Opportunities and Problems Offered to Software Companies by the Pandemic Process

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Abstract: The pandemic process is an event that we have never encountered in our lives, and it still continues as a reality that we do not know exactly when it will end. In fact, this problem experienced by individuals is also valid for all businesses. The pandemic continues to affect all sectors. Software is also one of the sectors affected by the pandemic. Although this influence has positive aspects, it also has serious negative aspects. Especially in this process, online working, information security, video conferencing systems, online education etc. While many new job opportunities have been provided for the software industry with many applications, a very significant need for experienced and qualified software developers has emerged. Especially the need for experienced software developers who can work independently and develop software has reached its peak in this process. These developments are seen in many countries in the world as well as in Turkey. Currently, the positive and negative effects of the pandemic on the software industry are felt much more aggressively in developed countries. As a result of this, there have been very serious transfers of experienced software developers to developed countries, especially in recent years.

Keywords: Pandemic, Software Companies, Software Engineers

Introduction

Pandemic is an epidemic disease that we have not encountered before. It has caused serious astonishment and uncertainty not only in our country, but also in all countries, both individually and institutionally. This epidemic, whose conclusion date is still unknown to anyone, has had very important reflections on the activities of both individuals and businesses. While these reflections have positive aspects, they also have many negative consequences.

The software industry, which constitutes the most important part of informatics, has also been one of the business lines most affected by these reflections. In particular, the informatics sector, which is named after our age, is the locomotive of economies today. Indeed, many countries that have made good use of the developments in this sector (Acarer, 2017), which has become an integral part of our lives and have become an integral part of our lives in recent years, have provided very positive developments in their general economies. Ireland, India, Iceland, Russia etc. Some countries, on the other hand, focused only on the software part of informatics and provided very important employment rates and economic income with very small investments. It is possible to observe many examples of these in the last fifteen years. Because of all the developments in the Informatics Sector also affect all other sectors that are under the influence of the sector (Tekin et al., 2000). The fact that the IT sector is dependent on technology and that this technology tends to develop continuously (Özdemir, 2009) is a very important factor.

The information sector, which is named after the century we are in; It is an important production tool in the activities of companies in terms of efficiency and competition. (Özgün, 2015). As a result of this, if the enterprises make maximum use of the developments in the information sector, which is very closely related to

their own activities, they will gain very important advantages in the competition they will make. Otherwise, it is almost impossible for companies that cannot benefit from and keep up with the developments in this sector to continue their activities (Kılınç & Ünal, 2019).

The most important reflections of this sector, which is defined as ICT (Information Communication Technology) in the international literature, are still seen in Big Data (Big Data) and Artificial Intelligence (Artificial Intelligence), which processes and makes sense of this data. It is only possible to get the desired result in these two areas and to transform it into an economic model, only by employing sufficient number and quality of software developers.

Developments in the IT Sector

The IT sector, as a high-tech sector, is gradually increasing its market share in Turkey and is becoming an industry where domestic investments are increasing (Bilir et al., 2017). The mobile communication infrastructure of informatics, which emerged for the first time in the early 1980s, has started to develop rapidly since this date. The first generation mobile communication systems (1G), which were analog, were known as car phones. These devices, which are quite large, draw serious energy, so they can be used in cars, buses, etc. Apart from mobile devices, its practical use has not been possible. Afterwards, a new generation of mobile communication emerged every 10 years. Narrowband data service was started to be used for the first time with the second generation systems (2G). In 2G, the data rate was also quite low, since the bandwidth was low.

It has started to be used as broadband mobile communication systems with the third generation mobile communication systems (3G). With the communication opportunity provided by broadband, "applications" have started to find application areas intensively and the transmission of services that require large bandwidth such as video communication, video, picture has become possible. With the fourth generation systems (4G), Internet Protocol (IP) has been used in mobile communication and the infrastructure has turned into a very different technology compared to previous generations. The IP infrastructure has also been the beginning of the change in the architectural structure of the mobile communication system. The transformation of the infrastructure to IP is a very important and radical change point for mobile communication, and it has also prepared the ground for the necessary technological infrastructure for the fifth and further generations.

The architectural infrastructure of the fifth generation mobile communication systems (5G) is different than the other generations. With the use of this generation, the mobile communication infrastructure will include a very different technology. Since the bandwidths of the 5th generation systems where different communication bands are planned to be used are planned to be used, it is foreseen to reach very high speeds in data transmission and internet communication and to switch to very different applications in mobile communication. The chart below (Figure 1) shows the years in which different generations emerged, their development trends and the number of global subscribers, taking into account the years. (Technology Futures Inch., 2018) As can be seen from this table, with the emergence of each new generation, the subscriber growth rate in the previous generation stops and the number of previous generation subscribers decreases as the years progress.
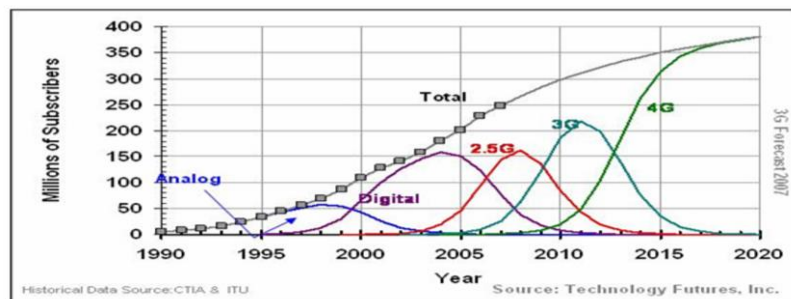

Figure 1. Diffusion of mobile technologies

Parallel to the developments in mobile communication generations in the IT sector, there is a significant increase in data usage. Because each next generation contains more broadband than the previous generation, and therefore the data transmission rate increases at that rate. As can be seen from the graphic below (IDC Global DataSpere, November 2018, Data Age 2025), the biggest increase in usage has been experienced since 2010. (1 Zettabyte = 1 billion x 1 Terabyte = $8*1021$ bits = 1 billion means 1 TB hard disk). Because, as explained above, the use of mobile broadband first started with 3G systems and has increased exponentially every year

thereafter. Especially after 2011, when 4G started to be used, data rate and amount increased significantly and nearly doubled every year compared to previous generations (Acarer, 2017).

As can be seen from the chart below, it is predicted that the real increase in data usage will start with the widespread use of fifth generation systems and a much faster increase trend will be experienced after that (IDC Global DataSphere, November 2018). An increase in bandwidth means an increase in speed at the same rate. This means that much more data is used for different functions and services. Again, from the aforementioned graph, it is predicted that my data usage calculated in 2025 will be more than 150 times compared to 2010. The most important source in this will be the large bandwidth that 5G systems will provide and the increase in data usage due to speed.
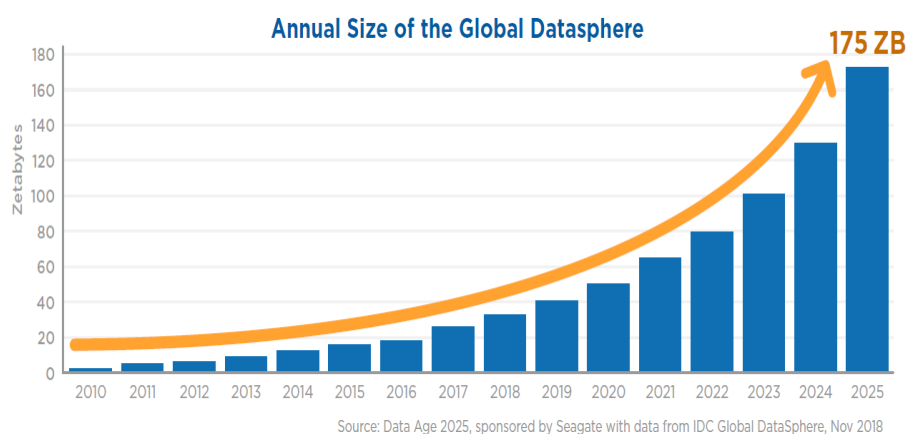

Figure 2. Annual size of the global datasphere

Evaluation of Big Data

Today, data is called "the raw material of our age". This fact has naturally been known by giant IT companies such as Google, Amazon, Twitter and Facebook from the very beginning, and this issue even lies at the basis of the founding philosophy of these companies (Ege, 2013). The volume and diversity of data in the world is still increasing at a rate never seen before in human history. With the penetration of internet technologies and social media into every phase of our lives and even our mobile phones, people have come to a point where they produce data even in their daily activities (Aktan, 2018). There are many resources such as smart phones, tablet computers, sensors, medical equipment, web traffic records, interactions in social networks and scientific research that offers solutions in fields such as pharmacy, meteorology, simulation (Schneider, 2012). In addition, the data stacks obtained by combining the data generated on websites, social media and mobile platforms from sensors and the internet of things and the data within the organizations have revealed the concept of "big data" (Goes, 2014).

However, the increasing heterogeneity of the web environment causes the provision of big data content in different media such as text, images and videos on web pages, and in genres such as encyclopedias, news, blogs, as well as subjects such as entertainment, sports, technology (Achsas & Nfaoui, 2017). Big data analytics is a technique used to analyze large data sets in order to obtain information that will guide the decision-making process (Gandomi & Haider, 2015). At the analysis stage, either all big data elements are combined or it is determined which big data element is relevant to the result to be obtained (Katal et al, 2013).

The century we live in is defined as the information age. Accordingly, the more data the businesses have or the more data they can access while continuing their activities, it is possible to make much healthier decisions by processing them. Because the larger the data, the better predictions can be made (Schönberger & Cukier, 2013). For this purpose, many businesses either employ software developers who can analyze the data in question, or they get this service from outside for a fee. In the meantime, many companies employ software personnel in order to evaluate the data for the service they provide within their own structure, and the functions of these units are gradually increasing.

One of the important reflections of the IT sector on all sectors is the increase in the productivity of companies serving in these sectors. The most important factor in this is that managers use the opportunities offered by the information sector and channel their expertise and knowledge to their work faster without wasting time on administrative issues. (Kolbjørnsrud et al., 2016) This naturally affects the service provided in businesses

positively. In big data analytics, it is possible to collect more data than necessary, which causes many security and privacy violations (Gahi, et al., 2016). In the meantime, it is necessary to take big data security measures in order to open the data to the outside world and thus prevent the data from falling into the wrong hands (Chandra et al., 2017).

Software Engineer Need

Software engineering is one of the most popular professions today. Software engineering is a science that deals with software. As representatives of this science, software engineers examine the requirements, design and structure of the software to be created in line with the needs of the users, or they create the software using programming languages. Depending on the development of informatics and the related internet, this field of engineering is increasing its effectiveness with each passing day. Today, many large and small companies employ software engineers of different qualifications. Because today, even companies that produce different hardware equipment use very serious software support in their activities, and software support is used in the development of all products.

In software engineering, which is one of the most special engineering fields of today and defined as "Software engineer" in the international literature, the most important problem faced by all companies is the supply of software developers with a certain level of knowledge. Because in order to provide services with sufficient efficiency in this field of engineering, only the education received at the university is not sufficient, it is necessary to closely follow all the developments in this field and make the necessary modifications in different programs according to the new software languages. Otherwise, a software language that is very popular and useful today and preferred by all segments may turn into a software language that is rather cumbersome and not preferred compared to new ones after a while. For this reason, a software developer who uses up-to-date software languages and can produce work on his own is still the most preferred and sought-after employee in the software industry.

It takes years of work experience to train an engineer of this quality. Because of in software projects, teamwork is generally done and each project member produces one side of the work. These studies are considered as a kind of internship activity for newly graduated software developers. Because software engineering stages generally require engineers and partners serving in different fields to work together (Giray & Uysal, 2017). Currently, there are approximately 140,000 Software Developer human resources in Turkey, and our country ranks 12th in Europe with this number. In this regard, Germany ranks first with approximately 837,000 Software Developers, England ranks second and third with 814,000 and France 467,000. Russia, Netherlands, Italy, Spain, Poland and Ukraine follow the top three countries in the number of software development personnel in Europe, respectively.

The most important problem experienced in this field during the pandemic process is that the said teamwork could not be done in general. Although teamwork is done online, its efficiency is far from face-to-face teamwork. Because it is very difficult to discuss and evaluate the opinions of other people in the online environment, this negatively affects the efficiency of the meeting at the same rate. The most negatively affected part of this situation is inexperienced software developers. Programmers of this nature, whose individual business development and project completion knowledge are quite weak, cannot find a job in general because they cannot find an environment where they can develop themselves.

Today, businesses usually establish teams for the projects they try to develop in the software they use in their activities, and there are senior officers called "Chief engineer" or "Senor engineer" in international terms. With the coordination of these senior officials, younger software developers, who are less experienced and generally defined as "junior", take part in the meetings held at different periods, and different projects are implemented in this way. However, since face-to-face team work is done in very limited and difficult conditions, it becomes more difficult for inexperienced software developers to be trained quickly and to produce projects independently. It is possible to see many examples of this in the last 2 years. This problem has increased gradually during the pandemic process. Although there is still very little team work with online meetings, the general opinion is that the desired efficiency cannot be obtained from such meetings and that there are not enough software developers who can work independently, especially in the last 1.5 years.

It is possible to say that this issue has turned into a crisis in Turkey. Apart from this, many companies still have to use more financial resources and manpower to invest in high information capacity, which constitutes a different dimension of this issue. For this reason, many countries such as Iceland, Canada, Belgium, Germany

and Australia, which see the informatics sector as a repulsive field in recent years, have started to supply experienced and independent software developers from different countries. Serious fees are paid for these and human resources organizations are used. It is possible to define this function as fully trained software transfers.

This situation regarding experienced software developer transfers still continues at a rapid pace. This situation further increases the negative impact of the pandemic in countries that have lost such qualified software developers. In the last 2/3 years, like Turkey, many seriously trained software developers have lost due to these developments, and this process still continues to a large extent. We see the most important reflections of the developments in this field in our country. On the one hand, the need for software developers of this nature has increased, on the other hand, the wages of existing software developers have reached a level that will force the dimension of international competition.

Turkey sees software as an important area for its development in the IT sector. Despite the preparation and implementation of many incentive measures for this purpose, these developments are still seen as the most important obstacle to the development of our country in this regard. There is a sufficient level of young population in Turkey, even more than many other countries in the world. However, the fact that newly graduated software developers cannot find the opportunity to work in joint projects caused by the pandemic causes this problem to grow even more and its effect becomes negative.

One of the other important reflections of this ongoing process in our country is the increase in the domestic wages of the said personnel in a way that challenges the conditions of international competition. As a result of these developments, although the net salaries of such personnel in Turkey are still over $3,000/4,000, it is still not possible to obtain the required number and quality of software developers. According to the data of the IT Sector, the wages of experienced software personnel have increased by approximately % 45/50 in just the last year. This issue is still seen as the most important problem of both the software industry and other industries that use a large number of software developers in our country, and these developments take place as a serious disadvantage in the international competition of these organizations.

Recommendation for Solution

It is extremely difficult to find a permanent solution to this problem, which has emerged in recent years, in a short time. The most important factor in this is that the pandemic process is prolonged beyond everyone's estimates and that it is not known when it will be completed. Under these conditions, it seems very difficult for young and inexperienced software developers to grow up in a short time and carry out projects independently. From the beginning of the pandemic until today, as in many sectors, all companies in the software industry hoped that this process would end after a while. However, the gradual prolongation of the end of the pandemic delayed the taking of permanent measures to meet the need for software developers. For this reason, in the last few years, international human resources companies have started to intervene and they have started to act as an intermediary in the transfer of experienced software developers from Turkey to abroad, as well as from many countries. This process is still going on extremely intensely. This situation has led to an increasing need for software developers in our country and accordingly the problem on this issue. This issue is still one of the most important problems in the software industry of our country, and it does not seem to be resolved in the near future unless measures are taken. Already in the last few years, rising software developer fees cause software companies to suffer serious problems, especially in international competition. For this reason, in order to reduce the problem in question, or even to isolate it in the middle period and turn this issue into an advantageous situation for Turkey, it is of great benefit to make training programs in the software languages required by the software industry by making use of online communication opportunities. For this purpose, qualified trainers suitable for these programs and young software developers who will receive these trainings should be determined and the necessary economic support should be given to them during this training.

There is an appropriate amount of young software developers in Turkey who will receive the said training. According to Tübisad data, there are approximately 143.000 employees in the ICT Sector in our country, of which 33.000 work in communication and 1110.000 in the field of information technologies (Turkey's Digital Transformation Index Report, Tübisad, 2020). Although the number of employees in information technologies is less than in developed countries, it contains a very high number compared to many countries. In the Tübisad report, there is an increase of 7% in the field of information technologies, while the communication sector decreases by an average of 1% every year. The most important reasons for this are; In many universities in our

country, it is possible to determine the opening of departments in the fields of software and information technologies in recent years, the increase in their capacities and the increase in the interest in these departments.

In line with these evaluations, it can be said that the problem with the software is not in the number of personnel involved, the problem is a quality problem, and if adequate training is provided to these personnel, this issue can be turned from a disadvantage to an advantage for our country. For this, it is of great benefit that relevant NGOs in the IT sector, relevant public institutions and universities cooperate to ensure that training programs are provided in line with the above-mentioned evaluations. For this purpose, it is possible for relevant NGOs such as Yasad and Tübisad to make the necessary coordination. In addition, it is necessary to prepare training programs suitable for the required software areas and to provide financial support to the people who will receive the said training.

For this, the monetary balance of the training to be done should be prepared and appropriate projects should be implemented. Thus, it is possible to meet the need for experienced software developers in our country in a few years and to provide a serious resource to our country's economy by creating a serious employment. The applications related to conferences, working from home, meetings and training held online during the pandemic process have also prepared the necessary infrastructure for the above training program, and will allow the training in question to be carried out extremely quickly and at a reasonable cost.

In the meantime, it would be beneficial to follow an interactive course method in order to ensure maximum efficiency in the training to be given to software personnel. In this way, it is possible to make the training in question and answer form both more interactive and maximize its efficiency. Since the content of this training will be aimed at quality development rather than learning, it is thought that such an application will yield very positive results. Again, at the end of the training to be given on this subject, it is foreseen that the short and interactive exams held at the end of the departments will make a very important contribution to the efficiency of the said programs, instead of the general assessment exams.

Conclusion

While the pandemic process we have been experiencing for the last two years has created serious opportunities in informatics and especially in the software part of it, as in many sectors, it has also led to very complex problems. With the pandemic, especially online education, working from home, teleconferences, online meetings, etc. functions have provided great business resources for existing software companies. The software companies providing these services had great increases in their business volumes and export opportunities in this process. On the other hand, in the software industry, the problem of experienced software developers arose in this process. This problem negatively affected Turkey as well as all other countries, and its impact is still increasing.

The most important problem still experienced in the software industry is the need for experienced software developers who can work on projects individually. These personnel, called "Senor Engineer" or Chief Engineer in the software industry, are generally defined as software developers with 10/12 years of experience. In other words, the supply of project leaders or such personnel who can drag the projects on their own is a problem in all countries. In this regard, the inability of young software developers to work as a team during the pandemic and to stay away from project work is another negative development in the training of such personnel.

This problem in the software industry is valid for all countries, and Turkey is one of the countries that has been adversely affected by this issue. In this regard, especially EU countries such as the Netherlands, Belgium, Iceland, Germany, and countries such as Canada, Australia have started to import many experienced software developers with serious fees from countries with young and qualified software developers such as Turkey in recent years. Turkey is at the forefront of the countries that lost such personnel in this regard. This unfavorable situation for our country still continues at a rapid pace.

In order to solve this problem, what needs to be done in our country is the preparation of an action plan urgently. For this purpose, under the coordination of NGOs such as Yasad and Tübisad, public institutions and universities need to come together, decide on the required software languages and in which areas to provide training. With these training programs, it will be possible to train knowledgeable software developers in a very short time and in a reasonable time in the required software fields.

In this regard, there are software developers who have received the desired training in Turkey. While finding a solution to the problem of qualified software developers with the trainings to be made in this way, software developers can be trained in the languages and fields that the software industry needs, and this issue can be transformed into a serious economic gain for our country. For this purpose, the specified institutions should act together, training programs should be implemented by combining their capabilities within the framework of an action plan, and this should be presented to the informatics sector as a role model.

Scientific Ethics Declaration

The author declares that the scientific ethical and legal responsibility of this article published in EPESS journal belongs to the author.

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