UNIVERSIDAD

EMPRESARIAL DE COSTA RICA

(UNEM)

IT INDUSTRY AND CLOUD IT APPLICATIONS IN TURKEY: THE CASE OF BANKING

A thesis submitted to partially fulfill the requirements for the PhD degree in Management Information Systems

by

Tuğçe UĞRAR

Supervisor:Dr. Altay ERTÜRK

Istanbul-2023

UNIVERSIDAD
EMPRESARIAL DE COSTA RICA
(UNEM)

IT INDUSTRY AND CLOUD IT APPLICATIONS IN TURKEY: THE CASE OF BANKING

A thesis submitted to partially fulfill the requirements for the PhD degree in Management Information Systems

by

Tuğçe UĞRAR

Supervisor:Dr. Altay ERTÜRK

Istanbul-2023

UNIVERSIDAD

EMPRESARIAL DE COSTA RICA

(UNEM)

IT INDUSTRY AND CLOUD IT APPLICATIONS IN TURKEY: THE CASE OF BANKING

A thesis submitted by Tuğçe UĞRAR in partial fulfillment of the requirements for the PhD degree of Management Information Systems is approved by the committee on .../..../2023

Dedicated to my mother

ABSTRACT

The information age is characterized by an extraordinary increase in the amount of information that needs to be processed and produced. This ultimately requires computational power. Information and information technologies offer solutions to this situation.

The transition to cloud technology is fundamentally a process of major change and transformation. Therefore, the organization should have a vision for the transition. The transition to cloud technology basically marks a major change and transformation process. Therefore, the organization must have a vision for the transition.

As a result of this study, which examines the structures of cloud service providers within the scope of information technologies used in the banking sector, it is understood that technology continues its rapid development.

The banking sector has a large number of applications through information technologies, and technological changes are easily adapted due to the conveniences and flexible systems.

The adoption of cloud technology, which provides future-shaping and digital transformation in financial services, is vital for business operations. As of March 2022, there are 57 organizations serving in Turkey. Considering the enterprises, 35 of which are deposit banks and 16 of which are development and investment banks, it is understood that even a single bank will have an impact on the country's economy.

Within the scope of infrastructure service, platform service and software service called IaaS, PaaS and SaaS, there is an official organization that can carry out cloud technology transformation for 57 organizations. Inter-Cloud, a cloud service provider, is the only institution that started its operations on December 31, 2021, with pre-approval by the BRSA.

The fact that cloud technology applications, the development of which is monitored and continued in Turkey, offer advantages such as customer experience and satisfaction and cost savings in the banking sector depends on the adoption and implementation of the innovation approach.

Keywords: Cloud, Turkey (Türkiye), Banking, Cloud Applications

FOREWORD

With the rapid change in the digital environment for the banking and finance industry, customers quickly need solutions and business partners that they can use immediately. As data ingestion increases exponentially, banks need fast, innovative and secure ways to store, analyze and use their important data.

Financial institutions are generally known to have data collected and used by current applications. Various options are offered for moving this data to Azure. It is possible to connect as if it were a business center and to enable relocation with minimal changes. Except for this situation, which is especially applicable to the use of Microsoft Azure SQL database, solutions can be found in the application market for databases such as Oracle, Teradata, MongoDB. With various migration strategies and latency, Azure offers high reliability and data transparency. Lift & Shift model is used in database migration, in-house databases are taken and moved directly to the cloud (Microsoft, 2021).

I would like to thank my esteemed advisor Dr. Altay ERTÜRK for his support during this study.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

Public institutions and organizations, higher education institutions, independent solution partners and many more organizations are trying to collect data in order to achieve their goals and to obtain results by processing the collected data. The information age we live in provides an extraordinary increase in the amount of information that needs to be processed and produced (Applegate, 2019). This ultimately requires computational power. A solution to this situation is offered through information and information technologies. In fact, it has advanced qualifications to meet all data information and meta information needs of industries, institutions and organizations covering information technologies and systems.

Enterprise data computing, which was performed via mainframe-mainframe in the 1960s, can be achieved with personal computers in the 1980s and with mobile clients today. As a result of what has been conveyed, it is understood that it is a necessity to innovate in an intense competitive environment and to produce solutions that make life easier, and to gain competitive and cost advantage by implementing the solutions produced immediately. In this context, meeting the requirements especially by the institutions and organizations that provide service depends on the compatibility ratio of the organizational structure with the current technology and how well the technology is used (Göleli, 2019: 2). For this reason, the digitalization trend has started and it has become inevitable to benefit from cloud technologies.

The transition to cloud technology basically marks a major change and transformation process. Therefore, the organization must contain a vision for the transition. In addition, the type of cloud that can be preferred, the strategies to turn the services offered by cloud technology into opportunities, the management of cloud environments, and the cloud culture adapted to the cost burden arising from cloud technologies are important. This indicates the necessity of managing cloud technologies. This management and execution is related to the adoption by the organization under the leadership of the relevant manager before the technical details and to show overlap with the goals of the organization (Isom and Holley, 2012:28).

As it can be understood, the transition to cloud technologies requires preliminary preparation. Considering that it is necessary to benefit from the solutions presented in the literature during the preparation process in question, the aim of this study is to examine the Turkish IT sector and inform about cloud computing applications in order to base it on the reasons for the transition to technologies. The aim is to present an example by considering the banking sector in particular for institutions evaluating cloud computing applications.

2. DEVELOPMENT OF THE INFORMATICS SECTOR

2.1. Concept and Development of Computer

Binary code system converts the information transmitted to the units, which are defined as input units, into numbers 0 and 1. These numbers, which are processed and stored as information in the central processing unit, are transferred to the output units if necessary. In this respect, highly advanced calculators are called computers. It aims to process the information coming to the input unit from the first moment it was produced to the present day (Memiş, 2021: 3). The units valid for the whole computer and the 4 main logical elements are shared in Table 1 (Staff, 2022:5-7).

Tablo 1. Computer Units

Data Input (Input Units)	Camera, Keyboard, Mouse, Scanner
Information Processing	Central Processing Unit (CPU)
Information Storage (Memory)	Random access memory (RAM), Readable memory (ROM), Universal serial bus (USB), Optical discs (CD/DVD) etc.
Information Output (Output Units)	Speaker, Monitor, Printer etc

A computer consists of two parts, hardware and software. All of the electromechanical and electronic physical parts of the computer responsible for the formation are called hardware. Non-physical programs that convey what the hardware should do and work ways and enable information to be processed are called software (Canay and Güngörsün, 2016: 3-4). Peripherals, electronic circuit elements and physical devices are hardware, systems and applications are software types. System software is operating systems such as Ubuntu, Linux, Pardus, Windows and provides communication between the computer and the user. Application software, on the other hand, is programs like Excel, Paint, PowerPoint, Word and are used in line with certain targets (Memiş, 2021:3).

2.1.1. Development of Computer

The chronological evolution of the computer is listed below.

600 BC: Invention of the abacus

100 BC: Invention of the Antikythera Machine

1623: By means of Wilhelm Schickard, who made it possible to add and subtract 6-digit numbers, the user was notified by ringing the bell.

1642: The first comprehensive mechanical calculator is developed by Blaise Pascal.

1671: Leibnitz Pascal develops a calculator capable of division and multiplication.

1801: The first trace of making software is the punch cards produced by Joseph Marie Jacquard.

1810: Calculators are first commercially introduced by Charles Thomas.

1832: Charles Babbage is the inventor of the first planned automatic calculator.

1854: Boole's laws of thought are published.

1941: The machine "Z", which processed binary code for the first time with real numbers, was developed by Konrad Zuse.

1941: Atanasoff-Berry is produced with a capacitor-based memory equipped with a binary number system based on space tubes.

1944: Harvard Mark produces the first limited programmable computer.

1946: ENIAC is the first decimal-based electronic computer for general use.

1951: The first commercially available computer is the Universal Atomic Computer (UNIVAC1).

1959: 2nd generation computers were produced with transistors instead of vacuum tubes.

1963: 1,000,000 operations/sec with integrated circuit. fast working 3rd generation computers were developed.

1971: First 4-bit 4004 microprocessor INTEL; The first microprocessor (15,000 transistors on a microchip) was manufactured by Texas Instruments. Integrated circuits began to be used on silicon, and the age of the 4th generation computer, which still continues, has entered.

1978: 500 thousand computers were used in the USA, 16-bit Intel 8080 microprocessor was produced.

1980: Having licensed the UNIX operating system, Microsoft released the XENIX operating system. There are 1 million computers in the USA.

1981: Commodore produced the VIC 20 home/office computer, which would sell more than 1 million copies, and Adam Osborne developed the first portable computer.

1989: After more than 100 million uses in the world, Poqet introduced the MSDOS operating system pocket computer and offered the same feature, battery-operated laptops for sale.

1995: Microsoft released the Windows 95 Operating System.

1998: Z3 was proven to be Turing compatible and the title of the first computer was given, Microsoft released the Windows 98 Operating System.

1999: Intel produced the Pentium III microprocessor with 9.5 million transistors.

2001: Windows XP released.

2007: Windows Vista released.

2009: Windows 7 released.

2012: Windows 8 released.

2015: Windows 10 released.

2019: Global computer sales exceed 260 million (Wikipedia, 2020).

2.1.2. Types of Computers

When computers are examined, they are classified by their size as well as their classification as digital, analog and hybrid suitable for general and special use. Based on their size, computers are categorized as personal computers, mainframes, workstations, and supercomputers. It is briefly described below (Memiş, 2021:5-7)

Micro personal computers (PCs) are capable of running application software such as design and art programs, office applications, database applications, which can also be used for commercial purposes for the use of an individual. Tablet computers are a type of portable computer that is controlled by a finger or its own stylus and has a digital keyboard rather than an external keyboard. Smartphones are systems that have their own advanced operating system, apart from all the functions of the mobile phone. Fablet computers are smartphones with screens the size of tablet computers. Smartphones with screens as big as these are called by this name today (Akpınar, 2020: 13).

Desktop computers can be fixed, are difficult to move, have the advantages of easy part replacement and in-case heat transfer, and are not subject to malfunction, breakage, etc. since they are not moved too much. are computers with low probability (Memiş, 2021). They are low-capacity systems with a large case structure consisting of a safe, screen, keyboard and peripherals (Akpınar, 2020: 11). Notebook computers are portable systems that generally consist of a keyboard and screen (Memiş, 2021). Laptops, which are produced in response to the use of any place, have almost all the capabilities of a desktop computer, but are small in size and light (Akpınar, 2020: 11). Notebook computers are systems that are used in office and internet applications, have lower performance compared to laptops, and are produced with higher performance and lighter weight today as they continue to develop with technology (Memiş, 2021). Although it can use the same operating systems as other types, basic versions are preferred. The most important features are screen sizes between 7-11 inches, atomic processors integrated with the main board, consuming low energy, and having a longer battery life than laptops (Akpınar, 2020: 11). Handheld-palm computers offer business life, media, agenda and communication applications since most of the operations that can be provided with remote access are performed by personal digital assistant (PDA) (Memiş, 2021).

Mini-computers are low-power, compact, economical, low-cost systems used by medium-sized businesses that can be equipped in addition to other types. It has functions such as web browsing and e-mail access and meets the basic requirements of computing (Memiş, 2021).

Mainframes are systems that handle data storage at the operator center, relatively slow to supercomputers. This type of hospital, university, bank and data processing centers, which are preferred in the business environment where intensive entry-exit transactions are carried out and processing high-dimensional data, are used (Akpınar, 2020: 16). It includes application, transaction and database servers, web and e-mail servers serving thousands of users at the same time. It contains applications that require higher levels of usability and security (Memiş, 2021). Numerous functions are realized, supporting powerful math and graphics applications. They are server systems with a large capacity that respond simultaneously to computer requests in a private center (Akpınar, 2020: 16).

Workstations are used today in jobs that put a lot of strain on the computer's processor (CPU), constantly increase the temperature, and require long work (rendering, iteration, simulation, etc.). The most important qualities are having a long life due to the main board and server-based processors used, 24/7 using the infrastructure, using ECC Ram memory and composite hard disk (SSD+HDD), having a cooling system, having relatively quiet operation of the servers, running multiple apps at the same time (Akpınar, 2020: 11).

Supercomputers are systems that consist of thousands of processors, in which processors are built with millions of transistors. The fastest of this type, which can reach petaflop speeds, is the Japanese production Fukagu. It trades at a speed of 415 petaflops per second. The fact that the first computer (ENIAC) is a machine with a weight of 30 tons, packed in an area of 167 m^2, enables the production with the fastest and largest capacity today with technology (Memiş, 2021). Cluster computers consist of high performance vector processors and dense parallel processors. Trillions of simultaneous transactions occur per second. It has tens of thousands of microprocessors. The widest usage areas are simulation operations for military and civilian purposes. The most common areas of use are nuclear energy research (next generation atomic bomb), financial world (stock market forecast, economic risk analysis), climate modelling, astrophysics studies, defense industry (password cracking/creation, cryptology), war games simulation, missile trajectory tracking, space and aircraft modelling, medical field (DNA research, drug design) (Akpınar, 2020: 18).

Finally, the general usage areas of computers have a wide range that cannot be listed. Still, aviation, medicine and health, education, communications, engineering, entertainment and broadcasting services are the most heavily utilized areas. Since it is within the scope of the research, it is useful to say that there are usage areas in banking services such as recording and keeping all accounts and user information, performing account activities, enabling mobile or online shopping, and popularizing the use of credit cards.

2.2. Concept and Development of Internet

Although it appears to be a new dynamic, it is theoretically included in scientific articles published in the 1800s. The world wide web (www) application, as the most important internet tool, was developed by the article "As We May Think" by Vannevar Bush in 1945. The article, which includes the special storage technique in which images and information can be stored for a long time through microfilm, formed the basis of the internet (Buckland, 1992: 284-294). The internet, which was developed in the 1960s to be used in the military and scientific research, was turned into a project by the US defense units to provide information sharing (Yalçın, 2010: 4). In 1962, the idea of interconnecting computers was first mentioned by Licklider. This idea, which emerged from the Masachusettes Institute of Technology, was brought to life with ARPA and DARPA systems. After its formation, it became usable with ARPANET in 1969 (Yayla, 2010:7). In 1973, the protocols were changed and address information (IP) was added to each of the machines, and in 1976 the package program was produced and named UNIX-UUCP, thus allowing file transfer over the internet (Yıldırım, 2019: 54). In 1986, the foundation of today's internet, which was developed rapidly by the US National Science Foundation, was laid (Yalçın, 2010:5). Since the 1990s, ARPANET has gathered all the computers in the world on a single network, and then new networks have been developed for commercial and scientific purposes. Tim Bernes-Lee, the staff of the CERN Research Center, developed the "www" system for the internet, which was started to be used for commercial purposes, and released it to global distribution in 1991. Many hackers developed their own browser systems during this period. Mark Andressen's browser software called Mosaic, which has multimedia features, and "Netscape Navigator", which was developed in 1994, opened new doors for the internet. Finally, Microsoft-made Internet Explorer, which was developed in 1995, started a new era. The internet has been opened to the access of large masses by means of widespread personal computers. With the increasing number of users, the content and information it contains has also increased (Yıldırım, 2019:54).

2.2.1. WEB 1.0-WEB 4.0: Evolution of Internet

At the beginning of the 2000s, floppy disks (floppy disks), 56k modems, limited connection, one-way communication is possible, the internet is an indispensable element of life today, where information and content are obtained by browsing the page. It has no boundaries and provides mutual and continuous interaction. Thanks to the developing web technologies in every field from commerce to communication, from education to social life, it has become available at any time. The rapid progress has enabled a new generation of web developers to experience a comprehensive and useful web. Its developments, from the increase in the number of users to the hosting of a wide variety of devices, are divided into periods as Web 1.0, Web 2.0, Web 3.0 and Web 4.0.

- Web 1.0: Static website and contents.
- Web 2.0: The people-oriented web (semantic, participatory and non-collaborative).
- Web 3.0: The semantic web (the descriptive layer to which resources are linked).
- Web 4.0: Web of destinations (intelligent connection with semantic source and destination). (Benhaddi, 2017:2).

The Web 1.0 (1990-2000) era is the most primitive and first era of the internet. The only observable internet does not allow the creation of personal content. In the period called read-only by experts, there is a one-way information flow. Web 1.0, acting as an online library, was widely used by HTML-based business pages. This is because users cannot add content and comment.

The Web 2.0 (2000-2010) era, collaborative and user-oriented environment made the web popular. Users can participate in content production, share (information, visual and video content with interactive tools), and create platforms through bidirectional and dynamic connection. Since it is possible for users to interact socially with each other, the term is also referred to as the "social web". It is the period when websites and applications such as Wikipedia, Instagram, YouTube, Twitter, Facebook, blogs, which feature social media with information access, organization and sharing, and which have various functions, are used. Databases and ready-made admin panels where technical knowledge is not required are offered to user services. Technologies such as XML, AJAX, API, RSS, SOA, applications, programming languages such as PHP, ASP.NET have been developed for dynamic websites.

In the Web 3.0 (2010-2020) period, the contents transferred to the virtual world in the previous period have been interpreted. The data that comes out of the control of the individual is structured and labeled in a way that the computer can read directly, and it refers to the web environment that is made smart by interpreting it with software responses such as artificial intelligence. This situation caused the period to be described as “semantic web”. Technology ensures that data is collected and interpreted by computers while being used by users. In the period that created the personalized advertising, sales and marketing revolution, database systems communicating with each other offer similar results, advertisements and suggestions with criteria for user preference and interests through advanced algorithms. The criteria are previously visited, shopping venues, locations, favorite pages, etc. Some of the recommendation systems used are image processing technologies such as integrated assistant, video intelligence, photo tagging, face recognition from photo. Some of these technologies are XML, API, URI, OAUTH, OWL, RDF.

In the Web 4.0 (2020-2030) period, cloud computing (internet-based computing) applications come to the fore in the storage of personal data, content and files, working entirely over a virtual network, away from physical disks, and virtual and real are intertwined. Augmented reality and artificial intelligence technology are at the forefront in the period. It includes highly intelligent interactions from virtual assistants to virtual reality, from holograms to the internet of things. The machines have reached the level of intelligence to interpret and make sense of the contents on the internet and provide maximum performance-quality results. For this reason, the term is characterized as the "intelligent or symbiotic web". Some applications utilized during the period are EyeOS, Spreadsheets, Google Docs (online office), DesktopTwo, Goowy, Glide, G.ho.st, YouOS. Thinking like individuals, artificial intelligence algorithms personalize the user-web relationship. It has become possible to connect and install programs to any location in the world via the cloud system without the need to install programs on a computer. All it takes is a high speed internet connection. The projected web architecture is 100 gigabits/s. is the connection speed and bandwidth (Badgers, 2021).

The current state of the Internet is summarized as follows (Çevik, 2009: 37):

- It provides secure, fast, easy and economical access to information.
- It contains too many iterations.
- It is a platform for democracy and increases the perception of freedom since it allows personal and free expression.
- It has global prevalence and its growth is continuous.
- There is no central management. It operates companies, government, universities and service providers.
- It is dynamic without borders.
- It is possible to access a large number of information with a single button.
- It offers applications that make life easier, such as banking services, TV-radio broadcasts, home shopping, newspapers.

Since the Internet has become an element of daily life, it causes some situations to change. The example that best represents this situation is in the field of banking, which is also relevant to the subject. Today, bills are collected via internet banking rather than going to the bank.

2.3. Concept and Development of Telecommunication

Telecommunication is a technology of French origin, derived from the Greek words "tele" (distance) and the Latin "communicatio" (communication), which enables the approximation of physical distance between individuals. The first person to use the term is Edouard Estaunie (Kıldan, 2021:3). The concept defined by the International Telecommunication Union as "communication with optics, radio, wire or various electromagnetic systems" is also referred to as Telecom. Communication with systems means receiving or transferring data such as audio, video, image, text, signal, sign (Recommendation, 1993:6-7). Data transfer in telecommunication networks is between transceiver devices. Protocols provide data communication between devices. Telecommunications network basic components (Telecommunication, 2022):

- Terminals such as mobile phones (accessing the network)
- Network devices (in communication with data transfer)
- Software and protocols (to make sense of communication between network devices)

2.3.1. Historical Background of Telecommunication

Contrary to the fact that communication was provided by signals such as pigeons, flares, light, smoke, and sound before the technological advances of the 20th century, the use of electric and electromagnetic waves in long distance communication shows the way forward in the history of humanity (Kıldan, 2021: 4). The first use of electrical signals as a long distance communication tool was thanks to the telegraph invented in 1837 (Yeren, 2022). The telephone, which was subsequently invented by Graham Bell in 1876, is the first example of telecommunications. Telephone conversations with the transmission of electrical signals and sound were provided by a manually directed operator. In 1891, people connected directly to the called person made the first wireless phone calls with microwave signals in 1948. The invention of mobile phones using cellular service was only possible in 1984. Communication between individuals was provided by radio frequencies, and gained speed thanks to the Internet, which became widespread in the 1990s. After the phones that started to be used by all segments in the 2000s, the use of smart phones has become widespread since 2012 (Chai, 2020).

When the Turkish history of telecommunication is examined, it is observed that it started in the last period of the Ottoman Empire. Post Office Amirane was founded by Abdülmecit in 1840 (İçöz, 2003:47). After the proclamation of the Republic, the PTT (General Directorate of Postal Telegraph and Telephone) was established in 1924 and the first GSM technology-based telephone call was made in 1994. The service is only available in Ankara, Istanbul and Izmir,

and until that year telecommunication activities were managed by the PTT. This administration, which was carried out under the supervision of the state, resulted in the separation of telecommunication and postal services in 1994, the establishment of a Turkish telecommunication joint stock company, and the privatization (Kıldan, 2021: 4). Turkey, which has been using 2G technology for many years, switched to 3G technology in 2009 and launched 4.5 G in 2016. In the same year, LTE (first national and domestic) base station ULAK was included in the communication network devices category (Türk Telekom, 2022).

The telecommunications sector is one of the sectors that is highly open to development. The demand for the sector is increasing with the increasing urbanization trend, developing digitalization and increasing population. In line with the services provided, a decrease is not expected in the upward momentum in the amount of demand in the medium term, but a decrease is observed in some sub-items. The impact of Covid 19 on the world in 2020 revealed the need for uninterrupted infrastructure, and efforts were made to maintain education and business life remotely. All telecommunication enterprises on a global basis met with high demand, isolation and quarantine practices caused a 75% increase in global data traffic. The strategic importance of telecommunication technologies has increased, unlike the sector, which was influenced by the growth plan and many enterprises that stopped their investments, which were affected by the process. Predicting the intense demand and producing appropriate solutions for the requirements have transformed telecommunication enterprises into technology enterprises. Thus, investments have been increased, infrastructure works have accelerated and R&D studies have gained intensity (KPMG Turkey 2020:3).

2.4. Characters of the Computer Sector

It is the best all-purpose vehicle information technology ever made. The speed of the information and thought application scale, which is used for the processing and distribution of digital information, is increasing with the means of thinking, information technologies (Cohen et al., 2000: 4). The IT sector, which is heterogeneous in terms of advanced technology processes, products and sectors, covers the sectors to which quite different fields belong. Nanotechnology and biotechnology are not accepted as technology sectors (Armağan, 2012:29). Compared to 1975 in 2010, the computing power of the computer is 10 thousand times higher. Therefore, the cost of computer production has decreased by 10 thousand times.

The knowledge economy is beyond technology that spreads faster and better, and it is a means of thought for individuals and institutions to determine what technology tools will do and by what method. Today, most individuals use the phrase that they can make written calculations

in long numbers to describe the power of the computer. However, basically the computer cannot calculate, it only processes symbols. With this technology, data such as programs, speech, music, writing, numbers, programs that can be digitized can be transformed, transmitted, classified, stored and recalled algorithmically. This situation, which is in the interest of people, is not numerical. Various methods, organizational structures and processes are established in order to use the capacity. (Cohen et al., 2000:4).

The report prepared in 2000 revealed that the USA gained efficiency from new economy sectors, including the share of the IT sector (Armağan, 2012:57; Uchitelle, 2012). Even in the economic recession in 2001, the new economy enabled the productivity increase in the economy to continue (Armağan, 2012:29). According to Nordhaus, rapid productivity increase is achieved with new economy sectors, and productivity increase is accelerated in various sectors with manufactured products (Nordhaus, 2002: 240-242). Baily (2002:3) agrees with this view, and Robert J. Gordon thinks that if the increase in total productivity in new economy sectors is accelerated, the productivity growth of other sectors will slow down (Gordon, 2000:49-74). Information technology is characterized as general purpose technology instead of traditional capital investment (Bresnahan and Trajtenberg, 1995:84). Often its contributions are much greater than the capital investment spent. It also provides economic benefits as it facilitates complementary innovations (Bresnahan and Hitt, 2000:24). So much so that the real value in IT investment is that it forms the basis for complementary investments such as computers, business applications and business processes. Examples of general-purpose technologies are the electric motor, the steam engine, and the telegraph.

Technology enterprises are enterprises that engage in planning, developing and revealing new products or production processes with the systematic application of technical and scientific knowledge. It is known that they generally benefit from advanced methods, that a large part of the costs originate from R&D, and their employment structure consists of engineering, technique and science to a large extent. Informatics companies, on the other hand, increase the quality of existing and new products by improving features such as diversity, quality and usability. Thus, the increase in efficiency depends on partial or total change in IT investment organizations. Otherwise, the benefits provided by the computer create a loss of productivity due to organizational incompatibility. The mentality defined as “all or nothing” has had economic and social consequences with the invention of the mobile phone and its becoming economical over time. The use of mobile phones has become a means of economic empowerment for the poor, but when infrastructure deficiencies such as poor transportation conditions and slow postal organization are compensated, they have reached a competent market and provided incentives for entrepreneurship.

The mobile phone, which was used in developed countries before, was the first telecommunication device for developing countries, making an extra contribution to economic growth (Armağan, 2012:31-33). Network equipment and falling mobile phone prices paved the way for mobile operator activities. Prepaid/prepaid systems have become widespread. Production costs were reduced from $250 in 1997 to $20 in 2009. Microfinance loans were given to those who could not afford mobile phones. Thus, their use has become increasingly widespread (Eureka Moments, 2009:4-5). In addition, various studies have been carried out for mobile phones that provide tax income, new investments and employment.

Jensen (2007:922) examined the fish prices in Kerela, South India during the period 1997-2001. He found that the consumer price decreased by 4% and the profit of the fisherman increased by 8% due to the mobile phone effect. He also stated that the information disseminated via mobile phones and mobile phones provides effective transactions in the fish market, thus creating an increase in welfare in the region. Aker (2008), in his micro-economic study in Niger, examined the grain markets for the period 2001-2006, found a decrease in price differences, and also reported an increase in producer profits and a decrease in consumer spending.

Qiang (2009: 7-9) included 120 countries with mobile phone, fixed phone, broadband and dial-up internet access in his 2009 macroeconomic report prepared by the World Bank. In the report, in which the effects of Gross Domestic Product (GDP) are evaluated in developing and developed countries, the 10% increase in mobile phone usage, which has become widespread, led to a 0.8% increase in GDP. It also had less success than mobile phone internet types, which were more successful than landline phones. However, in terms of prevalence, the effect on growth is quite high. Streamlining the markets, increasing the efficiency and decreasing the costs show that the telecommunication services are more in the developing countries. Economic benefits are realized through messages in underdeveloped countries. So much so that farmers find customers by message, get expert advice, get forecasts from daily/seasonal weather conditions, and perform an effortless and low-cost mobile money transfer (Beyond Voice, 2009). After the 2020 sales of smart mobile phones, which are also important for internet access, the number of users in Turkey reached 76.89 million. The sales realized in 2020 increased by 20 million people and the rate increased to 97.2%. Internet access is about to exceed the 8 billion band, and the number of people accessing the Internet on a global basis is 6.4 billion (TRT Haber, 2021; Milliyet, 2021).

2.4.1. Informatics Sector and New Economy

The informatics sector, which has an intense impact on the old economy with various developments, is a factor in the formation of the new economy. The effect of current informatics on the new economy, which expresses a knowledge-based economy in general, is the fact that it is a dominant technology that is used for various purposes in different ways. With the new economy, which is not dependent on a specific technology or time, social organizations and society in the past have also been affected. Technological innovations in the past can be listed as railways, canals, steam engines, printing press and mass media (Armağan, 2012:33-37).

The key to success in the new economy is invention, knowledge and technology. There are three main reasons why the new economy, which is entrepreneurial and global, integrated with products and services, creates economic competition on a global scale (Atkinson and Correa, 2007:15):

1. It is made possible to do business from a distance. Supply chains can be supplied from all over the world with the support of informatics. Moreover, much more work is done on the phone or digitally, without the need for face-to-face communication.
2. The importance of attracting investments with international mobility has been understood by many countries. Even developing countries have succeeded in providing the necessary business environment, qualified workforce and infrastructure in order to attract investment.
3. Artificially low exchange rates, high customs duties, commercial activities, and low wage rates are other factors that allow developing countries to compete with developed countries. Table 2 is used to compare the old and new economy.

Table 2. Differences of Old Economy and New Economy

	Old Economy	New Economy
Main Technology Immersive	Mechanicalness	Numeracy
Main Production Item	Capital/Labor	Development/Ideas
Structure of Employment	Guaranteed	Risky
Workforce	Organization Man	Internal Entrepreneur
Attributes	Job Specific	Wide and Variable
Organization Format	Hierarchical	Multi-Link (Networked)
Markets	Stable	Dynamic
Competitive Advantage	Economies of Scale	Development/Quality
Competitive Surface	National	Spherical
Inter-Business Relations	Individuality	Partnership
Production System	Mass Production	Flexible Manufacturing

Source: Atkinson and Correa, 2007:3

In addition, global IT expenditures were approximately 2.4 trillion dollars in 2003 and 3.5 trillion dollars in 2008. Due to the global crisis that started, the total expenditure fell below $3.4 trillion in 2009 (Armağan, 2012:42), but rose again in 2010 to reach $8.037 billion. Total spending in 2019 was $7,926 billion. The current potential in Turkey was determined as $24.6 billion for 2018, but $8.8 billion was spent.

2.5. Informatics Sector in Turkey

Today's information age shows that the most important power is information. At this point, informatics is the ability to process information logically and regularly, especially with electronic devices such as computers. The cluster of related parts such as collecting, processing, organizing, sharing and storing information is the developments in the field and has created the concept of information system. In this context, it is defined as an organized resource set information system that organizes assets including hardware, software, data acquisition methods, processing, communication and employees. Technically, they are systems that provide control and coordination with the support of decision-making from institutions or organizations, helping to solve the problems of employees and managers, to envision complex issues, and to create new products (Aydın, 2012). When information and communication technologies (ICT), which includes communication technologies (CT) covering electronic communication and hardware areas and Information technologies (IT) subgroups covering software, hardware and service areas, it is observed that individual and system performances create an increase in the quality of business and daily life through innovative developments. Information that is quickly and easily accessed through the internet, which has found application in all sectors of business life, and telecommunications including communication tools and wireless networks has completely changed the way of learning, working, interaction, communication and work-life.

ICT requires that information stored electronically be subject to a high level of security. This is security protection, information integrity, confidentiality and availability. Necessary measures should be taken to prevent situations such as theft, alteration, damage to software, violations that endanger information security, and the Information Security Management System should be implemented effectively (Tükel, 2020: 5). By Moulton (2003) the systems and processes that support this depend on the audit environments established and the maintenance performed in order to manage the related risks. For this reason, many private and public organizations want to establish an Information security management system (ISMS) and to have TS ISO / IEC 27001 certificate. ISMS, which focuses only on hardware and software risks and planned risks, has to cover all business processes. Otherwise, many risks are ignored

(Karabacak and Özkan, 2010). However, the most comprehensive part of information security is related to social relations and processes, and only a part of it is related to technological and technical affairs. When you have a good system, system and human errors, malicious attacks, operational interruptions can cause minimal damage to institutions and organizations. At this point, all music, including worker health and safety, should be evaluated and a holistic risk management process should be applied. Due to many reasons such as ICT, reduced dimensions of electronic devices and devices, mobile computer systems, advanced wireless network and interrelated cyber-physical environment, smart environment, environmental intelligence, internet of things; the IT sector, which has moved away from being a unique field by integrating into all business life, and has become covering activities such as R&D, innovation, productivity and production for all sectors, is under intense competition, especially in developed and industrialized countries. When the possibilities possible with the technology in question are evaluated, it is observed that limited success has been achieved and that states can be attributed as development efforts if they are transformed into applications without losing time. The World Competitiveness Forum Global Competitiveness Report published in 2019 shows that Turkey is 71st among 140 countries in 2018 and 69th among 141 countries in 2019. In addition, the ICT volume for the country is around 27-30 billion USD. In the report published in 2019 by the Turkish IT industry association (TUBISAD), the following were determined that in 2018, 139 thousand personnel and 5405 enterprises took part in the IT sector, 33 thousand individuals work in communication and 106 thousand individuals in information technology, 4% of employees are subcontractors, 21 of them are R&D personnel, 56% of them are higher education graduates, 32% of them are women, and it is stated that the most important problem is determined as qualified workforce (Tükel, 2020: 5-6).

3. INFORMATION SYSTEMS

3.1. Concept of Informatics

When it comes to informatics, it is understood that data whose users are made meaningful and useful. This data is of great importance as it provides up-to-date and reliable information for every individual who is in the process of making a decision. In this context, change systems and technologies are developing. Information systems can be comprehended by understanding the concepts of data, information and meta-information (Akolaş, 2004:29). In Figure 1, the relationship of the concepts is shown, and then the related definitions are given.

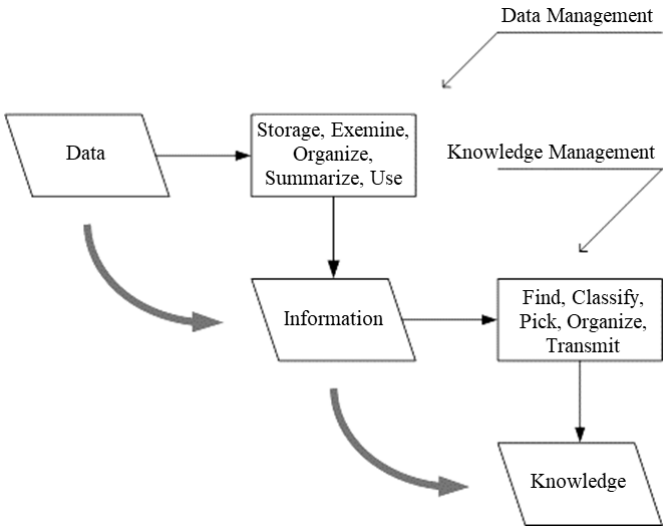


Figure 1. Concepts of Informatics

Source: KDR, 2018

- Data refers to the unprocessed facts that can be used in the production of knowledge to make sense of it. These phenomena can be in the form of symbols, alphabetical order or numerical as well as graphic. Since it includes real events, we apply various transformation processes for the results and the data is made meaningful for users.
- Information is the results that are analyzed, processed and ultimately reached to make them meaningful in order to assist in the recruitment processes. In addition, any text about which a definite judgment is made is called video and sound information and takes its source from the data.
- Knowledge is defined as the type of knowledge that is prepared by preparing the information for use in the future by means of various grouping classification analyzes in order to reveal the rules and facts on specific subjects or to achieve various purposes and obtained by interpretation.

Locations where header information can be accessed are places such as international or national documentation centers, research centers, libraries. In this context, information systems are a formal system that enables the collection, processing, storage and reporting of information required for decision making by managers from different sources. In formal information systems, technologies that are likely to be computer-aided can be used, as well as manual technologies (Akolaş, 2004:29).

Since the starting point in information systems is information production, if computer technology is used, the inputs can be called software. For the same reason, it needs input consisting of personnel and equipment. At this point, it can be said that the evaluations for the system are carried out by examining the personnel and equipment main parts and the changes that develop over them (Vijaj et al., 2000:159).

The information, which is called the basis of all information systems, has to have various features. The main features that can determine the value of information within the scope of these obligations (Türksel, 1996:14) are as follows:

- Cheapness
- Propriety
- Suitability
- Timeliness
- Integrity
- Accuracy

The lack of any of the listed qualifications causes problems for the decision-maker at the time of decision-making. As it can be understood, it is expected that the information that has all the qualifications will be valuable and meaningful for the users. With information systems, information can be collected, stored, stored, processed, accessed and combined with technologies that serve its distribution. In this context, technologies that serve until the distribution stage can purchase software and development tools, communication and network tools, data storage tools and computers. Services, on the other hand, can be exemplified as information access services, data banks, application software development, and information processing. As reported, information systems contain important information about the organization in which they are contained and the people and places around them (Akolaş, 2004:29). Since information forms the basis of organizational and individual decisions, it differs for each person and organization, although it is needed in achieving goals and at every stage of the organization. As an example of this situation, it can be given that lower-level managers in organizations need information to make decisions about the continuation of routine work, and middle and top-level managers need information on issues such as policy making and long-term decision making (Curtis, 1994:45).

In any business that has a policy of diffusion with information systems and is acquainted with these policies, large resources are thrown away and business activities that are changed as a natural result of the information system are defined, services for the organization are developed and profits are increased. At this point, institutional and social organizations are made extremely effective in information systems and technologies that need to be developed. In this case, the hierarchy in organizations disappears. The reason for this is that the information technologies and systems used are transmitted from the personnel to their supervisors and faster downstream to supervisors and personnel through various structures. Accordingly, in wired information worlds, basic management processes such as budgeting, auditing and planning find the opportunity to work with tools such as group software, teleconferencing, e-mail, removing the distance difference and disregarding company boundaries (Stewart, 1997: 252).

In Table 4, the roles assumed by information systems, which have developed in organizations over time, are presented.

Table 3. Development of Information Systems

Data Processing (1950-1960)	Managerial Reporting (1960-1970)	Decision Support (1970-1980)	Strategic and End User Support (1980-1990)
- Electronic Data Processing Systems - Monitoring of Commercia Transactions, Retention of Records, Traditional Accounting Practices	- Management information systems - Administrative Reports Prepared for Predetermined Information to Support Decision Making	- Decision Support Systems - Interacting Systems to Support Administrative Decision Making	- End User Computer Systems - Direct Computer Support to Increase End User's Productivity - Senior Management Information Systems - Providing Critical Information for Senior Management - Expert Systems - Providing Knowledge Based Expertise Support for End User - Strategic Information Systems - Delivering Strategic Products and Services to Provide Competitive Advantage

Source: Akolaş, 2004:32

3.2. Information Technologies and Systems

It is known that every development in information technologies ensures that corporate activities are positively affected. The most important elements in information technologies are service quality, time and cost. It allows it to create radical changes in the institutional structure, to have a say in the market and the market, to increase the marketability of service-products, to increase the efficiency of its processes and ultimately to create customer loyalty (Papazoglou and Tsalgatidou, 2000: 301).

Information technologies are the technologies that collect, process and store information in the most general context (Ceyhun and Çağlayan, 1997: 12). In the time that passes before the information can be stored and processed, it is systematically transmitted to a different place at any time.

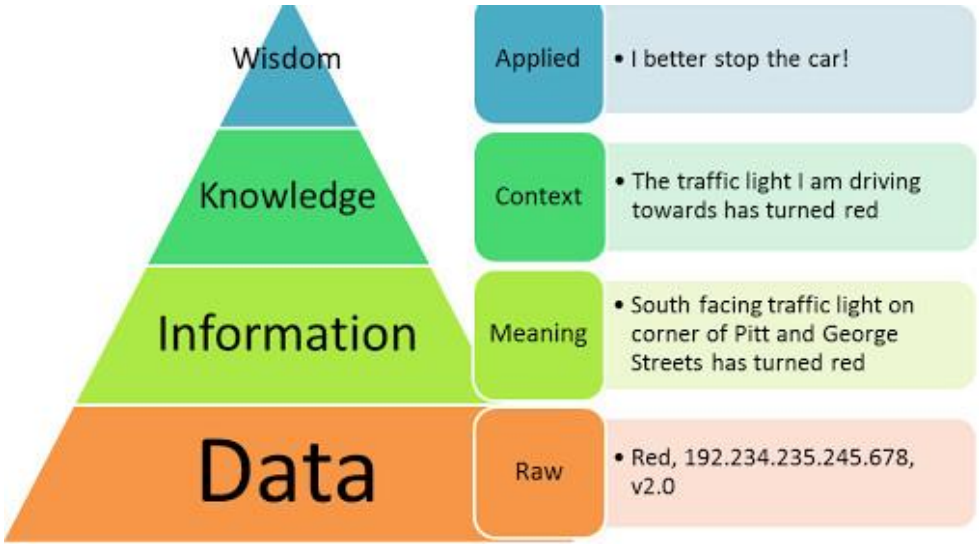
The global development of globalizing technologies and the growth in information economies increase the importance given to information technologies and systems. The rapid development of internet technologies can create new business processes and business models. These situations increase the dissemination of information. This is why digital businesses come to the forefront with electronic and advanced commerce. Through information systems, businesses have become able to market products and services from long distances (Laudon and Laudon, 2005. 4).

From the information age we live, after the industrial revolution, every development is increasing and a working technology is created that combines with human labor apart from human power. In business environments where human labor is integrated, various divisions occur and provide an intense flow that shifts to the area of interest. Thus, the methods used in electronic data processing provide purposeful use by processing the data. Institutions create different information systems. The most important point here is to meet the information needs of the organization through information technologies and systems. For this reason, information systems form the organization by grouping it in the form of collecting and organizing the information that it needs until the decision-making process (Karahoca and Karahoca, 1998:8).

Routine decisions taken by managers at the operational level in information systems and strategic decisions made by senior managers support the process at every stage of the organization. Thus, the success of organizations depends on the accuracy of the decision made and the extent to which the information needed at the first moment is met as a result of the accuracy of the decision. While it was possible for it to function if it was an operator and developer in information systems in the past, today its final task is to organize, summarize and integrate the data in the hands of the user in a way that can be meaningful in decision-making processes (Tekin, 2020:5).

3.2.1. Elements of Information Systems

It is understood from the definitions made so far that the concepts of information and informatics have different meanings. Collecting and processing the data into a meaningful form is defined as information, and processing the organized results into a form that can guide decision-making authorities is defined as informatics. As it can be understood, there is a hierarchy between information and informatics. The information hierarchy is observed in Figure 2.



Source: Tecim, 2019

At this point, information systems process the inputs necessary for the transformation of data sources. The main resources needed in information systems are human, software and hardware resources (Tekin, 2020: 5).

Hardware consists of physical devices used to process information. In general, its components consist of computers and computer units. Computers basically have to fulfill 4 functions.

- Input
- Central Processing Unit
- Output
- Storage

Software, on the other hand, is detailed instructions that control operations in information and information systems, and software support is needed in computer systems to respond to information processing system requirements. Otherwise, the hardware does not perform the operations that can be expected in computers without software (Laudon and Laudon, 2005.164). In this context, software functions contain various features.

- It manages the computer resource of organizations.
- It produces several arguments for managers to take advantage of computer resources regardless of the capacity of the workforce.
- It acts as a bridge between stored information and organizations.
- It consists of system software that provides control of the applications written to meet the needs and needs of the user and the operations performed by the computer, supports it, and provides access to the computer hardware through the applications it has.

At this point, users are those who enter the data into the system and those who will operate it. The users examined in this context are divided into two groups: information system experts and end users. Information system specialists are individuals who are in charge of the business after the development of information systems. Computer operators, programmers, and systems analysts are included in this category. End users, on the other hand, are individuals who use information systems or the information produced. At this point, they can shape the system they use according to their own needs (Tekin, 2020: 6).

3.3. Subsystems of Information Systems

The basic systems that make up the information systems are the preparation of the data, which is described as a subsystem, and the processing of the data. Transforming transactions into information and providing the necessary flow in inter-system activities refers to this process. In data processing systems that are stored in appropriate environments and used when needed, information collected through management information systems is made reportable. Thus, the data collected from outside and inside the institution are transformed into information in order to contribute to the effective decisions that can be taken on the planning, management and audit issues that the managers are particularly interested in for their activities (Akal, 2022; Sevgi, 2022).

Senior managers benefit from the human resources system in order to manage the salary level, training needs and promotion status of the personnel, to evaluate the candidates during the job application and to access the information in an up-to-date and fast manner (Akal, 2022; Sevgi, 2022).

Information systems create production information systems in order to gain customer support, apart from the design and efforts for various needs of organizations. With the outputs produced, it is only possible for the organization to gain space in the competitive market and to be ahead of rival businesses with marketing strategies. Thus, it creates marketing plans and strategies through information systems that provide analysis and interpretation of customer needs. This situation naturally reflects positively on the organization (Akal, 2022; Sevgi, 2022).

It is known that the attitude of the consumer to the organization is important in accessing products and services. Providing a transparent process with the help of information systems from inputs to output, from the procurement stage to transportation and informing the customer about this process creates an increased sense of trust, thus bringing customer satisfaction to the organization (Akal, 2022; Sevgi, 2022).

With information systems, cost analyzes are carried out for organizations to provide quality products and services, and finance and accounting departments gain comfort and speed by recording the general and pre-accounting of the organization (Akal, 2022; Sevgi, 2022).

In Figure 3, the subsystems that make up the information systems are given.

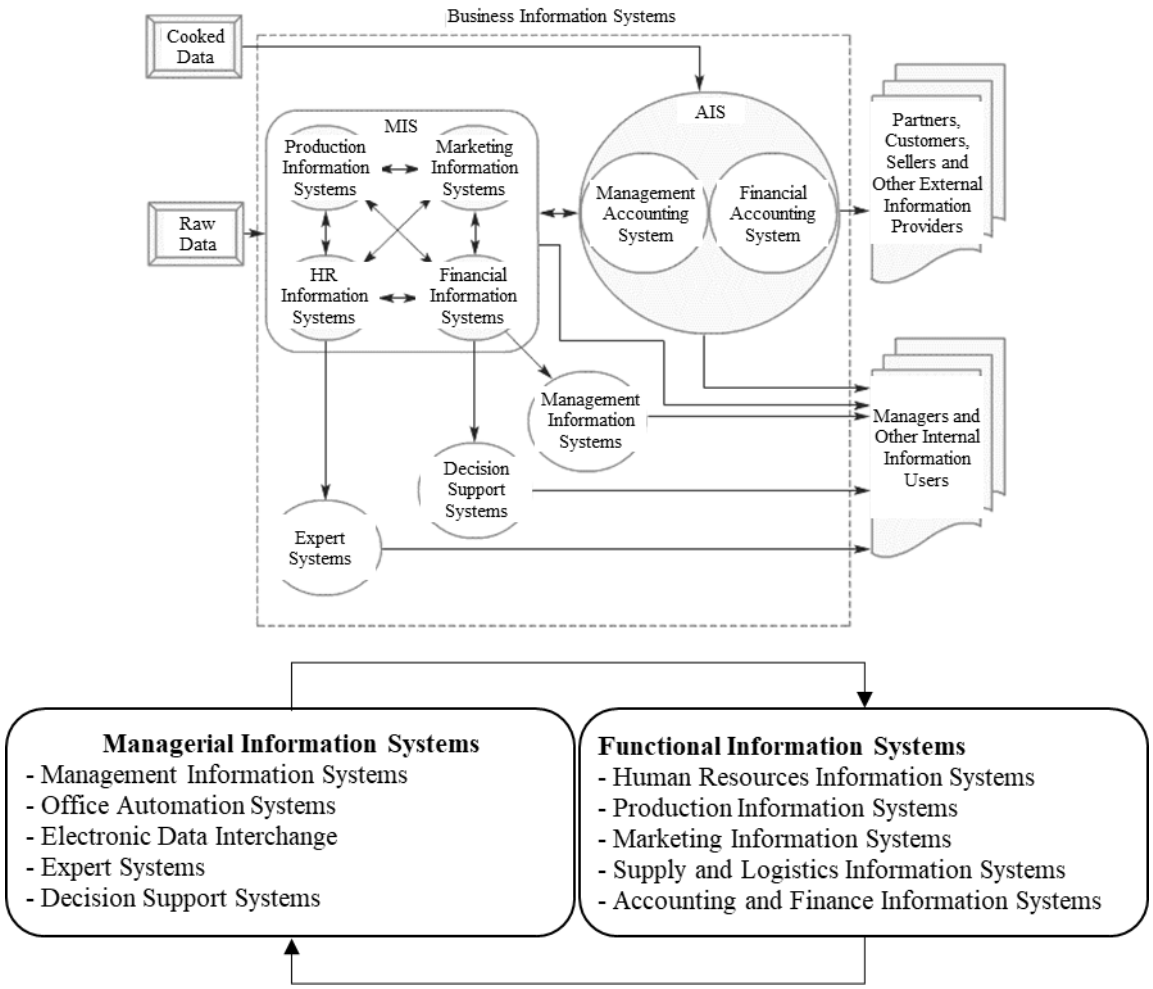


Figure 2. Sub-Elements of Information System

Source: Şahin, 2013

3.3.1. Data Processing Systems

They are systems that provide data support to processes at a functional level by institutions. Periodic outputs are necessary and must meet the needs of operational level personnel. The main purpose of data processing systems with the mentioned qualifications is to prevent time loss for boring operations performed by utilizing human power, and to automatically record and execute operations such as calculations by means of programs. It is the most suitable system that enables the use of a large number of data with similar processes in terms of management and summarization, and it informs the managers about the situation in internal operations and provides information about the relations around the institution. Examples of operations performed by data processing systems are training follow-up polls, overtime follow-ups, payrolls, order entries and sales (Özyılmaz, 2014:22).

Information systems used in businesses today are exemplified in the form of a pyramid in Figure 3.

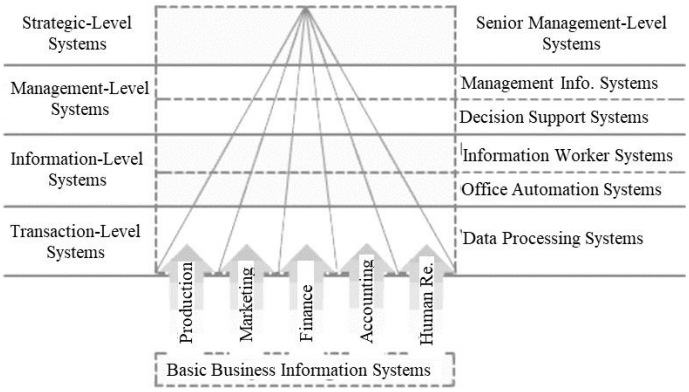


Figure 3. Business Data Processing Systems

Source: THY, 2014

3.3.2. Management Information Systems (MIS)

Since the importance of the decisions that can be made in the activities of the organization is understood at the knowledge level, the managers have decided to support the system approaches with managerial practices to meet their needs. In fact, this situation, which was born as a necessity, paved the way for the creation of management information systems. The concept of management information systems, called MIS, consists of system information and management concepts. If the concept of management is mentioned, apart from the previously explained concepts, it covers all of the processes carried out to take the decision that will create the most effective and efficient way for the activities to be carried out in line with various goals and determined purposes, first of all, and then non-cash and non-cash resources and equipment to display adaptive relations with each other in a specified period of time, and the implementation of this decision (Eren, 2001: 3). When evaluated from this point of view, it is understood that Management Information Systems contain common features (Karahoca and Karahoca, 1998:32).

- It offers support for structured decisions at management levels and throughout the enterprise.
- It ensures that objectives are set and planned by management personnel.
- It offers reports reflecting the controls other than the controls it has in its center.
- It usually serves to make decisions using existing or developed data.
- It is not flexible due to its structure.
- It is stable and defined in terms of its structure, since the needs for information are a stable and defined structure.
- It takes time to perform analyzes and primarily requires design studies.

Figure 4 shows the management information systems pyramid.

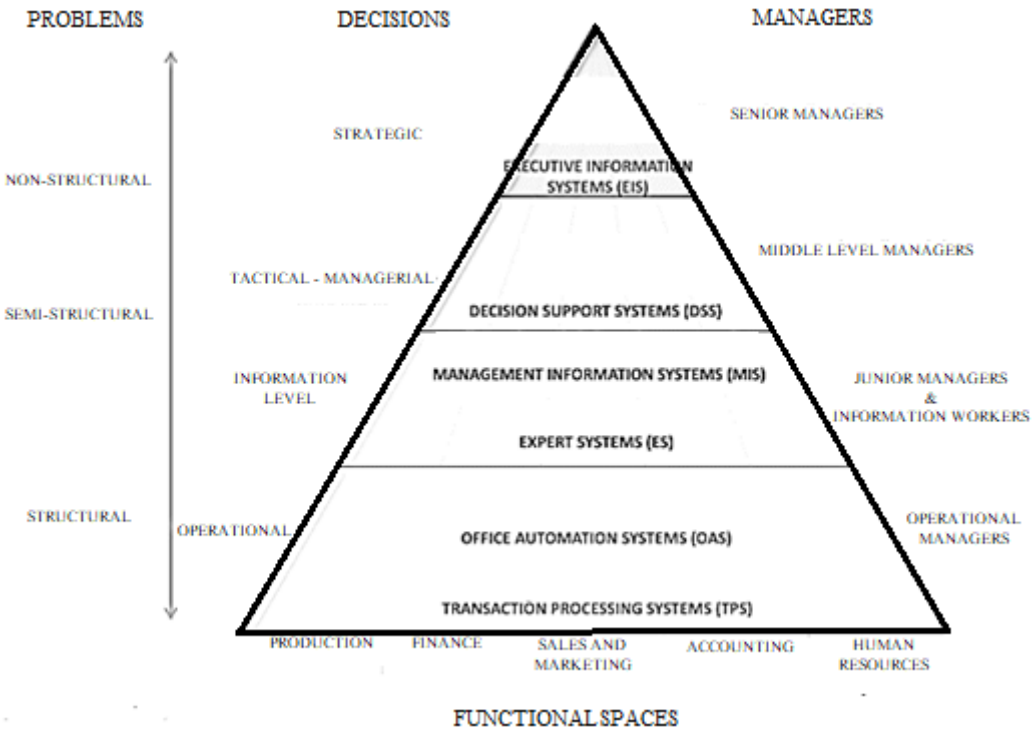


Figure 4. Management Information Systems Pyramid

Source: Tecim, 2019

3.3.3. Human Resources Information Systems

Human resources, which are an important factor for successful execution in organizational activities, use information systems in order to monitor and implement issues such as personnel recruitment, career planning, training requirement planning, performance evaluation, promotion and leave. Thus, these systems, which take the name of human resources information systems, perform an effective execution. The convenience recognized is to create the opportunity to carry out all the activities desired and needed by the human resources at any time (Vural, 2011: 18)

3.3.4. Marketing Information Systems

The presentation of products and services to the customer concerns the marketing department for many activities. For this reason, marketing information systems, which are used to carry out marketing activities, are important. Marketing information systems, which analyze the information that can create satisfaction and analyze the information that can create satisfaction, make use of mobile systems, especially in recent years. Thus, high performance is achieved in direct marketing and trust is gained by meeting customer requirements on time (Tekin, 2020:8).

3.3.5. Production Information Systems

The success of organizations in the intense competitive environment they are in depends on the level of meeting the needs and requests of the customers within the scope of products and services. At this point, the timing of the products and services to be released in response to the needs and demands is very important. Production information systems are used in all processes and production activities, starting from the idea and design process of the product planned to be offered, to the after-sales support services to be provided to the customer after the purchase. Thus, production is accelerated, timely entry to the market is achieved, products and services offered in line with customer orders are met on time, creating customer satisfaction (Dalay, 2013:42).

3.3.6. Accounting and Financing Information Systems

There are evaluations such as investment projects, stocks, cash, financial forecasts in accounting and financing transactions and take a long time. Transactions performed by saving a great deal of time through accounting and finance information systems can provide planning, transaction and reporting support to be presented to senior management, financial management and other departments. In addition, since the information provided by the information system is more consistent and more scientific, it is an important element in the financial decisions to be taken (Dalay, 2013:132-134).

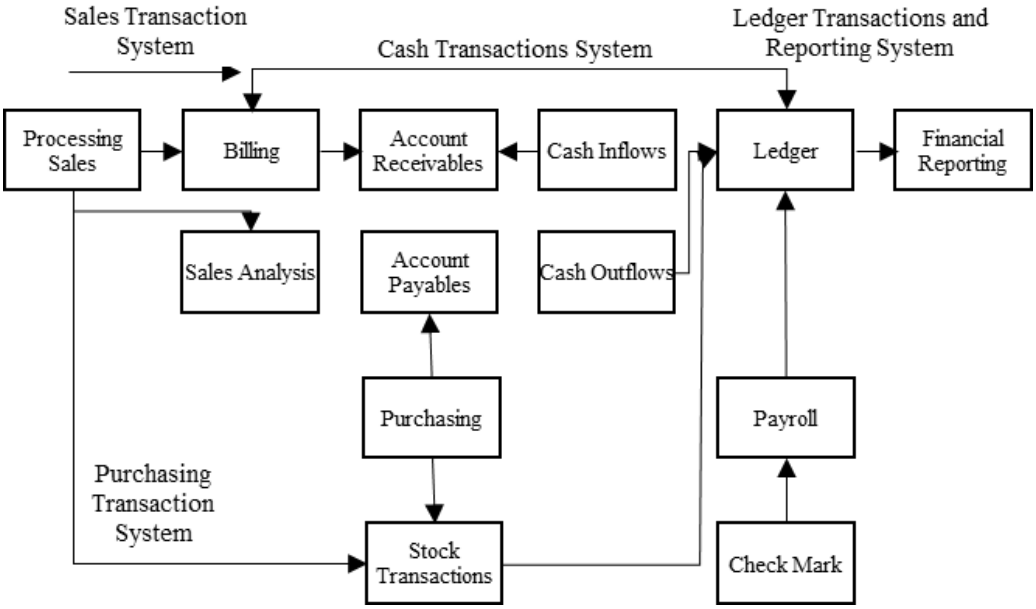


Figure 5. Accounting Information System

Source: Tecim, 2019

3.3.7. Supply and Logistics Information Systems

It is important to make the location unimportant in order to be successful in the intensely competitive market recently, and to be able to meet the needs of the customers who have different requests by being in any location. The increasing importance of the logistics sector in the activities of the organization is a reflection of this situation. As a matter of fact, the efficiency of organizations can be increased by utilizing supply and logistics information systems. Moreover, it is of vital importance that the supply and logistics process, which are necessary to ensure customer satisfaction, deliver the orders at the desired time and place, the effective management of the resources used in this process and the continuation of the stock management. On the other hand, through the information systems used in the logistics industry, businesses can experience an increase in performance within themselves. In addition, services such as individualized product, labeling, packaging, repackaging and collective modeling, which can create added value, can be realized by making use of the said information systems (Saraçoğlu, 2020:16-17). Figure 6 presents logistics information systems.

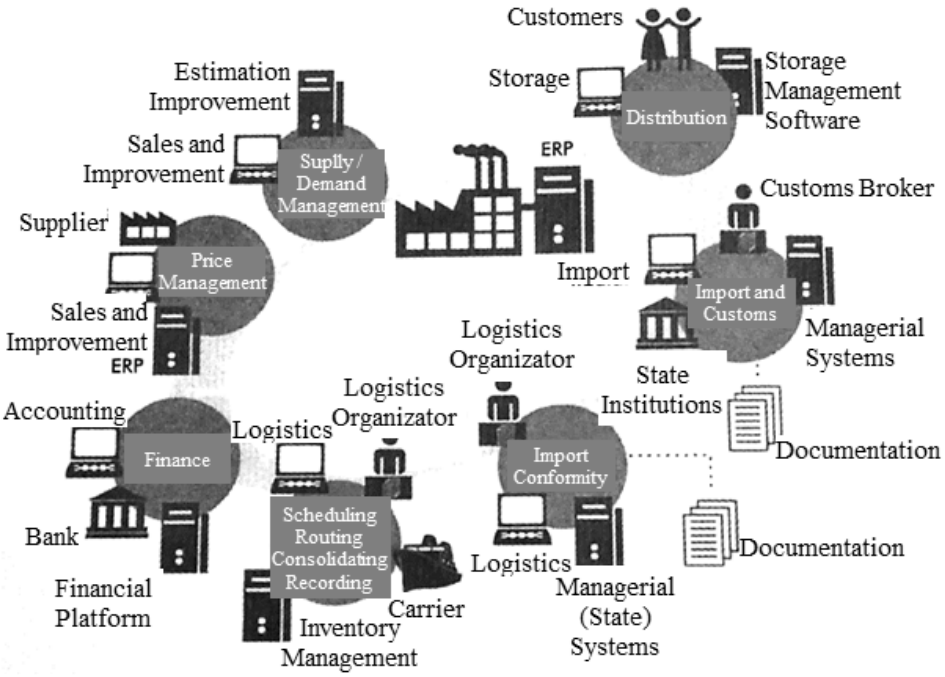


Figure 6. Logistics Information System Applications

Source: Saraçoğlu, 2010:22

As a summary of all transferred information, the basic business information systems and their sub-components are presented in Figure 8.

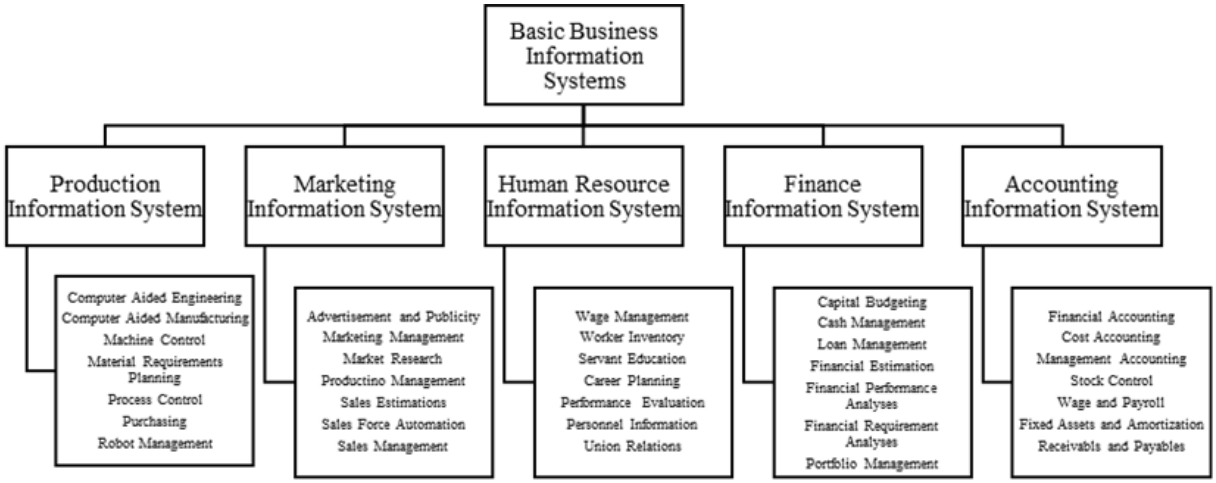


Figure 7. Basic Business Information Systems

Source: Saraçoğlu, 2010:22

3.4. Development of Information Systems

In order not to lag behind the developing technology world in information systems and to maintain profitability, it is necessary to follow and implement the trends that occur. In this context, being one of the constantly improving and innovative organizations constitutes a good vision for making the right decisions, while at the same time reflecting the importance of taking the right decisions. In this context, it is essential for businesses to use communication tools and information systems effectively and to apply all innovations to the organizational culture as a follower of new developments. With the effect of globalization in an intensely competitive environment, the banking sector obtains the most added value from information. It is one of the areas where information technologies and systems are used the most, and it has provided a significant increase in customer satisfaction and employee performance. Information systems increase efficiency and competency in every organization they are used in, so they succeed in increasing operational processes, customer satisfaction and employee performance. Depending on the development in information technologies, the expectations of the enterprises have changed, just like the expectations of the customers. The development in information technologies, which is explained with the theory of stages, includes the usage tendencies determined after a certain time. Accordingly, there are three phases: data processing, micro and network period.

3.4.1. Data Processing Period

The period covers the years 1960-1980 and includes the shaping of industrial products powered by mainframe computers. Mini-computer and main-computer transformation takes place, and it expresses the dominance of mini-computers used as main computers in the central structure. However, this dominance has not yet become widespread. The purpose of using computers in enterprises is to increase organizational efficiency in the most general scope, and therefore to provide automation for the lower levels of operational and administrative works. The data processing period reveals clear procedures and ways of doing business in the functional organization of enterprises. In the 1970s, the use of minicomputers increased with the decline of mainframe-oriented demands. Thus, the computer industry has begun to develop computer technologies and systems that middle-level managers can benefit from.

3.4.2. Micro Period

In the 1980s, it became a recommendation and then a necessity to benefit from information technologies by the process information personnel, which evolved into the micro period. The period includes informing the joint payment managers about their needs and needs. Even if it is thought that the biggest difference with the processing period is automation, there is another important element: the aim of increasing the efficiency and effectiveness of the workforce in the organization. Microcomputers used for this purpose continue to be preferred as a type of computer that enables the use of programs without the need to learn the program language and includes a graphical interface. As a natural consequence of microcomputers, the use of which has become completely widespread, middle-level managers have decreased. There are also computers included in many products and services.

3.4.3. Network Period

The need for communication between computer technologies, which continue to develop until today, globalization, the continuous development of organizations and businesses, an increase that can be considered as a revolution in the use of computers and the internet has increased the importance of information systems and caused an increase in the need for network systems in information technologies. Network systems developed at this point are categorized as wide area network and local area network. Wide area network is a connection type used in different geographies and local area network is used in the same geography (Kale, 2016:9).

The data obtained as a result of the "Research on the Use of Information Technologies in Enterprises" conducted by the Turkish Statistical Institute in 2021 are listed below (TUIK, 2021).

Internet access rate of enterprises in terms of number of employees is as follows:

- 1-10 employees : 95.3%
- 10-49 employees : 94.7%
- 50-249 employees : 98.0%
- 250+ employees : 99.9%

The internet access rate of enterprises in terms of fixed broadband usage speeds is as follows:

- 93.0% of businesses use fixed broadband connection.
- 1-10 Mbit/s : 9.7%
- 10-99 Mbit/s : 62.2%
- 100+ Mbit/s : 28.1%
- In enterprises with at least 250 employees, the rate of internet usage with a speed of at least 100 Mbit/s is 47.7% (2020 data: 37.6%).

The rate of using robot (service or industrial) technology in terms of the number of employees of the enterprises is as follows:

- 1-10 employees : %4,8
- 10-49 employees : %3,7
- 50-249 employees : %8,5
- 250+ Employees : %23,7

The rate of using paid cloud computing technology in terms of the number of employees of the enterprises is as follows:

- 1-10 employees : %10,8
- 10-49 employees : %8,5
- 50-249 employees : %19,5
- 250+ Employees : %41,0

3.5. Information Systems in Turkey

The rate of countries' use of information technology and systems and their production output are the factors that cause the intensification of competition. As a result of the intense competitive environment, business-oriented, scalable and multi-user systems that are planned to be developed in order to increase the productivity level and efficiency of the enterprises have been expressed. These developed systems continue to function as information systems (Armağan, 2012:49-52).

When the use of information technologies, which has increased globally, is evaluated on the basis of Turkey, it is stated that there has been a development in recent years. It has been widely used in private sector enterprises, including public institutions and organizations. Moreover, it is trying to develop its own technology. However, despite the crowded and young population, the market size does not meet the potential (IDC, 2019)

In the Republic of Turkey, the sectors that spend the most on information technologies and allocate budgets are banking, retailing, telecommunications, production, finance and public sector. However, the investments are consumer-oriented and 77% of them are hardware investments. In Figure 8, the Turkish IT market is revealed in a comprehensive research conducted by Karel (2018).

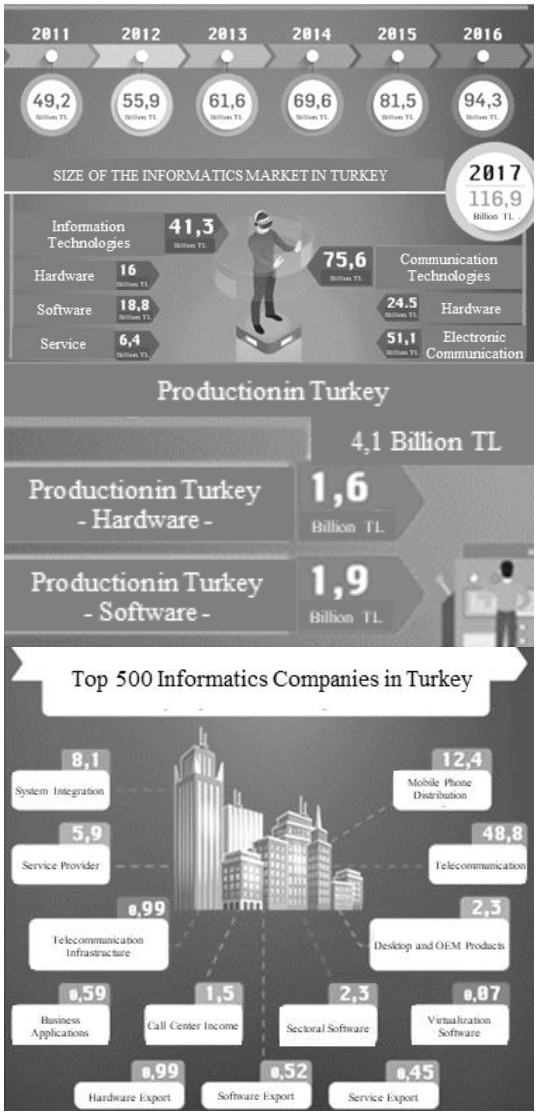


Figure 8. Information Systems in Turkey 2018
Source: Karel, 2018

	Turkey	France	Germany	UK	Spain	Italy	Poland	South Africa	UAE	Saudi Arabia	Israel
Population	81	65	82	66	46	59	38	55	10	27	9
Population Growth (%)	1.3	0.4	0.2	0.6	0.1	-0.1	-0.2	1.4	1.1	2.2	1.9
Median Age	30.5	41.2	46.8	40.5	42.3	45.1	40.3	26.8	30.3	27.2	29.7
GDP	848	2,590	3,706	2,636	1.311	2.156	526	350	383	687	353
Real GDP Growth	5.1	1.2	1.8	2.0	2.8	1.0	3.8	1.1	3.2	2.2	3.4
GDP per head	10,507	39,853	44,779	39,824	28,156	35,102	13,760	6,166	40,694	20,997	40,561
IT Spending (2018 – M$)	**8,612**	**72,425**	**101,216**	**110,728**	**27,879**	**33,732**	**11,973**	**13,745**	**7,679**	**10,853**	**9,019**
Hardware	77%	35%	35%	32%	40%	41%	54%	40%	49%	56%	49%
Software	10%	22%	30%	24%	16%	22%	15%	17%	16%	11%	17%
IT Services	13%	43%	35%	44%	44%	37%	31%	43%	35%	33%	34%

Figure 9. Situation of Investments

Source: IDC, 2019

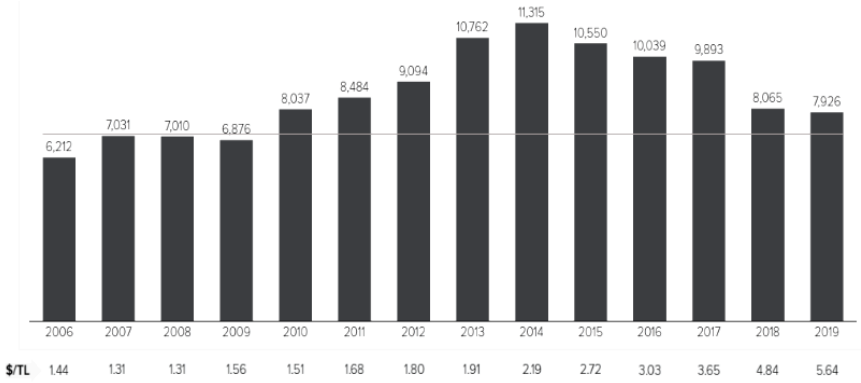


Figure 10. Turkey Information Systems Investments

Source: IDC, 2019

As can be seen, the finance and banking sector, which needs to be utilized the most, cannot attract the required investment demand, although it has gained intensity recently. In the report presented by IDC, Turkey's informatics framework is expressed in 5 basic scopes (IDC, 2019).

- The value obtained by the institutions should become the priority element of the top management together with the innovation. Thus, it is likely to have a positive impact on IT investments in the future.
- In order to be agile and follow the innovation, the technology investments of the institutions should be increased and much more interaction should be established.
- Robotic process automation should be used especially to reduce labor costs and increase operational efficiency.
- Information investments should be made urgently for analytical and big data environments.
- A significant contribution will be made to the digital transformation process through the flexibility provided by cloud computing technology.

As can be seen, Turkey seems to be late for the targets set by the European Union. However, as a result of being aware of the competitive advantage that can be achieved with globalization, appropriate steps are taken and an increase in investments is expected with the understanding that the most important technology that determines the basic power is information technology. Other investment issues that should be noticed are that applications called blockchain gain weight and that the customer experience that is desired to be improved is strengthened with technologies such as Open API. It should not be forgotten that information technologies, which are referred to as the determinant of social economic power, directly affect all social formations such as military, political, economic, social and cultural ties and will provide the largest share in the development of the country (Armağan, 2012: 240-242).

3.6. Management of Information Technologies and Systems

Technology management includes all the concepts of technology transfer, planning of technology, marketing of technology and planning activities for the supply of technology, technology control, coordination of technology and organization of technology by establishing a connection between technical expertise and management in technology management (Beşkese and Tanyaş, 2006: 218). In this context, it is defined as the association in technical engineering and management disciplines in line with the planning, development and application of the technological capabilities that businesses have acquired in order to shape their goals at operational and strategic levels and reach these goals (Akın, 2001: 278).

In order to achieve competitive advantage in organizations, new generation and advanced technology investments are needed. Management in information systems is primarily subjected to the planning stage. Before the investments to be made in information systems, the necessary planning should be completed and the planned investment should be evaluated. These evaluations of senior managers in the field of information technologies are of serious importance for businesses. As a matter of fact, when all resources are taken into account, the amount of resources allocated to information technologies has a very high rate. For this reason, investments to be made within the scope of information technologies maintain their strategic importance on the performance of the organization. Maximizing performance by adhering to their existing structures is only possible with the value they will gain from information systems. For this reason, it has to be evaluated which information technology or which information system will make the maximum contribution to the organizational performance. This situation requires individuals who have expertise in the advanced field of information technologies and individuals who have experience in basic management issues to evaluate information systems together (Beşkese and Tanyaş, 2006:218).

Table 4 presents the implementation of management functions in post-industrial and industrial organizations as quoted by Tekin (2020) from the study of Bohr and Dennehy (1994).

Table 4. How Management Functions Are Implemented

	Postmodern	Modern
Planning	horizontal direction	vertical oriented
	long term profit target	short term profit target
	Employees; investment	Employees; cost
	Focus on internal/external customer	Focus is top down
	Disorganization occurs with planning	Planning creates order
	Flexible production	Batch production
Organizing	Work teams, highly skilled workers	Single and unqualified jobs for the employee
	Unity between employee-management	Contrast between employee and management
	It is flexible when departments are intertwined	Segmentation of departments
	Horizontally stable	Vertically stable
	Heterogeneity is strong	Homogeneity is strong
	Top management is pluralistic	Top management is single-minded
	Efficiency is reduced by specialization, formality, routinization, fragmentation, and division of labor.	Efficiency rises with specialization, formality, routine, division of labor, and division.
Interacting	Power is in the hands of team leaders	Power is in the hands of top management
	Intrinsic reward and punishment system	Extrinsic reward and punishment system
	No surveillance mechanism	Surveillance mechanism is in all areas
	Equal wage policy (women, minorities, etc.)	Wage policy is low (women, minorities, etc.)
	Based on multiple thoughts	Thought is based on elite people
	Rewarding team members	Solo employee rewards
Leading	Theory S	Theory X and Y
	Few rules decentralization	Rule-based tiered centralization
	People are at the center	At the center is the boss
	Equal career opportunities for all employees	Career opportunities for elite men
	Visionary employee is not directed	Employees are directed
Controlling	Decentralized control and management	Central control and management
	Quality control is based on collection	Quality control is at the end of the line
	two-way observation	One-way observation
	There are no red lines	Red lines are available
	Rules and procedures for observation are removed	Rules and procedures are increased for monitoring
	Measuring process criteria	Measuring outcome criteria
	Information available to all	Information is accumulated
	Control is self	Control is for fear
	Training of all employees	Top management training

Source: Tekin, 2020: 14-15

As it is understood from the table, the management of information technologies is important on 5 basic business functions: planning, organization, directing, coordination, supervision. In this context, the steps involved in the planning process are collecting information, storing and analyzing information. The information rapidly acquired by information technologies provides concrete information about current and future situations during the planned management. In addition, information technologies have important functions in the implementation and evaluation phase of the plans. As a result of the operations carried out by information technologies, management activities can be coordinated, the dependence on the human workforce is overcome, the potential for error is minimized, transparency is brought to the management by conducting electronic processes, and advantages that provide competitive advantage in the external environment are obtained.

3.7. Benefits of Information Systems

The correct and regular operation of information systems should be checked and the benefits it provides for the organization should be evaluated rather than the physical performance during this control. In this context, the benefits offered by the composition systems are listed below (Şener, 2006).

- It increases efficiency in all operational processes in the organization. This makes routine work less costly and faster.
- It creates a very high quality service opportunity for the external and internal customers of the organizations. As a matter of fact, in industries such as banking and tourism, which have a large share even in the national economy, transactions are accelerated through information systems and high quality services are provided to all customers.
- It minimizes the possibility of error despite the shortened processing times.
- It makes a great contribution to the differentiation, design, updating and development of products and services.
- It makes it sustainable to be in the position of accessing and processing information in the fastest way in the current period with the competitive advantage it provides.
- It enables us to recognize, discover and access market opportunities.
- It increases coordination and interaction with lower-level employees by minimizing the time and energy to be spent on elements such as management hierarchy and strategic planning for upper-level management.
- It is possible to perform transactions more flexible and faster as a result of the efficiency achieved in coordination.
- It refers to the information that is followed quickly and accurately within the scope of the creation of the impact plan presented in the control function.
- It makes an extraordinary contribution to the institutionalization process apart from labor and time savings.
- It provides a broad perspective and changes the way of doing business in a valuable way as a result of effective decision making and differentiation from competing businesses.

4. CLOUD INFORMATION SYSTEMS

Information technologies, which have gained institutional quality, normalize the continuous transformation in business life with itself. Cloud computing is the most popular technology trend that has been used even by the consumer in recent years, and it has a structure that is constantly accessible, exhibits an elastic structure in accordance with the usage needs, can be contracted and expanded, and the cost of use can be calculated in a simple way. Cloud computing technology, which is defined in various ways, is generally referred to as the execution of computation processes on different physical infrastructures. It is a type of technology that is easy to calculate, easily accessible, durable and economical (Arslan, 2019).

According to the report published by NIST (Table 5), it is explained with 5 important qualities: wide network access, on-demand service, automated flexibility, measurability of received services, and resource pooling (Mell and Grance, 2011).

Table 5. Concepts of Cloud Information

Key Elements	Quickness and flexibility Wide network access Optional, self-serve Common resource pool Measurable service
Service Delivery Model	Infrastructure as a service Platform as a service Software as a service
Positioning Model	Public Cloud Private Cloud Hybrid Cloud Community Cloud

Source: NIST, 2009

The qualifications included in the definition made by NIST are briefly described in the continuation of the content.

- Resources can be accessed from anywhere and devices such as smart phones and computers can be used for this access with wide network access.
- They are resources that have a selective feature expressed by optional service and can be used by the user at any time. By not pooling resources, what is meant is pooling of computer resources that combine. This feature, which indicates the infinity of the automated flexibility resource pool, performs resource assignment regardless of the requirement.
- Assigned resources are rapidly expanded and narrowed. Thus, rather than assigning resources before the expected campaign load, it performs resource assignment after the incoming load. As can be seen from this example, this feature of cloud computing technology brings cost advantage.
- It is stated that the fee can be paid according to the measurability of the services received and the amount of resource benefited. Pricing is completely transparent.

4.1. Main Technologies of Cloud

The evolution of information technologies is shared in the report presented by IDC (2025). Then, in this evolution, important developments for cloud computing technology are presented.

BEFORE 1980	1980-2000	AFTER 2000
Data sits almost exclusively in datacenters	Data and compute are distributed	Datacenters expand to cloud infrastructures
Data and compute centralized	Datacenters expand role in managing data	Compute continues to be distributed; data begins to contract
Business-focused	Quick expansion in entertainment	Add social to the mix

Figure 11. Evolution of Information Technology

Source: IDC, 2025

It was first described by McCarty at MIT in 1961 and characterized as being organized in the form of computer resources and utilities similar to electricity. It is observed that its first use in academic terminology was realized by Chellappa in 1997. In the speech at the Informs Meeting event, he mentions that the boundaries of informatics will be determined by the economic rationale (Göleli, 2019:8).

Large-scale mainframes used by businesses and universities in the 1950s can be accessed by super-thin clients. But the mainframe is quite expensive to get. For this reason, it is important to provide maximum benefit after taking it. By enabling CPU usage sharing and physical access by a large number of users, which is described as time sharing in market conditions, host idle times were eliminated and this helped to make the most of computers. Studies on the first cloud computing technologies In the 1950s, it was announced by Grosch that it would benefit from a system that could be operated on 15 large data centers called dumb terminals all over the world. It is mentioned in the marketing literature as the first commercial initiative of cloud technology that companies such as Geisko, Dial Data, National CSS, Tymshare, Beranek Newman, Bolt, which are quite expensive, open their computing capacities to time sharing by subjecting them to various regulations (Yunus, 2014). This is also an innovation that provides important technologies in the field of economy.

In the 1970s, solutions similar to today's virtual transportation environments were produced. Thus, it is possible to run virtual servers isolated on only one physical server.

In 1995, a German company - Simple Support For Cooperative Work (BSWC) - announced the possibility of installing and sharing on the allowed web base by creating a common space in clients using unix, Windows, Macintosh OS operating systems. The technology it looks like today is Onedrive and Dropbox.

Amazon S3 was launched in 2006, offering the first true cloud computing activity. It has been the pricing model developed for this service, which is considered to be the main invention. The model known as pay-as-you-go creates a de facto standard.

The first open source Eucalyptus to be used for private cloud deployment in 2008, and the compatible platform it leverages is Amazon Web Service - API. In addition, commercial application was launched by Hype and became one of the leading enterprises for 5 years. As included in the published Hype Cycle report, the cycle is shown in Figure 12 (Gartner, 2014).

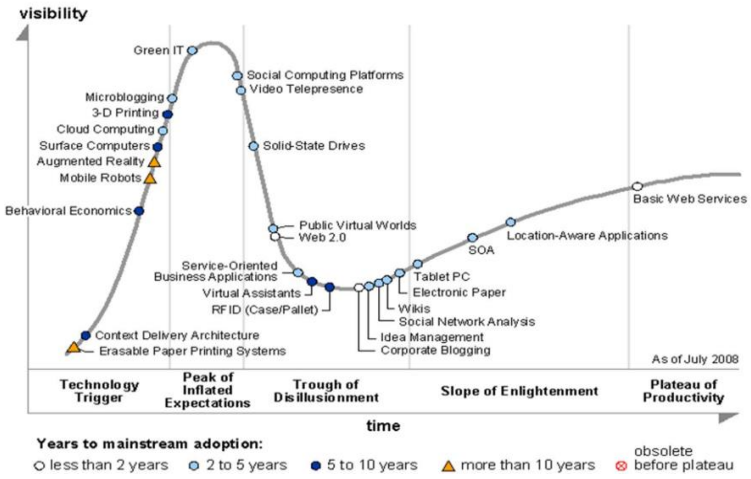


Figure 12. Gartner Hype Cycle

Source: Gartner, 2014

In 2010, the Reservoir Project was supported by the European Commission and the first open source software was presented (Figure 12). After this service, in which the federation and hybrid cloud system was implemented, IRMOS gave service quality guarantee for cloud-based infrastructures in the same year. Cloud computing technologies represent a never ending process.

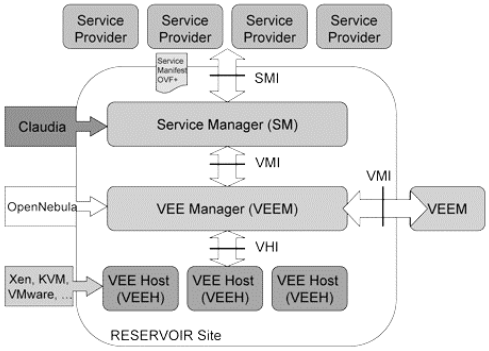


Figure 13. Reservoir Architecture

Source: Ercim, 2013

4.1.1. Virtualization

Virtualization, which refers to multiple applications or virtual servers running on only one physical server, is accepted as a software solution. It eliminates different software and hardware dependencies, thus providing savings for new service and product development costs. The concept was first used by IBM in 1972 for mainframe computers. Thus, the virtualization technology, which was started to be used by the IBM VM operating system, maintains its existence as IBM VM370 today. The use of related concepts in various systems makes the development and discovery of virtualization valuable. In virtualization, the biggest difficulty of which is referred to as disk systems, it is desired to create an opportunity to support more virtual machines than the disk drives included in the physical machine. In this context, virtual disks called mini disks are provided rather than allocating a disk drive for each virtual machine. Except for its size, every feature is the same as the system hard disk. In addition, the system is implemented with much more track allocation on the physical disk needed by the mini disk (Işık, 2021:4-5).

Following the spread of Intel x86 processors after the 1990s, many initiatives have been initiated for the application of virtualization technology. Thus, technologies that are still used today have been made suitable for VMware and Xen x90x86 processors. Since then, the usage area of virtualization support has been expanded to include open source agents and many operating systems (Göreli, 2019:11).

With virtualization technology, physical resources are abstracted into virtual machines. In this context, the main purpose is to create the illusion of hardware such as disk drive, memory, processor, network interface cards in a single computer in different working environments (Figure 15). At the heart of the technology are three components: the host, the hypervisor, which is called the Virtual Machine Manager (VMM), and the guest operating system. It refers to the component that performs the communication between the host operating system and the host computer, which is responsible for the creation and operation of hypervisor virtual machines, as well as the host computer or physical server as the main hardware system that enables virtual machines to run. The guest operating system is the computer or virtual machine running on the host (Isik, 2021:4-5).

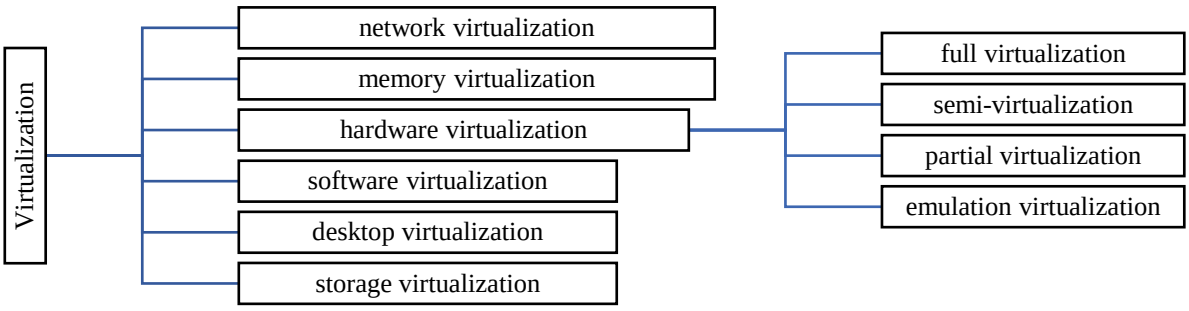


Figure 14. Types of Virtualization

Source: Işık, 2021:19

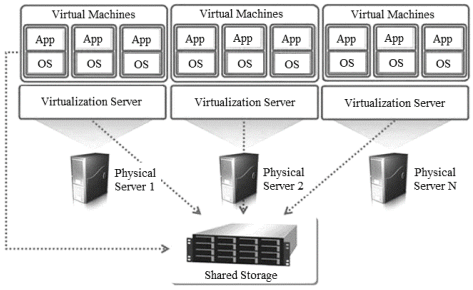


Figure 15. Virtualized Computer Architecture

Source: Karakuş, 2014:191

The server-based type is not preferred in corporate businesses as its capabilities are limited in terms of reliability and manageability. It is possible to exemplify as Oracle VirtualBox and Vmware Player. The hypervisor-based type is much more common in enterprise environments. It is possible to exemplify Vmware vCenter Server, Vmware DRS (Göreli, 2019:11).

4.1.2. Multi-tenancy

A large number of systems, applications or data belonging to various organizations are hosted on the same physical hardware. This is the most basic method used in the infrastructure of cloud computing technology, and it contains a solution to a problem experienced in public cloud services offered by service providers. The problem is that customers do not know each other despite using common components and resources. At this point, logical separation is made by cloud computing technologies rather than physical separation. Thus, while it is possible for attackers to exploit the vulnerabilities of cloud components by being included in the system as a cloud customer, it is possible to gain unauthorized access to systems belonging to other customers (TSE, 2014:5;15).

4.1.3. Orchestrion

It is quite prominent in the data centers of public cloud providers. So much so that the number of facility security personnel in the data center is considerably higher than the IT specialists working in the data center operation. With orchestration, atomization layer systems are monitored, and resources are assigned, retrieved and managed in accordance with customer demand and policy. Virtualization and multi-tenancy require an automated method of resource pools that can shrink and expand. The biggest difference between the cloud and the virtualized environment is the automated management layer, and institutions that want to manage the virtualized environment as a cloud should integrate open source or commercial software such as Openstack Openshift, Kubernetes, Puppet, Chef into their environment (TSE, 2014:5).

4.2. Types of Cloud Computing Technology

Cloud computing technology types are categorized in three ways: by deployment, user scope, and type of service offered. The classification made is shared in Figure 15, followed by a brief description of the species.

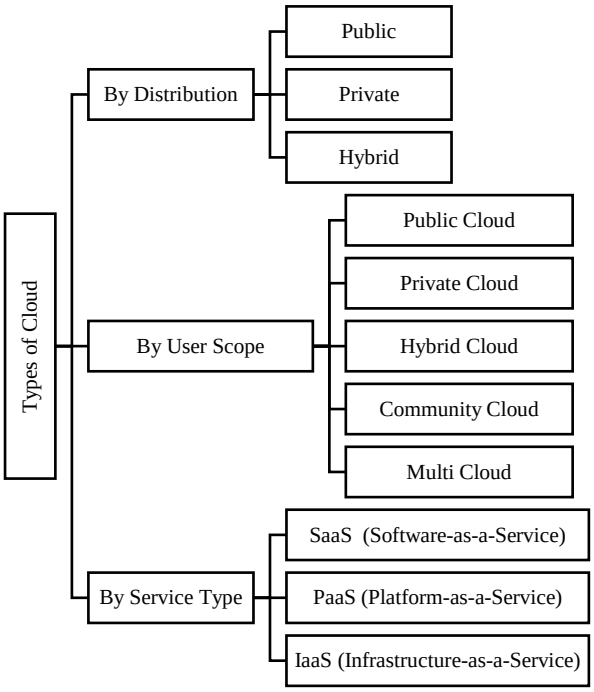


Figure 16. Types of Cloud

Source: Created by the Author.

4.2.1. Available for Distribution

The public cloud is the computing services offered by third-party providers to those who want to be able to use or purchase over the public internet. Services can be free or paid. However, users can pay for the amount of CPU cycles, bandwidth or storage they use. The cloud service provider is responsible for all maintenance and management of the public cloud system, which provides savings such as purchasing in-house application and hardware infrastructure, eliminating the need for maintenance and management. The public cloud, which offers a platform that can be deployed much faster than infrastructures and is almost infinitely scalable for the enterprise, enables the same application to be used on any device from all branches and offices with internet access. This advantage for employees does not eliminate the security concerns of public cloud environments. However, as long as they are implemented correctly, they are at least as secure as private cloud applications. In this context, the required element is to take advantage of security methods such as IDPS, which are called unauthorized access detection and prevention systems (Azure, 2022a).

Private cloud is computing services provided for specific users as opposed to general usage via private internal network or internet. It can be called enterprise cloud or internal cloud. It offers flexibility, scalability, self-service for businesses, as well as the advantages of the public Cloud, providing customization and additional control through dedicated resources in the computing infrastructure. As a matter of fact, it offers high-level security and privacy through internal hosting and firewalls. Thus, access to confidential data and transactions by 3rd party providers is prevented. However, since the information technology department of the enterprises is responsible for the accountability and cost requirements for its management, it requires the same management, personnel and maintenance costs as the traditional data center. The applications offered cover two different cloud services. The first is the infrastructure service model and the second is the platform service model. With the infrastructure service model, it is possible to benefit from the infrastructure resources of the enterprise such as storage, network, and transaction as a service, and in the platform service model, all kinds of services from simple cloud-based applications to featured enterprise applications are long (Azure, 2022b).

Virtual private cloud (VPC) covers the private cloud service offered by public cloud providers. At this point, the public cloud provider offers its own resources by making use of virtualization structures as if it were a customer-owned data center. In this way, the customer can use his system, which is almost completely separated from public access, by defining his own IP blocks and managing network security equipment. Examples of public cloud providers that offer these solutions are Netmagic, Rackspace, Amazon Virtual Private Cloud (Göleli, 2019:13).

Hybrid (hybrid, hybrid) cloud refers to a set of services consisting of at least two clouds included in the classification based on user scope. Each cloud that makes up the cluster is essentially an independent structure. It gives the ability to be portable to applications and data. The main service, called cloud augmentation, refers to the traffic that is shifted from the private cloud service to the public cloud if the load reaches the size that cannot be covered by the enterprises. Recently, solutions that enable the installation of hybrid cloud structures are offered. Structures such as CohesiveFT VPN-Cubed, Sky tap Virtual Lab, Amazon Virtual Private Cloud are examples of the solution. In addition, these solutions are established with IPSec VPN tunnel formation between the public and private cloud (Göleli, 2019:14).

Since the demand for computing and processing has increased at a level that can open up the in-house data center opportunities, this Structure, which is used for processing more capacity, enables the capacity to be increased or decreased instantly. It relieves the business of the obligation to purchase, install, maintain and budget new servers that will not always be needed (Azure, 2022c).

4.2.2. Available for User Scope

It is classified as public, private and hybrid cloud technology, as well as multi and community cloud.

Although multicloud is confused with Hybrid cloud, it has important differences. So much so that it provides load balancing between public and private cloud in almost every case and management of both through an automation. However, multicloud describes situations where at least two public cloud providers can be used independently for various workloads without intervening management tools. Each provider is knowing to have the same competence in each subject. In this case, each different workload can be run economically and successfully in a different cloud provider (Azure, 2022).

A community cloud is a type of cloud that can generally be shared by at least two organizations and serve common purposes. It can be managed by the organization itself or by third parties, as well as pursuing common goals such as compliance discussions, policy, social duties, and community safety. Moreover, the resources can be located in the enterprise data center or leased data center. An example is OpenCirrus offered by Yahoo, Intel, HP and others (Azure, 2022c).

4.2.3. Available for Service Type

The service type refers to the layers where the responsibilities of the cloud provider and the subscriber are limited. Service types are presented in Figure 16. Accordingly, it is observed that while subscriber responsibilities decrease from left to right, they shift to cloud service providers.

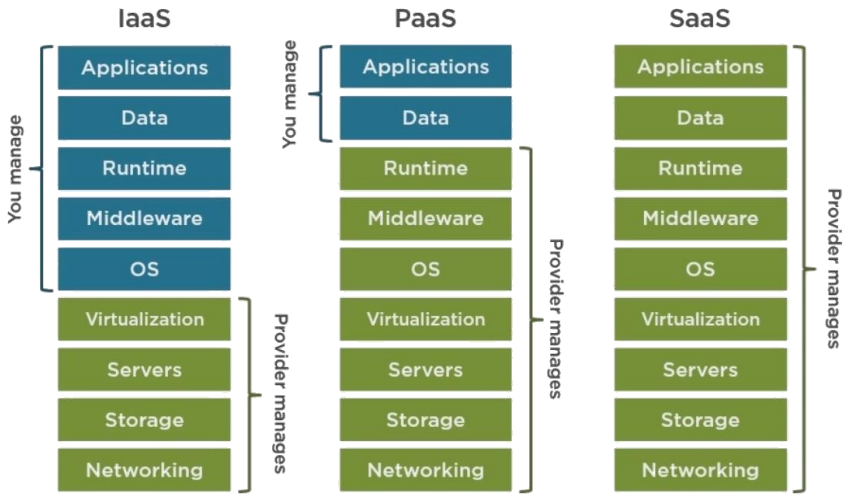


Figure 17. Infrastructure Service (IaaS), PaaS, SaaS

Source: Ünal, 2018

Infrastructure-as-a-service (IaaS) is not useful on its own, but it is a productive framework for solving a specific problem. It is explained by a situation exemplified through the transportation system. Although all highways have been built, they cannot make sense without trucks or related vehicles for transport. In this example, highways represent infrastructure service, trucks or related vehicles represent platform service. In addition, the objects or people to be transported can be considered as information and software services within the technical scope (Ünal, 2018).

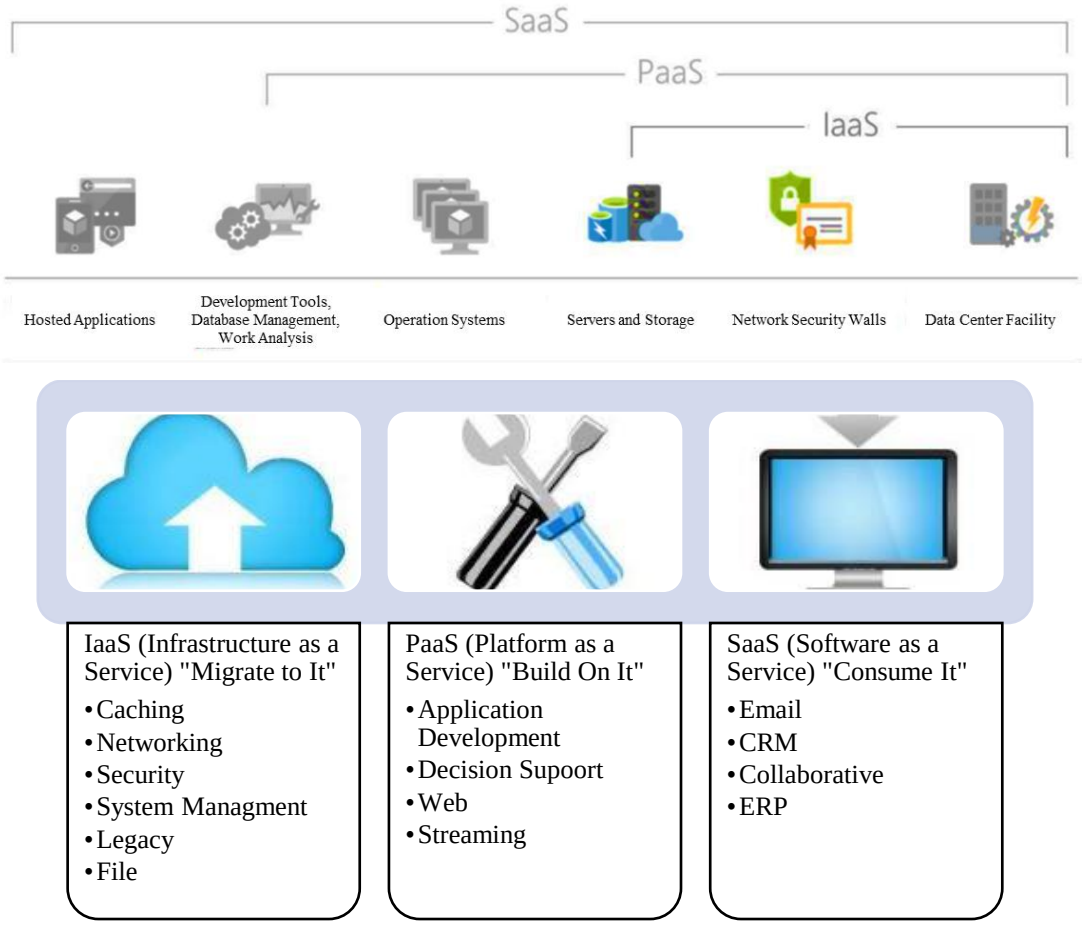


Figure 18. Service Scope

Source: Smith et al., 2018; Zenramalho, 2015

4.2.3.1.IaaS- Infrastructure Service

It creates the opportunity for institutions to operate in cloud technology in structures similar to local data centers. In such centers, the storage, processing power, network and cloud management elements that make up the infrastructure are operated by cloud providers. Operating system applications or layers are managed by the cloud user. Various considerations should be made in the selection of an infrastructure service solution. In this context, it is important who will operate the building, where the building will be hosted, and which elements will be shared (Göleli, 2019.17).

- In the operation of the structure, IaaS can be kept in or outsourced. The department, which is the cloud provider in the first presentation, is the information technology organization of the enterprise. In both cases, it is the infrastructure service provider's responsibility to manage everything under the operating system layer.
- A third-party data center may be preferred for hosting the structure, or hosting in a subscriber data center is also possible. It is usually located in the cloud provider's data center.
- In terms of sharing, basically all resources are shared with subscribers unless they are operated in the local data center. This indicates a multi-tenant structure. Today, single-tenant buildings are also offered as an option.

The ability of the infrastructure provided by the enterprise to meet the demands should be constantly checked and license follow-up should be carried out. This control requires human resources. In addition, since the subscriber is responsible for all applications on the operating system, control and follow-up is a very important issue. The efficient use of infrastructure services in businesses needs a cloud management team. Moreover, consultancy service should be obtained until the personnel reach the required competence. As a result of the fulfillment of responsibilities such as performance monitoring, availability and application security by the IT department, the administrative plan is no longer mandatory. However, cloud management tool (CMP) should be used for situations where end users or developers can assign and user privileges should be defined. Commonly known cloud management tool applications are RightScale Cloud Analytics, CloudHealthn Cloudyn. Providing IaaS solutions is usually a service provided by large cloud providers and requires significant investments (Smith et al., 2018).

IaaS infrastructure service is the most basic category of cloud services and allows IT infrastructure (server and virtual machine (VM), network, storage, operating systems) to be rented (Okutucu, 2012). Usage areas are as follows (Akıncı, 2020:5):

- Analysis of massive data
- Data storage, backup and recovery
- Hosting website and web applications
- Software application development and testing processes
- Meeting high-power computing needs
- In addition, the advantages it provides (Akıncı, 2020: 5);
- It eliminates investment expenditure as it enables all the IT infrastructure needed to be used without purchasing it, by leasing. Since no investment expenditure is made, it allows a very large resource to be used in different areas.

- It ensures the continuous survival of IT systems. It provides Disaster Recovery in the face of many undesirable situations such as the data center being out of use, which has a very high cost except for the cloud. Because it is necessary to invest in servers and infrastructure in different data centers for use in extraordinary situations, but thanks to cloud service providers, there is no need to put up with any of these investments.
- When a new formation, product or application is desired to be created, it allows this to be done quickly. When a new application or product is desired to be created without using the cloud, it can take weeks or months to prepare the necessary IT infrastructure, while with the cloud this time can be reduced to a few minutes.
- It allows scaling without investment. It enables the system resources to be increased and decreased at the desired day or hour. In this way, it continues to increase its cost advantage even more.
- Since the IT infrastructure is managed by the service provider, it provides savings in both time and maintenance costs.
- Cloud service providers provide superior IT infrastructure security and security beyond the cloud, much more than individual or on-premises security.

4.2.3.2.PaaS- Platform Service

The cloud provider provides an environment where users can develop their own applications. The platform can be provided as expandable, redundant and geographically dispersed. The developed application gains flexibility in resource usage and spreads geographically due to the infrastructure architecture of the cloud provider. It is also possible for the cloud provider to manage operating systems, virtualization layer, storage and network services. Application developers are only responsible for editing the application. Moreover, the application is suitable to be moved to hybrid cloud technology and has advantages such as operational redundancy, multi-neighborhood structure, scalability, and being offered as a software service. It is appropriate to think of the platform service as the data center operating system. Major platform service providers are Force.com, Acquia Cloud, Aprenda, Google App Engine, Amazon AWS (Göleli, 2019.17).

The usage areas of the platform service are listed below and the life cycle includes all functions such as application development, application testing, application management, putting into production, application updating (Akıncı, 2020: 7):

- Software development processes
- Business intelligence applications and data analysis
- Security, planning for application development
- Database management systems etc. Additional services

While application developers are responsible for publishing the application they have developed, the assignment of resources and all operations are carried out by the platform service architecture in the background. It has advantages such as presenting a ready-made infrastructure for application development and not incurring additional costs for development tools, providing integrated management in the trial development and production stages, thus enabling teamwork with higher efficiency and providing cost savings (Okutucu, 2012). Also (Akinci, 2020:7):

- It shortens application development times thanks to the ready-made application components it contains. In addition, by developing these components, the service provider can increase the application development capabilities of the user without incurring an additional cost.
- Some service providers offer cross-platform application development, allowing much faster and easier development for different platforms.
- It offers the user a complete platform needed for an application.
- It eliminates the need for operating system and application licenses needed during use. There is no additional fee other than the platform service fee used.
- It provides all the necessary support to implement a web application.

4.2.3.3.SaaS- Software Service

Software services generally refer to applications that can be accessed with an internet browser and located in the cloud. Through the software service that can serve private or public use, the authorized user can access certain applications defined for himself. Hosting applications, which are generally offered as software services, in a local data center requires high license costs. In addition, the renewal and maintenance costs that must be paid for current versions must be borne. Especially during installation, server hardware requires a high investment. This investment makes it difficult for the enterprise to implement a different application in case the needs of the enterprise change, and it is caused by the effort for the installation. In addition, the license fees paid to the terminated application create unnecessary expenditure. Software as a service saves all these costs and also reduces the burden of local computing units. Apart from this advantage provided by performing functions such as backup, resource planning and monitoring in the cloud, the software service provider undertakes to provide fast service in accordance with the service level agreement regardless of load size (Göleli, 2019:15; Akıncı, 2020:8).

Today, it is known that businesses operate an ODM (emergency center) as a result of their commercial needs or regulations. This center is usually located in a different location, and its data is kept up-to-date for the use of hardware or software replication management capabilities in times

of crisis. In replication structures, tuning is usually individual for each application. In this case, the establishment and operation of the structures requires high bandwidth costs and hardware costs between the main data center and the ODM. This capability, which is available in the software service, enables businesses to get rid of the extra cost burden. Today, SalesForce is positioned as the most successful software service provider in the market. Siebel, which is a leader in customer relationship management (CRM) software, is also one of the successful providers (Göleli, 2019:15). Other examples are Citrix GoToMeeting, Cisco Webex, Google Apps, online email applications, Office 365, Google Docs, One Drive, DropBox (Akıncı, 2020:8).

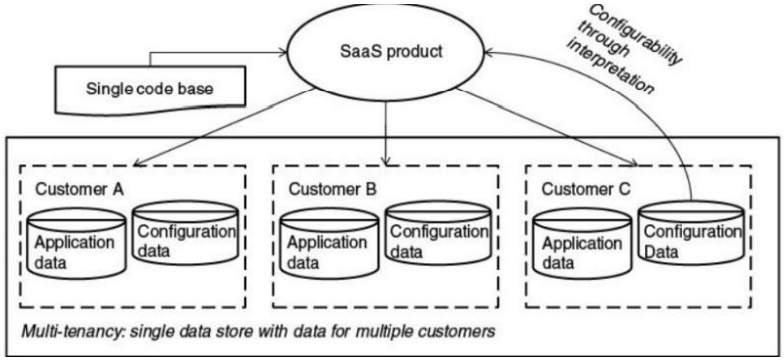


Figure 19. SaaS Architecture

Source: Göleli, 2019: 16

It is a method of offering software applications over the internet on demand and usually through a subscription system (Okutucu, 2012). To summarize briefly, it can be used in all personal and corporate applications that can be accessed with a web browser. The advantages of the software service are as follows (Akıncı, 2020:10):

- It provides easy access and use in any situation where the user has an internet connection.
- It does not need to install or purchase apps separately.
- It allows payment for the amount of usage.
- It eliminates the dependence on a fixed location, it can be accessed from anywhere.
- It reduces the security risks that may occur while accessing the applications, all security measures are provided by the service provider.

The usage areas of the software service are as follows (Akıncı, 2020:10):

- Web-based personal and corporate e-mail applications
- Storage and file transfer applications
- Enterprise resource planning applications
- Customer relationship management applications

4.3. Uses of Cloud Computing

Cloud computing systems are becoming usable by every individual through constantly advancing technology. As a matter of fact, media contents accessed through internet platforms, e-mails sent, online games played and many services that have a place in daily life are provided by cloud computing systems (Akıncı, 2020: 4).

Here is a brief summary of what can be done with the cloud (LogoSoft, 2021):

- Analyzing data for pattern creation and prediction
- Deploying optional software
- Storing data securely and accessible from anywhere with storage solutions such as OneDrive, Google Drive, Yandex Disk, DropBox
- Accessing online media content, broadcasting audio and video
- Streaming audio and video
- Doing data storage, backup and recovery
- Utilizing web e-mail applications
- Hosting websites, web apps and blogs
- Creating new apps and services

Cloud Storage Services (LogoSoft, 2021):

- Disk
- Dropbox
- Google Drive
- Google Picasa Web Albums
- iCloud
- iOmegaCloud
- Mega
- Mobile Me
- net
- OneDrive
- ownCloud
- Slax Drive
- TTnet NetDisk

5. BANKING SYSTEMS

Before moving on to cloud computing applications related to the banking sector, in this section called banking systems, banking as a concept, the historical development of the banking sector, and the banking sector in Turkey are examined.

5.1. Concept of Banking

The word bank was transformed from the Italian word banko (bench, desk, table) and was translated into Turkish as a bank. It is named in similar ways almost all over the world. The reason why it is named in this way is the money transactions carried out by the Lombardy Jews, who are known as bankers on the bank. It is even claimed that some bankers broke their banks as a result of not being loyal to the public debt at a time when they did not fulfill their commitments and went bankrupt (Parasız, 2007:17).

In the most general scope, it is defined as institutions where deposits collected from institutions or individuals are given as loans. The reason why they are the most important part of the general economy is the funds they have collected. Moreover, banks are institutions that provide investment opportunities by directing individuals who make demands in accordance with their needs and needs, and undertake roles to ensure efficiency in the economy with their financial arrangement (Şakar, 2006). The main purpose of banks, like other businesses, is to make a profit on the products and services they produce. In this case, individuals or businesses requesting deposits must earn more interest than the interest they have paid. In addition to its evaluations as service businesses, it conforms to service businesses in terms of business policies, methods and fundamentals. The banks, which are defined as financial enterprises by the Banking Law No. 5411 in Turkey, are classified into three types: Development and Investment Bank, Participation Bank, Deposit Bank. Development and investment banks refer to institutions that perform loan disbursement activities other than accepting participation or deposit funds, and fulfill their assignments by special laws. Participation banks refer to organizations operating on the basis of collecting points and providing loans through participation or private concubine accounts, and organizations operating on the principle of accepting deposits and extending loans on behalf of deposit banks on their own behalf (BDDK, 2022; Banking Law, 2005).

5.2. Development of Banking Sector

Banking was first developed in temples in the world, and the first bankers were priests. The first banking activities were carried out as a result of the individuals leaving the temple as a trust in order to protect their valuables and monetary assets from thieves. Goods lent to individuals in need by keeping records by the priests were closed by paying the borrowed amount with gifts of a kind called interest today. The basic banking rules that emerged in Europe in the 13th century were created through fairs. After the Conquest of Istanbul in 1453, banking activities, which witnessed important developments, faced the abolition of the interest law as a result of the Renaissance and reform movements. Banking activities, which gained their current functioning at the beginning of the 17th century, reached the status of an official institution with the establishment of banks (Özdemir, 2005).

DATE	ITEM	EXPLANATION
BC 3500	First Bank	Documents belonging to the banking system have been found showing that the priests were lending in the temples in Sumer and Babylon.
BC 2000	First Banking Laws	The documents, which are seen as the first of the banking laws, were issued by the Eshunnanca Kingdom and the interest rates were determined as 20%. With the Code of Hammurabi, lending, deposit collection, commission transactions were regulated, and credit notes were written in 2 copies on clays.
BC 1000	Development and Supervision of Banking	The concept of banking was developed by the Greeks, Romans and Egyptians in the First Age and the Middle Ages, while the interest was limited in the ancient Egyptian period, banking inspections were started in the ancient Greek period.
1609	First Modern Bank	Amsterdam Bank, known as the first modern bank, was established.
167	Use of Check and Banknote	With the establishment of the Bank of Venice, checks and banknotes began to be used.
1640	Goldsmiths and Certificate	Upon the seizure of the gold of the merchants by the King of England, the gold began to be given to the merchants called "goldsmith" in return for certificates.
1694	First Central Bank	The Bank of England, known as the first central bank, was established.
1907	Emergence of Modern Banking	With the Federal Reserve Bank, banking systems have reached maturity and the modern banking system has been formed.

Source: Aydın, 2006:21

As can be seen, the first modern bank was established in 1609, and after the Bank of Venice, which was established in 1637, the gold bars stored in the Tower of London were confiscated by the king, thereby breaking the trust in the system. For this reason, the feature of leaving escrow in return for a contract has been introduced. The Bank of England was the first central bank since it provided money to the state. Interest income was obtained from the valuable certificates distributed by the Bank of England. In the 19th century, many banks were established, following the example of the Bank of England. Banque de France, which was established in France, obtained the privilege of printing money in 1848, and in 1863, the USA National Bank Act was authorized to issue banknotes. Established in 1921 in Soviet Russia, Gosbank was appointed as the only financial institution that has emission authority and can issue loans (Tepegöz, 2012).

In the 20th century, central socialist planning economies developed due to the capitalist system, and the banking sector, which was reshaped after the Second World War, was included in the scope of special laws. It is stated that organizations such as the World Bank, European investment bank, and the International Monetary Fund have become prominent as products since this period (Aydın, 2006:22).

5.3. Development Process of the Banking Sector in Turkey

During the Ottoman Empire, the first paper money was printed in 1840 to close the budget problems, but the foreign trade deficits could not be closed, paving the way for the beginning of the banking sector. As a result of the continuation of foreign trade deficits, these paper money called Kaime decreased in value against foreign currency. As a result of this situation, an agreement was signed with Galata Bankers in 1845 to solve the problem. In 1847, Galata Bankers established the Istanbul Bank, and Istanbul Bank, which was accepted as the first bank for the Ottoman Empire, was liquidated in 1852. The Ottoman Bank, which is considered the beginning of the banking sector, was established in 1856. In 1863, Homeland Funds were established, and this institution, which was created to provide credit opportunities to farmers, was reorganized and transformed into Benefit Funds. However, Ziraat Bank, which was the first state bank, started its operations in 1888, as the use of funds aroused suspicion.

In the period that corresponds to the years 1923-1933, which is called the national banks period, 13 of the existing banks are foreign and 22 of them are national. The first private bank was Türkiye İş Bankası in 1924; The first development bank was the Industry and Maddin Bank of Turkey and was established in 1925. Türkiye İş Bankası was able to achieve its planned targets, but the other bank was transferred to Sümerbank in 1933. In 1930, the Central Bank of the Republic of Turkey started its activities.

The period corresponding to the years 1933-1945 is called the period of public banks. Sümerbank and İller Bankası were established in 1933, Etibank in 1935, Denizbank in 1937 and Halk Bank in 1938.

In the period called the private banks period and corresponding to the years 1945-1960, production in the market increased, investments increased, the general population and national income increased, causing the need for credit and money in the economy. The private banking period started when positive returns were received from the investments made for the banking sector. In this context, Garanti Bank was established in 1946, Akbank in 1948, Turkey Industrial Development Bank in 1950, and Pamukbank in 1955.

It points to a process called the planned period of 1960-1980, which includes the significant limitation of the sector as a result of government guidance. Banks gained wealth with liberalization (Aydın, 2006). The banks established in this period, in which branch banking has developed, are listed below:

- Tourism Bank (1962)
- Industrial Investment and Credit Bank (1963)
- State Investment Bank (1964)
- American Turkish Foreign Trade Bank (1964)
- Mining Bank of Turkey (1968)
- State Industrial and Workers Investment Bank (1976)
- Arab Turkish Bank (1977)

In this period, which corresponds to the years of opening up and liberalization, in 1980 and 2004, financial markets were liberalized and deepened by implementing positive real interest rates and flexible exchange rates in line with new development policies (Korukçu, 1998:11). By incorporating information technologies into the sector, obtaining information has become much more economical, fast and easy. In this context, the lucrative position of banks in collecting information and directing borrowers has decreased, and non-bank financial intermediaries have become more profitable. The structuring process in the banking sector within the borders of the Republic of Turkey started after the 2001 crisis. In 2001, the Transition to a Strong Economy Program (GEGP) was announced in the sector, where regulations were made to ensure economic development. The transfer of Halk Bank and Ziraat Bank to the joint board of directors, the merger of Emlak Bank with Ziraat Bank as a result of the liquidation, and the merger of Pamukbank with Halk Bank by being taken over by the SDIF are some of the developments. In addition, the main purpose of the stability program, which was started to be implemented, is to eliminate the internal debt dynamics of the public sector, which has reached an unsustainable level, to restore the economy to a healthy and strong structure without the need for external support, and to make the banking sector operative with the financial markets reorganized in line with the determined targets. While the number of existing banks was 61 in this process, it was reduced to 48 in 2004 (Yiğitoğlu, 2005:7).

Despite the legally regulated banking sector, the fact that the financial markets were not subject to any regulation caused the banks to bear the costs put forward as a result of the regulations, but the financial intermediaries were exempted from these costs (Parasız, 2005: 25). The Savings Deposit Insurance Fund (TMSF) and the Banking Regulation and Supervision

Agency (BDDK) were established and assigned to decide on the results of monitoring, auditing and auditing in the activities processed in all banks. After the 2001 crisis, GEGP aimed to strengthen the banking sector, reduce inflation and reduce debts. Banks gained confidence in the face of the improving performance of the sector in 2004. As a result of the decision that the banks with financial problems will be transferred to the SDIF, financial markets have started to regulate and competition between banks has occurred (Tekin, 2020: 25).

5.4. Current Situation of the Banking Sector in Turkey

Banking activities in Turkey are carried out within the framework of the Banks Law, Law of Obligations, Turkish Commercial Code, Civil Law, Negotiable Documents Law, Enforcement Bankruptcy Law, Tax Laws, including the CBRT Law and the Capital Market Law,, the CBRT and the Prime Ministry Undersecretariat of Treasury and Foreign Trade, the circulars issued by the General Directorate of Banking, the written rules consisting of the ICC 500 brochure regulating international trade, and unwritten local and international practices (customs) (Arslan and Hotamisli, 2007:199).

Table 6. Data on the Banking Sector

			March 2021	December 2021	March 2022
Type of Bank	Number of Bank		%		Number of Employee
Participation	6	10,526			
Development and Investment	16	28,070	5.092	5.567	5.599
Deposit	35	61,404	180.889	179.681	179.401
Total	57	%100	185.981	185.248	185.000
Deposit					
-Foreign	21	59,999			
-Private	8	22,857			
-Public	3	8,571			
-Fund	3	8,571			
Total	35	%100			

Source: TBB, 2022:3.

As of March 2022, there are 57 banks operating in the Turkish banking sector. Of these banks, 6 are participation banks, 16 are development and investment banks, and 35 are deposit banks. In addition, since Support Investment Bank AŞ was granted an operating license in January 2022, it is the last bank to be established in Turkey. In Table 6, the number of banks in Turkey as of March 2022 and various data are shared (TBB, 2022).

As can be seen in Table 6, deposit banks constitute the largest group of the banking sector with 61,404%. Banks with foreign capital stand out among the deposit banks, with a ratio of 59.99%. Private banks have a ratio of 22.857%.

When the number of employees is examined, it is observed that 248 people decreased compared to December 2021 and 981 people compared to March 2021. Another finding that can be deduced from the March 2021 data is that the number of personnel working in development and investment banks increased by 507, and decreased by 1488 in deposit banks.

The banks whose branch numbers are shared in Table 7 are 9786 in total as of March 2020, excluding participation banks.

Table 7. Data on the Banking Sector

Type of Bank	March 2021	December 2021	March 2022
	Number of Branches		
Development and Investment	66	68	71
Deposit	9.858	9.724	9.715
Total	9.924	9.792	9.786

Source: TBB, 2022:5.

It is observed that deposit banks, whose number of branches are examined, decreased by 9 branches compared to December 2021 and 143 branches compared to March 2021, and development and investment banks have increased 3 branches compared to December 2021 and 6 branches compared to March 2021, but a total of 6 branches has decreased compared to December 2021 and 138 branches compared to March 2021. It is determined that since March 2002, each of the deposit banks has an average of 277.6 branches, and each of the development and investment banks has an average of 11.8 branches.

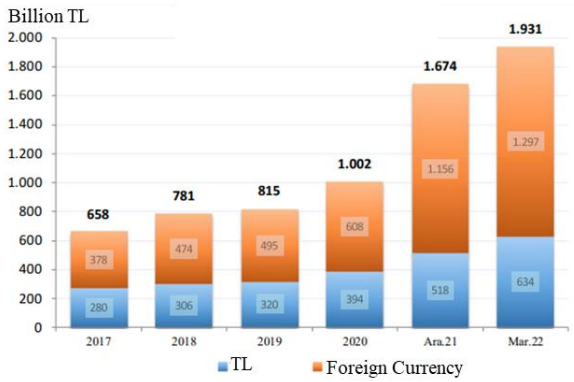


Figure 20. Non-Cash Credit Development

Source: BDDK, 2022:7

As of March 2022, the size of non-cash loans stood at TL 1,931 billion (Figure 20). In the income statement of the banking sector, interest income was TL 231 billion and interest expense was TL 115 billion. As of March 2022, the net profit of the Turkish banking sector is 116 billion TL (Figure 21).

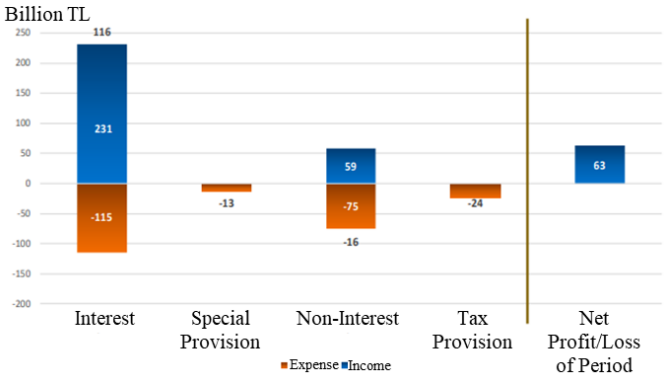


Figure 21. Income Statement

Source: BDDK, 2022:8

In the period of March 2022, the total loan amount is 5.503 billion TL, of which 3.221 billion TL is composed of Turkish currency loans and 2.282 billion TL is foreign currency loans (Figure 22).

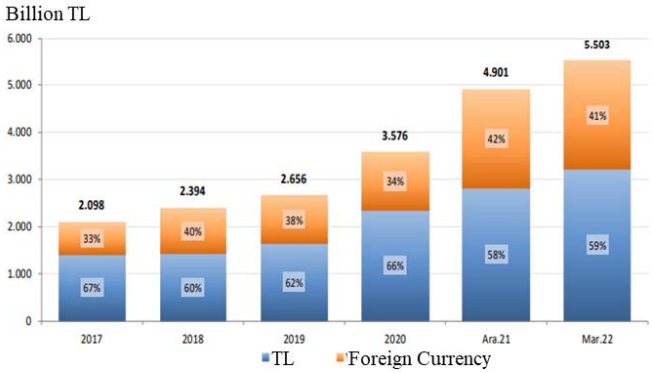


Figure 22. Loans

Source: BDDK, 2022:10

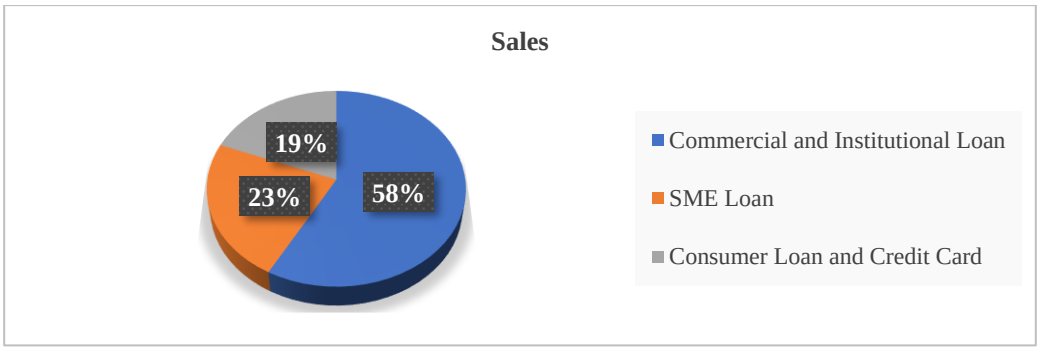


Figure 23. Distribution of Loans

Source: BDDK, 2022:10

Within the loans, the share of commercial and corporate loans is 58%, the share of SME loans is 23% and the share of consumer loans (including credit cards) is 19%.

The transformation of these loans is important within the scope of the country's economy. The reason for this is that the banking sector is the basis of the Turkish economy. Changes that develop with decreasing credit conversion rates directly affect the financial system and the economy. For this reason, the biggest obstacle to the increase in loan rates is non-repayable loans. As a result of the increasing rates of non-performing loans, these situations, which are likely to occur, cause banks to restrict the loan supply as a precaution (Demiralp, 2020)

- Resource costs incurred by provisioning provisions
- Increase in the capital adequacy level of the loans in the risky group
- Increased cost of funding due to increased bank risks.

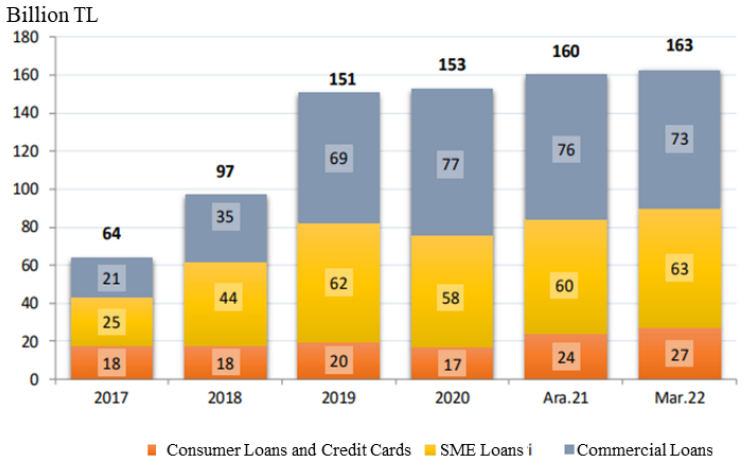


Figure 24. Non-Performing Loans

Source: BDDK, 2022:10

Since the tracking system, which is one of the new topics in which cloud computing systems are used, will be mentioned in the future, it is desired to include the relevant data. As shown in Figure 24, there is an increase in non-performing loans every year.

Almost 90% of the financial sector consists of the banking sector. In this context, it can be said that there is a cash shortage as a result of exchange rate changes. As of March 2022, the (gross) amount of non-performing loans is 163 billion TL. As a result of this amount, which was 97 billion TL in 2019, the ratio of non-performing loans (FPL) is 3.67%.

6. CLOUD SERVICE PROVIDERS IN BANKING SYSTEMS

Within the scope of cloud service providers in banking systems, the transition process to the cloud service period is discussed, and the vision of cloud computing technologies, the criteria to be used in the selection of applications and pre-transition criteria are mentioned. Then, cloud computing systems used in the banking sector are transferred. Following the sharing of the developments experienced by cloud computing service providers, the subject of legal follow-up, which covers an important cloud service process, is examined.

6.1.Migration to Cloud Service Providers

The popularity of cloud computing and the vital benefits provided by businesses have made it imperative to work with cloud service providers. There are some approaches developed in this context. The most important one is the approach that enables businesses to provide much more profit with much less cost. Successful cloud use depends on strategic decisions and good management. In this context, strategies that fully meet the needs of businesses should be created and it should be concluded that the service levels to be received from cloud service providers are sufficient.

Scalability Priority Strategy. It is aimed to meet the resource need for informatics before the transition to cloud service providers where new hardware and license investments are not required by the enterprise. When working with a fixed load, the required processing power can be provided with local resources, and the payment of software and hardware license costs once brings a great cost advantage. However, when the information technologies offered by the business have highly variable resource requirements, working with a cloud service provider is extremely efficient. In addition, it offers advantages in terms of reducing the effort and costs (OPEX and CAPEX), avoiding the use of IT resources for the commissioning and operation of services, and avoiding processes such as software hardware license procurement. The reason why cloud expenditures are generally evaluated within the scope of OPEX is that it is considered much more advantageous than CAPEX. In addition, scalability is generally provided by the IaaS service model. The main purpose is to ensure that the processing power is ready when the business needs it.

Availability Oriented Strategy. The main focus of availability, which is closely related to scalability, is the availability of information technology functions and services and the satisfaction of user criteria. This situation, which is especially at the core of corporate cloud strategies, does not take the risk that local resources will not meet any unforeseen load, regardless of the extent to which they are prepared. Thus, the cost of acquiring IT capabilities from the cloud service provider remains very low compared to the risk. In fact, lack of resources during aggressive campaign periods and interruptions in critical workloads will cause a large number of requests to be missed, thus bringing higher costs to the business than planned.

Market Driven Strategy. It is known that this approach is especially important for agile and small businesses. This is because there is no need for high-level software and hardware investments and there is no need to plan infrastructure installations. It is aimed to reduce operational and investment costs such as OPEX and CAPEX. In addition, customer-oriented service management should be considered, and the level of service provision in accordance with their needs and profiles should be planned.

Convenience-Oriented Strategy. In traditional structures, there are system administrators who manage the services used by users working in a location. It is aimed to make all services accessible over the internet, regardless of location, through the cloud service provider, and to reduce the need for system administrators who are responsible for managing the services. Cloud service providers that offer a high level of automation make this possible with their API (Application Programming Interface).

The implementation of the transferred strategies depends on the creation of the cloud vision. For this reason, cloud technology should be well defined and its concepts should be understood, and similar perspectives should be developed. The differentiation experienced after the establishment of togetherness brings various opportunities. These opportunities should be evaluated in the vision of the business in the form of productivity increase, capital preservation, revenue growth and increase in market share. Since the transition process requires a dynamic plan, it should be managed and implemented gradually, risk assessed and measures determined. It should be aware that cloud technologies will always continue to evolve. This means that use cases, risk and measures can be changed.

Use cases should be determined in lists. The scope of the determinations should include cloud migration and cloud management strategies. In addition, business development should be targeted and new ideas should be evaluated and opportunities should be taken advantage of. Innovation should be at the heart of the strategy. The use of trends such as workforce and working conditions transitions, social media, big data and mobile computing are examples of this situation.

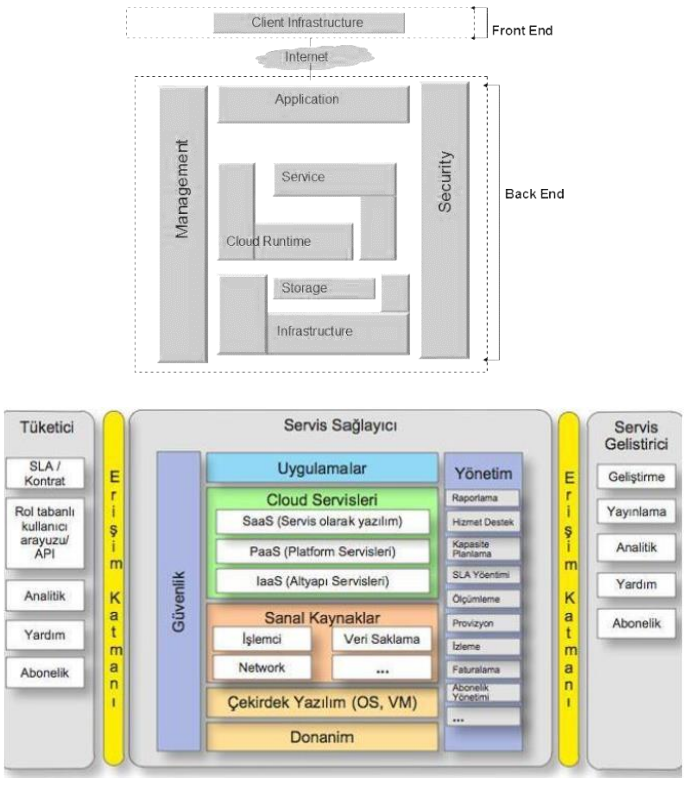
It is necessary to have an idea about the rate of return on business-oriented gains and investments to be made. Working within the scope of the return scenarios of cloud investments, open group states that the situations listed below should be considered (OpenGroup, 2019):

- As the IT workload will be reduced, departments can often assign their own resources without the need for an IT unit.
- No capital investments are required for a new solution.
- Since solutions are delivered faster, they are put into use faster and the market is entered in a short time.

- Operating costs are reduced.
- Commissioned services should be measured and reported
- Since the risks taken and the investments made are calculated, a road map should be drawn and an attempt should be made for investments.

There are criteria to be used in choosing a cloud service provider. This is because applications that are planned to be moved to the cloud can be selected from the application pool or from applications that are planned to be added to the environment. The criteria explained briefly in the continuation of the content make the choice easier.

Architectural. It covers a large number of technical considerations. Cloud compatibility of the application is the most important factor, and if compliance is present, the migration to the public cloud is greatly simplified. As a matter of fact, applications running as virtual machines or containers can be moved to the cloud without the need for redesign. Hardware architecture also needs to be evaluated. Since cloud providers generally do not provide RISC/Unix-based platforms, the platforms on which the applications run are changed and the cloud service provider is switched. Figure 21 shows the cloud computing architecture, which is evaluated in two ways, front and back. While the user or customer side is the front (external) side, the cloud portion of the system is the back (internal) side (Çelebi, 2014:4-6).



Source: Göleli, 2019:24; Çelebi, 2014:4-6

Security. Cloud computing system is generally accepted as secure. Cloud service providers have an accredited infrastructure that is constantly audited, allowing customers to operate regulations and current structures. It is known that the security element is detected as a part of the design when they are checked. Although it differs by the type of service planned to be received, services such as Web Application Firewalls, Facility Security, Firewall can be offered. It can leverage AWS and Azure systems for physical security (AWS, 2022; Microsoft, 2022). Cloud service providers undertake to encrypt the traffic during access to the data server and service and that even the cloud service provider cannot access the data. Cloud service providers that are deemed compliant by the European Union's general data protection regulation may not be allowed to go to business or country borders by regulatory liability or business policies. Although this situation is valid in the Republic of Turkey and some European Union countries, if there is no data center in the Republic of Turkey, it is impossible to move the services to the relevant cloud provider. Therefore, it is useful to seek legal advice. As stated in the Draft Regulation on Banks' Information Systems and Electronic Banking Services shared by the BRSA, the situation in question is included in Chapter Four/Article 44-5 and Chapter Six/Art.29-11.

Availability. There is no availability commitment for applications that do not comply with the cloud service. In this case, it should not be thought that higher rates may be encountered than the data center operated by the enterprise. For this reason, the level of compatibility and availability of applications should be examined (AWS, 2022; Göleli, 2019).

Performance. Performance requirements of applications need to be evaluated. Therefore, the important topics are low network access latency, low disk access time, high amount of RAM and high CPU power. Generally, it should be considered that cloud applications are not compatible with vertical growth and problems such as availability and high cost should be avoided. If the applications are grown horizontally, it is more convenient for cloud applications to meet the load by increasing the amount of instances (AWS, 2022; Göleli, 2019).

Scalability. It can be explained similarly to the performance criterion. However, in addition to enabling the expansion of resources when application services are needed, resources should be narrowed during low usage. It should be taken into account that services that support scalability are more suitable for migration to the cloud service provider. It should be known that the applications in question are generally developed in microservice architecture (AWS, 2022; Göleli, 2019).

Strategic Importance. Migrating critical applications requires much higher level research and knowledge. Contrary to the first stage, it is more appropriate for businesses with increased cloud competence and experience to move their applications to a cloud service provider, and low priority services should be put first (AWS, 2022; Göleli, 2019).

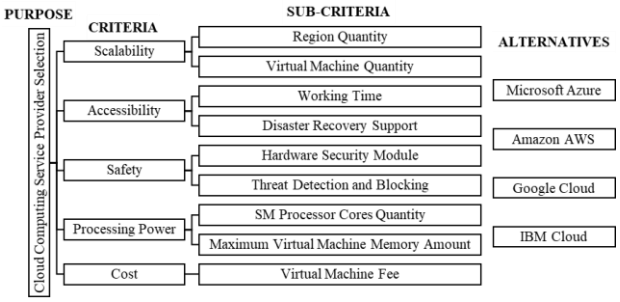


Figure 25. Hierarchical Structure Used in Identifying Cloud Service Providers

6.2.Information Systems in the Banking Sector

One of the criteria that can measure the value of a bank is the number of active customers. For this reason, special importance is given to customer relations in the banking sector. In this context, investments in information systems and technologies used can add dimension to customer relations. In addition, banks' becoming superior by gaining a competitive advantage and maintaining their superiority depends on reducing costs, increasing the number of services and quality. This situation is entirely due to systems that can be used and benefited in the most efficient and effective way. The technologies most heavily used in the banking sector are the world interbank financial communication institution (SWIFT), communication over internet protocol (VOIP), electronic fund transfer (EFT) and provide formatting in banking systems.

6.2.1. SWIFT

Prior to Swift, Telex was the instrument used in international fund transfers. However, the lack of a holistic code system has led to speed and security problems. For this reason, SWIFT was started to be used as a solution in 1973. The Society for Worldwide Interbank Financial Telecommunication is headquartered in Belgium, with the participation of 239 banks from 15 countries. Its main objectives are to standardize and facilitate financial transactions, reduce costs and reduce transaction risks. It is used by many banks and financial institutions to achieve these goals. Swift creates income and new business opportunities by providing a standardized communication environment to its members. Money transfers are made with the use of passwords specific to each of the member banks. After 2019, the number of bank or financial institution members exceeded 11 thousand (Bloomberght, 2022).

It refers to the instant and secure transmission, control and storage of messages of member banks in international standard sizes via the electronic communication network. It enables the Central Bank to work more rationally in international communication and to optimize the service. It started to be used in Turkey in 1989 (Central Bank, 1996).

Microsoft has become the first cloud provider to connect to SWIFT, a payment systems platform, through its own cloud system Azure, by integrating with Bank of New York-Mellon (Gürses, 2019).

Many Russian and Belarusian banks were removed from the SWIFT network within the scope of the economic sanctions that started to be implemented after Russia invaded Ukraine. This has disrupted the ability of banks to conduct financial transactions on an international scale (CNBC, 2022).

EFT

Electronic Fund Transfer (Electronic Fund Transfer) systems are modern communication information techniques used in transactions that replace the transmission of bills, banknotes, checks or other valuable papers, where the account is directed to the financial institution for crediting or debiting, similar to the transactions performed by traditional banking. The use of computer systems makes it possible to realize it in a very short time. So much so that it creates the opportunity for banks to use one another as their own branches. The service made possible by the buyer requires an existing account at a bank included in the system, performs interbank transfers, makes it possible to complete transactions between the central bank and other banks, public data and statistical communication in a very reliable and fast manner (Keating, 2022).

It is a term that encompasses a wide variety of electronic payments, including technical remittances, that do not directly refer to a type of payment. EFT payment types that are widely used are direct deposit, ATM (automatic cash machines), debit and credit cards, bank transfers, mobile payment systems and electronic checks. EFT, which started to be used on April 1, 1992, has evolved according to user needs (Rumelili, 2006). After 2000, the EFT 2 system was put into use as 2 generations. It is possible to carry out high-volume transactions together, allowing each transaction volume to be realized in such a short time that it cannot be noticed, under a specified limit. Meanwhile, the message sent to the central system in the form of a single message is processed by the central system. The processed messages are separated and sent to the recipients (Tekin, 2020:26).

Quick action can be taken in the financial market, the rate of transfer increases, the currency rate affects the economy with financial indicators after interest, thereby shortening the decision-making time in the authorities. However, requests that are not delivered within a certain time period are usually transferred to the buyer's account on the next business day. However, in order to complete the payment, important information such as the account types of the sender and the recipient, the name of the recipient bank, the recipient account number and contact number are needed. All of this information is stored by the cloud service provider (Keating, 2022).

6.2.2. VOIP

It refers to the data transmitted with voice packets over the physical medium and provides high cost savings. The system, which is especially used in banking, enables voices to be received or given with codecs during calls. By means of VoIP, which is an internet-based cloud system, it is not necessary to be physically present at the country's borders, and transactions can only be performed by obtaining the switchboard number. Voice packets that are encrypted in codecs and sent over the internet to the other party are also uploaded via the internet. Download is done in the same way. The type of system preferred by operators in Turkey, which uses various protocols in the background, is generally SIP (Session Initiation Protocol) protocol (Verimor, 2019). In this context, it is frequently used in banking activities, to reach customers, to inform about debts or campaigns. The advantages of the VOIP system are as follows:

- It reduces telecom costs, provides flexible solutions for corporate communication through the IP switchboard system, and offers free calls between branches.
- A maximum of 10 channels are searched by using ADSL technology without channel limitation.
- The allocation of numbers is free and quite fast. Calls can be received from geographical numbers such as 0212, 0242, 0316 and 0850 numbers regardless of the location.
- With the applications installed on Android, Iphone and Windows mobile devices, calls can be received and made over fixed numbers.

6.2.3. Credit Cards and POS

The most used systems in the banking sector are POS devices and credit cards. Among these factors, which are important for competitive advantage, credit cards enable commercial enterprises to shop without paying cash and make it possible to withdraw cash from ATMs. The system, which is extremely safe in terms of use, has quickly become widespread and has become a payment tool. Transactions recorded by cloud service providers not only provide data about the consumer, but also collect information about how consumer purchasing decisions have changed, and are directly used in the prevention of tax evasion (Kırçova, 2007). After receiving their statements (SMS, invoice, e-mail, etc.), credit card holders continue to use their cards by performing transactions on the payment date and amount agreed with the bank. In 1990, an interbank card center (BKM) was established with the cooperation of 13 banks, and the difference in domestic and international use arises from the agreements made through licensing (BKM, 2020). Globally operating credit cards are Visa, UnionPay, JCB Cards, Discover, Troy, American Express, Diners Club International, Master Card and Visa card is widely used in Turkey (TBB, 2022)

During the use of credit cards, the transfer of the amount to the enterprise is provided by 2 types of machines. The POS device system, which is called Imprinter and transmits the message instantly in electronic environment, can delay the payment date, deduct the shopping amount from the customer's account and make installments. Today, POS device loggers are virtual and can be managed with a touch screen (Tekin, 2020:29)

6.2.4. ATM

ATM, which is a switched cell-based protocol technology that provides high-speed transport of all data, transmits various network streams in the form of cells with a volume of 53 bytes (Electropazar.com, 2009). It contains three types of network interfaces for devices to connect to each other: Broadband Intermediate Carrier Interface, Network-to-Network Interface (NNI), user Network Interface (UNI). When the ATM data of 2001 in Turkey is examined, it is reported that there are 7264 Ziraat Bank ATMs, 6555 İşbank ATMs, 5,306 Garanti Bank ATMs, 5202 Akbank ATMs, 4526 Yapı ve Kredi Bankası ATMs (Nakit, 2022).

- A large number of financial transactions are carried out via ATMs, 24 hours a day, 7 days a week without the need to go to a branch.
- In the new generation ATM devices, there are conveniences such as cardless cash withdrawal, palm recognition, NFC 5 realization by using cloud service providers.
- In addition, joint ATMs can provide services without the need to be a bank customer.
- Audio or visual guidance for the visually or hearing impaired is carried out with special methods.

6.2.5. Internet Banking

Internet banking, which created awareness for the new customer segment and the workflow for many banks, started to receive investments as of 1995. With today's technology, it is possible to carry out all kinds of transactions without being physically in the bank (Aladwani, 2001).

Financial and historical control is provided in the system, which performs transactions by connecting to the bank over the internet. The fact that the heard documents can be printed and the service can be monitored visually are today's discussion topics for usability. Personalized marketing and promotion can be made and personalized services can be offered. Cloud service providers are used in all stages. In addition, since there are no working hours in the system, it is possible to log into the account at any time. Some of the advantages are that undesirable and non-consensual transactions are noticed in a short time and that it provides the opportunity to intervene quickly, and it provides cost savings (Xina, 2010).

6.2.6. Phone Banking

The use of the system, which started in the USA in the 1980s, came to Turkey in 1991. It is possible for each service performed at the ATM to be carried out interactively with the routing call operators. In this context, as a result of the referrals, customer services are connected and transactions can be continued. In addition, after receiving the requested information, the customer transferred to the voice response system (IVR) can receive information about the account or related issues, transfer between accounts and perform credit card transactions. (Sestek.com, 2018). With the voice guidance provided by cloud service providers, customers can quickly access the menu they want to access by saying a few words. Not all recordings are played on the phone, but individual action menus are listed (Tekin, 2020:32).

6.2.7. Mobile Banking

The technology provided by smartphones includes the wap protocol, which provides global access, and the banking transactions performed by using the service provided by GSM operators. 93% of those who connect to the internet outside the office and home, establish the connection with a smartphone (Wearesocial.com, 2019).

The mobile banking service offered to the Bank's customers creates the opportunity to make transactions at any time or place without intention. Mobile applications are suitable for the operating system of smart devices and the server downloaded by the user from the appropriate mobile application store is installed on the device system. Similar to internet banking, transactions can be made by completing various activation steps (KOSGEP, 2019).

The selfie trend has been continuing recently, and mobile banking applications can be accessed through face recognition technology. In addition, it is possible to log in to the mobile banking application as a result of comparing the scanned fingerprint information with the fingerprint recorded on the smart device. Although all these transfers point to different technologies, they are realized by cloud service providers at the data storage point (Akbank, 2022).

Except for cash transactions that will be carried out in physical form, almost all transactions are carried out via smart devices, making it possible to transfer money instantly. In addition, transactions that can be performed by scanning via ATM with QR Code Technology offer various privileges.

6.2.8. Legal Follow-Up

The loans extended by the banks should be classified appropriately, taking into account the relevant provisions of the legislation, within the stipulated framework, and the deficit arising from the non-collection should be recorded. Legal follow-up processes are initiated by the bank's lawyers due to non-payment of loans on time and disruptions in payments. In this process, execution openings, payment orders and foreclosure transactions are carried out. The loan process consists of:

- Allocation
- Use
- Hitch
- Tracing
- Administrative Follow-up
- Legal Tracking

With information systems, business processes can be completely changed or big differences can be made on these processes. With the facilities provided by information systems, the design, analysis and development of legal follow-up processes are carried out quickly. It is necessary to pay attention to how well the processes are designed and coordinated, because speed and customer satisfaction are the focus in the banking sector. Improving the processes according to the feedback received after the analysis can be the source of competitive advantage.

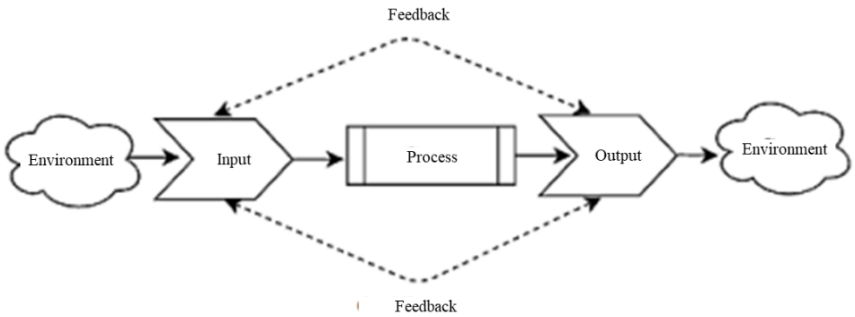


Figure 26. System Approach

Source: Tekin, 2020:38

There are strategic parts of information systems belonging to different bank institutions and organizations where legal follow-up processes are carried out. There are 5 basic elements that are decisive in systems: inputs, structure/transformation, outputs, feedback and environment (Şenaras and Sezen, 2017).

Inputs	Structure/Transformation	Outputs	Feedback	Environment
customer worker loan collection information source	transforming inputs into services by applying defined process procedures of management and organization	financial resources premium KTVU fees information resource efficiency	rearranging and improving the information obtained from the outputs with the inputs	internal social, economic, political values

Figure 27. System Determinants

Source: Tecim, 2004:86

Such transactions are initiated in the banking sector, as are the initiation of legal proceedings to ensure the payments of all types of institutions. There are systems developed to manage the follow-up of the payment of credit or other receivables of the relevant customers. These systems are used by every bank. ETCBase, İnnova, Icollect+ are given as examples of contracted external companies that purchase systems for the management of legal follow-up processes.

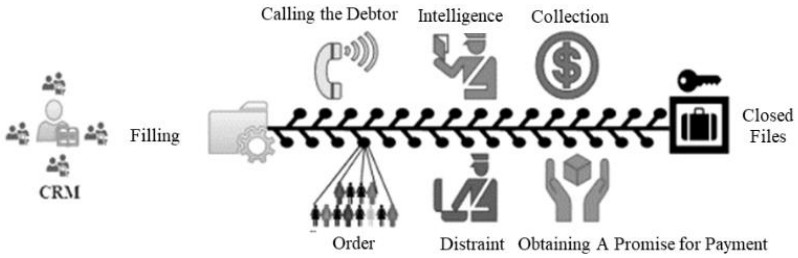


Figure 28. Legal Follow-Up System

All legal follow-up systems in the Turkish banking sector focus on collection-oriented improvements. All execution and litigation files of institutions that are dependent on collection processes are followed modernly through desktop or web applications. Automatic or manual file assignments can be made to law offices by the Center according to the criteria specified in the desired file type. Effective integrations with corporate systems can be achieved. In the integrations provided with the institutions, if interruptions are experienced by the institutions, interruptions occur on these systems as well. It is used to provide an effective legal follow-up process of existing interactive internal or external integrations with various integration system components (Table 8).

Integrated solutions and need-based technologies are used to ensure effectiveness in legal follow-up processes. The features that the compared ETCBase, Innova, IcollectLegal systems provide according to the needs and requirements of the users in the legal follow-up processes:

- CRM System
- Black List
- User Authorization
- Auto Search Engine
- Multi-Currency Support
- MERNIS Integration
- PTT Integration
- EGM Integration
- Outlook/Google Calendar Sync
- Document Management System
- Accounting / Finance
- Agenda Editing
- Voice Call Recording/Listening
- UYAP Integration
- SMS Integration
- TCBM Integration
- Lawyer Portal Integration
- E-Mail Integration

Internal Integrations	ETC Base Systems	Innova Systems	ICollectLegal Systems
CRM System	✓	✓	✓
Document Management System	✓	✓	✓
Black List	✓	✓	✓
Accounting/Financing	✓	✓	-
User Authorization	-	✓	-
Agenda Organization	-	-	-
Automatic Search Engine	-	-	-
Voice Call Recording/Listening	-	-	-
Multi Currency Support	-	-	-
External Integrations	**ETC Base Systems**	**Innova Systems**	**ICollectLegal Systems**
NJNIS Integration	✓	✓	-
CPMS Integration	✓	✓	-
SMS Integration	✓	✓	✓
PTT Integration	✓	✓	-
CBRT Integration	✓	✓	-
SGD Integration	✓	✓	-
Lawyer Portal Integration	✓	✓	-
Outlook/Google Calendar	✓	-	-
Synchronization	-	✓	✓
E-Mail Integration	✓	✓	✓

Table 8. System Integrations

6.3.Cloud Service Providers in Banking Systems

Leading cloud service providers are included by considering criteria such as cost advantage, installation, planning, management, technical knowledge, dominance and risk management.

6.3.1. inter-Cloud

inter-Cloud primary and secondary systems are hosted in the Intertech Data Center in Turkey. Software and hardware resources allocated exclusively to financial institutions are shared with the latest technologies and their logical separation is made by microsegmentation and multi-tenancy. As a cloud service provider, it has the following purposes (inter-Cloud, 2022):

- Increasing the maturity order in banks and financial institutions,
- Providing operational convenience with managed services,
- Starting activities from the secondary systems as soon as possible, returning to the primary system as soon as the situation is over in case of disasters and emergencies
- Performing periodic simulations for disaster recovery scenarios
- Providing cost advantage through license infrastructure and management common resources

Being the first company in Turkey and among the top 5 companies in the world in 2019, the company that installed Google Anthos ran DenizBank banking applications on a shared cloud infrastructure in 2020. It is known that inter-Cloud, which received preliminary approval from the BRSA in May 2020, started to serve as of 31 December 2021. It still offers the first and only BRSA approved financial cloud service provider infrastructure (bthaber, 2021)

Customers are isolated from each other in multi-tenancy environments, preventing them from accessing each other's infrastructures. In this isolated environment, the workload is logically divided into security segments and each segment is protected by its own security control. In this system called micro segmentation, there are segments such as UAT, PREPROD and PROD (inter-Cloud, 2022).

Thanks to its hardware, it provides high accessibility to even the smallest component with redundant structures. It provides services in triple cluster structures and continues smoothly even in frame losses (inter-Cloud, 2022).

It offers a scalable, flexible, low-cost, sustainable structure, in accordance with the regulations, adds strategic importance to financial enterprises, prevents data logging, provides competitive advantage, is managed with automation tools, offers isolated physical infrastructure and serves with flexible payment methods. Tier 3 certified primary data center is located in Istanbul and secondary data center (ODM) is located in Ankara (inter-Cloud, 2022). The services offered are:

- Security Managed Services
- Network Managed Services
- System Managed Services
- Application Managed Services
- Database Managed Services
- Backup Managed Services

Special infrastructure is provided for the needs of banks, financial institutions and software companies providing services to the financial sector, and the infrastructure can be managed by itself. The model in question is IaaS. As a result of the inclusion of all relevant resources in the cloud platform with subscription licensing, financial applications are offered with the SaaS model.

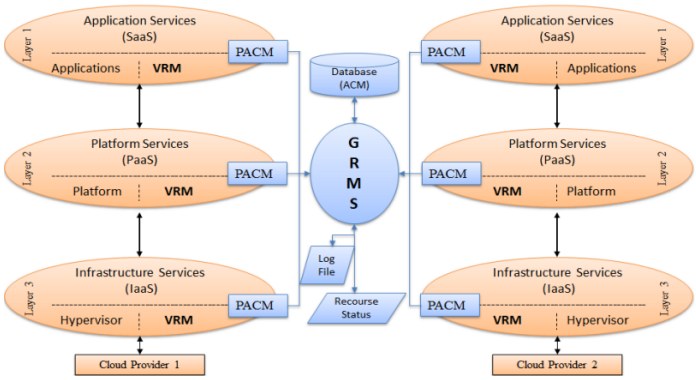


Figure 29. inter-Cloud and intra-Cloud Architecture

Source: inter-Cloud, 2022

6.3.2. Azure

Today, banks also provide security for a large amount of valuable information for firewalls and undertake the responsibility of storing it. It is enough that the information is about customers and the financial structure to be vital. With the data obtained, information about individuals who are at risk at the stage of obtaining a loan can be accessed quickly. This information is also used for decision-making processes during market portfolio evaluation stages. The acquired data can be used, stored, archived or deleted. A large number of decisions, of no small or great importance, are required to meet routine banking functions. For this reason, the security of data, which is of great importance, is protected by strict regulatory requirements and financial obligations. For this reason, it requires monitoring until the results of the data analysis at the time of first entry into the data store. At this point, Microsoft Azure can take on workloads such as traditional in-house data storage, processing, archiving and deletion. The benefits provided by Azure are listed below (Microsoft, 2021).

Financial institutions are generally known to have data collected and used by current applications. Various options are offered for moving this data to Azure. It is possible to connect as if it were a business center and to enable relocation with minimal changes. Except for this situation, which is especially applicable to the use of Microsoft Azure SQL database, solutions can be found in the application market for databases such as Oracle, Teradata, MongoDB. With various migration strategies and latency, Azure offers high reliability and data transparency. Lift & Shift model is used in database migration, in-house databases are taken and moved directly to the cloud (Microsoft, 2021).

Microsoft Azure is designed to weather all the challenges of data management in the banking industry. The architecture of connecting Azure's file share for banking applications, which provides services such as database migration service, bulk copy program for SQL server, Azure Blob, and file storage, is presented in Figure 30 (Microsoft, 2021).

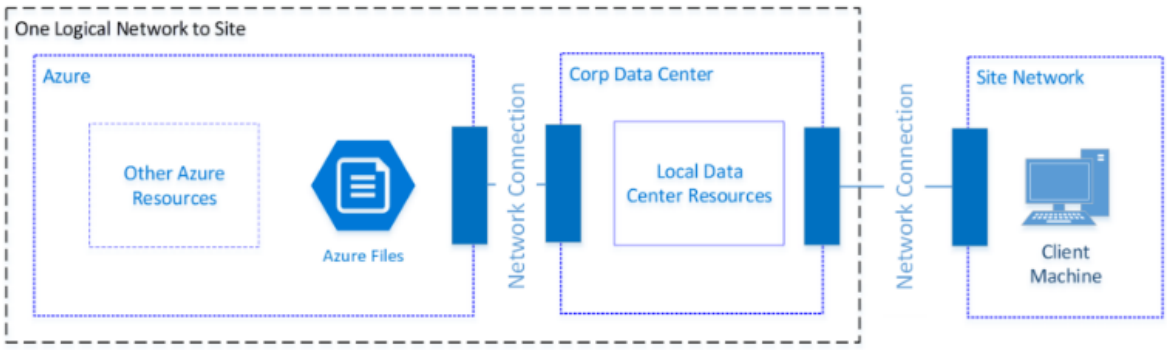


Figure 30. Azure File Sharing

As can be seen, the enterprise data center connects the files to the storage via the server message block (SMB) connection. In addition, various analysis and data management platforms such as Azure Data Box, Azure Information Protection (AIP), Data Services, Azure Data Factory are offered by Azure, and solutions for data archiving are presented (Microsoft, 2021).

With the rapid change in the digital environment for the banking and finance industry, customers quickly need solutions and business partners that they can use immediately. As data ingestion increases exponentially, banks need fast, innovative and secure ways to store, analyze and use their important data. Azure helps with data retrieval, processing, archiving, and deletion needs using a variety of technologies and strategies. The process of importing data into Azure is simple and various data stores can be used to store it depending on its type, structure, etc. Data solutions are available to include third-party databases beyond SQL Server and SQL Azure. By using Azure services such as Databricks and Data Factory, performing operations on this data can be simplified. Archive storage is used for long-term storage of rarely accessed data and can be deleted in a sequential cycle when needed (Microsoft, 2021).

6.3.3. IBM Cloud

It is a cloud system designed to establish a transparent cloud ecosystem by providing the resilience, compliance and security qualities that financial institutions are obliged to have. More than 90 banks benefit from IaaS and SaaS solution partnerships and the ecosystem it has created. It ensures that applications with critical missions are safely hosted in the cloud for efficient and fast operations (IBM, 2020:4).

With deep industry and legal expertise with IBM Promontory, IBM assists in running the workload. It ensures continuous compliance with pre-configured controls, reduces costs and speeds up the cloud process. It offers completely confidential and secure control. Consisting of independent fintech organizations and software firms, the IBM Framework is an integrated system that reduces risk and accelerates innovation. As you can see, it provides services with many solutions. Figure 31 presents the IBM Cloud designed for financial services (IBM, 2020:4).

.

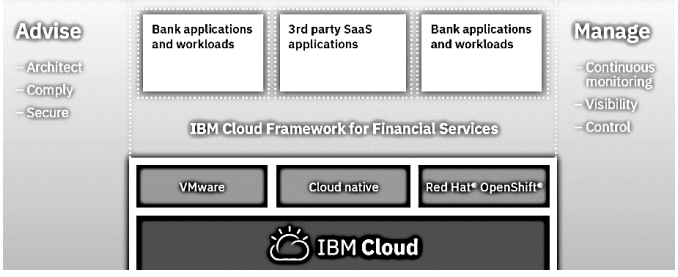


Figure 31. IBM Cloud for Financial Services

6.3.4. Amazon Web Services (AWS)

It is a secure cloud service platform that includes many functions such as database, processing power, content transmission and storage offered by Amazon and provides configuration as fast as possible. To meet changing customer needs and take advantage of evolving market opportunities, many banks have embarked on a modernization process with AWS to leverage machine learning, omnichannel applications, and mobile platforms at speed and scale. It offers four key services for banking operations: Grid, Data Lakes and Analytics, Digital Transformation, Machine learning (aws, 2022).

Network (Fig. 32). It is known that banks need a flexible information system that can be scaled quickly to better analyze customer behavior to try new products or predict the use of existing services, and to meet capital management and reporting requirements such as CECL and CCAR. Moving to a cloud service provider increases operational and cost efficiency, eliminating backlogs and accelerating time to market (aws, 2022).

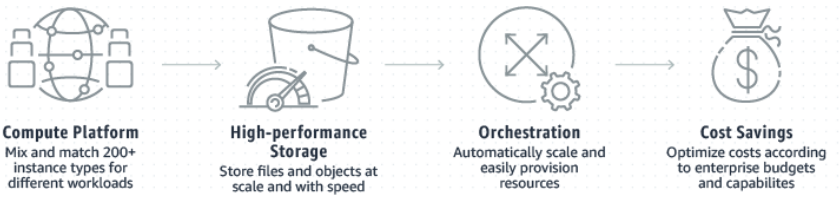


Figure 32. Network-Platform

Data Lakes and Analytics (Figure 33). Traditional infrastructures can no longer keep up with the business intelligence, customer insights and regulatory reporting that banks need. Therefore, it creates secure data lakes that serve as the base of analytics and innovation to protect, manage and grow the business (aws, 2022).

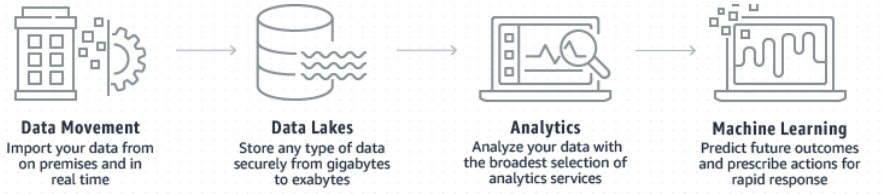


Figure 33. Data

Digital Transformation (Fig. 34). Today's banking customers expect personalized interactions and seamless transactions. From seamless digital onboarding across channels to real-time transaction updates, banks are choosing the cloud to help create richer experiences. It relies on the cloud to modernize core systems, launch spin-offs at unprecedented speeds, prepare open banking, and generate ideas, iterate, and innovate (aws, 2022).

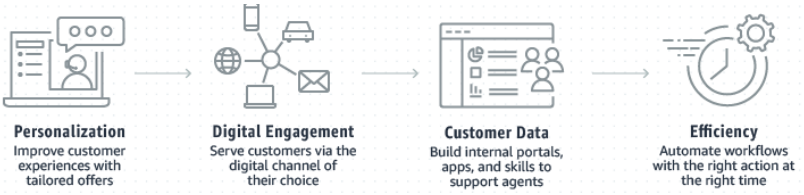


Figure 34. Competency

Machine learning (Fig. 35). To meet new needs, banks must harness the power of machine learning. AWS offers the broadest, deepest set of machine learning services they can use to transform customer experiences, automate processes, detect fraud, and facilitate compliance and authentication (aws, 2022).

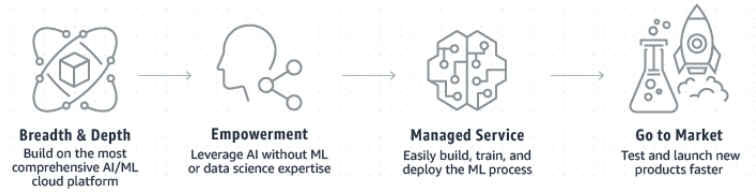


Figure 35. Machine Learning

6.3.5. Google Cloud

Google Cloud belongs to Google and has adopted the principle of helping to solve difficult problems. Paying particular attention to efficiency, the cloud service provider leverages data to maximize customer experience and connected interactions. It can modernize core operations and transform data and analytics so banks have the power to calculate risk, liquidity and capital, and accelerate time to insight (cloud, 2022).

- It encourages API use, open banking, accelerating open banking compliance, structured API Proxy usage, internal and external innovation to create new customer experiences, open the ecosystem to new offerings, and attract customers through third-party applications.
- It provides operational and cost efficiency.
- It offers risk and compliance management, BigQuery enterprise data warehouse, Anthos infrastructure system, reporting and liquidity reporting, operational resilience.
- It is developing special accelerators for the UK, Australia, Brazil.

7. CONCLUSION AND RECOMMENDATIONS

As a result of this study, which examines the structures of cloud service providers within the scope of information technologies used in the banking sector, it is understood that technology continues its rapid development.

The banking sector has a large number of applications through information technologies, and technological changes are easily adapted due to the conveniences and flexible systems.

Today, the most important factor in all fields, regardless of the sector, is to obtain data. Especially banking and finance activities are carried out with data as large as possible. For this reason, high-level use of cloud technologies becomes a necessity (Tekin, 2020).

The adoption of cloud technology, which provides future-shaping and digital transformation in financial services, is vital for business operations. As of March 2022, there are 57 organizations serving in Turkey. Considering the enterprises, 35 of which are deposit banks and 16 of which are development and investment banks, it is understood that even a single bank will have an impact on the country's economy.

Within the scope of infrastructure service, platform service and software service called IaaS, PaaS and SaaS, there is an official organization that can carry out cloud technology transformation for 57 organizations. Inter-Cloud, a cloud service provider, is the only institution that started its operations on December 31, 2021, with pre-approval by the BRSA. The common goal of Azure, IBM Cloud, AWS, Google Cloud, which offers a widespread role as a worldwide cloud service provider, is cost savings, security and efficiency (Akıncı, 2019).

The fact that cloud technology applications, the development of which is monitored and continued in Turkey, offer advantages such as customer experience and satisfaction and cost savings in the banking sector depends on the adoption and implementation of the innovation approach.

REFERENCES

Akal, M. (2022). Bilişim firmalarında bilgi güvenliği farkındalığı. Master Thesis, Ufuk University / Institute of Social Sciences

Akbank (2022). Akbank Mobil'e Selfie ile Giriş. https://www.akbank.com/tr-tr/Akbank-Direkt/Sayfalar/selfie.aspx

Aker, J.C. (2008). Does Digital Divide or Provide? The Impact of Cell Phones on Grain Markets in Niger. Center for Global Development Working Paper No: 154, pp.64.

Akın, H. (2001). Yeni Ekonomi. Konya: Çizgi Kitabevi

Akolaş, A. (2004). Bilişim Sistemleri ve Bilişim Teknolojisinin Küreselleşme Olgusu Ve Girişimcilik Üzerine Yansımaları. http://dergisosyalbil.selcuk.edu.tr/susbed/article/view/693

Akpınar, Y. (2020). Temel Bilgi Teknolojileri. https://docplayer.biz.tr/135799914-Bilgisayar-turleri-ve-bilgisayarlarin-kullanim-alanlari.html

Aladwani, A.M. (2001). Online banking: a field study of drivers, development. International Journal of Information Management, 21(3), 213-225

Applegate, L.M. (2019). Business Research for Business Leaders. https://hbswk.hbs.edu/archive/chapter-building-information-age-businesses-for-the-21st-century-how-to-fashion-your-new-e-business-model

Armağan, A.C. (2012). Bilişim Sektöründe Emeğin Statüsü: Türkiye'de Bilişim Çalışanlarının Vasıfları Üzerine Bir Araştırma. Istanbul University Institute of Social Sciences, PhD Disseertation, Istanbul

Armağan, A.C. (2012). Bilişim Sektöründe Emeğin Statüsü: Türkiye'de Bilişim Çalışanlarının Vasıfları Üzerine Bir Araştırma. PhD Dissertation, Istanbul University Institute of Social Sciences

Arslan, K. (2019). Performance evaluation of iot data security on cloud computing. Master Thesis, Ankara Yıldırım Beyazıt University / Institute of Science and Technology

Arslan, R., Hotamışlı, M. (2007). Türk Bankacılık Sisteminde Kurumsal Çevrenin Bankaların Yapı ve Uygulamaları Üzerinde Oluşturduğu Teşvik ve Kısıtlamalar. İ.İ.B.F. Yönetim ve Ekonomi Dergisi, 14(1) 196-207

Atkinson, R.D. and Correa, D.K. (2007). The 2007 State New Economy Index, Benchmarking Economic Transformation in the States, The Information Technology and Innovation Foundation.

AWS (2022). Banking. https://aws.amazon.com/tr/financial-services/banking/

AWS (2022). Neden AWS Bulut'a geçmelisiniz? https://aws.amazon.com/tr/cloud-migration/?nc2=h_ql_sol_use_cm

Aydın, İ. (2012). Bilişim Sektörü ve Türkiye'nin Sektördeki Potansiyeli. International Journal of New Trends in Arts, Sports & Science Education. 1(1): 180-200.

Aydın, N. (2006). Bankacılık Uygulamaları. Anadolu Üniversitesi Yayınları

Azure (2022a). Genel bulut nedir? https://azure.microsoft.com/tr-tr/resources/cloud-computing-dictionary/what-is-a-public-cloud/

Azure (2022b). Özel bulut nedir? https://azure.microsoft.com/tr-tr/resources/cloud-computing-dictionary/what-is-a-private-cloud/

Azure (2022c). Hibrit bulut nedir? https://azure.microsoft.com/tr-tr/overview/what-is-hybrid-cloud-computing/

Badgers, H. (2021). WEB 1.0'dan WEB 4.0'a İnternetin Evrimi. https://nttdata-solutions.com/tr/local-blog/web-bir-sifirdan-web-dort-sifira-internetin-evrimi/

Baily, M.N. (2002). The New Economy: Postmortem of Second Wind? Journal of Economic Perspectives, 16(2): 3-22

Banking Law (2005). Banking Law No. 5411. https://www.mevzuat.gov.tr/MevzuatMetin/1.5.5411.pdf

BDDK (2022). https://www.bddk.org.tr/Kurulus/Liste/77

BDDK (2022). https://www.bddk.org.tr/Veri/EkGetir/8?ekId=86

Benhaddi, M. (2017). Web of Goals: A Proposal for a New Highly Smart Web. Conference: 19th International Conference on Enterprise Information Systems. https://www.researchgate.net/publication/317117175_Web_of_Goals_A_Proposal_for_a_New_Highly_Smart_Web

Beşkese, B. M., Tanyaş, M. (2006). Bilişim Teknolojisi Yatırımlarının Değerlendirilmesine Yönelik Uygun Yöntemin Seçilmesi Modeli: – ERP Yazılımı Seçimi Uygulaması. İstanbul Teknik Üniversitesi Dergisi, 5(1), 217-227.

Beyond Voice (2009). A Special Report on Telecoms in Emerging Markets," The Economist, https://www.economist.com/special-report/2009/09/26/beyond-voice

BKM (2020). Bankalararası Kart Merkezi. https://bkm.com.tr/kronoloji/

Bloomberght (2022). Swift nedir? Ne için kullanılır? https://www.bloomberght.com/swift-nedir-ne-icin-kullanilir-2299926

Bresnahan, T.F., Trajtenberg, M. (1995). General Purpose Technologies: 'Engines of Growth? Journal of Econometrics, 65(1): 83-108

Brynjolfsson, E., Hitt, L.M. (2000). Beyond Computation: Information Technology, Organizational Transformation and Business Performance. Journal of Economic Perspectives, 14(4): 23-48.

bthaber (2021). Intertech, inter-Cloud adı altında BDDK onaylı ilk ve tek finansal bulut hizmet sağlayıcı altyapısını devreye aldı. https://www.bthaber.com/intertech-inter-cloud-adi-altinda-bddk-onayli-ilk-ve-tek-finansal-bulut-hizmet-saglayici-altyapisini-devreye-aldi/

Buckland, M.K. (1992). Emanuel Goldberg, Electronic Document Retrieval, and Vannevar Bush's Memex. Journal of the American Society for Information Science, 43(4), 284.

Canay, Ö. and Güngörsün, T. (2016). Bilgisayar Donanımı ve Bileşenleri. İstanbul: Değişim Yayınları.

Ceyhun, Y., & Çağlayan, M. (1997). Bilgi Teknolojileri Türkiye İçin Nasıl Bir Gelecek Hazırlamakta (p. 12). içinde Ankara: Türkiye İş Bankası Kültür Yayınları.

Chai, W. (2020). Telecommunications (telecom). https://searchnetworking.techtarget.com/definition/telecommunications-telecom

cloud (2022). Google Cloud for banking. https://cloud.google.com/solutions/financial-services/retail-banking

CNBC (2022). Rus bankaları küresel finanstan nasıl kesildi: Bir 'SWIFT' sistem açıklayıcısı. https://www.cnbc.com/video/2022/04/04/what-is-swift-how-russian-banks-got-cut-out-of-the-financial-system.html

Cohen, S.S., DeLong, J.B., Zysman, J. (2000). Tools for Thought: What Is New and Important About the E-conomy," BRIE Working Paper No: 138, February 22, 2000

Curtis, Graham Business Information Systems, Addison-Wesley Publishing Company, Second Edition, 1994, p. 45

Çevik, S. (2009). Turizm Pazarlamasında Bilgi İletişim Teknolojileri: Seyahat Acenteleri İnternet Siteleri Üzerine Uygulamalı Bir Çalışma. Dokuz Eylül University, Institute of Social Sciences, Master Thesis.

D. Smith, L. Leong and R. Bala, «Magic Quadrant for Cloud Infrastructure as a Service, Worldwide,» Gartner, 2018.

Dalay, M. (2013). Bir İşletmede Tüm Tedarik Zincirlerinin Etkin Yönetimi, Üretim, Planlama, Envanter, Taşımacılık, Dağıtım Süreçlerinin Optimizasyonu Ve Yönetim Bilişim Sistemleri İle Uygulanması (SAP Destekli). Master Thesis, Beykent University Institute of Social Sciences

Ercim (2013). RESERVOIR - A European Cloud Computing Project. https://ercim-news.ercim.eu/en83/special/reservoir-a-european-cloud-computing-project

Eren K. (2017). Bulut Bilişim Teknolojileri ve Nosql Veritabanları Kullanarak Türkiye'de Terör Olaylarının İncelenmesi. Master Thesis. Sakarya University Management Information Systems

Eren, E. (2001). Yönetim ve Organizasyon. İstanbul: Beta Basım.

Eureka Moments (2009). A Special Report on Telecoms in Emerging Markets," The Economist. https://www.economist.com/special-report/2009/09/26/eureka-moments

Gartner (2014). Hype Cycle for Emerging Technologies. https://www.gartner.com/account/signin?method=initialize&TARGET=http%3A%2F%2Fwww.gartner.com%2Fdocument%2F717415

Gordon, R.J. (2000). Does the "New Economy" Measure up to the Great Inventions of the Past. Journal of Economic Perspectives, 14(4): 49-74.

Göleli, H. (2019). Bulut Geçiş Çalışması ve Buluta Taşınacak Uygulamaları Belirlemede Kullanılacak Bir Yöntem. Master Thesis, Maltepe University Institute of Science and Technology

Gürses, U. (2019). Dijitalde bulut, klasik bankacılığı unut

IBM (2020). IBM Cloud for Financial Services. https://www.ibm.com/downloads/cas/PLPO3PZY

IDC (2019) IDC Türkiye Hakkında. https://www.idc.com/mea/turkey

IDC (2025). IDC Data Age 2025. The Digitization of the World From Edge to Core. https://www.seagate.com/files/www-content/our-story/trends/files/idc-seagate-dataage-whitepaper.pdf

Işık, G. (2021). Bulut Ortamlarında Hipervizör ve Konteyner Tipi Sanallaştırmanın Farklı Özellikte İş Yüklerinin Performansına Etkisinin Değerlendirilmesi. Master Thesis, Eskisehir Osmangazi University Institute of Science and Technology

İçöz, Ö., 2003. Telekomünikasyon sektöründe regülâsyon ve rekabet. Uzmanlık Tezleri Serisi. Ankara: Rekabet Kurulu Yayını. Publication No: 98.

intercloud (2022). Türkiye'nin ilk ve tek BDDK onaylı, paylaşımlı Finansal Bulut Platformu. https://intercloud.intertech.com.tr/

Jensen, R. (2007). The Digital Provide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector. Quarterly Journal of Economics, Oxford University Press, 122(3): 879-924.

Kale, A. (2016). Kavramsal ağ temelli yerel alan ağı alt yapısı tasarım modeli. Master Thesis, Kırıkkale University, Institute of Science and Technology

Karabacak, B. and Özkan, S. 2010. Bilgi Güvenliği Yönetim Sistemleri İçin Süreç Tabanlı Risk Analizi. III. Ağ ve Bilgi Güvenliği Sempozyumu. Ankara

Karahoca, D., & Karahoca, A. (1998). İşletmeciler, Mühendisler ve Yöneticiler İçin Yönetim Bilişim Sistemleri ve Uygulamaları. Ankara: Beta Basım Yayım

Karakuş, K. (2014). Bulut Bilişim. Temel Bilgi Teknolojileri II. Atatürk Üniversitesi AÖF. https://kagan.ahievran.edu.tr/kullanicidosya/files/uzaktanegitim/temel%20bilgi%20teknolojileri%202%20%C3%9Cnite%208.pdf

KDR (2018). Veri-Bilgi-Enformasyon Kavramları. https://kdrpnlc.com/veri-bilgi-enformasyon-kavramlari/

Keating, R. (2022). What is an EFT payment? https://gocardless.com/guides/posts/what-is-an-eft-payment/#:~:text=So%2C%20what%20is%20EFT%3F,institution%20or%20different%20financial%20institutions.

Kıldan, K. (2021). Telekomünikasyon Sektöründe Çağrı Merkezlerine Müşteri Şikayeti İçin Bir Alternatif – Sosyal Medyanın Müşteri Şikayeti İçin Kullanımı. Bahçeşehir University, Graduate Education Institute, Master Thesis, Istanbul.

Kırçova, İ. (2007, Ağustos). Kredi Kartı Kullanımının Tüketici Alışkanlıklarına ve Alışverişlerin Yer, Zaman ve Marka Tercihlerine Etkisi. İstanbul Ticaret Odası, 11.

KOSGEP (2019). Mobil Bankacılık Uygulamaları Nedir? Nasıl İndirilir? https://www.kosgebkrediler.com/mobil-bankacilik-uygulamalari-nedir/

KPMG Türkiye. 2020. Telekomünikasyon sektörel bakış. https://assets.kpmg/content/dam/kpmg/tr/pdf/2020/05/sektorel-bakis-2020- telekomunikasyon.pdf

Laudon, K. C., & Laudon, J. P. (2005). Essentials Of Management Information Systems: Managing The Digital Firm. ABD: Pearson Prentice Hall.

LogoSoft360 (2021). Bulut Teknolojisi Nedir? Çeşitleri, Kullanım Alanları ve Faydaları Nelerdir? https://www.logosoft360.com/Post2.aspx?t=1

medyasoft (2020). Kalkınmada İtici Güç Olarak Bilişim Sektörü ve Türkiye'deki Gelişim Alanları. https://www.medyasoft.com.tr/tr/blog/kalkinmada-itici-guc-olarak-bilisim-sektoru-ve-turkiyedeki-gelisim-alanlari

Memiş, S. (2021). Bilgisayarlarda Kullanılan Tüm Parçaların İş Sağlığı ve Güvenliği Açısından Değerlendirilmesi. İnönü University Institute of Science and Technology, Master Thesis, Malatya.

Microsoft (2021). Bankacılıkta veri yönetimi. https://docs.microsoft.com/tr-tr/azure/architecture/industries/finance/data-management-banking-overview

Microsoft (2022). Azure facilities, premises, and physical security. https://docs.microsoft.com/en-us/azure/security/fundamentals/physical-security

Milliyet (2021). Dünyada toplamda kaç kişinin 'telefon sahibi' olduğu açıklandı! https://www.milliyet.com.tr/teknoloji/dunyada-toplamda-kac-kisinin-telefon-sahibi-oldugu-aciklandi-6588850#:~:text=Ayn%C4%B1%20rapora%20g%C3%B6re%20ge%C3%A7en%20y%C4%B1l,6.4%20milyar%C4%B1%20ak%C4%B1ll%C4%B1%20telefonlardan%20ula%C5%9F%C4%B1yor.

Moulton, R., and Coles, R.S. 2003. Applying Information Security Governance. Computers and Security. 22(7):580-584

Nakit (2022). Türkiye'deki Bankaların ATM Sayıları 2021! https://www.nakitbasit.com/blog-banka-atm-sayilari.html

Nordhaus, W.D. (2002). Productivity Growth and the New Economy. Brookings Papers on Economic Activity, 2002(2):211-244

Okutucu O. (2012). Bulut Bilişim ve Teknolojileri. Yüksek Lisans Tezi. Okan Üniversitesi Bilgisayar Mühendisliği

OpenGroup (2019). Building Return on Investment from Cloud Computing http://www.opengroup.org/cloud/wp_cloud_roi/p2.htm

Orka T., (2017). Bulut Bilişim Uygulamaları ve Büyük Veri Analizinin Özellikle Müşteri İlişkileri Yönetimi Ve Pazarlama Stratejilerinin Belirlenmesindeki Etkileri. Yüksek Lisans Tezi. TOBB Ekonomi ve Teknoloji Üniversitesi İşletme

Özdemir, Z. (2005). Bilanço Yapısı İtibarıyla Türk Bankacılık Sistemi. Sosyal Siyaset Konferansları Dergisi, (50), 867-899.

Özyılmaz, A.F. (2014). Bilişim sistemleri, sağlıkta bilişim sistemleri ve performans. Master Thesis, Beykent University / Institute of Social Sciences

P. K. Isom and K. Holley, Is Your Company Ready for Cloud: Choosing the Best Cloud Adoption Strategy for Your Business, Chicago: IBM Press, 2012

Papazoglou, M., & Tsalgatidou, A. (2000). Business-to-Business Electronic Commerce Issues and Solutions. Decision Support Systems, 29(4), 301-304.

Parasız, İ. (2007). Modern Bankacılık, Teori ve Uygulama. İstanbul: Ezgi Kitabevi

Qiang, C.Z. (2009). Mobile Telephony: A Transformation Tool for Growth and Development. Private Sector & Development, (4): 7-9.

Recommendation ITU-R V.662-2, Terms and definitions, 1993. https://www.itu.int/dms_pubrec/itu-r/rec/v/R-REC-V.662-2-199304-S!!PDF-E.pdf

Rumelili, Ö. M. (2006). Ödeme Sistemlerinde Bilgi Teknolojileri Riskleri. Master Thesis. Ankara: Ankara Institute of Social Sciences, Department of Business Administration.

Saraçoğlu, G. (2010). Örgüt performansında lojistik bilişim sistemlerinin müşteri hizmet algısına olan etkisi ve Ege bölgesinde ihracat yapan firmalar üzerine bir çalışma. Master Thesis, Bandırma Onyedi Eylül University / Institute of Social Sciences

Sevgi, A. (2022). Kamu sektöründe bilişim sistemleri denetimi: Gümrük örneği. Master Thesis, Dokuz Eylul University / Institute of Social Sciences

Staff (2022). https://staff.emu.edu.tr/hasanozcelikhan/tr/Documents/EETE264/EETE264-Ders1.pptx

Staff, (2022). Bilgisayar ve Çevre Üniteleri. Doğu Akdeniz Üniversitesi, Bilgisayar ve Teknoloji Yüksek Okulu Elektrik ve Elektronik Teknolojisi.

Stewart, Thomas A., Entellektüel Sermaye;Kuruluşların Yeni Zenginliği, Translator: Nurettin Elhüseyni , Kontent Kitap, BZD Yayıncılık,İstanbul,1997, p.252.

Şahin, Ş. (2013). Bilişim Sistemleri Uygulamalarının İşletme Performansına Etkileri. Dicle Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi 2(6):43-56

Şakar, B. (2006). Banka Kredileri ve Yönetimi. İstanbul: Beta Basım Yayım Dağıtım.

Şenaras, A. E., Sezen, K. (2017). Sistem Düşüncesi. Journal of Life Economics, 4(1), 39-58.

Şener, S. (2006). Karar destek ve üstyönetim bilişim sistemleri ve Türkiye'de bilişim sektöründe bir analiz. Master Thesis, Beykent University / Institute of Social Sciences

Tecim, V. (2004). Sistem Yaklaşımı ve Soft Sistem Düşüncesi. Dokuz Eylül Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi, 19(2), 75-100

Tecim, V. (2019). Yönetim Bilişim Sistemleri (YBS). https://vahaptecim.com.tr/yonetim-bilisim-sistemleri/

Tekin, F .(2020). Bilişim Sistemleri ile Yasal Takip Süreci: Bir Devlet Bankası Üzerinde İnceleme. Master Thesis, Sakarya University Graduate School of Business

Telecommunication (2022). Basic concept, Telecom application for socio-economic development of masses. https://rasfreenotes.in/main-notes/ras-mains-paper-2/general-science-andtechnoloy/telecommunication-basic-concept-telecom-application-for-socioeconomic-development-of-masses/

The Power of Mobile Money (2009). No: 8650, The Economist. https://www.economist.com/leaders/2009/09/24/the-power-of-mobile-money

THY, (2014). Veri İşleme Sistemleri. https://studylibtr.com/doc/729089/veri-i%CC%87%C5%9Fleme-sistemleri

TRT Haber (2021). Akıllı telefon harcamaları son bir yılda yüzde 50 arttı. https://www.trthaber.com/haber/ekonomi/akilli-telefon-harcamalari-son-bir-yilda-yuzde-50-artti-571161.html

TSE, (2014). Bulut Bilişim Güvenlik ve Kullanım Standardı. Türk Standartları Enstitüsü. https://statik.tse.org.tr/upload/tr/dosya/icerikyonetimi/1202/17032015093613-3.pdf

TÜİK (2021). Girişimlerde Bilişim Teknolojileri Kullanım Araştırması, 2021. https://data.tuik.gov.tr/Bulten/Index?p=Girisimlerde-Bilisim-Teknolojileri-Kullanim-Arastirmasi-2021-37435

Tükel, K. (2020). Bilişim Sektöründe Risk Analizi, Risklerin Değerlendirilmesi ve İş Sağlığı ve Güvenliği ile Entegrasyonu. Çukurova University Institute of Science and Technology, Master Thesis, Adana

Türk Telekom. Türk Telekom Tarihçe, http://www.ttyatirimciiliskileri.com.tr/tr-tr/turktelekom-grubu/turk-telekoma-yatirim/sayfalar/tarihce.aspx

Türksel Kaya- Bensghir, Bilgi Teknolojileri ve Örgütsel Değişim, TODAİ, Publication No: 274, 1st Edition, Ankara,1996, p.14

Uchitelle, L. (2000). Economic View: Productivity Finally Shows the Impact of Computers. https://archive.nytimes.com/www.nytimes.com/library/financial/sunday/031200biz-econ.html

Ünal, E. (2018). Bulut Mimarisinin Temelleri. https://enginunal.medium.com/bulut-mimarisinin-temelleri-111489c61fd7

Verimor. (2019). Voip Nedir? Voip Kullanmanın Avantajları Nelerdir? https://www.verimor.com.tr/makaleler/voip-nedir-voip-kullanmanin-avantajlari-nelerdir/

Vijay Gurbaxani ve diğerleri, "The Production On Information Services:A Firm Level Analysis", Information Systems Research ,Volume:11, Issue:2, June 2000, pp159-176, p.159

Vural, (2011). Yönetim bilişim sistemleri ve bir alt sistem olarak insan kaynakları uygulaması (Kırgızistan-Türkiye Manas Üniversitesi örneği. Master Thesis, Kyrgyzstan-Turkey Manas University / Institute of Social Sciences

Wearesocial.com. (2019). Digital in 2019. https://wearesocial.com/global digital-report-2019

Wikpedia (2020).https://tr.wikipedia.org/wiki/Bilgisayar

Xina L., Yuan, S.K. (2010). Present and Future of Internet Banking in China. Journal of Internet Banking and Commerce, 15(1), 362-380

Yalçın, F. (2012). İnternet Pazarlamasında Müşteri Memnuniyeti: Günün Fırsatları Üzerine Bir Uygulama. Atılım University Institute of Social Sciences, Master Thesis.

Yayla, K. (2010). İnternet Pazarlamasında Yeni Eğilimler: Çevrimiçi Sosyal Ağların Üniversite Öğrencilerinin Satın Alma Davranışlarına Etkisi. Celal Bayar University Institute of Social Sciences, Master Thesis.

Yeren, A. (2022). Telekomünikasyon nedir? https://www.mediaclick.com.tr/tr/blog/telekomunikasyon-nedir

Yiğitoğlu, A. İ. (2005). 2001 Krizi Sonrası Dönemde Türkiye Ekonomisinin ve Bankacılık Sektörünün Değerlendirilmesi. Sosyaekonomi Dergisi, 1(1), 118-119.

Yunus (2014). Bulut Bilişim Tarihi. https://yunus.hacettepe.edu.tr/~berrak10/webfinal/tarihce.html

Zenramalho, (2015). Saas, PaaS e IaaS. https://sisinfosite.wordpress.com/2015/11/18/saas-paas-e-iaas/