

Emerging Technologies Ecosystem in Türkiye

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(Arif Hüdaverdi Yaman - Anadolu Agency)

Türkiye has emerged as a promising destination for technology startups. This policy outlook will highlight the established technology sectors that have represented phenomenal growth, showcasing the strength of the Turkish startup ecosystem. Then, it will explore the emergence of trending industries currently enjoying considerable growth, tracing factors acting as growth catalysts. Finally, even though Türkiye's vibrant startup ecosystem offers plenty of excitement, sustained growth and success require a forward-looking approach. Subsequently, this paper will underline sectors, which are presently at a nascent stage of development, but will likely contribute to the next technological innovation cycle from Türkiye to the world.

An Established Regional Tech Hub

Türkiye has emerged as a promising destination for technology startups, leveraging its economic size, being the [19th largest economy](#) in the world as of 2023, with a Gross Domestic Product (GDP) of more than 906 billion USD. With an average annual GDP growth of [6.1 percent between 1999 and 2022](#), it is among the top emerging economies, having achieved impressive economic and social development since the past two decades. This has led to increased employment, higher incomes and elevated the country to the status of an [upper-middle-income country](#). The labor market of Türkiye has the potential to contribute significantly to the country's economic growth. It is projected that Türkiye's population will increase by 20 percent to reach 90 million by 2040, which is a higher growth rate than that of China, whose population is expected to rise by just over 1 percent. Moreover, Türkiye's population is anticipated to be relatively youthful and educated, with [more than half of its population](#) below the age of 40 in 2040. Positive developments in the Turkish labor market could gradually encourage a transition towards industries that offer higher value-added, potentially resulting in the development of multiple centers of excellence within the country by 2041.

With that said, although the Turkish startup ecosystem was relatively small before 2010, it has rapidly expanded in size and importance due to other factors such as high internet penetration and [credit card adoption](#), which have made it a "rising tech star" in Europe and the Middle East - in fact, Istanbul's startup ecosystem is ranked second to Tel Aviv's in the MENA region. According to Statista, more than [77 percent of the population](#) in Türkiye has a mobile phone, and with that mobile internet, which makes access to technology products much easier. Türkiye's central location also serves as an attractive hub. Thus, it does not come as a surprise that Startup Genome ranked Istanbul among the top 30 startup ecosystems in the world, [14th place](#) to be exact, creating 17 billion USD in wealth in just over two years.

This policy outlook will highlight the sectors that have represented phenomenal growth, showcasing the strength of the Turkish startup ecosystem. Then it will look at the emergence of trending sectors that are enjoying considerable growth currently, tracing factors that have acted as growth catalysts. Finally, even though Türkiye's vibrant startup ecosystem offers plenty of excitement, sustained growth and success require a forward-looking approach. This paper will then outline sectors that are at a nascent stage of development presently but will likely contribute to the next technological innovation from Türkiye to the world.

Developed Sectors Overview

Türkiye's technology ecosystem has various players, including established local and international players and breakthrough startups that have expanded globally. The startups leveraged their entrepreneurial spirit and talented human capital to create rapid growth in certain sectors such as e-commerce, fintech, healthtech, cybersecurity and gaming. These have become key strengths in terms of being pillars of Türkiye's startup success. An overview of the growth in these sectors will showcase the breadth and depth of the flourishing Turkish technology scene.

E-commerce

Firstly, projections indicate that Türkiye's e-commerce market will reach a value of [22 billion USD](#) by 2023. Trendyol, established in 2010, is among the most prominent e-commerce platforms in Türkiye, with over 35 million registered users. It is known to be the country's [first decacorn](#). Other noteworthy e-commerce platforms in the country include Hepsiburada, GittiGidiyor, and n11. Hepsiburada has gone through an IPO and is now listed on the NASDAQ. Apart from domestic e-commerce platforms, international players such as Alibaba's AliExpress, eBay, and Amazon have also entered the Turkish market. Nevertheless, Turkish consumers tend to exhibit a preference for local e-commerce platforms, as they are more familiar with the brands and the products offered tend to be more localized. Mobile commerce (m-commerce) is [now gaining in popularity](#) in Türkiye, with many consumers making use of their smartphones to make online purchases. Consequently, Turkish e-commerce firms are investing heavily in mobile-optimized websites and applications in order to enhance the shopping experience for their customers and grow their footprint in the country.

Financial Technology (FinTech)

Secondly, the rapidly growing Turkish fintech sector owes its rise to a range of innovative startups that emerged to challenge established financial sector players such as the country's local and international banks. One of the key drivers of this growth has been the country's large and youthful population being very comfortable with using digital platforms for financial services. Some of the most notable fintech startups offering these financial services in Türkiye include companies like [Iyzico](#), which offers payment solutions for e-commerce businesses, and [Paratika](#), which provides mobile payment services for public transportation. Other key players in the Turkish fintech landscape include digital banks such as [Papara](#) and [Enpara](#).

Healthcare (HealthTech)

The third notable industry that technology has disrupted in Türkiye is [healthcare](#). The healthtech sector in Türkiye has been [growing rapidly in recent years](#), driven by a range of factors including rising healthcare costs, an aging population, and the increasing availability of digital technologies. The sector encompasses a broad range of companies and services, from telemedicine and remote monitoring platforms to digital health records and medical devices. One of the key players in the Turkish healthtech scene is the startup [DoktorTakvimi](#), which provides an online platform that allows patients to book appointments with doctors and healthcare providers. The platform also offers a range of other features, such as a patient management system and telemedicine consultations, that help to streamline the healthcare experience for both patients and providers.

Cybersecurity

Fourthly, the cybersecurity industry in Türkiye has been growing rapidly in recent years, driven by a range of factors including increasing cyber threats, rising demand for secure digital technologies, and the government's commitment to building a strong cybersecurity ecosystem. One of the key players in the Turkish cybersecurity scene is the [Turkish Cyber Security Cluster](#) (Türkiye Siber Güvenlik Kümelenmesi), a public-private partnership established in 2018 with the aim of promoting collaboration and innovation in the field of cybersecurity. The cluster brings together a range of stakeholders from industry, academia, and government to develop new cybersecurity solutions, share best practices, and raise awareness about cybersecurity threats. In addition to the Cyber Security Cluster, there are a number of other organizations and initiatives that are helping to drive the development of the cybersecurity industry in Türkiye. These include the [National Cyber Incident Response Center](#) (USOM), which is responsible for coordinating cybersecurity efforts across government and private sector organizations, and the [Cyber Defense Institute](#) (CyDef), which offers training and certification programs for cybersecurity professionals. Besides these public-private partnership based cybersecurity initiatives, Turkish cybersecurity startups are making significant contributions to the industry both domestically and internationally. One notable example is Sertifier, which is a blockchain-based cybersecurity startup that offers secure document management and verification solutions. The company's technology enables users to verify the authenticity of documents such as certificates and diplomas, reducing the risk of fraud and identity theft. With the growing demand for cybersecurity solutions globally, the Turkish cybersecurity startup ecosystem is poised to play an increasingly important role in the global industry.

Gaming

Last but definitely not the least, the Turkish gaming sector is an industry that has been [gaining fantastic momen-](#)

[tum](#) over the past few years. The Turkish gaming sector received the most investment in 2021 in the entire global gaming market. More than half of the country's population is under the age of 30, which represents a large market for gaming companies. In addition to the young population, Türkiye has a growing middle class with increasing disposable income. This trend has been reflected in the [multibillion dollar growth](#) of the Turkish gaming industry - by April 2022, Türkiye's share in the global gaming market. Another factor contributing to the growth of the Turkish gaming sector is the country's expanding broadband infrastructure. As more people have access to high-speed internet, they are able to play online games, which has led to an increase in the popularity of multiplayer games and esports in Türkiye. The mobile gaming segment is the largest and fastest-growing segment of the Turkish gaming market. In addition to mobile gaming, PC and console gaming are also popular in the country. PC gaming is particularly popular among young adults and esports enthusiasts, with a growing number of tournaments and national leagues. Some [notable Turkish game developers](#) include Peak Games, which is one of the largest mobile gaming companies in the world and is known for its popular games like Toy Blast and Toon Blast. Peak Games is known for its [unicorn status](#) as it was acquired for 1.8 billion USD in 2020. Another notable startup is Peakcode, which is a game development company that specializes in creating educational games for children. The company was founded in 2014 and has since created several successful educational games, including Cefo and Kafa Topu. The Turkish gaming industry has many such successful gaming startups and studios that have flourished in the past decade or so. According to a new report by Startup Centrum, Türkiye ranked first in gaming startup investments in Europe in 2022: 61 startups received [1.28 billion USD](#) in the first 3 months of 2022 alone.

Trending Emerging Technologies

Given the backdrop of established technology-based industries in Türkiye as described above, it was only a matter of time before new trends started to take root in the country. Many of these newer trending emerging technologies were becoming popular the world over but some appeared to be more geared towards success in Türkiye.

Blockchain Technology Applications (Cryptocurrencies and Non-Fungible Tokens)

One of the emerging technologies that is becoming particularly successful in Türkiye is blockchain, with several startups emerging to develop innovative blockchain-based solutions in various industries, such as finance, logistics, healthcare, and more. One of the reasons for Türkiye's

growing blockchain startup ecosystem is that the country boasts a [large pool of talented developers](#) and engineers who are capable of working on complex blockchain projects. This talent pool has helped to create a vibrant ecosystem for blockchain startups in the country. The country also has a number of blockchain-focused organizations and initiatives, such as the Blockchain Türkiye Platform and the Istanbul Blockchain Week conference, to foster the development of a community around blockchain. Türkiye has [experienced high adoption of cryptocurrencies](#), and their increasing use has led to a growing interest in the underlying blockchain technology. The high adoption of cryptocurrencies is linked to factors such as them being perceived as a hedge against high inflation. Türkiye is also a significant recipient of remittances, and many migrant workers send money back to their families in the country. Cryptocurrencies offer a cheaper and faster way to transfer money across borders compared to traditional methods, such as banks or money transfer operators. In recent years, many cryptocurrency startups have cropped up and thrived. Notable ones include [Paribu](#), which is now one of the largest cryptocurrency exchanges in Türkiye, with over 2 million registered users, and [BtcTurk](#), which is one of the oldest cryptocurrency exchanges that has been operating in Türkiye since 2013. Another application of blockchain technology - non fungible tokens or NFTs - have also gained attention, leading to the emergence of NFT startups, particularly in the art and game industries of the country. Notably, Turkish digital currency startup Metatime [raised the sum of 11 million USD](#) in early 2023 looks to develop a blockchain protocol, a digital wallet as well as a NFT trading marketplace.

Artificial Intelligence (AI)

Türkiye's AI startup scene is poised for take-off. One of the main factors driving this growth is the increasing number of venture capital funds in the country, which has made it easier for startups to secure funding. Some of the most active VC firms in Türkiye include 212 Capital Partners, Earlybird Venture Capital, and Hummingbird Ventures. The Turkish government has also been actively supporting the development of the AI startup ecosystem. Recognizing "the [rapidly transforming nature](#) of the AI field [that] necessitates a dynamic implementation process", the Turkish government published its [National Artificial Intelligence Strategy](#) (NAIS) in 2021, which is the first national strategy document on AI in the country. In fact, Turkish President Recep Tayyip Erdoğan has stated that "the field of artificial intelligence is [not a matter of choice](#), but one of the biggest bearers of our development goals."

The strategy was prepared with a participatory approach, involving contributions from public institutions, academia, professional organizations, private sector, NGOs, and international organizations. It focuses on six strategic priorities, including training AI experts and increasing employment in the domain, supporting research, entrepreneurship, and

innovation, facilitating access to quality data and technical infrastructure, regulating to accelerate socioeconomic adaptation, strengthening international cooperation, and accelerating structural and labor transformation. The strategy includes 24 objectives and 119 measures to align the country's efforts on AI for the period 2021-2025. A core objective of the national AI plan is to reduce interdependencies and reliance on external technologies, achieving greater AI autonomy. This also includes financial and regulatory support for AI startups. There is a strong focus on AI programs in colleges and universities to strengthen educational governance and create an AI network. The national AI plan has three objectives, which include elevating AI research and development to a national priority by 2025 and making Türkiye a world-renowned AI destination by 2030. In response, Turkish institutions have announced over 50 new AI-related programs, and the policy advocates for universal education combining training and development possibilities with existing education techniques. The Turkish government has recognized national and local talent programs to attract AI researchers to the country and support Turkish researchers at the local level. Incentives such as "The 10,000 Talents Initiative" provide academics with substantial incentives to return to Türkiye. The media has frequently recognized this study document as a significant factor in Türkiye's advancement in the field of AI, both geopolitically and commercially.

There are many diverse AI startups in Türkiye, with companies focused on a wide range of industries, including healthcare, finance, education, and e-commerce. Some of the most promising startups in the country include Segmentify, a personalization platform for e-commerce websites; Insider, a marketing automation platform that uses AI to help companies optimize their customer engagement; Datagen, a platform that automates the data annotation process for AI training datasets; DeepZen, a startup that uses AI to generate voiceovers for audiovisual content; and Hepsiburada, one of Türkiye's largest e-commerce platforms, which uses AI to personalize the shopping experience for customers. Blue.cloud, a cloud-based digital transformation firm, has forged a partnership with Koç Digital, the foremost provider of AI implementation services in Türkiye, to advance AI innovation. The aim is to drive digital transformation initiatives by [leveraging AI and Internet of Things \(IoT\) solutions](#) to enhance predictive analysis in the enterprise. Koç Digital has established strategic partnerships with leading tech giants such as Microsoft, SAS, Siemens, and Amazon. Through the state-backed Tech-InvesTR VC Program, [early-stage companies are receiving valuable support](#). Tiko, an AI-supported real estate startup, raised an impressive 65 million USD in 2021 during its Series A funding round, making it the largest of its kind in Türkiye to date. In addition, Cameralyze, a no-code AI platform, secured 3 million USD in seed funding in February 2022, while logistics company Yolda.com raised 5 million USD in its seed round in December 2021.

The national AI strategy “forecasts a [two-fold increase in market size](#) and global AI expenditures within five years”. Given the strong support of the Turkish government enabling a concerted public-private effort to develop AI capacities in the country, the ever-increasing number of VC funds looking to sponsor AI research and products as well as the role of Turkish universities’ AI programs specifically developing an AI talent pipeline to meet the country’s growing demand, there is reason to believe that Türkiye may be able to meet the goals and objectives of its national AI strategy.

Micromobility

In recent years, the micromobility sector in Türkiye has become increasingly important as people look for more sustainable transportation options. With its [large urban centers and high levels of traffic congestion](#), the need for alternative transportation solutions has become more pressing in Türkiye. This has led to the growth of the micromobility sector, with a focus on electric scooters and bikes. One of the reasons for the growth of the micromobility sector in Türkiye is the increasing [awareness of environmental issues](#). As people become more concerned about climate change and air pollution, they are looking for ways to reduce their carbon footprint. Micromobility services, which typically use electric vehicles and bicycles, offer a more sustainable alternative to traditional gasoline-powered vehicles. Another driver of growth in the micromobility sector, as noted above, is the high levels of traffic congestion in urban areas in Türkiye. Cities like Istanbul are notorious for their traffic, and many people find it difficult to navigate the city by car. Electric scooters and bikes offer a faster and more convenient way to get around the city, allowing people to avoid traffic jams and arrive at their destinations more quickly. The Turkish micromobility sector was valued at [92.8 million USD in 2020](#), with an expected CAGR of 64.5 percent between 2021-2030, with the first and last mile models to gain the fastest traction. Several companies are now offering micromobility services in Türkiye, both domestic startups and international players. Notable Turkish micromobility startups include [Martı](#) and [Bin Bin](#).

Education Technology (EdTech)

With such a large young population, education is a high priority for not just the Turkish families but also the Turkish government. Thus, the environment is ripe for the development of a thriving edtech sector. In January 2023, there were a total of [317 edtech startups](#) operating in Türkiye. Some of the earliest edtech startups in Türkiye were focused on online tutoring and test preparation. For example, an early edtech startup was [Lider Eğitim](#) (Leader Education), a state-led initiative founded in 2007, and provides online and offline courses and test preparation services. The edtech industry in Türkiye has since then diversified and expanded into areas such as language learning, online

degree programs, and educational games and apps even in the private enterprise sphere. Notable edtech startups in Türkiye are [Bionluk](#) (platform connecting education providers with education consumers) and [WEXT](#) (AI-based platform offering English learning solutions). Many Turkish companies are now working on edtech projects including online teacher training, e-learning content development for tertiary education as well as artificial intelligence (AI) powered education solutions. This is likely in response to rising demand for [quality educational tools and solutions](#) amongst the Turkish public.

The importance of education technology development is not lost on the Turkish government either as distance education was [prioritized highly as part of the government’s response](#) to the Covid-19 pandemic. The EBA (Education Computing Network) platform was developed and used for education delivery along with TRT-EBA (a television based educational delivery solution) to provide access to students who may not have access to computing equipment. EBA (or Akademik Destek) had already been providing online tutoring and test preparation services to students across Türkiye since 2003. The Ministry of National Education (MEB) launched “distance learning” lessons and “virtual classroom” practices via both TRT-EBA and EBA. Thus, effective use of resources to encourage remote learning during school closures in the pandemic led to greater acceptance and adoption of edtech solutions later on as well.

However, [Turkish edtech startups](#) do face a number of challenges that are, at times, unique to the Turkish ecosystem, while others are common to edtech startups in many other countries. Some of these challenges include limited Internet connectivity in some parts of the country (even though Internet penetration is relatively high in Türkiye), limited funding opportunities (particularly for early stage investment in Türkiye), a fragmented education market with many different kinds of education providers that make it [difficult for edtech startups to scale](#), and, finally, resistance to change, especially amongst the older or more traditional educators, leading to issues of traction for education technology startups. With that said, the Turkish edtech landscape is looking brighter by the day as the demand for quality education is only growing stronger given such a large young population.

Agriculture Technology (AgriTech)

Agriculture technology (or agritech) is [another trending emerging technology](#) due to both being the need of the hour and the ease with which this sector can thrive in Türkiye. First of all, one of the main drivers of the development of agritech startups in Türkiye is the fact that the country’s agricultural sector is one of the largest in the world, and produces a large range of agricultural products. The sector [significantly contributes](#) to the Turkish economy and employs many people. Agritech, which mostly aims to

improve production efficiency and access of agricultural producers to consumers locally and internationally, has been increasingly gaining attention and support from the government, investors, and the general public. There is increasing realization of the need for innovation in agriculture.

One of the earliest and most successful Turkish agritech startups is [Tarımsal Pazarlama](#) (Tarimsoft) that was founded in 2012 and developed an online platform that connected farmers with buyers, allowing farmers to sell their products directly to consumers and businesses. Other more recent ones include [Agrovisio](#) (smart agriculture-related solutions for sustainable food production and security) and [Pişir.com](#) (venture facilitating home cooking). In addition to these startups, there are several others that are working on [various agritech-related projects](#), including crop monitoring and management, precision agriculture, and agricultural education and training.

Like other growing technology sectors in most places, agritech startups in Türkiye face a range of challenges, some of which are common to startups in other sectors, while others are [specific to the agricultural industry](#). Some of these challenges include limited access to funding, fragmented and traditional agriculture industry, lack of data and infrastructure (lack of high quality data leads to agritech startups facing difficulty in developing data driven solutions), limited awareness of the benefits of agritech leading to barriers of adoption as well as regulatory controls that can be difficult to navigate for agritech startups.

Looking to the Future

With all the established and growing startups in Türkiye, it is an exciting time. However, to ensure continued success and uninterrupted growth, it is important to look to the future and identify sectors that are at the nascent stage of development but, given the right environment in terms of government policy support and funding sources, seeds planted now may translate it into significant bounty tomorrow. In this sense, it appears that the Turkish startup ecosystem is looking to incorporate and develop both AR/VR/XR tech as well as climate tech in the future as part of its efforts to address global challenges and strengthen its economy.

ClimateTech

Türkiye's [climate tech scene is gaining momentum](#) as the country recognizes the importance of addressing climate change and promoting sustainability. The government's efforts to support sustainable development and encourage the growth of the climate tech ecosystem have been critical in driving innovation in this space. The Turkish government has implemented a range of programs and initiatives, such as the [Sustainable Production and Consumption](#)

[Program](#), to support startups focused on developing sustainable technologies. Additionally, [Türkiye's National Innovation System](#) has been instrumental in promoting entrepreneurship and fostering innovation in the country. The country also has a number of incubators and accelerators that support startups focused on sustainability, including the Istanbul Startup Angels and Eczacıbaşı Entrepreneurship Center. The climate tech startups in Türkiye are diverse, with many working on innovative solutions to address environmental challenges. For example, [VoltLines](#) is a sustainable transportation company that provides electric buses to businesses and municipalities, helping to reduce carbon emissions and improve air quality.

Virtual Reality, Augmented Reality and Mixed Reality (VR/AR/XR)

Recent years have seen the emergence of Virtual Reality (VR) startups in Türkiye, but the industry is still in its early stages. A notable VR startup in Türkiye is [VR-Masters](#), which was founded in 2014 and has developed a platform for creating VR content. Another startup, [VR Future](#), founded in 2021, combines VR with blockchain technology for blockchain gaming and has also become one of the leading distributors of VR content in the country. In addition to these startups, there are others that are working in various industries, including tourism and medicine. However, besides the [implementation challenges](#) confronting VR and AR industries internationally, such as limited use cases and high price of developing new technology, there are challenges specific to Türkiye such as limited access to funding and lack of specialized talent. With that said, the industry is growing slowly but surely.

Conclusion

To conclude, the emerging technologies ecosystem in Türkiye is growing rapidly, with the government investing heavily in infrastructure and incentives for technology startups. The country boasts a highly educated and technically skilled workforce, and has been able to attract significant foreign investment in the various emerging technology sectors in recent years. The Turkish government has also established a number of initiatives to promote innovation, entrepreneurship as well as research and development activities, making Türkiye an increasingly attractive destination for tech companies and startups for not just local entrepreneurs but also regional and global companies. Türkiye's emerging technologies ecosystem is one to watch, with significant potential for growth and development in the years to come in key sectors as noted above. As the country continues to invest in infrastructure, talent, and innovation, it is likely to become an increasingly important player in the global tech industry.