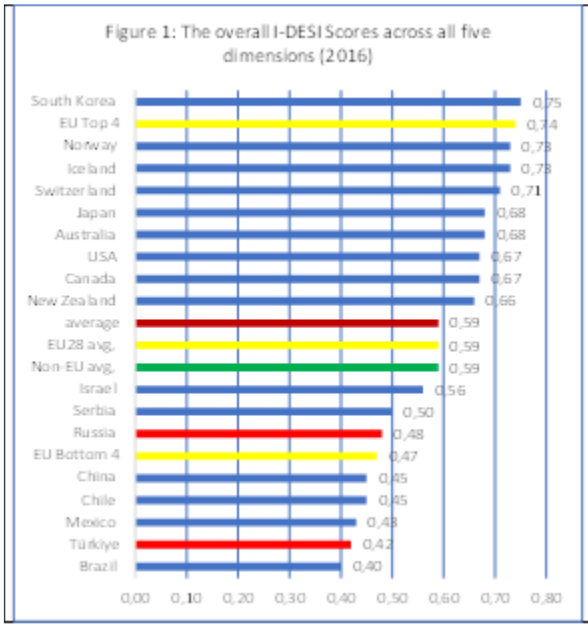


Table 1: Descriptive statistics for I-DESI

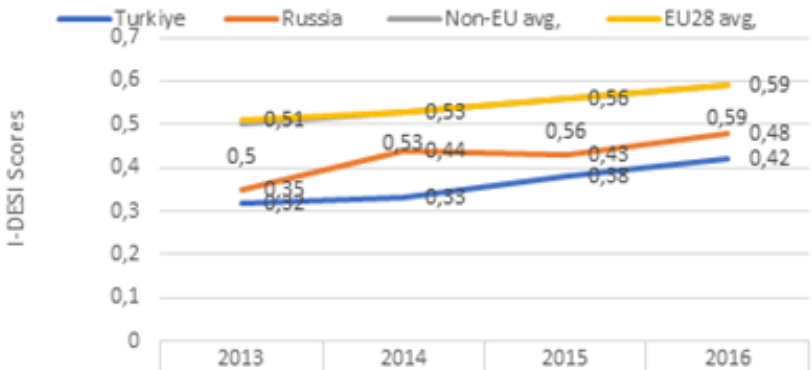
Arithmetic mean	0,588222
Standard Error	0,016075
Median	0,58
Mod	0,48
Standard Deviation	0,107836
Range	0,36
Maximum(1)	0,76
Minimum(1)	0,4

Turkey is ranking behind all EU countries even below Russia. Turkey ranks 44 with a value of 42%, only higher than Brazil of the 45 countries studied. Russia has the rank 39 of 45, with a score of 0.48, lags behind the EU average, higher than Chile, China, Romania, Mexico, Turkey, Brazil and the four worst performing EU member states.

Some descriptive statistics belonged 45 countries has been given at Table 1. The I-DESI average score of the these countries is about 58,8 per cent. It is rather close to the EU average score 58,9. Arithmetic mean and median are quite near each other. Turkey and Brazil clearly lag behind on this dimension and they are the worst performing states of this composite index.

As might be expected with increasing adoption and use of digital technologies, Figure 2 also shows there has been an increase in scores over the years. Turkey, on overall, increased by 31 per cent across the four years of the study. Russia 37%, EU28 Member States 16%, Non EU States 18% respectively. However Russia shows more better performance than Turkey, she is lag behind of Eu and Non Eu average scores over years. Turkey has the lowest score among those four.

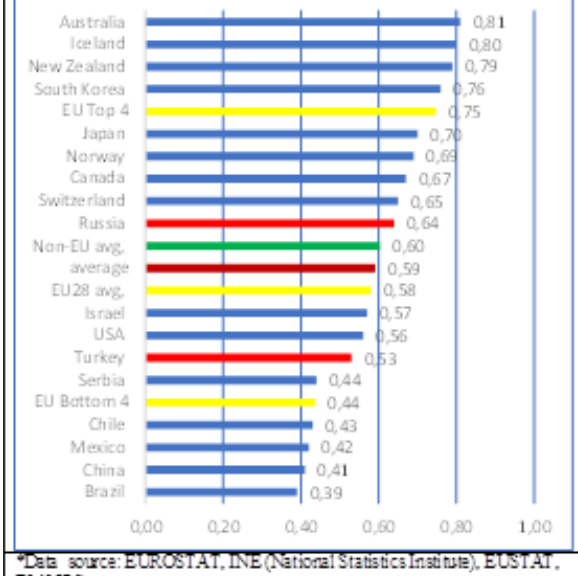
Figure 2: Average Scores across all dimensions for I-DESI 2013 to 2016



	2013	2014	2015	2016
Turkiye	0,32	0,33	0,38	0,42
Russia	0,35	0,44	0,43	0,48
Non-EU avg,	0,5	0,53	0,56	0,59
EU28 avg,	0,51	0,53	0,56	0,59

Years

Figure 3: Composite scores of the human capital dimension (2016)*



*Data source: EUROSTAT, INE (National Statistics Institute), EUSTAT, IKANOS

Table 2: Descriptive statistics for human capital

Arithmetic mean	0,588444
Standard Error	0,018392
Median	0,6
Mod	0,62
Standard Deviation	0,12338
Range	0,42
Maximum(1)	0,39
Minimum(1)	0,81

3. The human capital dimension

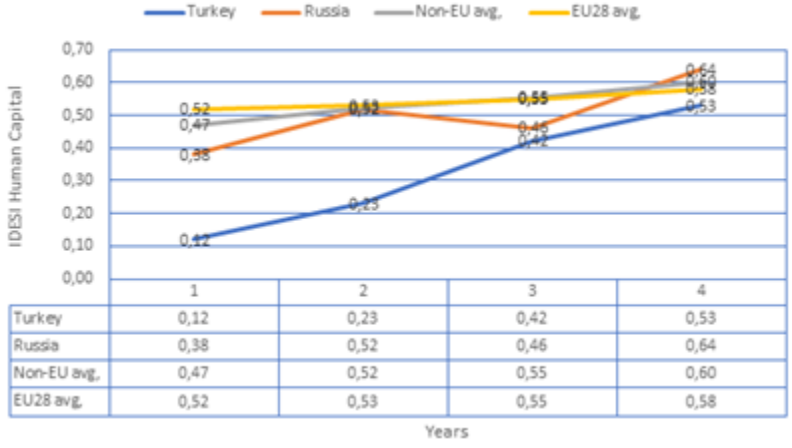
Human capital dimension examines the skills needed to take advantage of the opportunities offered by a digital society. It has two sub-dimensions and each one is comprised of two indicators.

Figure 3 shows normalized scores for all selected countries (IDESI-Tier 2 see: IDESI,2018). It presents the main ranking of countries across all human capital dimensions. According to the indicator, the leading or best performing country in the 2016 was Australia, with a score of (80.5). In the second and third place were Iceland (80.2) and New Zealand (79.3). Then South Korea and after EU Top 4, Japan ranks 6th.

The average performance of EU28 member states was 58.0, and Non EU states was 60. Nine of the 17 non-EU countries had a higher score. In 2016 the top four EU28 member states (average score 74.7) performed behind South Korea and three other non-EU countries, but ahead of Japan and the USA. The average score for the bottom four EU28 member states (43.7) is ahead of China and three other non-EU countries. Brazil (39,7) is ranking the worst in this dimension.

Regarding human capital scores for digitization Turkey is performing behind USA and even below Russia and EU's average. Turkey ranks 36 with a value of 53.1 per cent, higher than EU Bottom 4. Russia has the rank 13 of 45, with a score of (64,1), and higher than EU Average, lags behind the EU Top 4.

Figure 4: Average performance scores for the human capital dimension



	1	2	3	4
Turkey	0,12	0,23	0,42	0,53
Russia	0,38	0,52	0,46	0,64
Non-EU avg.	0,47	0,52	0,55	0,60
EU28 avg.	0,52	0,53	0,55	0,58

Some descriptive statistics belonged 45 countries are below. As it can be seen average score of the whole countries studied is 58,8 per cent and it is little higher then EU average. The arithmetic mean and median is near each other.

Figure 4 provides an overview of the average performance score for the human capital dimension of Turkey and Russia over the years. As might be expected, there has been an increase in scores of the countries over the years. Turkey on overall, increased by 31 per cent across the four years of the study, from 12% in 2013 to 53% in 2016. Russia 37%, from 38% in 2013 to 64% in 2016., EU28 Member States 16%, Non EU States 18% respectively. Russia shows the best performance with regards to Turkey, Non EU avg. and EU28 avg. scores.

Although the increase rate was higher than others for some years, Turkey's scores over years was the worst amongst them. Whilst Russia had third rank in 2013, by showing a good performance she has got first rank in 2016.

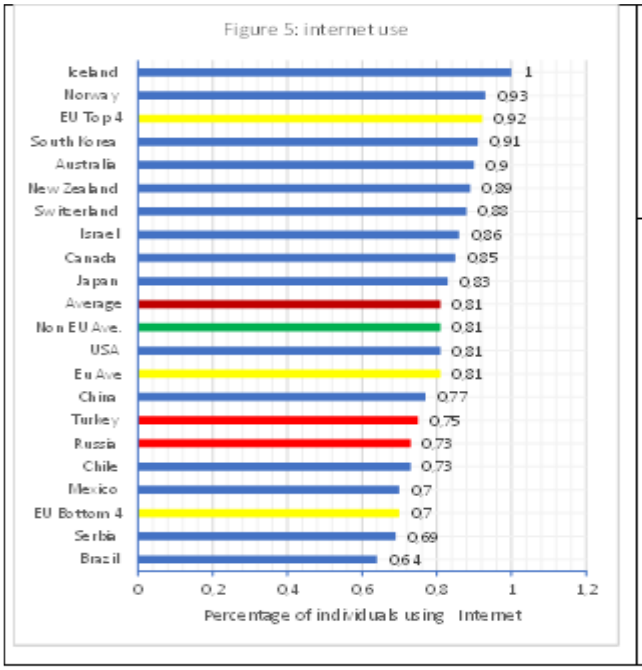


Table 3: Descriptive statistics for Internet use

Arithmetic mean	0,815125
Standard Error	0,021887
Median	0,82
Mod	0,7
Standard Deviation	0,09788
Range	0,36
Maximum (1)	0,64
Minimum(1)	1

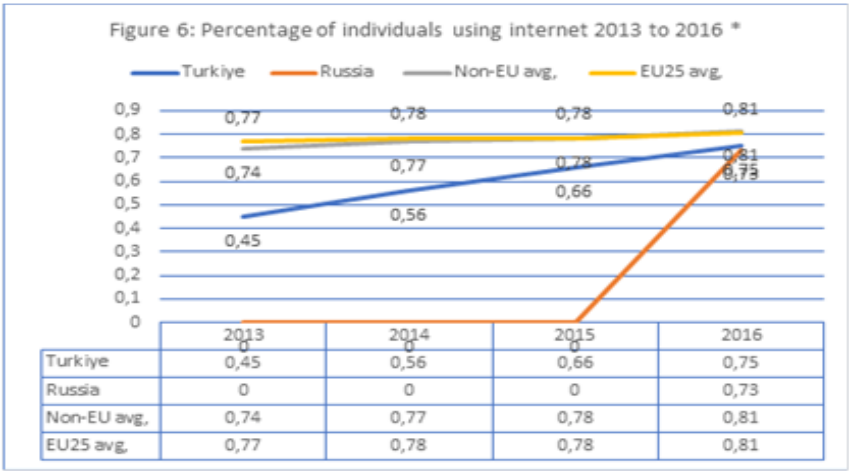
3.1. Basic skills and internet usage: sub-dimension 2.a

This sub-dimension is comprised of two indicators. The first indicator examines internet use or users and the second indicator examines basic digital skills.

3.1.1. Internet users: 2.a.1

When zooming in on the frequency of internet use, Iceland is in the lead (0,99) before Norway (0,93). In 2016 the level of Internet use was 0,75 per cent of the population in Turkey, 0,73 per cent of the population in Russia. Turkey is two per cent higher than Russia.

In 2016 the average level of Internet use was 81 per cent of the population in EU28 Member States. Both Turkey and Russia are lower from the average rate of EU28 member states.



	2013	2014	2015	2016
Turkiye	0,45	0,56	0,66	0,75
Russia	0	0	0	0,73
Non-EU avg,	0,74	0,77	0,78	0,81
EU25 avg,	0,77	0,78	0,78	0,81

**Data is not available for Russia from 2013 to 2015. EU25 does not include Malta, Luxembourg and Cyprus*

Three of the 11 Non-EU countries had a higher level of internet use. In the top four EU28 member states on average 91 per cent of the population used the internet. The level of Internet use amongst the bottom four EU28 member states averaged 70 per cent. Two of the Non-EU countries had the lowest level of internet use and Brazil was the worst. The arithmetic mean, median and mode are nearer to each other.

Find out about the current state of a country and to give a response if it is going in the right direction what aspects we should address, it can be compare data with previous years.

When we investigate the increasing of internet use by the time window there has been a rapid rise the score of Turkey with 0,66% over the years between 2013 -2016. As for Russia, no data found for 2013-2015. There has been a steady increase in scores of the EU and Non-EU countries over the years. Non EU states on overall increased by 9 per cent across the four years of the study and EU25 member states 4%.

3.1.2. Basic digital skills 2.a.2

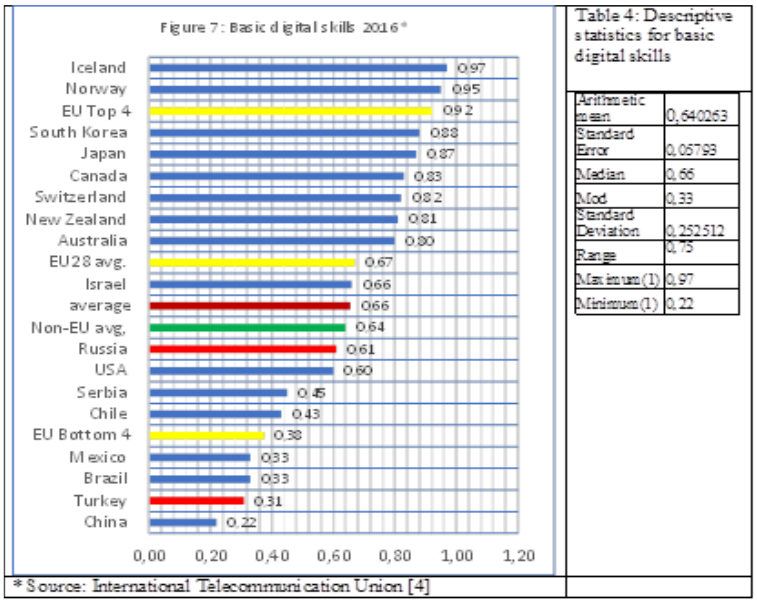


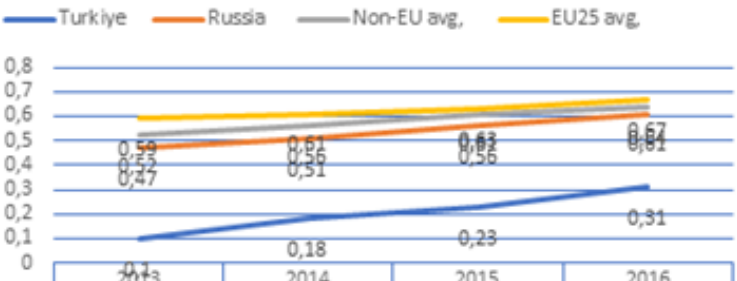
Table 4: Descriptive statistics for basic digital skills

Arithmetic mean	0,640263
Standard Error	0,05793
Median	0,66
Mod	0,33
Standard Deviation	0,252512
Range	0,75
Maximum (1)	0,97
Minimum (1)	0,22

The second indicator in this sub-dimension is related with the basic digital skills. In 2016 the average level of regular Internet use in EU28 Member States was 79.2 per cent. Nine of the 17 non-EU countries had a higher level of internet use. Regular Internet use by the top four EU28 Member States in 2016 was 89.6 per cent. Five of the non-EU countries had a higher level of regular internet use. Regular internet use was higher in the bottom four performing EU28 member states (average 69.5 per cent) than for six non-EU countries.

Russia' score (61%) is behind Non-EU average and higher than USA. Turkey has the second lowest rank just above China.

Figure 8: Basic digital skills 2013 to 2016



	2013	2014	2015	2016
Turkiye	0,1	0,18	0,23	0,31
Russia	0,47	0,51	0,56	0,61
Non-EU avg,	0,52	0,56	0,61	0,64
EU25 avg,	0,59	0,61	0,63	0,67

When we investigate the increasing of basic digital skills by the time window there has been a rapid rise the score of Turkey with 2,1 over the years between 2013 -2016. There has been a steady increase in scores of the Russia (0,30), Non-EU avg. (0,23) and EU25 avg (0,14) .over the years. Even in this circumstance the gap is quite high between Turkey and others.

3.2. Advanced skills and development: 2b

The advanced skills and development sub-dimension measures the percentage of people with ICT specialist skills and the share of graduates with STEM education. This sub-dimension is comprised of two indicators. The first indicator is related with the Information and Communication Technology (ICT) specialists. The second indicator is the Science, Technology, Engineering and Mathematics (STEM) graduates.

3.2.1. Information and communication technology (ICT) specialists 2.b.1.

This indicator uses data about employment in knowledge intensive industries and measures the level of employment in knowledge intensive industries. The analysis has been only made for 2014 because of data on hand.

In 2014, 19,7 per cent of Turkey employment was in these industries. With this score Turkey has the second lowest rank, only ahead of Mexico.

For the same year, 44,2 per cent of Russia employment was in these industries and with this score Russia has a higher rank than overall and EU28 averages.

Seven of the fourteen Non-EU countries had a higher level of employment then EU average in these industries in 2014. The average level of employment amongst the top four EU member states was 51,4 per cent. The bottom five includes Japan, South Korea and Brazil.

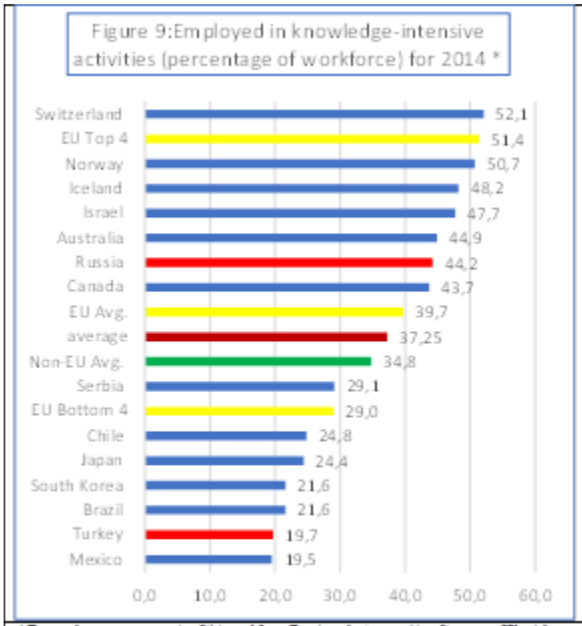


Table 5: Descriptive statistics for ICT specialist

Arithmetic mean	35,7875
Standard Error	3,23553
Median	36,4
Mod	21,6
Standard Deviation	12,94212
Range	32,6
Maximum(1)	19,5
Minimum(1)	52,1

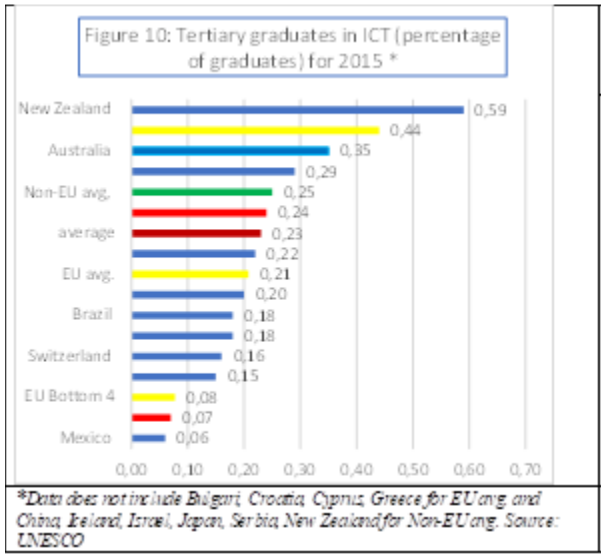


Table 6: Descriptive statistics for STEM graduates

Arithmetic mean	0,227694
Standard Error	0,036985
Median	0,2
Mod	0,18
Standard Deviation	0,143244
Range	0,53
Maximum(1)	0,06
Minimum(1)	0,59

3.2.2. Science, technology, engineering and mathematics (STEM) graduates 2b2

This indicator examines the number of tertiary graduates in ICT as a proportion of all graduates. It has a slightly different focus than the EU-DESI, which examines all STEM subjects.

The overall average score is higher than the EU average score. Turkey had 24 per cent of graduates in ICT in 2015. Her level is between overall average and Non-EU average score.

Russia had 7 per cent of graduates in ICT in 2015. With this score Russia, is lower than the EU bottom 4 avg., had 8 per cent graduates in ICT and just higher Mexico the worst.

EU Member States on average had 21 per cent of graduates in ICT, Non-EU countries on average had 25 percent of graduates in ICT in 2015. EU Top 4 avg. had 44 per cent of graduates in ICT.

4. Analyzing index scores

Below is Table 7 shows the results of the analysis for the years 2013 to 2016, in terms of position, scores in the ranking and differences over time if data is available. Table facilitates a comparative analysis for Turkey and Russia.

Table 7: Summarized information of dimensions

Dimension	*2a1 (2013-**2016**)*			2a2 *(2013-**2016**)*			*2b1 (2013-**2014**)*		
	Rank	*Score*	*Difference*	*Rank*	*Score*	*Difference*	*Rank*	*Score*	*Difference*
Turkey	32/42	75	0,66	44/45	31	2,1	41/42	19,7	0,026
Russia	34/42	73	No data available	28/45	61	0,30	13/42	44,2	0,013
EU		81	0,04		67	0,14		39,7	0,01
Non-EU		81	0,1		64	0,23		34,8	0,00

Dimension	*2b2 (2015)*			*Human Capital (2013-2016)*			*IDESI (2013-2016)*		
	Rank	*Score*	*Difference*	*Rank*	*Score*	*Difference*	*Rank*	*Score*	*Difference*
Turkey	*11/36*	*0,24*	*No data available*	*36/45*	*53*	*3,4*	*44/45*	*42*	*0,31*
Russia	*33/36*	*0,07*	*No data available*	*13/45*	*64*	*0,68*	*39/45*	*48*	*0,37*
EU		*0,21*			*58*	*0,12*		*59*	*0,16*
Non-EU		*0,25*			*60*	*0,28*		*59*	*0,18*

Regarding overall I-DESI rank of Turkey, 44th position of 45th, for overall Human Capital rank, 36th position of 45th. Scores 42% and 53% respectively. Both scores are lower than EU and Non-EU countries average scores.

Over the course of the period 2013-2016, Turkey overall I-DESI score for 2016 has improved by almost 31% in comparison with 2013 and Russia's score 37%. With the 44th and 37th position of the 45, It can be said that both country showed worst performance for this indicator. Whilst Russia has a higher rank than Turkey, It was the fact that Turkey was crawling of this indicator.

Turkey composite Human Capital score for 2016 has improved by almost 3,4 times in comparison with 2013 and Russia's score 68%. With the 30th and 18th position of the 45 Russia has a better rank than Turkey. Nevertheless both country didn't show a good performance for this indicator.

Regarding to internet usage and basic skills(2a) sub-dimension Turkey ranks at the bottom of the studied countries. Russia's performance was not good but better than Turkey's.

Regarding to advanced skills and development dimension, there is a contradictory situation both Turkey and Russia in terms of its sub-dimensions. Turkey ranks 41th, the second worst of ICT specialist, but performs good enough on STEM graduates (11th of36). Russia ranks (13th of 42) ICT specialist, but performs 33th third worst on STEM graduates.

This is due to the fact that their results in both sub-dimension of the human capital dimension need improving, while in advanced skills it has obtained better values then basic skills.

There is a striking contrast between the remarkable level of people graduated in the scientific-technological field (STEM) and the low level of ICT specialists in the labor market for Turkey.

The invers contradiction is valid for Russia. It is the low level of people graduated in STEM and the high level of ICT specialists in the labor market.

5. Conclusions

We can see that Turkey is one of the worst performers on the three out of four sub dimensions. Regarding to Russia two out of four dimension is not performed well. All rooms require improvement for both countries with regards to figures.

Considering the workforce it appears that the STEM graduates may not be able to participate adequately in the job market at their own areas in Turkey. In contrast for Russia the STEM graduates participate in the job market at their own area.

Worth mentioning in this regard are both countries have the potential to improve basic digital skills. Turkey should be encouraged to develop business potential in the ICT sector. Russia should increase educational opportunities in STEM areas.

In recent years a new approach has emerged in education. The science, technology, engineering, mathematics (STEM) with the inclusion of "Art" to these disciplines has been named as "STEM + A". This extended contend can be a key role to improve creativity and quality. (TUSIAD, 2017)

Quick wins could not be realized by improving the state of dimensions lagging the most behind in both countries. But it may be an alternative to start. Moreover it is rather important to develop and implement some holistic policy recommendations.

References

TBF, Accentura Turkey Digization index 2016, Turkey Bişim Vakfı, 2017, (visited 08.10.2020), http://tbv.org.tr/en/accenture-Turkey-dijitallesme-endeksi-2/

Digital Anadolu 2, Sektör Bazlı Digital Dönüşüm Yol Haritası, TURKONFED, 2018, (visited 08.09.2020), http://turkonfed.org/detay/1950/dijital-anadolu-2-sektor-bazli-dijital-donusum-yol-haritasi/

DESBC, Digital Economy and Society in the Basque Country, 2018, ISSN 2340-7638, (visited 08.10.2020), https://www.orkestra.deusto.es/basque-economy-digital/2018/digitisation-basque-country-2018-sub-dimensions-indicators-human-capital.php

Urbach, N., & Röglinger, M. (2019). Introduction to digitalization cases: how organizations rethink their business for the digital age. In *Digitalization cases* (pp. 1-12). Springer, Cham. (visited 18.11.2021), https://www.researchgate.net/publication/327799867

Kotarba M., Measuring Digitalization, Key Metrics, Foundations of Management, Vol. 9 (2017), ISSN 2080-7279 DOI: 10.1515/fman-2017-0010 123. (Visited 18.11.2021), https://www.econstor.eu/bitstream/10419/184621/1/fman-2017-0010.pdf

TUSIAD, 2023'e Doğru Tuŕkiye'de STEM Gereksinimi, (visited 23.12.2020), https ://tusiad.org/tr/yayinlar /raporlar/item/9735-2023-e-dog-ru-tu-rkiye-de-stem-gereksinimi, 2017

Techrunch, 2015, (visited 23.12.2020), https://techcrunch.com/2015/03/03/ in-the-age-of-disintermediation-the-battle-is-all-for-the-customer-interface/

Hosseini, S., Frank, L., Fridgen, G. and Heger, S. (2018). Do Not Forget About Smart Towns - How to Bring Customized Digital Innovation to Rural Areas, *Business & Information Systems Engineering*, 60(3), 243-257. (visited 18.11.2021). https://aisel.aisnet.org/bise/vol60/iss3/5.

Google, 2020, (visited 23.12.2020), https://www.google.com/ search?q=how+many+smart+ devices+are+ expected+ to+be+connected+to +the+Internet+by+2020& rlz=1C1NHXL_ trTR841TR841 &oq=how+many+ smart+devices+are+expected+to+be+connected+ to+ the+ Internet+by+ 2020&aqs=chrome..69i57.34787j1j15 &sourceid=chrome&ie=UTF-8.

DSMEU, (visited 23.12.2020), https://ec.europa.eu/digital-single-market/en/news/how-digital-europe-compared-other-major-world-economies.

IDESI, International Digital Economy and Society Index (I-DESI), Final Report for European Commission, Capgemini Consulting, ISBN 9789279582738, 2018.

HCDI, HumanCapitalDigital Inclusion and Skills, Europen Commission, Digital Economy and Society Index Report 2019, Human Capital. (visited 15.12.2020) https://digital-strategy.ec.europa.eu/en/policies/desi-human-capital

IDESIFR, International Digital Economy and Society Index 2018, FINAL REPORT, European Commission, DG Communications, ISBN 978-92-79-85699-0, 2019. (visited 18.11.2021), https://digital-strategy.ec.europa.eu/en/policies/desi-human-capital

Özet

Dijital dönüşüm, bir kurumun kaynaklarını dijital teknolojilerin sunduğu fırsatlardan yararlanarak kuruma değer katan eylemsel sonuçlara kaydırma sürecidir. Dijital teknolojiler, yenilikçi iş yapma yollarını mümkün kılar. Giriş engellerini ortadan kaldırmak yoluyla endüstrilerin yapısını değiştirmek yanı sıra endüstriler arası ekosistemler aracılığıyla ülkelerin rekabet gücünü artırır.

Ekonomik devresel dalgalanma ve dijital dönüşüm küresel boyutta salınımlar ortaya çıkarmaktadır. Mevcut salınımı sanayi devrimi de dahil olmak üzere önceki dönüşüm dönemlerinden ayıran; ülkelerin-kurumların uzman-rekabetçi oldukları alanlarında rekabet avantajlarını dijitalleşme ve yenilikçi süreçlerle birleştirme olanağıdır. Bu olanaktan yararlanabilme, ülkelerin dijital dönüşümü ekonomik kalkınmada bir kaldıraç olarak kullanmayı öğrenip kendi yol haritalarını oluşturmayı gerektirir.

Kurumların - ülkelerin dijitalleşme düzeyleri, dijitalleşme indeksleri ile ölçülür. Uluslararası Dijital Ekonomi ve Toplum İndeksi (I-DESİ), Avrupa Birliğince (AB) geliştirilen beş boyutlu Dijital Ekonomi ve Toplum İndeksi (DESI) 'ne dayanır. Değerleri 0 (en kötü) ile 1 (en iyi) arasında değişen indeksi hesaplama formülü şöyledir:

I-DESI = *Bağlantı x 0.25 +* ***İnsan Kaynağı*** *x 0.25 + Internet Kullanımı x 0.15 + Dijital teknolojilerinin entegrasyonu x 0.2 + Dijital kamu hizmetleri x 0.15*

Beş boyutlu dijital ekonominin temel bileşenlerinden **bağlantı** boyutu, geniş bant altyapısının dağıtımı ve kalitesini ölçer. **İnternet kullanımı**, vatandaşlar tarafından halihazırda çevrimiçi olarak gerçekleştirilen çeşitli tüketim (videolar, müzik, oyunlar vb.), modern iletişim veya çevrimiçi alışveriş ve bankacılık gibi faaliyetleri konu alır. **Dijital teknolojinin entegrasyonu** boyutu, işletmelerin dijitalleşmesi ve çevrimiçi satış kanalından yararlanma düzeylerini ölçer. İşletmeler, bu araçla verimliliği artırabilir, maliyetleri azaltabilir, müşterilerle, çalışanlarla ve iş ortaklarıyla daha iyi etkileşim kurabilir. **Dijital kamu hizmetleri** boyutu, kamu hizmetlerinin dijitalleşme düzeyini ölçer ve özellikle e-Devlet'e odaklanır. Çalışma, dijitalleşmenin ikinci boyutu olarak yapılandırılan **İnsan kaynağı** boyutuna odaklanmaktadır. Fiziksel altyapı, dijital toplum için yeterli değildir; İnternetin sunduğu olanaklardan yararlanmak, yeni dijital mal - hizmetler geliştirmek, tüketmek için insan kaynağının uygun bilgi ve becerilere sahip olması gerekmektedir. Dijital beceriler verimliliği ve ekonomik büyümeyi artırmak için ekonomi ve toplumun dijital dönüşüm sürecinin ayrılmaz bir parçasıdır. Dijitalleşmenin insan kaynağı boyutu dört alt gruptan oluşur: İnternet kullanımı (2a1), Temel dijital beceriler (2a2), Bilgi ve iletişim teknoloji (ICT) uzmanları (2b1), Bilim, teknoloji, mühendislik ve matematik (STEM) mezunları (2b2). Aşağıdaki tabloda 2013-2016 arasında karşılaştırmaya elverişli veri olan yıllar için dijitalleşme indeks sıralamaları ve değerleri verilmiştir.

Boyut	*IDESI (2013-2016)*		*İnsan Kaynağı (2013-2016)*		*2a1 (2013-2016)*		*2a2 (2013-2016)*		*2b1 (2013-2014)*		*2b2 (2015)*	
Ülkeler	*Sıra*	*Oran*	*Sıra*	*Oran*	*Sıra*	*Oran*	*Sıra*	*Oran*	*Sıra*	*Oran*	*Sıra*	*Oran*
Türkiye	44/45	42	36/45	53	32/42	75	44/45	41/42	41/42	20	11/36	24
Rusya	39/45	48	13/45	64	34/42	73	28/45	13/42	13/42	44	33/36	07
AB		59		58		81				40		21
AB dışı		59		60		81				35		25

Çalışmada ele alınan 45 ülke IDESI oranlarına bakıldığında Türkiye'nin %42 indeks oranı ile 44, Rusya'nın %48 indeks oranı ile 39. sırada yer aldığı görülür. **İnsan kaynağı** sıralamasında Türkiye %53 indeks değeri ile 36, Rusya %64 indeks değeri ile 13. sıradadır. Türkiye'nin her iki indeks değeri hem AB üyesi ülkeler hem de AB üyesi olmayan ülkeler ortalamasından düşüktür.

Internet kullanımı ve temel beceriler (2a) alt boyutunda Türkiye, incelenen ülkeler arasında en alt sıralarda yer almaktadır. Rusya'nın performansı Türkiye'den daha iyi durumdadır. İleri beceri ve gelişme boyutunda (2b) ; hem Türkiye hem de Rusya alt boyutları açısından çelişkili bir durum söz konusudur. Her iki alt boyuttaki sonuçların iyileştirilmesine ihtiyaç duyulmakla birlikte ileri becerilerde, temel becerilerden daha olumlu değerler

gözlenmektedir. Türkiye dört alt boyutun üçünde en kötü performans gösteren ülkeler arasında yer almaktadır. Rusya ise dört boyuttan ikisinde iyi performans göstermemektedir.

İşgücüne katılım yönüyle, STEM mezunlarının Türkiye'de kendi alanlarında iş piyasasına yeterince katılamadıkları, Rusya'da ise katıldıkları görülür. Her iki ülke temel dijital becerileri geliştirme potansiyeline sahiptir. En düşük indeks değerlerine sahip alt boyutlar geliştirmeye başlamak için bir alternatif olabilir. Türkiye, bilişim sektöründe iş potansiyeli geliştirmeyi teşvik edebilir. Rusya, STEM + A alanlarında eğitim fırsatlarını artırabilir. Bütüncül stratejiler-politika önerileri geliştirmek ve uygulamak önemlidir.