



Posta Sektöründe Dijital Dönüşümün Dinamikleri: Teknolojiler, Etkiler ve Geleceğe Bakış



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ÖZET

Posta sektörü, toplumsal iletişim ağları ve küresel lojistik sistemlerinin merkezi bir bileşeni olarak hem ekonomik süreçlerde hem de günlük yaşamın işleyişinde kritik bir rol oynamaktadır. Günümüzde dijital teknolojilerin üretim, dağıtım ve hizmet modellerini yeniden şekillendirmesiyle birlikte posta sektörü dönüşüm baskılarını en yoğun biçimde yaşayan alanlardan biri hâline gelmiştir. Mektup hacimlerindeki düşüş, e-ticaretin hızlı yükselişi ve Covid-19 pandemisinin hızlandırıcı etkisi bu dönüşümü daha da belirgin hâle getirmiştir. Bu sürecin temel dinamiğini iş süreçlerine entegre edilen dijital teknolojiler oluşturmaktadır. Özellikle yapay zekâ (AI), nesnelerin interneti (IoT), büyük veri analitiği, robotik süreç otomasyonu, bulut bilişim ve blok zincir gibi yenilikçi teknolojiler, posta sektörünün geleneksel hizmet anlayışını dönüştürerek yapısal bir değişim yaratmaktadır. Bu teknolojiler yalnızca operasyonel süreçlerde hız, doğruluk ve verimlilik sağlamakla kalmamakta, aynı zamanda müşteri odaklı hizmet tasarımlarının geliştirilmesine de imkân tanımaktadır. Bahse konu gelişmeler, rekabet dinamiklerini köklü biçimde değiştirerek dijital dönüşüme uyum sağlayan işletmelerin pazardaki konumlarını güçlendirmesine, hizmet çeşitliliğini artırmasına ve müşteri taleplerine daha etkin yanıt vermesine imkân tanımıştır. Bu çalışma, posta sektöründe dijital dönüşümün etkilerini ele almakta ve yenilikçi teknolojilerin sektördeki kullanım alanlarını incelemektedir. Ayrıca bu teknolojilerin operasyonel süreçler, hizmet modelleri ve rekabet dinamikleri üzerindeki yansımaları ele alınmaktadır.

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Dynamics of Digital Transformation in The Postal Sector: Technologies, Impacts and Future Outlook

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ABSTRACT

The postal sector plays a critical role in both economic processes and the functioning of daily life as a central component of social communication networks and global logistics systems. Today, with digital technologies reshaping production, distribution, and service models, the postal sector has become one of the areas experiencing the most intense pressure for transformation. The decline in letter volumes, the rapid rise of e-commerce, and the accelerating effect of the Covid-19 pandemic have made this transformation even more pronounced. Digital technologies integrated into business processes form the fundamental dynamic of this process. Innovative technologies such as artificial intelligence (AI), the Internet of Things (IoT), big data analytics, robotic process automation, cloud computing, and blockchain are creating structural change by transforming the postal sector's traditional service approach. These technologies not only provide speed, accuracy, and efficiency in operational processes, but also enable the development of customer-focused service designs. These developments have fundamentally changed the dynamics of competition, enabling businesses that adapt to digital transformation to strengthen their market position, increase service diversity, and respond more effectively to customer demands. This study examines the effects of digital transformation in the postal sector and explores the areas of application for innovative technologies in the sector. It also addresses the implications of these technologies on operational processes, service models, and competitive dynamics.

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1. INTRODUCTION (GİRİŞ)

The postal sector has played a fundamental role not only in the transportation of physical items from the past to the present, but also in supporting socio-economic connectivity through communication, parcel, and money transfer services [1,2]. Representing social inclusiveness through its extensive access network in almost every country, the sector provides global coverage that enables people to send items to anyone, anywhere [2]. Today, postal networks also contribute to the functionality of supply and distribution systems by facilitating e-commerce logistics and trade flows [1]. Furthermore, as a strategic domain shaped by public policies, international standards, and regulatory frameworks, the postal sector remains closely linked to governmental and institutional agendas [2,3]. Considering the accelerating effects of digitalization and technology-driven change in the industry, the postal sector has become a focal point not only of technological transformation but also of broader social and economic transformation [1,3]. Due to these characteristics, the postal sector offers a suitable and meaningful research area for examining digital transformation processes [3]. At this point, outlining the conceptual framework of postal services is essential to understand the impacts of digital transformation on the sector.

In the most general sense, mail is the transmission of a shipment from one place to another for the purpose of communication. According to TDK, the term “postal mail” is defined as “all of the letters and entrusts that come from or are sent to a place” [4]. Postal service can be defined as a special transportation or distribution system that involves the transportation of goods from one point to another. However, there are some unique features that distinguish the postal service from other distribution methods. The most prominent feature of the postal service is that it is based on the transfer of shipments that contain address information, need to be transported in a regular and scheduled manner, and are usually distributed over a regional network [5]. In this context, not only the definition and characteristics of postal services but also their relationship with e-commerce is important for understanding the transformation of the sector.

The relationship between the postal sector and e-commerce is very important, and these two sectors complement each other. Products purchased through e-commerce platforms must be physically delivered to consumers. Postal service providers come into play at this stage. Postal service providers ensure that these

processes are carried out efficiently [6]. The growth of the e-commerce sector has a significant impact on the postal sector. While the long-term lockdowns and social distancing measures implemented due to the Covid-19 pandemic caused a serious contraction in many sectors of the global economy, they contributed to the growth of the e-commerce sector. With the increase in e-commerce volume, postal service providers have had to meet consumer needs with innovative approaches such as same-day or contactless delivery, easy return processes, instant order tracking, and multiple delivery attempts [7]. In this process, postal service providers have been trying to integrate these innovative approaches into their business processes through digital transformation technologies, while also attempting to overcome these challenges with alternative delivery models [8].

The postal sector is undergoing a fundamental transformation alongside the spread of digitalization and e-commerce. The replacement of traditional letter delivery with digital communication tools such as email, social media, and instant messaging is forcing postal service providers to adapt to changing user habits. In this context, postal service providers are diversifying their means of reaching consumers by leveraging digital technologies and increasingly shifting their sectoral activities towards parcel delivery and freight transport. To maintain their presence in a competitive environment, they must continue to develop innovative solutions and invest in digitalization [9].

2. DIGITAL TRANSFORMATION (DİJİTAL DÖNÜŞÜM)

Digital transformation is also defined as a process where various digital innovations come together to create new actors, structures, practices, values and beliefs that change, threaten, transform or complement existing rules [10]. Digital transformation is a process that enables enhanced customer experiences, streamlined operations and new business models by enabling significant improvements in business processes through the use of new digital technologies such as social media, mobile technology, analytics and embedded devices [11]. In shorter terms, digital transformation is the integration of technological developments into business and operational processes [12].

Digital transformation means that businesses adapt to the digital age by adapting to new technologies. This process affects various sectors such as industry, energy, logistics, electronic communication and mail. Businesses that want to gain competitive advantage

tend to digitalize their business processes. For this transformation to be effective, the right human resources, led by qualified experts, are required. In addition, transformations should be strategically analyzed and supported by budget planning [13]. Digital technologies have significantly changed the way businesses interact with customers, understand competition, manage data and approach innovation. This change allows businesses to better understand customer needs, gain competitive advantage and develop innovative products and services [14]. In this context, it is important to identify the key technologies that drive digital transformation and shape sectoral practices.

The most widely used digital transformation technologies today are artificial intelligence, internet of things, robotics, big data, blockchain, cloud computing, robotic process automation. The relationship between these technologies and the postal sector is described below. These technologies are shown in Figure 1. Before examining their role in the postal sector, it is useful to briefly outline the characteristics of these technologies.



Figure 1: Digital Transformation Technologies (*Dijital Dönüşüm Teknolojileri*)

2.1. Artificial Intelligence (*Yapay Zeka*)

Artificial intelligence is a set of techniques that can produce solutions with similar designs to solve problems and in this process tries to imitate human intelligence in computer environment [15]. In other words, artificial intelligence is the field of computer science that aims to design systems with abilities such

as learning, reasoning, problem solving, etc. that we observe in human behavior [16].

2.2. Internet of Things (*Nesnelerin İnterneti*)

The IoT concept is defined as electronic devices that have the ability to connect to the internet and communicate with each other via their IP (Internet Protocol) addresses over the internet. Electronic devices that interact with each other in the IoT network are referred to as objects. These objects can perform identification, detection, networking and processing processes with each other [17]. Objects in these networks have the ability to automatically organize, share information, react to situations and changes in the environment, and move [18].

2.3 Blockchain (*Blokzincir*)

Blockchain is defined as a database in the most basic terms. In the working logic of this technology, data or information is sequentially stored in blocks. When the data capacity of a block reaches the upper limit, a new block is produced with the data of the other block and moved to another block. The moved blocks are connected to each other in the form of a chain. Each connected block chain has its own unique sequence rule. The size and data fields of the blocks in the block chain are unique characteristics [19]. A blockchain is actually a database where all transactions executed and shared between participating parties are kept in a distributed ledger. Each transaction in the public ledger is verified by the consensus of the majority of participants in the system. The information obtained as a result of this transaction can never be deleted and contains a precise and verifiable record of every single transaction ever made [20].

2.4 Cloud Computing (*Bulut Bilişim*)

Cloud computing can be briefly defined as an internet-based computing method. Thanks to cloud computing, information shared with hardware and software resources can be transferred to computers and other devices on demand, regardless of the source. NIST (National Institute of Standards and Technology) defines cloud computing as a pay-per-use model that provides on-demand network access to configurable computing repositories (including storage, software, services) [21].

2.5 Robotics (*Robotik*)

The term "robot" is defined by the International Organization for Standardization (ISO) as "a programmed, operated mechanism possessing a degree of autonomy to perform movements,

manipulation, or positioning." Robotics is an engineering discipline that involves the design, manufacturing, and operation of robots. The aim of the field of robotics is to develop intelligent machines that can assist humans in various ways. In robotics technology, robots may resemble humans or be used to perform repetitive tasks typically carried out by people [22].

2.6 Robotic Process Automation (*Robotik Süreç Otomasyonu*)

With the integration of computer and software sciences into robotic technologies, the concept of Robotic Process Automation (RPA) has emerged. RPA is a technology designed to reduce human intervention in computer applications, particularly in repetitive business processes. It operates through user interfaces similarly to humans and is specifically developed to automate business processes. RPA transforms simple, repetitive, and structured tasks from manual execution to automation [23].

2.7 Big Data (*Büyük Veri*)

Big data refers to high-volume, high-velocity, and highly diverse data that is difficult to process using traditional computing techniques. However, such data can be utilized to generate meaningful insights and support better decision-making [24]. Unlike traditional data, the term big data encompasses large and continuously growing datasets composed of heterogeneous formats, including structured, unstructured, and semi-structured data [25]. In general, big data denotes datasets that have become too large and complex to be handled by conventional tools and database management systems [26].

3. DIGITAL TRANSFORMATION AND POSTAL SECTOR (*DIJİTAL DÖNÜŞÜM VE POSTA SEKTÖRÜ*)

The impacts of digital transformation are being significantly felt in the postal sector, as in many other industries. With the acceleration of technological advancements, the implementation of digital transformation initiatives and projects within this sector has become increasingly widespread. Digital transformation in the postal sector has influenced the way postal services are delivered, the competitive dynamics of postal service providers and access to postal services. At every stage of postal operations, digital transformation has brought about a profound shift. The replacement of traditional postal procedures with digital tracking and automation systems has

accelerated business processes and enhanced overall efficiency [27].

Postal operators should adopt a strategic approach to capitalize on opportunities in the digital transformation process. These approaches include adopting new business models and technologies to reduce fixed costs, making organizational changes to make inflexible processes more agile, modernizing complex and legacy systems, investing in integrating physical and digital channels, using data analytics to better understand customer needs, and creating a culture of innovation to adopt new technologies [28]. To better understand the dynamics of this transformation, the effects of key digital technologies such as artificial intelligence, the Internet of Things, big data analytics, robotic process automation, cloud computing, robotics, and blockchain on the postal sector are examined.

3.1. Artificial Intelligence and the Postal Sector (*Yapay Zeka ve Posta Sektörü*)

Artificial intelligence technologies are used at every stage of postal services, including the collection, sorting, tracking and delivery of parcels and letters. Artificial intelligence has changed the correspondence system in the postal sector. Barcode technologies record information such as sender and recipient addresses and type of delivery. With RFID (Radio Frequency Identification) or barcode technologies, letters and packages can be tracked, enabling real-time information flow. In addition, advanced optical character recognition (OCR) technology in mail and parcel sorting processes enables automated reading of handwritten addresses. This technology helps postal operators to sort letters and parcels automatically [29].

One of the most important areas of digitalization in the postal sector is the supply chain and logistics processes. In the supply chain, artificial intelligence technologies help to optimize processes and balance demand and supply through data analysis. It is used in demand forecasting processes and inventory tracking in warehouses. In addition, with AI-based route optimization technologies, postal businesses can reduce the cost of delivery and distribution and provide faster delivery. Thanks to unmanned aerial vehicles or autonomous vehicles, efficiency is increased by continuous delivery. Artificial intelligence technologies provide businesses with a better workflow in case of staff shortages. Chat bots or virtual assistants use natural language processing from AI technologies to provide 24/7 support to consumers. As a result, consumers can access the

necessary information at any time and do not have to wait for a response from staff [29].

3.2 Internet of Things and the Postal Sector

(Nesnelerin İnterneti ve Posta Sektörü)

IoT technology has brought innovations and improvements to the postal sector. IoT enables postal businesses to monitor their shipments in real time. In particular, through small sensors and tags, the location of each shipment can be tracked and parameters such as temperature, humidity, weight, as well as the security status of packages can be monitored. This reduces the risk of loss and damage and makes tracking shipments more effective [30]. Thanks to the sensors installed in vehicles carrying postal shipments, package transportation processes can be monitored. In this way, routes can be optimized, routing can be made according to traffic conditions and delivery times can be shortened. At the same time, the maintenance needs of the vehicles can be monitored so that malfunctions can be detected in advance and planned maintenance can be carried out [31].

IoT technologies also facilitate storage and inventory management. Sensors can automatically monitor inventory in storage areas, report stock levels in real time and optimize reordering processes. This enables stock optimization and increases efficiency. IoT also enhances postal companies' security measures. Sensors can detect the movement of packages and alert in case of unauthorized access or theft. This can secure shipments and reduce the risk of theft. IoT offers a wide range of benefits from logistics businesses to the consumer. These benefits have an impact throughout the logistics value chain, including warehousing operations, freight transportation and final stage delivery [32].

3.3 Blockchain and the Postal Sector

(Blokzincir ve Posta Sektörü)

Blockchain technology is being used in many areas in the postal sector. These applications include contract enforcement, authentication services, network and device management, and records management. Blockchain technology can also be used in the postal sector, device and vehicle management, and supply chain management processes [33].

Blockchain technology can make financial transactions in postal services more secure, transparent and efficient. A blockchain-based platform enables direct and faster transactions between postal services. Blockchain technology can make authentication processes in postal services more

secure and transparent. A blockchain-based authentication system enables senders and recipients to verify their identities securely. Blockchain technology can be used to secure and manage IoT devices in postal service processes. A blockchain-based device management system can allow devices to record and transfer their data more securely. Blockchain allows packages and mail to be uniquely identified and each shipment to be tracked. This can enable more accurate identification of where packages and mail are and when they will be delivered [33].

3.4 Cloud Computing and the Postal Sector

(Bulut Bilişim ve Posta Sektörü)

Cloud computing stands out as a technology that provides various advantages for the postal sector. Since postal operators have to process and manage large amounts of data, cloud computing facilitates the secure storage and access of this data. Data is stored on cloud-based servers and can be accessed from anywhere when desired [34]. Cloud-based systems can convert capital costs into operational costs by providing cost savings. It also facilitates information sharing by eliminating compatibility problems by providing access to all components of the supply chain. Cloud-based systems can host different activities of the postal supply chain on a single platform and provide access to supply chain partners from any location. In addition, it is stated that cloud-based systems can reduce environmental impact by reducing energy costs and contribute to creating a sustainable supply chain [35].

Cloud computing can provide great benefits to postal companies in their postal service processes. Processes such as shipment tracking, inventory management, vehicle routing and last-mile delivery can be managed more efficiently with cloud-based systems. Cloud-based communication tools help postal companies to communicate effectively with their internal and external stakeholders. Collaboration activities such as data sharing, document editing, project management, etc. among employees, consumers and suppliers can be easily carried out via cloud-based platforms [35].

3.5 Robotics and the Postal Sector

(Robotik ve Posta Sektörü)

Robotic technology is used in the postal sector to enhance automation and efficiency in processes such as warehouse management, distribution, and delivery. Robots in the postal sector can be employed at various stages of operation. One example is autonomous mobile robots. These robots use sensors and navigation technologies to transport materials in open areas without human intervention. In storage facilities,

different types of autonomous robots are used to move containers and pallets between sorting machines. Recent advancements in automation technology have increased the range and complexity of tasks that robots can perform. Meanwhile, major postal service providers around the world are testing the delivery of certain products by robots in selected cities [36].

3.6 Robotic Process Automation and the Postal Sector *(Robotik Süreç Otomasyonu ve Posta Sektörü)*

In the postal sector, RPA can enhance operational performance by automating various business processes and improving efficiency. RPA can automate manual tasks such as extracting customer information from invoices and entering data into systems. It can also play a role in verifying the accuracy of addresses, postal codes, and other data, thereby reducing errors and increasing delivery accuracy. Furthermore, RPA can support the reporting of business processes, contributing to improved organizational oversight and decision-making [37].

RPA can automate the order fulfillment process by eliminating the need to manually process incoming orders [38]. It is capable of monitoring postal data in real time, automatically updating shipment statuses, and sending notifications to users at various stages of the delivery process. RPA can also be beneficial in warehouse and inventory management operations. In return logistics, it can automate the return and refund processes, thereby optimizing reverse logistics and enhancing customer satisfaction [39]. Additionally, RPA can support customer service operations by automatically responding to frequently asked questions, analyzing customer inquiries, and forwarding complex issues to call center agents [40]. Overall, RPA facilitates business processes in the postal sector by automating repetitive, rule-based tasks, enabling human resources to focus on more complex and value-added activities. It enhances operational efficiency, reduces costs, and ultimately contributes to a more competitive and flexible environment in the postal industry.

3.7 Big Data and the Postal Sector *(Büyük Veri ve Posta Sektörü)*

The postal sector is one of the industries with significant potential to benefit from big data. Postal operators can generate large datasets by collecting information related to shipments, user profiles, and operational activities. By applying big data analytics techniques, postal companies can reduce transportation costs. These technologies help optimize delivery routes, lower fuel consumption, and enable more efficient vehicle dispatching [41]. Moreover, big

data analytics contributes to improving customer experience. It allows businesses to gain deeper insights into consumer behavior and trends. This knowledge enables postal service providers to design services that are better aligned with the needs and preferences of their customers [42].

One of the greatest advantages of big data is its ability to help businesses track package deliveries. Through big data, the entire transportation process of a package can be monitored from start to finish. Big data can also be utilized for route optimization in logistics and supply chain management processes. With the help of sensors installed on delivery vehicles, companies can collect data not only from big data technologies but also from weather reports and traffic updates [43].

Big data technology can also be used to optimize inventory levels of supply materials. Postal operators operating on a global scale are increasingly adopting smart warehouse technologies. These smart warehouses, which offer faster and higher performance compared to traditional ones, contribute to enhanced efficiency. With the real-time insights provided by big data technology, businesses can monitor and track their current inventory levels. As a result, big data enables efficient warehouse management [43]. On the other hand, postal companies are turning to big data analytics to optimize their internal operations and are exploring its use beyond postal data for various other purposes. By leveraging big data, the postal sector can deliver better services to customers, improve operational efficiency, and gain a competitive advantage [44].

4. THE INNOVATIONS THAT DIGITAL TRANSFORMATION BRINGS TO THE POSTAL SECTOR *(DİJİTAL DÖNÜŞÜMÜN POSTA SEKTÖRÜNE GETİRDİĞİ YENİLİKLER)*

Innovative technologies in postal service processes have been developing rapidly in recent years. These advancements, referring to a range of technologies employed to make postal services more effective, efficient, and faster, are utilized by postal operators to enhance operational efficiency, improve delivery times, and optimize the customer experience. In this context, the innovations that digital transformation brings to the postal sector are presented in Table 1.

Table 1. Digital innovations in the postal sector *(Posta Sektöründeki Dijital Yenilikler)*

Innovations	Description
Barcoding	Enables automated and accurate item tracking, improving processing speed and reliability.

Computer-Based Sensors	Uses vision sensors to support automated recognition and traceability, enhancing delivery performance.
Tag Learning Software Systems	AI-based label recognition and routing, adaptable to new label formats via specialized interfaces.
Fingerprinting Technologies	Identifies items through visual features, enabling label-free sorting when labels are missing/unreadable.
OCR	Digitizes address/recipient data to accelerate sorting and reduce human error and costs.
RFID	Provides real-time tracking and secure monitoring, improving inventory control and reducing errors/theft.
Route Optimization	Algorithmic routing improves delivery efficiency and lowers costs under traffic and capacity constraints.
Parcel Lockers	Secure, contactless last-mile option that increases accessibility, especially in dense areas.
Automation	Streamlines repetitive operations to improve service consistency and reduce labor-intensive processing.
Autonomous Vehicles and Drones	Supports faster and potentially greener delivery, particularly for remote or hard-to-access locations.
Smart Conveyor Systems	Sensor-enabled conveyors automate sorting and routing with high speed and accuracy.
Digitalization of Business Processes	Digitizes documents/workflows to improve accessibility, efficiency, and sustainability.
Mobile Applications	Enables tracking, delivery preferences, digital payments, and real-time customer communication.
Innovative Delivery Models	Integrates flexible delivery modes (e.g., lockers, pick-up points, same-day/contactless) for e-commerce needs.
Chatbots and IVR (Interactive Voice Response)	Provides 24/7 automated customer support and delivery management, reducing workload and waiting times.

The rapid adoption of innovative technologies has not only transformed the operational logic of postal services but also redefined the sector's role in meeting

changing customer expectations. These technologies are increasingly embedded into various stages of postal processes, from collection and sorting to transportation and final delivery, in order to enhance speed, reliability, and service quality. To present this transformation in a more systematic manner, their areas of application and impact within postal service processes are illustrated in Figure 2.

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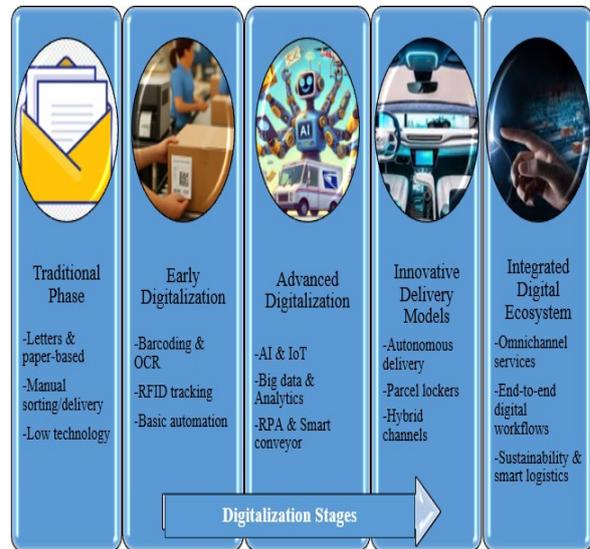


Figure 2 Digital Transformation Stages in the Postal Sector (*Posta Sektöründeki Dijital Dönüşüm Aşamaları*)

5. CONCLUSION AND RECOMMENDATION (SONUÇ VE ÖNERİLER)

In today's digital age, the traditional service structure of the postal sector has undergone a fundamental transformation driven by technological advancements. Digital technologies such as artificial intelligence, big data, the Internet of Things, cloud computing, blockchain, and robotic process automation have enabled postal service providers to enhance operational efficiency, reduce errors, and improve service quality. These innovations have led to the digitization and significant automation of processes such as mail and parcel sorting, shipment tracking, delivery planning, and customer service.

The rapid expansion of the e-commerce sector has further compelled postal service providers to provide faster and more flexible services in response to rising demand, making the adoption of digital technologies a necessity rather than a strategic choice. In this context, the growing use of parcel lockers has emerged as a contactless delivery model that minimizes failed delivery attempts and allows recipients to collect their parcels at their convenience. Particularly in densely populated urban areas, these systems have become a key innovation in last-mile delivery, representing a practical and effective application of digital transformation. Moreover, global crises such as the Covid-19 pandemic have highlighted the critical importance of this transformation, as organizations with robust digital infrastructure were able to sustain operations, while others faced significant disruptions and bottlenecks.

Moreover, the data-driven approach enabled by digital transformation has provided postal operators with significant advantages not only in operational processes but also in strategic planning, demand forecasting, and customer segmentation. The analysis of shipment history, customer behavior, and routing data allows organizations to make more informed decisions and offer personalized services. This transformation has repositioned postal operators from being merely delivery carriers to becoming data-oriented digital service providers. However, sustaining this transformation requires more than just technological investment; it also depends on organizational agility, equipping the workforce with digital competencies, and adopting a forward-looking strategic vision. Postal enterprises that fail to adapt to digitalization face the risk of falling behind in an increasingly competitive market environment.

In the future, the development of a more competitive, sustainable, and user-friendly postal sector will heavily depend on the integration of digitalization strategies with next-generation technologies. First, micro-mobility solutions—such as electric bikes and small autonomous delivery robots—can alleviate urban traffic congestion while enhancing speed and efficiency in last-mile deliveries. Additionally, logistics systems supported by augmented reality (AR) can enable faster and more accurate inventory management within warehouses. With AR glasses, employees can easily locate packages, receive navigation guidance, and manage workloads more effectively.

Furthermore, digital twin technology offers the potential to create virtual replicas of operational processes, particularly in high-volume distribution centers. This enables real-time monitoring and

simulation to proactively identify and mitigate potential risks, allowing for improved maintenance, capacity planning, and bottleneck management. Sustainability-focused technologies are also expected to become key drivers in the postal sector of the future. Solar-powered parcel lockers, electric delivery vehicles, and digital reporting systems that track carbon emissions will offer strategic advantages to environmentally conscious organizations. AI-powered customer experience platforms will further enhance competitiveness by delivering personalized services not only in delivery operations, but also in complaint handling, service recommendations, and dynamic pricing. Within this framework, postal operators that view technology not merely as an operational tool but as a strategic lever will be well-positioned to achieve transformative change, both economically and socially.

In recent years, the postal sector in Türkiye has taken significant steps toward digitalization, and postal service providers have begun to reshape their operational processes with advanced technologies. Barcode and RFID-based solutions enable end-to-end tracking of shipments, thereby increasing transparency and reliability. OCR systems allow address information to be read quickly and accurately, while computer vision-based sensors facilitate the automatic recognition of parcels. Postal service providers are also deploying AI-powered forecasting models and route optimization systems to shorten delivery times and reduce costs. In addition, smart conveyor systems accelerate sorting and routing operations in large distribution centers to enhance operational efficiency, while robotic process automation helps reduce repetitive workloads and contributes to more flexible and error-free processes.

Postal service providers operating in Türkiye are focusing not only on operational efficiency but also on innovative delivery models designed to improve customer experience. In particular, smart parcel lockers, which have become widespread in major cities, offer consumers flexible and contactless delivery options, while practices such as same-day delivery and multiple delivery attempts have significantly increased customer satisfaction. Real-time shipment tracking via mobile applications, digital payment systems, and chatbot-based customer support services further strengthen user experience. In addition, environmentally friendly practices such as the use of electric vehicles and sustainable packaging solutions are becoming more widespread. All these developments demonstrate that the digitalization journey of Türkiye's postal sector is evolving not only at the operational level but also toward a customer-oriented, flexible, and sustainable service model.

In order for the postal sector in Turkey to increase its future competitiveness and effectively meet customer expectations, it must shift towards a service model based on end-to-end digital integration. In this model, all stages from collection and sorting to transfer, transport, and last-mile delivery must be supported by digital technologies. This will enable consumers to track the entire life cycle of their shipments and manage the delivery process digitally. As a result, the postal sector will not only achieve operational efficiency but also become a customer-focused, sustainable, and globally integrated digital ecosystem.

The successful and sustainable implementation of digital transformation in the postal sector is not only dependent on technological investments but also requires an effective regulatory structure, inclusive policy frameworks, and multi-stakeholder collaboration mechanisms. In this regard, strong and continuous institutional coordination between the sector's regulatory authority BTK, and postal service providers is of critical importance. BTK should act not only as a supervisory body but also as a facilitator and enabler of digitalization. Accordingly, it is necessary to update the regulatory infrastructure to allow the integration of next-generation technologies—such as artificial intelligence, blockchain, and robotic process automation—into the sector, and to define clear rules and standards in areas such as data security, ethical AI use, and cybersecurity. Furthermore, BTK should carry out impact assessments to monitor the effectiveness of digital transformation practices and develop compliance criteria.

To make digitalization accessible to all postal service providers, access to digital infrastructure for small and medium-sized enterprises must be facilitated. In this context, inclusive mechanisms should be developed through state-supported incentive programs, grants, tax relief, or public-private partnerships. Additionally, the sector must implement training and certification programs to enhance the digital competencies of its human resources. BTK may support these efforts by setting minimum standards for digital skills and promoting policies that enhance workforce qualifications. In conclusion, a holistic regulatory approach shaped by the principles of legal compliance, social inclusion, and economic sustainability will institutionalize digital transformation and enable the postal sector to evolve into a more competitive, resilient, and customer-centric structure.

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