DOI: iibfdkastamonu.453156

Submitted: 13.08.2018
Accepted: 23.10.2018

Kastamonu Üniversitesi
İktisadi ve İdari Bilimler Fakültesi Dergisi
2018, 20 (4)

Research Article

Do Technology Trigger Unemployment and Unhappiness?*

Türkay DERELİ[1]
Cihan ÇETİNKAYA[2]
Nazmiye ÇELİK[3]

Abstract: The development of technology and the fact that robots are part of everyday life has caused fear and concern among people. The issue that technology will eradicate many jobs and diminish the workforce is one of the most important debates in recent times. There is a concern and curiosity among people whether they are going to be employed. How is the job market evolved? Is the impact of the robots on the job market created new jobs, or lead to only unemployment? The answers to these questions are important in terms of concern and happiness felt by people. The aim of this study is to understand effects of robots and technology on employment and in this way happiness of people. Thus, in this study, it is stated that whether future occupations will be able to take the place of disappearing occupations. The impact of technology on employment is analyzed using 10 indexes focused on technology. Considering the all technological variables together, it is observed that there is an effect on employment but this effect is not direct. Furthermore, effect of happiness index on technology is examined. It can be also said that technology has a powerful influence on happiness, but many other factors for happiness index need to be accounted for.

Keywords: Employment, Technology, Robots, Happiness.
Jel Codes: O,O10,O14,O30,O33

Teknoloji, İşsizliği ve Mutsuzluğu Tetikliyor mu?

Öz: Teknolojinin gelişimi ve robotların günlük yaşamın bir parçası olduğu gerçeği, insanlar arasında korku ve endişeye neden olmaktadır. Son zamanlardaki en önemli tartışma konularından biri teknolojinin birçok mesleği ortadan kaldıracağı ve iş gücünü azaltacağına dairdir. İnsanlar arasında istihdam edilip edilmeyeceklerine dair merak ve endişe vardır. İş piyasası nasıl gelişiyor? Robotların iş piyasası üzerindeki etkisi yeni işleri ortaya çıkarıyor mu, yoksa sadece işsizliğe mi yol açıyor? Bu soruların cevaplanabilmesi insanların duyduğu endişe ve mutlu olabilmeleri açısından önemlidir. Bu çalışmanın amacı; robotların ve teknolojinin istihdam üzerindeki etkilerini ve bu doğrultuda insanların mutluluğunu anlayabilmektir. Bu yüzden bu çalışmada, geleceğin mesleklerinin gittikçe yok olan mesleklerin yerini alıp alamayacağı gösterilmektedir. Teknolojinin istihdam üzerindeki etkisi, teknolojiye odaklı 10 indeks kullanılarak analiz edilmiştir. Tüm teknolojik değişkenler birlikte dikkate alındığında, teknolojinin istihdam üzerinde bir etkisi olduğu ancak bu etkinin doğrudan olmadığı görülmektedir. Ayrıca, mutluluk indeksinin teknoloji üzerindeki etkisi incelenmiştir. Teknolojinin mutluluk üzerinde güçlü bir etkisi olduğu söylenebilse de, mutluluk indeksi için diğer birçok faktörün hesaba katılması gerekmektedir.

Anahtar Kelimeler: İstihdam, Teknoloji, Robotlar, Mutluluk
Jel Kodu: O,O10,O14,O30,O33

---

* *This work is an extended version of the work presented at the ISMSIT 2017- Tokat (1st International Symposium on Multidisciplinary Studies and Innovative Technologies) conference and it was published as abstract in abstracts book.*

[1] *Head of President, Iskenderun Technical University and Prof Dr., Gaziantep University, Department of Industrial Engineering, dereli@gantep.edu.tr*

[2] *Assoc.Prof. Dr., Adana Science and Technology University, Department of Management Information Systems, ccetinkaya@adanabtu.edu.tr*

[3] *Res.Assist, Gaziantep University, Department of Industrial Engineering,* nazmiye@gantep.edu.tr

Atıf Künyesi: *Dereli, T., Çetinkaya, C. ve Çelik, N. (2018). Do Technology trigger unemployment and unhappiness?, Kastamonu Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 20/4, 146-157.*

Citation: *Dereli, T., Çetinkaya, C. ve Çelik, N. (2018). Do Technology trigger unemployment and unhappiness?, Journal of Kastamonu University Faculty of Economics and Administrative Sciences, 20/4, 146-157.*

Introduction of robots into human life has caused many different effects. These effects can be negative or positive that may vary according to the people who care about the issue. According to Baykasoglu and Dereli (2006:71), it took a long time to realize that robots don't sleep, don't tired, don't afraid, and don't sick because of the fear of unemployment. However, very important benefits can be gained when robots are replaced with people in the right place and at the right time.

According to the World Robotic Reports (2017) for 2016, sales of robots rose to 294,312 units, it corresponds to 16% for one year; and it has reached the highest level in 2015. The main trigger of the growth was electrical/electronics industry (+41%) in 2016 like in 2015.Sales to metal and machinery industry slightly reduced by 3% but sales of subsectors such as basic metals and metal products have kept a rising trend. Plastics and rubber industry with 16% followed an increased trend between 2009 and 2015. In 2016, sales decreased by 8% in this area. For the automotive industry, the robot sales just moderately increased by 6% to a new peak of 103,300 units, accounting for a share of 35% of the total supply in 2016.

Studies about the effects of robots on employment has been done even many years ago. Edler and Ribakova (1994) presented results of an empirical simulation study about impacts of robots on employment in Germany in 1994. Their findings showed that industrial robots have significance impact on the structure of employment and the sectors. Miller and Atkinson (2013:29) handled argument about "are robots killing our jobs" and they formed a relationship between productivity and employment. They emphasized that productivity is highly effective on nation's economy. Acemoglu and Restrepo (2017) presented analysis about impact of the increasing usage of industrial robots between 1990 and 2007 for the local labor markets in US. The paper presented positive and negative effects of robots. While positive effect is related to productivity, negative effect shows direct displacement of workers. Darrell M. West (2015) showed impact of robots, artificial intelligence and machine learning as emerging technologies on the labor force in fields of social insurance, health benefits and pensions. He mentioned about how societies will fulfill their lives despite of relatively few workers in future. Cascio and Ramiro (2016) examined devastating effects of arising communication and information technologies. The impact of technology on business and organizations was addressed.

1.1. Occupations of the Future

The utilization of robotics will enhance unemployment statistics among people. Robotics can be used as labor force in the work life and be supportive where necessary. Robots can make physically demanding workings, this leads human to turn to intellectual tasks. Prominent future occupations are shown as follows (Thompson, 2017):

1. Data analysts will be popular.

2. Computers and mathematically based occupations will start to grow.

3. Architects and engineering jobs will remain stable.

4. Specialized sales personnel will be needed in the field.

5. Across the industry, senior managers will be needed to lead firms through duration of transformations.

6. Product designers will still exist.

7. Both human resources and organizational development specialists will also be needed to assist re skill workers.

8. Because of companies adopting new technologies, request for regulatory and government relations specialists will continue to rise.

Figure 1 shows outlook of employment through job groups.

Figure 1: Outlook of employment through job groups (Future of Jobs Report, World Economic Forum)

The data is from 2015 to 2020. According to World economic forum, 8 occupations each corporation will be hiring for by 2020. Although many occupations are disappearing, some new occupations will be demanded in the future. However, the general view is that

disappearing jobs demand more employee than future demanding jobs.

1.2. Comments of Some Elite People about Subject

"The automation of factories has already decimated jobs in traditional manufacturing, and the rise of artificial intelligence is likely to extend this job destruction deep into the middle classes, with only the most caring, creative or supervisory roles remaining."—Stephen Hawking

"What to do about mass unemployment? This is going to be a massive social challenge. There will be fewer and fewer jobs that a robot cannot do better [than a human]. These are not things that I wish will happen. These are simply things that I think probably will happen."—Elon Musk

"You cross the threshold of job-replacement of certain activities all sort of at once. So, you know, warehouse work, driving, room cleanup, there's quite a few things that are meaningful job categories that, certainly in the next 20 years [will go away]."—Bill Gates (Larson, 2017).

"Smart machines now collect our highway tolls, check us out at stores, take our blood pressure, massage our backs, give us directions, answer our phones, print our documents, transmit our messages, rock our babies, read our books, turn on our lights, shine our shoes, guard our homes, fly our planes, write our wills, teach our children, kill our enemies, and the list goes on."- Jeffrey Sachs (Vardi, 2017).

"Indeed AI and automation are already having profound effects on employment, as former assembly line workers, postal employees, and bank tellers will confirm. Also, soon to be affected are even some mid-level professionals such as attorneys, radiologists, stockbrokers, and newspaper writers. I think that the result of all of this automation will be continuing structural unemployment, especially among unskilled and not-sufficiently educated people."- Nils J. Nilsson (Nilsson, 2017).

1.3. Humanoid Robot Sophia

Robots seem to penetrate every aspect of life. Recently, humanoid robots, which can be called almost real, have been developed. "Sophia" is the most sophisticated and most advanced robot for now. She has been interviewing many media organizations and referred as media darling. Sophia sang in a concert and even took part in the cover of the best fashion magazines. Facial expressions are not different from real people. Sophia's interview hit social media's agenda

and billions of views emerged. Sophia has shown that she can also be effective in the business world. She has made face-to-face interviews with prominent figures in various sectors. These were media and entertainment, banking, property development, auto manufacturing and insurance industries. In addition, she attended to conferences as a presenter and panel member. The subject was how robotics and artificial intelligence will cover a large part of human life. After all, it seems impossible for people not to worry about whether robots will replace mankind (Hanson Robotics, 2017).

As a summary in this study, the factors affecting employment is considered based on specified countries with the highest number of robots and the relationship between dependent and independent variables are determined. Accordingly, employment rates are examined among these special countries. Furthermore, happiness of countries is evaluated taking into account same independent variables. Study is thought to help understand of the effects of robots and technology on employment.

2. MATERIALS AND METHOD

According to the IFR (International Federation of Robotics) (Word Robotics Report, 2017), 22 countries with relatively more robots in the manufacturing industry are selected. In this context, the other factors are also taken into account and their employment effects are analyzed.

2.1. Defining Variables

Number of robots (nor), innovation index (ii) and high technology export (hte) are chosen as independent variables for following reasons:

- Since robots are seen as the main cause of unemployment, the input variables are created based on the countries with the largest number of robots.
- Elaborate metrics of innovation performance of 127 countries and economies are ensured by global innovation index. 81 indicators examine innovation in a wide range, containing infrastructure, political environment, education, and business sophistication (The Global Innovation Index, 2017). Therefore, innovation index effect on employment is used in this study (Global Innovation Index 2017 rankings, 2017).
- For high-tech exports, the world's leading countries are in a state of never-ending competition for top positions. High technology exports are constituted of all kinds of products that require important research and resources to improve and produce such as

scientific instruments, pharmaceutical, aerospace, computer and electrical machinery industries (Worldatlas, 2017). High technology export (% manufactured exports) is also taken as an independent variable (The World Bank, 2017).

- Network readiness index (nrı), availability of latest technologies (alt), firm-level technology absorption (fta), capacity for innovation (ci), ICT use for business-to-business transactions (ICT), impact of ICTs on business models (ICT2), share of workforce employed in knowledge-intensive activities (wf, as percent) are the other independent variables that are thought to have impact on employment. Network readiness index is presented as a key factor in evaluating preparedness of countries to gather advantages of emerging technologies and benefits digital transformation. NRI can assist to evaluate countries' ability to benefit on the digital revolution and their readiness to gain from the emerging Fourth Industrial Revolution (The Global Information Technology Report, 2016). Employment (emp) is considered as dependent variable in this study (The World Bank, 2017). Table 1 shows values of independent and dependent variables for year 2017.

Table 1: Values of All Variables

No	Country	nor	Ii	hte	nrı	alt	fta	ci	ict	ict2	wf	Emp.
1	Republic of Korea	631	57.7	26.8	5.6	5.6	5.4	4.8	5.3	5.5	21.6	24.786
2	Singapore	488	58.69	49.2	6	6.2	5.7	5.1	5.8	5.8	52.7	16.315
3	Germany	309	58.39	16.6	5.6	6.2	5.7	5.6	5.7	5.4	43.5	27.259
4	Japan	303	54.72	16.7	5.6	6.2	6.1	5.3	6.1	5.3	24.4	25.578
5	Sweden	223	63.82	14.2	5.8	6.5	6	5.7	5.8	5.6	49.4	18.138
6	Denmark	211	58.7	15.9	5.6	6	5.7	5.3	5.6	5.1	45.3	18.79
7	USA	189	61.4	18.9	5.8	6.5	6.1	5.9	5.7	5.5	38	18.89
8	Italy	185	46.96	7.2	4.4	5.1	4.2	4.5	4.5	4.4	35.6	26.323
9	Belgium	184	49.85	13	5.4	6.2	5.6	5.3	5.7	5.4	46.2	21.343
10	Spain	160	48.81	7.1	4.8	5.5	4.9	4.1	5	5.1	33.1	19.497
11	Netherlands	153	63.36	19.9	5.8	6.3	5.6	5.2	6	5.8	46.4	16.537
12	Canada	145	53.65	13.8	5.6	6.2	5.4	4.9	5.6	5.5	43.7	19.619
13	Austria	144	53.1	13.3	5.4	6.1	5.7	5.4	5.7	5.3	40.4	25.617
14	Finland	138	58.49	8.7	6	6.6	5.8	5.6	5.9	5.9	45.2	22.286
15	Slovenia	137	45.8	6.42	4.7	5.5	4.9	4.4	5.2	4.5	41.7	32.585
16	Slovakia	135	43.43	10.2	4.4	5.5	4.8	3.8	5.5	4.6	31.9	36.341
17	France	132	54.18	26.8	5.3	6	5.5	5.1	5.3	5.2	44	20.366

18	Switzerland	128	67.69	26.8	5.8	6.4	6	6	6	5.7	52.1	20.736
19	Czech Republic	101	50.98	14.9	4.7	5.6	5	4.8	5.5	5	37.9	37.869
20	Australia	83	51.83	13.5	5.5	5.9	5.6	4.8	5.5	4.9	44.9	19.139
21	UK	71	60.89	20.8	5.7	6.5	5.7	5.4	6	5.9	47.4	18.359
22	China	68	52.54	25.7	4.2	5.5	4.7	4.2	4.9	4.7	33.3	26.621

Country rankings are made considering countries with many robots. Values of other independent variables are also shown by country order. It is observed that these variables are close to each other based on columns.

2.2. Regression Analysis

The regression equation is constructed using the variables we have shown in Table 1. According to the regression equation, R square is founded as 0.82. But adjusted R square is founded as 0.66. Independent variables can explain more than 66% of the dependent variable meaning. Considering the all independent variables together, it is observed that there is an effect on employment but this effect is not direct.

The results show that employment is not only affected by technological factors. Many other reasons for employment need to be analysed. These causes can be extended from educational factor to psychological factors. Figure 2 shows technological position of 22 countries. As seen in the figure2, variables except number of robots and employment are close to each other for all countries. In fact, it is not right to examine employment based solely on robots. This is a multi-dimensional issue that needs to be considered.

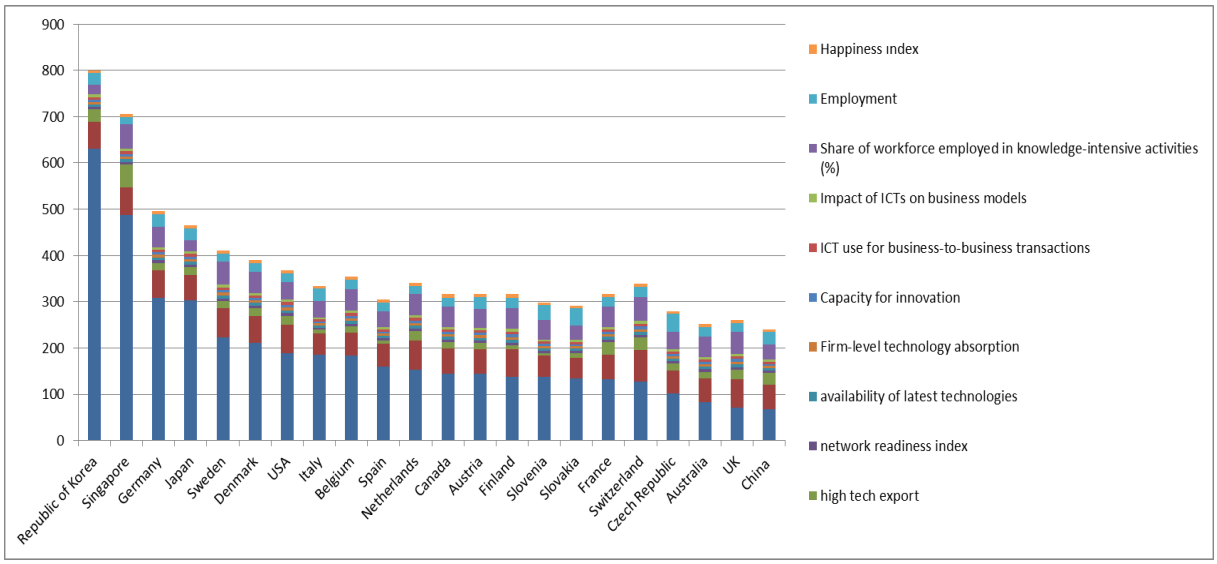

Figure 2: Technological Position of 22 Countries

As shown in the figure 3, employment rates have declined in time except China. The low cost of labor in China has attracted other countries. In this way, some foreign companies have turned to produce their products in China. This has caused an increase in employment rate in China.

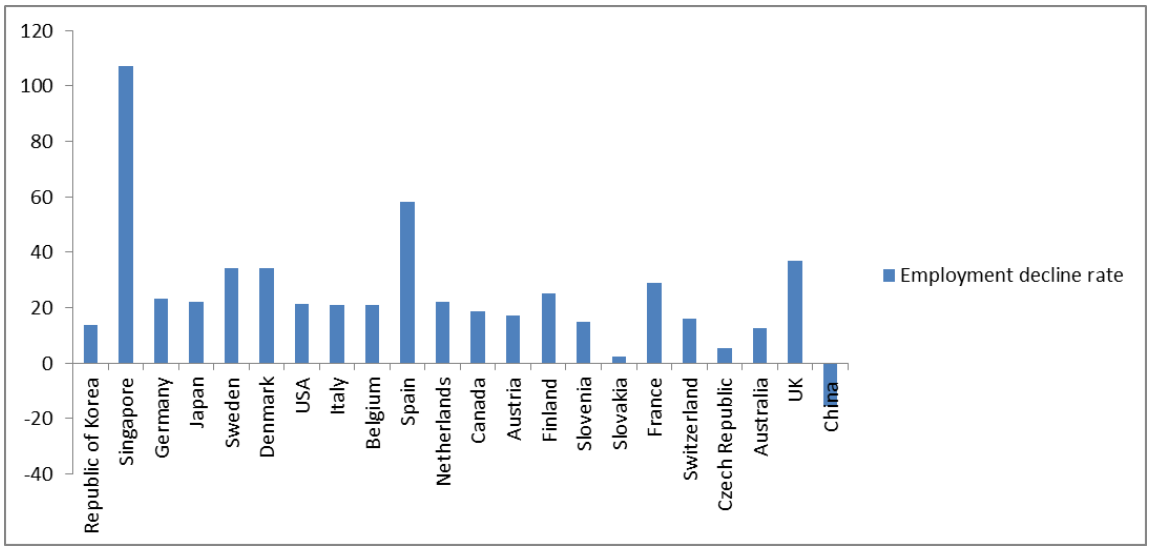

Figure 3: Employment Decline Rate

Robots are important for industry 4.0 because of flexibility, high speed, reduced cost, automatic program creation, reliability, increases of productivity etc. In year 2000, internet of things that constitutes of the industry 4.0 entered the lives. Internet of things is a concept basically connecting machines or any other devices to each other or internet for providing above mentioned benefits. Thus, employment decline rate is shown for 2000 and 2017 years in figure 3.

2.3. Effect of Technology on Happiness

Happiness is one of the focal point for economists (Bruni, 2004:19). According to the Oswald (1997) the more high economic performance means the more high happiness for a nation. Where the happiness index is in these situations is important point. Impacts of all above mentioned technology and employment variables on happiness are considered. According to the world happiness report (World Happiness Report, 2017) since the majority of people spends most of their lives at work; the impact of employment is important on peoples' happiness. The employment for people's simple welfare is important and it shines a spotlight on the poverty and unhappiness. The data show that unemployment has an infectious side and can affect people negatively even those with employment. Again according to this report (World Happiness Report, 2017) as seen in figure 4, welfare of individuals around the world

is presented whether or not they are employed. Since employment has been taken into account when calculating the happiness index, all technological variables which influence employment are associated with happiness in this study.

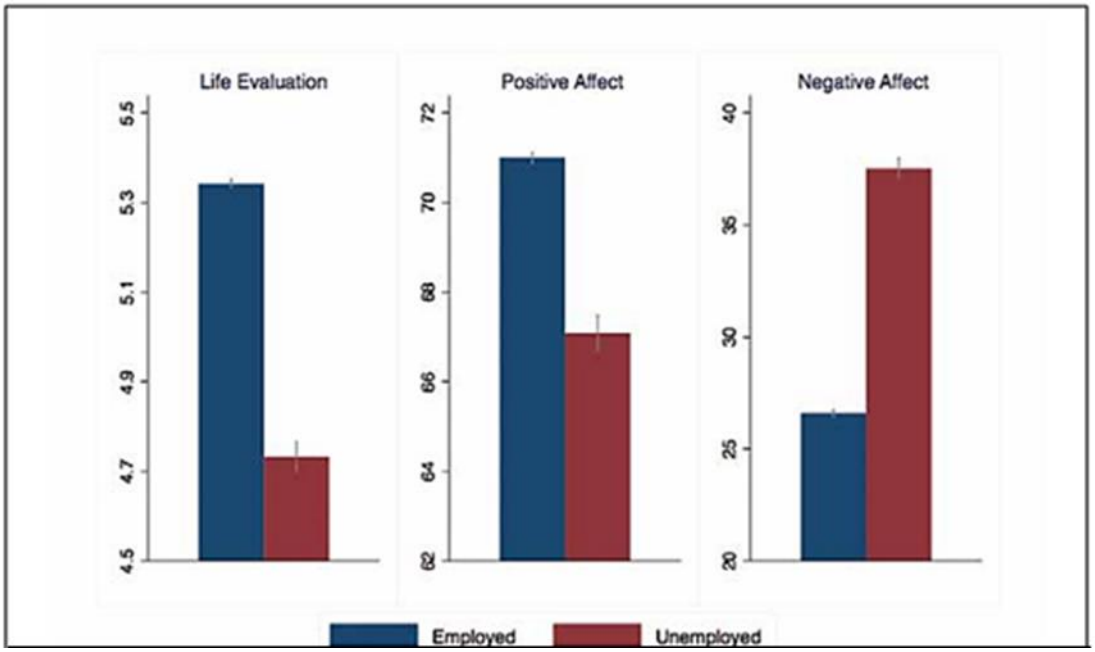

Figure 4: Welfare and Employment (Source: Gallup World Poll)

Regression analysis is done using same independent variables and happiness dependent variable. Table 2 shows happiness index of 22 countries. Again, country rankings are made considering countries with many robots. R square is founded as 0.85. It can be said that technology has a powerful influence on happiness only when this value is taken into consideration. However, when adjusted r square is taken into account, it is seen that independent variables can explain more than 71% of the dependent variable meaning. Again, many other factors for happiness index need to be accounted for.

Table 2: Happiness Index of 22 Countries (World happiness report 2017)

No	**Countries**	**Happiness**
1	Republic of Korea	5.838
2	Singapore	6.572
3	Germany	6.951
4	Japan	5.92
5	Sweden	7.284
6	Denmark	7.522
7	USA	6.993
8	Italy	5.964
9	Belgium	6.891
10	Spain	6.403
11	Netherlands	7.377
12	Canada	7.316

13	Austria	7.006
14	Finland	7.469
15	Slovenia	5.758
16	Slovakia	6.098
17	France	6.442
18	Switzerland	7.494
19	Czech Republic	6.609
20	Australia	7.284
21	UK	6.714
22	China	5.273

In general, the happiness indexes of these countries seem to be close to each other and quite good. It is observed that not only technological coefficients but also other factors are influential in the values.

CONCLUSION

With the robots entering into life, debates about effects of technology on human and employment have been flared up. As some occupations began to disappear, some new occupations have emerged. However, in the future the workforce based on physical power will be replaced by the information-intensive workforce. This means that the number of employees will be decrease in the future. The creation of robots, which are very similar to human beings such as Sophia, increases the uneasiness among people. The passing of factories through fully automated systems is reducing the demand for human power. Drones, internet of things, intelligent systems and many other technologies are progressing incredibly. These developments inevitably lead to unemployment concerns among people.

In this paper, the occupations that are disappearing in time and will become popular are mentioned besides various opinions about subject. 22 countries with relatively more robots are selected and in this context, other determined factors are also taken into account and their employment effect is analysed. 10 independent variables are selected for analyses. These variables are: number of robots, innovation index, high tech export, network readiness index, availability of latest technologies, firm-level technology absorption, capacity for innovation, ICT use for business-to-business transactions, impact of ICTs on business models, share of workforce employed in knowledge-intensive activities (%).According to the regression equation, R square is founded as 0.82. But adjusted r square is founded as 0.66. Independent variables can explain more than 66% of the dependent variable meaning. Considering the all independent variables together, it is observed that there is an effect on employment but this effect is not direct. The results show that employment is not only affected by technological factors. Many other reasons for employment need to be analyzed. For happiness index,

regression analysis is done. R square is founded as 0.85. It can be said that technology has a powerful influence on happiness only when this value is taken into consideration. However, when adjusted r square is taken into account, it is seen that independent variables can explain more than 71% of the dependent variable meaning as a whole due to the large number of independent variables. Although, happiness indexes of examined countries seem to be close to each other and happiness values seem quite good for these countries, other factors affecting the result must also be considered.

As a result, it is inevitable that technology will advance and robots will be part of our lives. The important thing is to be able to catch this technology and compete with other countries. It is important to train staff who can work in information intensive jobs. Besides the disadvantages, there are many aspects of technology that make life easy. This study examines employment in many respects including robotics issues, technological factors and psychological aspect. In future studies, new independent variables can be determined and the effect of each variable on each other can be examined. Maybe, the subject can be looked at in terms of the efficiency of robots and human.

REFERENCES

Acemoglu, D., Restrepo, P. (2017). Robots and jobs: evidence from US labor markets, *National Bureau of Economic Research*, Cambridge, MA 02138.

Baykasoglu,A., Dereli, T..(2006). Üretimde bilgi teknolojisi yöntemleri, pp 254.

Bruni, L. (2004). The ‘‘Technology of Happiness’’ and the tradition of economic science. *Journal of the History of Economic Thought*, 26(19-44).

Cascio, W.F, Ramiro, M. (2016). How technology is changing work and organizations. *Annual Revıew of Organizational Psychology and Organizational Behavior*, 3(349-375).

Edler,D., Rıbakova,T.(1994). The impact of industrial robots on the level and structure of employment in Germany - A simulation study for the period 1980-2000. *Technological Forecasting and Social Change*, 45(255-274).

Executive summary world robotics 2017 industrial robots. (2017).Retrieved from https://ifr.org/downloads/press/Executive_Summary_WR_2017_Industrial_Robots.pdf, access date: 02/07/2018

Global high tech exports by country, Worldatlas. (2017). Retrieved from http://www.worldatlas.com/articles/countries-with-the-most-high-tech-exports.html, access date: 02/07/2018

The global information technology report 2016. (2016). Innovating in the digital economy, World Economic Forum.

The Global Innovation Index 2017. (2017). Innovation feeding the world, tenth edition.

Global innovation index 2017 rankings. (2017). Retrieved from https://www.globalinnovationindex.org/, access date: 02/07/2018

Hanson Robotics. (2017). Retrieved from http://www.hansonrobotics.com/robot/sophia/, access date: 01/09/2017

Larson, Q. (2017). A warning from Bill Gates, Elon Musk, and Stephen Hawking. Retrieved from https://medium.freecodecamp.org/bill-gates-and-elon-musk-just-warned-us-about-the-one-thing-politicians-are-too-scared-to-talk-8db9815fd398, access date: 01/09/2017

Miller, B., Atkinson, R.D. (2013). Are robots taking our jobs, or making them? *The Information Technology & Innovation Foundation*, 1-36.

Nilsson, N.J. (2017). The Future of work: Automation's effect on jobs—This time is different, PacificStandard,2015. Retrieved from https://psmag.com/economics/the-future-of-work-automations-effect-on-jobsthis-time-is-different, access date: 01/09/2017

Oswald, A.J. (1997). Happiness and economic performance, *Economic Journal*.1815–1831

TheWorldBank.(2017).Retrieved from http://data.worldbank.org/indicator/TX.VAL.TECH.MF .ZS, access date: 02/07/2018

TheWorldBank.(2017).Retrieved from https://data.worldbank.org/indicator/SL.IND.EMPL.ZS, access date: 02/07/2018

Thompson,C.(2017). 8 jobs every company will be hiring for by 2020, World Economic Forum. *The impact of robotics on future societies.* Retrieved from https://www.weforum.org/agenda/2016/01/8-jobs-every-company-will-be-hiring-for-by2020/, access date: 01/09/2017

Vardi, M.Y.(2017). Are robots going to steal your job? Probably. Retrieved from https://www.theguardian.com/commentisfree/2016/apr/07/robots-replacing-jobs-luddites-economics-labor, access date: 01/09/2017

West, D.M. (2015). What happens if robots take the jobs? , The impact of emerging technologies on employment and public policy, *Center for technology innovation at bookings*, October.

World Robotics Report 2016.(2017). International Federation of Robotics, Retrieved from https://ifr.org/ifr-press-releases/news/world-robotics-report-2016, access date: 01/09/2017

World Happiness Report 2017(2017). Retrieved from https://s3.amazonaws.com/happinessreport/2017/HR17.pdf, access date: 02/07/2018