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INTERNET SPEED ISSUE OF TURKEY

Authors: Hüseyin CEYLAN*, Gizem DEMİR, Ziya ELRİ

*Corresponding Author: huseyinceylan@kku.edu.tr

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INTERNET SPEED ISSUE OF TURKEY

Hüseyin CEYLAN[1*], Gizem DEMİR[2], Ziya ELRİ[3]

[1]Kırıkkale University, Kırıkkale Vocational School, Kırıkkale, Turkey.
[2]Ericsson, IT Test Engineer, Ankara, Turkey.
[3]Kirikkale University, Institute of Science, Defense Technologies Department, Kırıkkale, Turkey.

[*]Corresponding Author: huseyinceylan@kku.edu.tr
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ABSTRACT: The internet, used by a large population around the world, has become a part of daily life. The internet is used in scientific research, education, commerce, health, communication, banking, tourism, transportation and many similar fields. The need for internet increases in parallel with digitalization and becomes more and more important day by day. Especially during the covid-19 epidemic, providing education over the internet and doing some work from home over the internet has more increased dependence on the internet. Turkey has one of the 20 largest economies in the world by economy size. It is an important country with a population of approximately 84 million. According to the Turkey Statistical Institute (TurkStat) data, in 2020, 90.7% of house in Turkey have access to the internet and the proportion of individuals using the internet is 79.0%. In Turkey, which is one of the important countries of the world and where the use of the internet is widespread, the internet is not at the desired speed. According to the latest report of Speedtest, founded by Ookla in 2006, which measures internet speed most accurately and regularly publishes the "Speedtest Global Index", Turkey is ranked 103 out of 175 countries with Fixed Broadband Internet Speed. Moreover, the 30.51 Mbps download speed is far below the global average of 96.98 Mbps. It is remarkable that the internet speeds of countries that are incomparable to Turkey in terms of economic size and some of which can be called island states are higher than Turkey. These countries are Andorra, Macau (SAR), Liechtenstein, San Marino, Barbados, Trinidad and Tobago, Grenada, Southern Cyprus Greek Region, Armenia, Montenegro, Kosovo, The Bahamas, Saint Lucia, Guyana, Laos, Madagascar, Belize, Dominica, North Macedonia, Côte d'Ivoire, Saint Kitts and Nevis. Turkey has passed to 4,5 G as of April 1, 2016 to increase the speed of the internet. Despite this, Turkey's internet speed is relatively slow and this is an important ergonomic problem. Low connection speeds negatively affect both education and all sectors where the internet is used during the global epidemic. In this study, the reasons for the slow internet speed in Turkey are examined and various solutions to the problem are proposed.

Keywords: Internet, Speed, Fiber, Turkey, Ergonomics, User-Friendly Systems, SpeedTest.

1. INTRODUCTION

The Internet is described by many as the greatest technological breakthrough of our time, sometimes of all time. With the rapid development of technology in recent years, the internet has become a part of our daily life. In the time we lived in, internet technologies have begun to take place in our lives so much and made our lives easier that it has become almost impossible to imagine a life without the internet. The internet, which was developed by the US Department of Defense in the 1970s to connect remote points and to provide information exchange between these points, brought with it many innovations and facilities. It is now possible to access anywhere in the world and accesses all kinds of information via the Internet. Thanks to the internet, which is the basis of communication today, people can easily

access everything they see away. This access is not limited to information only. With the introduction of social networks in our lives, communication and interaction between people has also increased. In addition to increasing the accessibility of the Internet, another reason why it has become so important in human life is that it makes many works in daily life easier. Especially recently, some innovations such as digital banking, online shopping applications, online education tools have become indispensable for the internet. People can perform transactions they want to do via the internet without going to banks and stores. The benefits of the internet in education are also undeniable. Previously, students spent time going to libraries and learning the right information from the right books. Nowadays, this confusion has been eliminated with the internet to reach information and students can access the information they want by using search engines. In addition, many educational institutions provide their education on the internet. People can easily receive training from experts or even teachers elsewhere in the world in accordance with their interests. The fact that the internet is a part of daily life causes technological developments to increase gradually. While people used to access the Internet from their mobile phones, tablets and computers, lately they can also access the Internet through other household items. With this technology developed as the "Internet of Things (IoT)", it is aimed for household items to communicate with each other using the internet and to make daily work easier.

For many people, accessing the internet is very important, even at low speed. However, high-speed internet also has quite high importance in accessing information. Everything from browsing browsers to downloading apps becomes more convenient and easier with high-speed internet. Today, even photo galleries are kept and stored in internet-based applications known as the cloud [1]. High speed internet makes it easy to access these storages. Although people prefer to access the internet for little money due to the low fees paid to internet service providers for low-speed internet, this solution will not be enough in the long run. In today's digital world where online trainings, conferences and live broadcasts are held, reaching the fast internet has become the goal, not the reaching internet. Thanks to the fast internet, the working time of people is shortened and thus both time and money are saved.

It can still be experienced major Internet outages in Turkey in 2021Turkey ranks 103rd among 170 countries in the Hard Broad-Band Internet Speed and in the mobile Internet, speed ranks 57th among 140 countries [2]. This is not acceptable for a country that is one of the 20 largest economies in the world and aims to be in the top 10. In this study, the reasons for Turkey's internet speed problem are discussed and proposals are made to solve this problem which is vital for the Turkish economy.

2. INTERNET AND TECHNICAL FEATURES

The birth of the Internet started with the increase in the importance of communication. As a result of the experiments carried out in the laboratory for the US military to communicate, it was possible to transfer information from one computer to another with various communication protocols [3]. This adventure, which started with data transfer between two computers, has turned into a network system that is effective worldwide today, that is, the internet.

The Internet can be defined as a global computer network that supports packet-switched data transmission between computer systems with completely different operating systems controlled by the TCP/IP protocol suite, where connections between each other are provided by a telecommunications infrastructure [4]. It is clear that the future is in digital and electronic

environment. The Internet is one of the keys to the future. Internet engineering departments can also be opened at universities [5]. Nowadays, Internet has become a mandatory need. If the people of a country cannot access the Internet in ideal conditions, it will be very difficult for them to access information and keep up with the age. Today, internet usage rates and especially broadband internet services penetration are important in terms of showing the competitiveness of countries [6].

There is no owner of the internet in the world [3]. A person, an institution, or a state does not have any rights over it. However, there are Internet Service Providers (ISP) that allow a user to easily access a huge computer network for a fee. These companies allow the user to access the internet via fiber optic cable infrastructure or wireless network (cellular, GSM, 3G, 4G, 4.5 G, 5G, etc.).

2.1. What is Cellular Network?

A cellular network is a type of wireless network created using several radio cells (also called "cells" for short) [7]. Base stations serve each cell. Popular examples today are GSM, DECT or Wi-fi.
Cellular networks have many advantages according to the regular networks [7]:

- ✓ Higher capacity
- ✓ Less power consumption
- ✓ Better scope

Cellular networks, which form the basis of internet technologies, have shown a great development until today. 1G networks, known as 1st Generation Networks, came into our lives in the 1980s and were designed only for analog voice transmission [8]. After that, 2nd Generation Networks have been developed. 2G technology, the technical name of which is Global System for Mobile Communications (GSM), is a mobile phone communication protocol and unlike 1G, it is completely digital [8]. Because it supports GPRS technologies for text message (SMS), video message (MMS) and internet access, it has made it inevitable to increase the number of mobile devices immeasurably, strengthen the infrastructure and improve the quality of Service. Especially with the introduction of smart phones in the market, mobile internet access has gained importance.

2.2. What is 3G?

After 2G, 3G technology (3rd Generation Networks) that includes more data, video calls and mobile internet, emerged. 3N or 3rd Generation networks are a family of standards defined by the International Telecommunication Union and covering GSM EDGE, UMTS, CDMA2000, DECT and WiMAX technologies [9]. 3G (3rd Generation) technology, which replaced GPRS, EDGE and MMS technologies, made it possible to transfer voice, data and images at high speed due to its infrastructure. Although it is around Gigabit in terms of bandwidth, it has been observed that users have reached data transfer speeds of around 20 Mbps. The data rate in 3G networks, which can be described as slow in current conditions, reaches 2Mbps in fixed or stationary devices and up to 384 Kbps in roaming devices [9]. In this way, it has been possible to access sites and transfer data through IP and packet switching technologies over all devices that can connect to the internet, including mobile devices. This is how it started to stand next to companies that provide internet over cable infrastructure.

2.3. What are 4G and 4.5G?

4th generation wireless communication networks are generally called 4G. 4G (LTE) and 4.5G (LTE-Advanced) networks are used today. Due to the fact that a more advanced version of 4G will be used in Turkey, the 4.5G (LTE Advanced) concept is used instead of 4G. This technology is a mobile communication technology that provides higher speed, lower latency and high capacity mobile internet [7]. Cellular networks that are approximately 500 times faster than 3G; support high-definition mobile TV, video conferencing and much more. In LTE networks, the base station defines a bandwidth of 1.4-20 MHz for each mobile phone or device [9]. The delay of 100-500 milliseconds observed in 3G networks has dropped to 20-30 milliseconds with 4.5G [10]. Due to the decrease in latency and the increase in defined bandwidth, LTE networks allow us to connect to the internet more quickly today.

High-speed broadband offers internet service with a completely IP-based network structure. It is considered as a continuation of WiMAX technology. Turkey has started to use 4.5G as of April 1, 2016.

2.4. Differences between 3G and 4.5 G [11]:

- ✓ 4.5G is faster than 3G in terms of speed.
- ✓ The frequency amount of mobile network operators increased from 183.8 MHz to 549.2 MHz. Therefore, users will have the opportunity to receive faster service on broadband.
- ✓ While downloading an 8GB high resolution movie takes approximately 27 minutes on 3G, it takes 67 seconds on 4.5G.
- ✓ In 2022, it is estimated that an average of 4 family members in OECD countries, including Turkey, will have 50 devices connected to the internet. Internet traffic generated by these devices will be able to be transported easily over fast networks such as 4.5G. (IPv6)

2.5. Internet Speed

Internet speed is an important factor. The size of today's internet pages is increasing, and the need for high bandwidth in the data transfers that are now needed cannot be ignored.

In order to provide a healthy broadband high-speed internet, first of all forward and backward direction signals (from subscriber to circuit, from transfer to subscriber) must be transmitted without loss. In addition, it is an important factor that any point in the infrastructure is not affected by noise (electrical signal distortion).

The ping values, which are the time to reach the target of the data, should be low and the devices between the customer and the network should have bandwidth that can accommodate intensive data use [12]. The importance of this was experienced especially during the pandemic period, and it was observed that many internet companies entered the bottleneck due to the intensive use of internet lines during the quarantine period.

Internet slowness can be experienced even if there is no problem in the infrastructure. The most important reason for this is the Wi-Fi connection between the computer and the modem. The factors that kill Wi-Fi signals need to be eliminated. First of all, the modem must be kept away from noise that may disturb wireless signals (wireless phone, microwave oven,

television) [13]. If the receiver and the transmitter are in different rooms, the type of walls can affect. (It can significantly reduce the low signal strength.) Another possible problem with wireless modems is due to the occupancy rate of the wireless frequency channels. If more than one wireless device in the environment provides a connection from the same channel, this channel enters the bottleneck and the data transfer rate decreases [14]. Channel setting can be selected automatically in today's modems. Despite all this, if there is still slowness, providing a device called an Access point to strengthen the signal and placing it in an appropriate point will greatly solve the problem.

3. TURKEY'S BUILT-IN SPEED INTERNET INFRASTRUCTURE

The internet has become an indispensable technology to develop, grow and capture the age in every subject. A world without internet is unthinkable today. The Internet provides instant access to the most up-to-date information wherever it is in the world. By accelerating the flow of data, the Internet removes the limits of communication. Approximately 4 billion IPv4 addresses, which determine the limit of devices that can be connected to the Internet, have been exhausted and various solutions such as IPv6 have been developed [12]. Considering that the world population is approximately 7.8 billion, it can be said that the importance of the internet is accepted by the whole world.

Turkey has an important place as geographic location. It is one of the 20 largest economies in the world and a member of the G20. It is a country that aims to be among the developed countries with its 83 million young populations and wants to have a say in the world in different sectors. In this case, it is not an acceptable situation to remain behind many developing countries and even in some of the island statelet in terms of internet speed and internet infrastructure. According to the latest reports published by Speedtest, Turkey's ranking among countries in Mobile and fixed broadband internet speeds is seen in Table 1 and Table 2. [2]

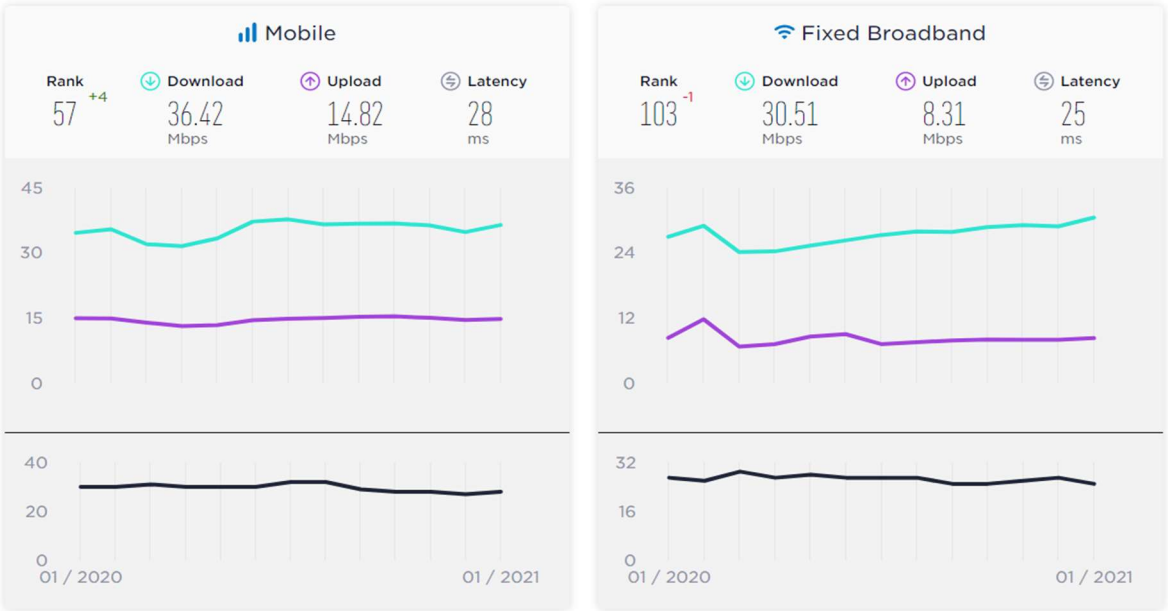
Table 1. Fixed Broadband Internet Speed Ranking of Countries (January 2021)-Speedtest Global Index.

Rank	Country	Download Speed (Mbps)
4	Romania	198.01
7	Monaco	187.88
16	Chile	171.02
21	Luxembourg	147.60
24	Malta	141.29
40	Moldova	97.36
58	Ukraine	63.81
62	Ghana	58.25
69	Grenada	52.23
87	Saint Vincent and the Grenadine	39.93
90	Belize	37.85
97	Côte d'Ivoire	33.45
102	Saint Kitts and Nevis	32.02
103	**Turkey**	**30.51**

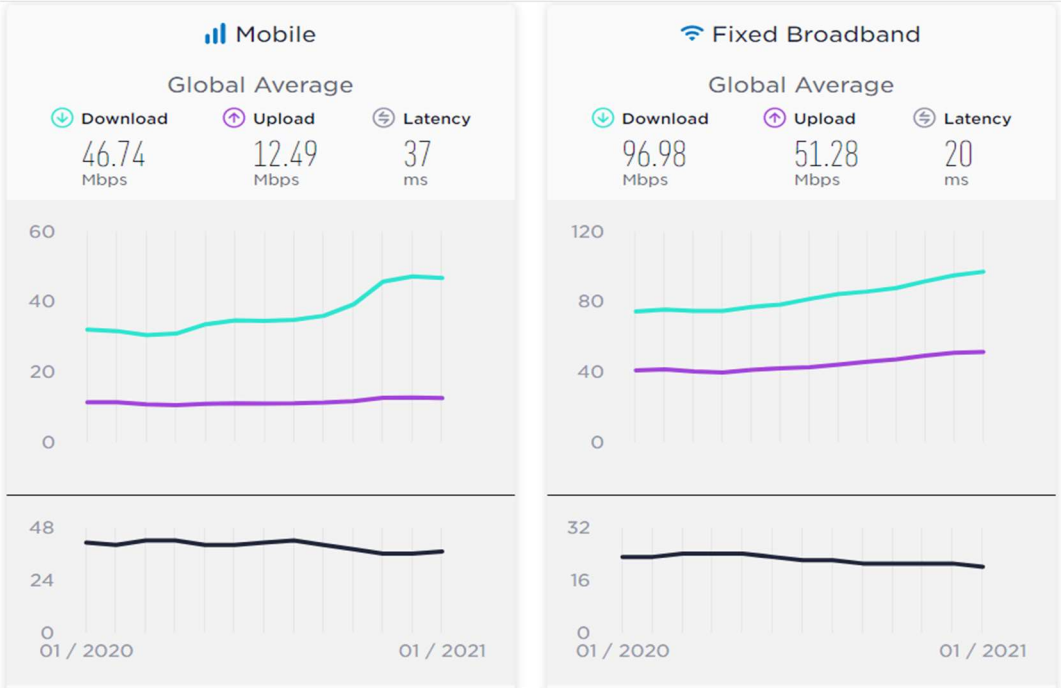
Table 2. Mobile Internet Speed Ranking of Countries (January 2021)-Speedtest Global Index.

Rank	Country	Download Speed (Mbps)
12	Luxembourg	82.87
18	Bahrain	70.45
21	Croatia	66.71
29	Greece	56.39
33	North Macedonia	51.49
35	Albania	50.15
38	Romania	47.69
45	Maldives	44.30
47	Malta	44.07
55	Georgia	36.86
56	Brunei	36.75
57	**Turkey**	**36.42**

Table 1 summarizes some of the country's fixed broadband internet speeds and Turkey's order is given as according to these countries. Looking at download speeds, Turkey ranks 103 out of 175 countries [2]. This shows that the internet download speed in Turkey is much lower than in other countries. With a download speed of 30.51 Mbps, it stayed behind even smaller countries in economic and social terms. Likewise, when we look at the countries in Table 2 mobile download speeds Turkey ranks 57 among 140 countries [2]. It stayed behind countries such as Albania, North Macedonia and Malta. Unfortunately, this situation showed that we are not at the desired level. The main reasons why Turkey gets behind other countries in terms of internet speed can be shown as insufficient infrastructure and less investment by internet service providers.



Graph 1. Mobile and Fixed Broadband Connection Speeds of Turkey.



Graph 2. Mobile and Fixed Broadband Connection Speeds (Global Average).

According to Speedtest's measurements, Turkey's mobile and fixed broadband internet speeds are given in Graph-1, and the world average is given in Graph-2 [2]. When the graphic-1 is viewed Turkey's mobile internet download speed is around 36 Mbps and upload speeds of 15 Mbps. Likewise, it has 31 Mbps download and 8 Mbps upload speeds on fixed broadband internet. When we compare these data with world averages, it seems that Turkey is very, very slow from the world in terms of constant broadband internet speed, both download and download speeds. World average fixed broadband internet has approximately 97 Mbps download speed and 51 Mbps upload speed. The world average fixed broadband internet speed is 2 times more than Turkey's download speed and 6 times more than Turkey's upload speed. The mobile internet with the world average of 47 Mbps download speed is still faster than Turkey. Just upload speed mobile internet in Turkey is approximately 12 Mbps, which is slightly better than the world average.

It would be wrong to treat this situation only as internet speed data. In the simplest way, the difference between loading speeds reveals the development and speed of development of a country. Because it is an issue that directly affects content production. On the other hand, download speed, access to information and the importance of communication is an issue that cannot be ignored. Given these data, it shows that there are serious problems with the internet infrastructure and speed in Turkey.

TURKSTAT has published its "Household Information Technologies (IT) Usage Survey" on August 25, 2020. According to this study, it has been determined that:

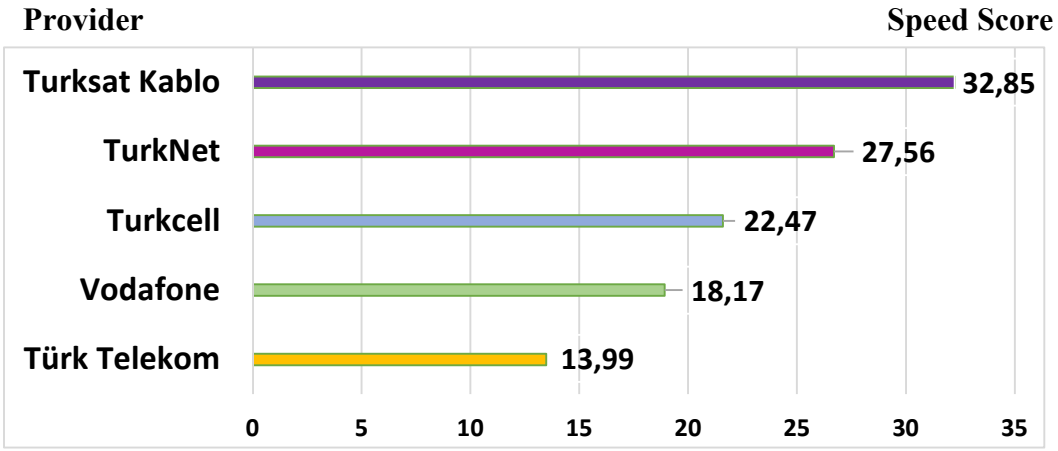
- ✓ The rate of individuals using the Internet is 79%,
- ✓ 90.7% of households have access to the Internet from home,
- ✓ 89.9% of households have access to broadband Internet,

In Turkey in 2020. The same study shows that in Turkey the use of internet increased compared to the previous year [15]. The number of individuals using the internet, which has increased in recent years, the opportunity to access the internet from home, the activity on social platforms, and the spread of e-government services reveals the importance of the

internet for Turkey. It is a serious problem that the speed of the internet, whose importance and use is increasing day by day in Turkey, is very slow compared to the world.

4. INTERNET SERVIS PROVIDERS IN TURKEY

In the report published by Speedtest on Turkey's internet speed in the 4th quarter of 2020, data on operators providing internet services are given in Graph-3. When these data are taken into consideration, "Turksat Kablo" is the operator providing the fastest internet service and "Turk Telekom" is in the last place [2].



Graph 3. Speed sequence of operators that provide Internet services in Turkey.

This situation is not only experienced at internet speed, but it is also seen in Table 3 where latency times of operators providing internet service are given and Table 4 where "Consistency Scores" are given. In addition to Turksat Cable, which is in the first place with 15 ms in delay time and second in consistency score, it is quite remarkable that Turk Telekom, which is the leader in this market, is in the last place [2].

Table 3. Ranking of Internet latency speed Internet service providers in Turkey.

Provider	Mean Latency
Turksat Kablo	15 ms
TurkNet	23 ms
Turkcell	27 ms
Türk Telekom	28 ms
Vodafone	38 ms

Table 4. Consistency scores of internet service providers in Turkey.

Provider	Consistency Score™
TurkNet	57.0%
Turksat Kablo	53.2%
Turkcell	40.8%
Vodafone	33.6%
Türk Telekom	21.7%

The fact that Turk Telekom, which has its own infrastructure, except for municipalities throughout the country, leases it to other internet service operators and is a leader in the sector, is at this level is a fact that brings down the entire sector.

Table 5. Number of subscribers by internet service providers in Turkey.

Provider	Number of subscribers (%)
TTNet	65,75
Superonline	14,73
Vodafone Net	7,58
D-Smart	3,87
Turknet	3,05
Millenicom	1,68
Others	3,34

Table 5 gives the number of subscribers of internet service providers in the last quarter of 2020. Considering these data, the three businesses with the highest share are Türk Telekom (TTNet), Turkcell (Superonline) and Vodafone Net. Türk Telekom ranks first with a ratio of approximately 65%. [16]

Internet service also has an economic dimension. It can be seen in the data shared above that internet use in Turkey has reached serious levels. In spite of this, it is shown in Table 6 that the average cost per Mbps has decreased worldwide in certain periods of 2019 and 2020 [17]. However, the average cost per Mbps for Turkey is much higher than these values. This situation is shown in Table 7. [18]

Table 6. Average Internet Prices for Certain Regions of the World.

Region	Average Cost per Mbps (Q2 2019)	Average Cost per Mbps (Q4 2019)	Average Cost per Mbps (Q2 2020)
Asia-Pacific	$0.14	$0.14	$0.10
Eastern Europe	$0.41	$0.36	$0.33
Latin America	$1.52	$1.51	$1.19
Middle East and Africa	$2.22	$2.75	$2.63
North America	$ 0.31	$ 0.28	$ 0.26
South and East Asia	$ 0.32	$ 0.31	$ 0.25
Western Europe	$0.23	$0.22	$0.20

Table 7. According to Turk Telekom's unlimited internet data prices in Turkey (Converted to dollars at the exchange rates is dated January 29, 2020).

Internet Speed	Price	Average Cost per Mbps (TL)	Average Cost per Mbps ($)
For 100 Mbps	330 TL	3,3 TL	0,57 $
For 50 Mbps	310 TL	6,2 TL	1,10 $
For 35 Mbps	290 TL	8,3 TL	1,44 $
For 24 Mbps	270 TL	11,25 TL	1,95 $
For 16 Mbps	255 TL	16 TL	2,77 $.
For 8 Mbps	155 TL	19,4 TL	3,37 $
For 100 Mbps	330 TL	3,3 TL	0,57 $

According to these data, there is a slow internet service with insufficient infrastructure in Turkey and this service is given much more expensive than the world market. As mentioned before, this is a serious problem and there are important reasons for this problem to occur.

There are two factors that provide internet infrastructure service throughout Turkey. These are Turk Telekom and municipalities. Other operators providing internet services use the infrastructure of these two. Due to this situation, the quality of the service they provide cannot go beyond the borders set by Turk Telekom and the municipalities. A simple example of this situation can be seen in Table 8. This table shows the top 5 cities with the fastest internet in Turkey according to the report published by the Speedtest. Ankara is the first in this ranking, but it can be easily seen that there is no big difference between the internet speeds provided. 5 cities given in Table 8 is Turkey's large cities and it shows that provided internet speeds are kept quality within certain limits. This situation also shows that there is no competitive environment between the operators providing internet service or that this competitive environment prevents the formation [2].

Table 8. Cities with the fastest internet in Turkey

Rank	City	Average Download Speed (Mbps)	Average Upload Speed (Mbps)	Average Latency (ms)
1	Ankara	32.83	7.38	22
2	Istanbul	31.48	9.65	24
3	Izmir	29.72	8.61	28
4	Adana	26.59	7.24	30
5	Bursa	24.18	5.73	27

Considering the progress of the process, there are two options that an operator who wants to provide internet service can choose. These options offer their own strict rules and terms. It is impossible to exclude Turk Telekom from this equation due to its infrastructure found throughout the country. Being aware of this situation, Turk Telekom has brought the dimension of the business to the point of being a monopoly. In this way, it has become a leader in the market and attained the support to maintain this position. But the biggest reason behind this problem is municipalities. Operators who want to work with municipalities are faced with higher than expected rental rates at this time. While on one side there are high usage costs and strict rules, on the other side there are astronomical rental prices. In this case, it prevents the competitive environment desired to be created in the sector and the aimed progress. On the contrary, the desired competitive environment moves away from its purpose and turns into a track where municipalities and Turk Telekom compete with each other. The customer who cannot get their money's worth is most affected by this situation. But since no steps have been taken to resolve this situation, it has been going on for a long time.

5. CONCLUSION, DISCUSSION AND SUGGESTIONS

The internet, which has become an important requirement even in the most remote corner of the world and is an integral part of life, unfortunately cannot see the importance and value it deserves in Turkey. Also the internet, which is one of the most important weapons for accessing information in developing countries like us, plays a key role not only in this, but also in social life, technology and government affairs. While developing countries take the necessary steps to have this key in the best way, Turkey remains a spectator.

In Turkey, while only Turk Telekom and municipalities are in the field, others on the edge of the field as a spectator in this sector. That's why; this sector is breaking away from the world and dropping behind every day. This service, which slows down day by day compared to the world and on the contrary increases in price, is the greatest proof of this situation. The attitude of municipalities established to serve the public and working with public taxes and Turk Telekom, which has existed for many years and has reached a monopoly position in the sector are the two main reasons behind this situation. The fact that this sector is deprived of legal regulations prevents the operators providing internet service, except for these two institutions, from entering the sector. As a result, there is no competition and the desired progress cannot be achieved.

One of the most important steps to be taken in order to prevent this situation is to make legal regulations regarding the sector. In this way, Turk Telekom's power over the sector can be broken and the attitudes of the municipalities can be changed. If the attitudes of the municipalities are changed, other operators providing internet service can participate in the race. As a result of this situation, a healthy competitive environment is created and a service that will satisfy internet users is provided. Breaking the power of Turk Telekom will lead to breaking and changing the rules, and in this way the sector will become more balanced and more open to investment. In addition, the infrastructure problem in the country must be solved and investments in this area must be increased. Factors such as the quality of the equipment used, the higher quality and safer line used for transmission, the higher bandwidth used by the Internet Service Provider companies directly affect the internet speed. Looking at developed countries where Internet speed is high, the infrastructure usually used is fiber and performs faster transmission, but this increases the cost. If we want to be among the developed countries in the future, technology, therefore, the internet is an important step for this and it is very important to increase investments in this field.

It is great importance not only for us but also for our future generations that Turkey, which has great goals, can use the internet, which is one of the most powerful weapons in this process. Internet is one of the most important colors in the palette that will paint the future.

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