MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE
STATE NON-COMMERCIAL COMPANY «STATE
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Air Transportation Management Department

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QUALIFICATION THESIS
(EXPLANATORY NOTES)

GRADUATE OF THE MASTER'S DEGREE

Theme: «Technology for servicing passengers on board aircraft»

Done by: Denys Volkov

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Kyiv 2025

МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ
ДЕРЖАВНЕ НЕКОМЕРЦІЙНЕ
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КВАЛІФІКАЦІЙНА РОБОТА
(ПОЯСНЮВАЛЬНА ЗАПИСКА)

ВИПУСКНИКА ОСВІТНЬОГО СТУПЕНЯ «МАГІСТР»

Тема: «Технологія обслуговування пасажирів на борту повітряних суден»

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Київ 2025

STATE NON-COMMERCIAL COMPANY «STATE UNIVERSITY «KYIV AVIATION INSTITUTE»

Faculty of Transport and Logistics
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Specialty 275 «Transport Technologies»
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Acting Head of the Department
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“______”_______________________2025

TASK

of completion the Qualification Thesis (Project)

Volkov Denys

1. The theme of the Qualification Thesis (Project) entitled «Technology for servicing passengers on board aircraft» was approved by a decree of the President of KAI order from 25.09.2025 №2045/st.
2. Term performance of thesis: from 29.09.2025 to 05.12.2025.
3. Initial data required for writing the Qualification Thesis: 29.09.2025
4. Content of the explanatory notes
5. List of mandatory graphic matters

1. Planning calendar

№	Assignment	Deadline for completion	Mark on completion
1.	Collection and processing of statistical data	2025	Done
2.	Writing and design of the theoretical part of the qualification work	2025	Done
5.	Writing and design of the analytical part of the qualification work	2025	Done
6.	Writing and design of the design part of the qualification work	2025	Done
7.	Writing of the introduction andsummary	2025	Done
8.	Execution of the explanatory note, graphic matters and the presentation	2025	Done

2. Consultants from individual sections

Section	Consultant (position, full name)	Date, signature	
		Issued the task	Accepted the task
1. Theoretical Part	Cand. Sci. (Tech.), Assoc. Prof. A.O. Antonova	2025	2025
2. Analytical Part	Cand. Sci. (Tech.), Assoc. Prof. A.O. Antonova	2025	2025
3. Design Part	Cand. Sci. (Tech.), Assoc. Prof. A.O. Antonova	2025	2025

3. Given date of the task: 25.09.2025.

Supervisor of the Qualification Thesis (Project):_______________ Antonova A.O.

(signature) (name, surname)

The task was accepted for completion:_______________ Volkov D.O.

(signature) (name, surname)

ABSTRACT

The explanatory notes to the qualification thesis on the theme: « Technology for servicing passengers on board aircraft » comprises of 109 pages, 2 tables, 2 figures and 60 references.

KEY WORDS: AIR PASSENGER TRANSPORTATION, COST MANAGEMENT, AIRLINE, PASSENGER HANDLING, AIRLINE CREW, COST MANAGEMENT, PASSENGER SERVICE, DIGITALIZATION.

The object of the study is passenger service technology on board civil aircraft..

The subject of the study is the process of implementing personalized and digitalized passenger service models in airlines.

The objective of the qualification thesis is to develop and scientifically justify an innovative model of personalized passenger service using dynamic digital profiles and to propose practical measures for its implementation in airlines.

The relevance of the qualification thesis lies in the necessity to improve passenger service efficiency, meet the expectations of digital-savvy customers, and strengthen competitive positions of airlines in the era of digital transformation.

In the theoretical part of the qualification thesis, the legal framework, international standards, and modern trends in passenger service technology were analyzed, revealing the need for proactive and customer-oriented service management.

In the analytical part of the qualification thesis , the operations and service technologies of Etihad Airways and Wizz Air were studied, identifying differences in business models, service challenges, and opportunities for digital personalization.

In the design part, an innovative model of personalized passenger service («Passenger 360») was developed, including its architecture, algorithms, implementation roadmap, and economic justification

The material base of this qualification thesis includes airline operational data, IT systems (booking, CRM, loyalty programs), industry reports (IATA, SITA, Boeing, Airbus), and academic literature on aviation service management and digital transformation.

LIST ABBREVIATIONS

AI – Artificial Intelligence

AOC – Air Operator Certificate

AR – Augmented Reality

BYOD – Bring Your Own Device

CASK – Cost per Available Seat Kilometer

CDP – Customer Data Platform

CRM – Customer Relationship Management

EASA – European Union Aviation Safety Agency

ESG – Environmental, Social, and Governance

FSC – Full Service Carrier

GDPR – General Data Protection Regulation

GDS – Global Distribution System

IATA – International Air Transport Association

ICAO – International Civil Aviation Organization

IFE – In-Flight Entertainment

IoT – Internet of Things

LCC – Low Cost Carrier

LTV – Lifetime Value

MCT – Minimum Connecting Time

NPS – Net Promoter Score

OTP – On-Time Performance

PIL – Passenger Information List

PLF – Passenger Load Factor

PNR – Passenger Name Record

POS – Point of Sale

PRM – Passengers with Reduced Mobility

PSS – Passenger Service System

SAF – Sustainable Aviation Fuel

SOP – Standard Operating Procedures

SPML – Special Meal

ULCC – Ultra-Low-Cost Carrier

UM – Unaccompanied Minor

VR – Virtual Reality

ПС – Aircraft

САП – Common Aviation Area (CAA)

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INTRODUCTION

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Standards Inspector	Yarotska T.R.						
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INTRODUCTION

Relevance of the Topic.

The global aviation industry is undergoing a profound transformation driven by shifting consumer priorities and the rapid development of digital technologies. Whereas ticket price or route network once served as the primary factors influencing passengers' choice of airline, today the focus has shifted toward the quality of the Passenger Experience and the level of onboard service. In the context of intense competition between Full Service Carriers (FSCs) and Low Cost Carriers (LCCs), the onboard service model has become a strategic tool that not only helps retain customers but also enables airlines to generate additional revenue.

Modern passengers expect a personalized approach regardless of their service class. However, existing technological procedures used by cabin crew often remain conservative and fail to fully leverage the capabilities of contemporary IT solutions. The absence of integrated systems that combine passenger data with real-time onboard service processes reduces crew efficiency and limits the potential to deliver a high-quality, tailored service experience.

A comparative analysis and adaptation of advanced service practices across airlines operating under different business models is becoming increasingly important. The experience of industry leaders such as Etihad Airways and Wizz Air illustrates diverse approaches to service organization, yet digitalization remains a unifying strategic priority for all. Exploring opportunities to enhance onboard service technology through the implementation of innovative tools is a highly relevant task, the solution of which will contribute to strengthening the competitive position of an airline.

Connection of the Work with Scientific Programs, Plans, and Topics.

This master’s thesis has been carried out in accordance with the research directions of the Department of Aviation Transportation Organization at the State University “Kyiv Aviation Institute” and aligns with the priorities for the development of Ukraine’s aviation transport system, particularly in terms of improving service quality and implementing advanced technologies.

Purpose and Objectives of the Study.

The purpose of this work is to develop theoretical foundations and practical recommendations for improving onboard passenger service technologies through the implementation of digital tools for personalization and optimization of crew–passenger interactions.

To achieve the stated goal, it is necessary to address the following **tasks**:

- Analyze the theoretical foundations and regulatory framework of passenger service processes;
- Investigate current trends in the digitalization of in-flight service in global aviation;
- Conduct a comparative analysis of service technologies in Full-Service (Etihad Airways) and Low-Cost (Wizz Air) airline models;
- Identify shortcomings in existing procedures and determine potential areas for optimization;
- Justify the feasibility of implementing an automated loyalty and onboard service management system;
- Develop a personalized service model using passengers' digital profiles;
- Assess the economic efficiency of the proposed improvement measures.

Research Object. The object of the study is the process of passenger service onboard aircraft of airlines operating under different business models.

Research Subject. The subject of the study is the methods, technologies, and tools for organizing in-flight service and improving passenger service quality in Wizz Air and Etihad Airways.

Research Methods. To achieve the stated objectives, a combination of methods was used in this study: analysis and synthesis (for reviewing regulatory frameworks and literature sources); comparative method (for comparing service standards of different airlines); systems approach (for considering service technology as a unified system); modeling method (for developing proposals for the implementation of new technologies); and economic calculation methods (for determining the efficiency of proposed project solutions).

Scientific Novelty of the Results. The scientific novelty of the obtained results lies in the development of theoretical and methodological foundations for the organization of passenger service in air transport, specifically:

- The approach to the technological interaction between "cabin crew – passenger" has been improved through the integration of digital communication channels directly during the flight;
- The concept of personalized service in the context of mass transportation has been further developed, allowing adaptation of service standards to individual passenger needs, even in the low-cost segment

Practical Significance of the Results. The recommendations proposed in this study for implementing a digital passenger experience management platform make it possible to optimize crew working time, enhance customer loyalty, and increase the volume of additional services offered onboard. The results of the research can be applied in the operational activities of airlines to modernize service standards.

Testing and Validation of the Results. The main provisions and results of the study were presented and discussed at scientific-practical conferences for graduate students and young researchers, dedicated to issues of aviation industry development and transport technologies.

Structure of the Work. The master's thesis consists of an introduction, three chapters (theoretical, analytical, and project sections), conclusions, and a list of references.

1. THEORETICAL PART

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1. THEORETICAL PART

1.1. Theoretical Foundations and Regulatory Framework of Passenger Service in Air Transport

The functioning of the modern global aviation transportation system represents a complex, multifaceted mechanism, the efficiency and reliability of which directly depend on the clear and systematic regulation of all technological processes. Among the full range of operational activities of an airline, the onboard passenger service process occupies a special, central role, as it integrates the technical, safety, legal, and service components of the transport service.

In contemporary professional literature, particularly in the fundamental works of leading domestic scholars—Professors D.O. Shevchuk, O.P. Harazhi, and H.M. Yun [32; 33; 34]—passenger service technology is understood not merely as a set of job instructions for staff, but as a systematic sequence of operations, precise action algorithms, and Standard Operating Procedures (SOPs) performed within the constraints of the confined, sealed cabin space and strictly limited time.

The primary goal of this process is to meet passengers' needs for safe transportation, while an imperative condition is the unconditional compliance with established international and national standards of aviation safety, flight regularity, and an adequate level of comfort.

The theoretical foundation of the passenger service process is based on a deep understanding of the dual nature of air transportation as a complex service. On one hand, it is a sophisticated engineering and technical process of physically moving material objects (people, baggage, cargo) through airspace, which is governed by the objective laws of aerodynamics, physics, navigation, and air traffic management. This aspect demands from aviation personnel a high level of discipline, mathematical precision in performing operations, and strict adherence to instructions.

On the other hand, it is a complex socio-psychological and economic process of interaction between the service provider (the airline, represented by its front-office staff—cabin crew) and the consumer (passenger), regulated by free market laws, service psychology, marketing strategies, and civil law norms. This is where the main dialectical conflict arises, which passenger service technology must resolve: how to effectively combine the rigid, non-negotiable safety requirements—where passengers must comply with crew instructions—with marketing-oriented customer focus, where the passenger is considered the primary business value, whose desires must be satisfied. Resolving this contradiction is possible only through the existence of a detailed, comprehensive, and harmonized regulatory framework that establishes clear boundaries of what is permissible and necessary for all participants in the transportation process.

The cornerstone and foundation of international air law is the Convention on International Civil Aviation, signed in Chicago on December 7, 1944 (the Chicago Convention) [11]. This historically significant document not only enshrined the principles of full and exclusive sovereignty of states over their airspace, but also established the institutional framework of the industry—the International Civil Aviation Organization (ICAO). The organization develops and implements Standards and Recommended Practices (SARPs), which are mandatory for incorporation into the national legislation of member states.

For passenger service technology, the 19 regulatory documents attached to the Convention, known as "Annexes," are of critical importance. Among them, Annex 9, "Facilitation," plays a particularly significant role in the context of service. It establishes global standards aimed at ensuring that administrative border-crossing procedures (customs, immigration, health) do not create unnecessary obstacles for passengers and do not delay aircraft departures.

For crew members, these standards translate into specific responsibilities: assisting passengers in completing immigration forms during the flight, providing comprehensive information on the health and quarantine requirements of the destination country, and properly handling special categories of passengers—specifically, inadmissible passengers. According to this Annex, the airline is obliged to accept such passengers back on board, and cabin crew must be familiar with the procedures for their service, supervision, and psychological support during the return flight, while ensuring the safety of other passengers.

An even more imperative and system-forming document is Annex 17, “Security”. This document establishes the absolute priority of aviation security over all other aspects of airline operations, including service and comfort. It obliges the carrier to develop and implement procedures that prevent weapons, explosives, and other dangerous items from being brought on board. In everyday passenger service technology, this is reflected in strict procedures: mandatory cabin inspections by the crew before passenger boarding (security search), continuous monitoring of carry-on luggage ownership, procedures for verifying that checked baggage belongs to passengers actually on board (baggage reconciliation), and absolute protection of the cockpit from unauthorized access during flight. O.M. Bilyakovych [37] emphasizes that modern cabin crew, while performing service functions, constantly carry out covert monitoring of the cabin (profiling) to identify potential threats, which is a direct requirement of Annex 17.

Issues of the carrier’s civil liability to passengers at the global level are governed by the Convention for the Unification of Certain Rules for International Carriage by Air (Montreal Convention, 1999) [10], which has been ratified by Ukraine and forms part of the national legal framework. The Convention established a modern two-tier system of liability for harm caused to passengers’ life and health. The first tier is strict liability (up to an amount equivalent to 128,821 Special Drawing Rights—SDR), which applies regardless of the airline’s fault if the incident occurs on board the aircraft or during boarding/disembarkation. This provision requires airlines to develop highly detailed safety instructions for cabin crew to minimize passenger injury risks: from securely locking food and beverage carts to prohibiting the direct handing of hot drinks to children.

The Convention also regulates liability for flight delays and baggage damage, obliging the crew to document such incidents on board and provide passengers with the appropriate forms to file claims (Property Irregularity Report), acting as the first link in the dispute resolution process.

At the regional level, considering Ukraine's strategic course toward European integration and the signing of the Common Aviation Area (CAA) Agreement with the EU, as well as the fact that the airlines under study (in particular Wizz Air) are European residents or operate flights to Europe (such as Etihad Airways), European Union law is critically important for shaping service standards. A central document in the field of passenger rights protection is Regulation (EC) No 261/2004 of the European Parliament and of the Council [12]. This legal act establishes clear and comprehensive passenger rights and carrier obligations in the event of denied boarding, flight cancellations, or long delays. According to this Regulation, after a certain duration of delay (e.g., 2 hours for flights up to 1500 km), passengers are unconditionally entitled to free meals and refreshments provided by the airline, as well as the right to make two telephone calls or send electronic messages. If the delay extends to the next day, the airline is obliged to provide accommodation and transfer. For cabin crew, this Regulation requires thorough knowledge of the procedures during tarmac delays: when to start distributing water, how to inform passengers of their rights, and how to document the provision of these services to avoid future legal claims and penalties.

Another important European regulation directly affecting passenger service technology is Regulation (EC) No 1107/2006 on the rights of persons with disabilities and persons with reduced mobility (PRM). This document prohibits any discrimination or refusal of carriage based on disability (except for technically justified safety requirements) and obliges airlines to provide such passengers with free assistance. This provision is directly implemented in service manuals: cabin crew must know the rules for safely seating such passengers in the cabin (categorical prohibition of seating near emergency exits), procedures for using a special on-board wheelchair to move to the lavatory, as well as ethical norms and psychological aspects of communication with passengers with special needs.

At the national level, the primary legislative act regulating the aviation industry in Ukraine is the Air Code of Ukraine (Law of Ukraine No. 3393-VI dated May 19, 2011) [1]. Article 100 of the Code establishes general requirements for the carriage of passengers and baggage, while Article 12 defines the legal status of aviation personnel, including cabin crew. An important aspect of national legislation is that the Code allows airlines to establish their own conditions of carriage, provided that they do not worsen the service standards established by state aviation regulations. This provision forms the legal basis for the operation of the low-cost model, where the base fare includes only the flight service, and all additional service elements (checked baggage, seat selection, in-flight meals) are offered for an extra fee at the passenger's discretion.

A detailed specification of the Air Code requirements is contained in a subordinate legal act — the "Rules for Air Transportation and Passenger and Baggage Service", approved by the State Aviation Administration of Ukraine on November 26, 2018, No. 1239 [4]. This document serves as a practical manual for the personnel of Ukrainian airlines. Chapter XI, "On-Board Service," defines the minimum set of mandatory services that an airline must provide regardless of its business model. These services include: informing passengers about flight conditions and rules of conduct, including mandatory demonstrations of emergency equipment use before takeoff; ensuring safety and order on board (the airline has the right to take action against passengers who pose a safety risk); providing first aid (availability of a medical kit and trained personnel); and meeting hygienic needs (functioning lavatories, providing water on demand).

A particularly important provision is that Rules No. 1239 (Section XI, Chapter 1, Clause 2) explicitly state: "The carrier may provide passengers with food and beverages if it is provided for in its rules." In other words, the provision of meals is not a state obligation but a commercial option of the airline. This fully legalizes Wizz Air's practice of offering paid menus (the Wizz Café concept) and allows Etihad Airways to provide premium complimentary meals as a competitive advantage in the premium segment, without violating any Ukrainian laws.

A separate block of national regulation concerns consumer rights protection. The Law of Ukraine "On Consumer Rights Protection" [3] applies to air transportation regarding the right to complete and accurate information as well as the right to proper service quality. If an airline, in its advertising materials or fare conditions, declares the availability of certain services (e.g., entertainment system, Wi-Fi, extra legroom), it is obliged to provide them. Malfunction of these systems or failure to provide the declared service constitutes grounds for a passenger claim regarding improper fulfillment of the carriage contract and the right to appropriate compensation.

In addition to national legislative acts, industry standards of the International Air Transport Association (IATA) play a significant role in regulating passenger service technology. Although IATA is a non-governmental organization, its standards are practically mandatory for member airlines (including Etihad Airways) and for those wishing to operate in the international market (such as Wizz Air, which complies with IOSA safety standards). The key document is the "Passenger Services Conference Resolutions Manual" (PSCRM) [15]. IATA resolutions unify technological procedures on a global scale, ensuring compatibility of processes among different carriers. They standardize electronic ticket formats, procedures for passenger data exchange (PNRGOV), baggage labeling standards, and—particularly important for service—the Special Service Request (SSR) codes. SSR codes are a universal language of communication between reservation systems and cabin crew. For example:

- VGML in the flight assignment is interpreted as a request for a vegan meal,
- WCHR indicates a passenger requires a wheelchair for movement to the aircraft door,
- UMNR denotes an unaccompanied minor.

Passenger service technology is built around correct interpretation and execution of these codes. An error in processing a code can have serious consequences for passenger health (e.g., allergic reaction) and for the airline's legal liability. Equally important are IATA standards for the carriage of dangerous goods by passengers (DGR — Dangerous Goods Regulations), which regulate the transportation of lithium batteries, electronic cigarettes, and other items that may pose a threat on board.

The theoretical understanding of passenger service organization requires the application of several conceptual scientific approaches, the synthesis of which allows forming a holistic picture of the process. The first approach is the logistical approach, thoroughly examined in the monographs of H.M. Yun and D.O. Shevchuk [38]. This approach considers passenger flow as a specific object of management within the logistics system of an airline and an airport. The main efficiency criteria here are time and throughput capacity. The service process is divided into elementary operations, each subject to strict timing and optimization. For low-cost carriers such as Wizz Air, this approach is dominant: minimizing boarding and deboarding time (to achieve an aircraft turnaround time of 25–30 minutes) increases the daily flight hours and reduces the cost per seat-kilometer. Within this approach, the service technology is maximally standardized and simplified (e.g., absence of seatback pockets to speed up cleaning, use of electronic boarding passes).

The second approach is marketing-oriented (service-oriented), which emphasizes the creation of a positive customer experience (CX). In this approach, service is viewed not as a production necessity but as a tool to create additional value and competitive advantage. Key interaction points, known as touchpoints, and critical situations, called moments of truth, are analyzed — these are pivotal moments when the customer forms an emotional impression of the company. For Etihad Airways, this approach is strategically important: substantial investments in staff training (e.g., training “flying nannies” for childcare or personal butlers in The Residence class) aim to create a deep emotional connection with the brand. Here, service quality is measured not by speed but by empathy, personalization, and anticipation of customer needs.

The third approach is qualitological, based on international quality management standards (ISO 9001 family, aviation standard AS 9100). O.P. Garazha in her research [36] proposes using the SERVQUAL model for a comprehensive assessment of aviation service quality. This model evaluates five dimensions of quality:

- Tangibles — appearance of the cabin, crew uniforms, quality of meals;
- Reliability — accurate fulfillment of promises regarding schedule and service;
- Responsiveness — readiness of staff to promptly assist passengers;
- Assurance — competence and the sense of safety conveyed by the crew;
- Empathy — individualized attention to the passenger.

Standardization of quality norms is ensured through internal airline documents — Service Manuals, which are mandatory for all personnel.

The fourth approach is the safety-oriented approach (Safety Management System – SMS). In modern aviation, service cannot exist separately from safety. The Flight Safety Management System (SMS), implementation of which is required by Annex 19 to the Chicago Convention and Article 10 of the Air Code of Ukraine [1], integrates all service procedures into the overall corporate risk management system.

Any new service procedure (e.g., serving hot meals on a new type of dishware) is first analyzed for potential risks (burns, injuries during turbulence, fire safety), and only after risk control measures are developed is it implemented in practice.

A particularly urgent challenge of modern regulatory oversight, given the total digitalization of the industry, is the protection of passenger personal data. During booking, check-in, and in-flight service, airlines accumulate vast amounts of sensitive passenger information forming a Passenger Name Record (PNR). This data includes itinerary, contacts, payment instruments, companions, and special dietary preferences (which may indirectly indicate religious beliefs or health conditions). The implementation of the EU General Data Protection Regulation (GDPR) [17] and the corresponding Law of Ukraine "On Personal Data Protection" impose strict limitations on the collection, processing, and use of this information.

The technology of personalized in-flight service, which involves flight attendants using tablets with passenger information (e.g., greeting a passenger on their birthday or offering a preferred drink based on previous orders), must be legally fully compliant. Crew members should have access only to the information necessary for performing their official duties (data minimization principle), and transferring data to personal devices of flight attendants is strictly prohibited and technically prevented. Airlines develop detailed privacy policies, which become an integral part of the carriage contract.

In summary, a comprehensive analysis of the theoretical foundations and regulatory framework indicates that passenger service in air transport is one of the most heavily regulated sectors of the global economy. The regulatory environment is harmonized and multi-tiered: Ukraine's national aviation regulations [4] are fully aligned with European Union regulations [12; 17] and the global standards of ICAO [11]. However, the pace of industry development often outstrips the legislative process. The emergence of new hybrid business models, the rapid implementation of digital technologies (biometrics, artificial intelligence), and changing passenger expectations require continuous adaptation and updating of airlines' internal standards.

The modern flight attendant operates within a highly complex legal and psychological environment, simultaneously assuming the roles of a strict safety inspector (ensuring unconditional compliance with rules), an empathetic psychologist (resolving conflicts and calming passengers), and an effective marketer (promoting goods and services). Each of these roles has a clearly defined regulatory basis. Understanding this intricate regulatory architecture is a necessary prerequisite for the development and implementation of any innovations in passenger service.

The introduction of new technologies, which is the subject of this master's research, cannot contravene the imperative requirements of safety and passenger rights protection. On the contrary, digital tools should enable airlines to fulfill their obligations more accurately, rapidly, and efficiently, in accordance with current legislation and the carriage contract. Therefore, in the following chapters, while analyzing the operational activities of Wizz Air and Etihad Airways, this study will examine in detail how these leading carriers implement the aforementioned theoretical principles and legal norms in their daily operations, ensuring a high level of service and safety.

1.2. Modern Trends in In-Flight Service Technologies and the Impact of Digitalization on the Aviation Industry

The global aviation industry, historically a driver of technological progress, is undergoing a period of fundamental, tectonic transformation in the third decade of the 21st century. Leading industry experts and scholars classify this stage as the transition to a new technological paradigm—the era of "Aviation 4.0." This phase of air transport evolution is characterized not merely by the isolated implementation of computer systems or automation of routine operations, but by a comprehensive, all-encompassing digitalization of all business processes, the creation of integrated digital ecosystems, and a radical shift in the very philosophy of interaction between airlines and passengers.

As noted in the authoritative industry report by SITA, Passenger IT Insights 2024 [26], 92% of airlines worldwide plan significant, strategic investments in comprehensive digital transformation programs over the next three years, with the absolute priority for top management being the radical improvement of the Passenger Experience (PX). The impact of digitalization on in-flight service technology is systemic, profound, and irreversible, as it transforms the role of cabin crew, shapes new customer expectations, and alters the economic model of flight operations, effectively converting a traditional transport service into an interactive digital platform, as confirmed by IATA studies [28].

One of the most revolutionary technological trends shaping the future of in-flight service is the full-scale implementation of the "Connected Aircraft" concept. For many decades of commercial aviation, aircraft in flight remained an informational "blind spot" for ground services: data exchange was limited to brief technical messages via ACARS for pilots and voice radio communications, while passengers and cabin crew remained in a complete information vacuum for hours.

Modern next-generation aircraft, such as the Airbus A350-1000 or Boeing 787 Dreamliner, which form the backbone of long-haul fleets of carriers like Etihad

Airways [22; 23], are equipped at the production stage with integrated high-speed satellite communication systems. The use of Ka-band, Ku-band, and L-band frequencies provides stable broadband access to the global Internet directly at cruising altitude, enabling the transmission of large volumes of data in real time. This technological achievement fundamentally transforms the architecture of in-flight service, turning the aircraft into an active node of the global information network, as detailed in Boeing’s analytical materials [30].

For passengers, the implementation of the “Connected Aircraft” concept ensures the continuity of their digital life and professional activities, which is a critical factor in today’s information society. The ability to work with cloud-based corporate services, promptly respond to emails, communicate via messengers, stream high-quality video, or even fully participate in video conferences on platforms such as Zoom or Teams at an altitude of 10,000 meters has shifted from a luxury to a basic functional requirement. This is particularly relevant for the high-margin segment of business travelers, for whom in-flight time is counted as work time with a high monetary value.

IATA’s Global Passenger Survey 2024 [29] convincingly shows that for 42% of surveyed passengers, the availability of high-quality and stable onboard Wi-Fi is a decisive factor in airline choice, surpassing even free meals or complimentary baggage allowances in importance. This trend forces even traditional low-cost carriers to reconsider their historically conservative cost-saving strategies. Whereas Wizz Air previously categorically refused to install satellite communication antennas on the fuselage due to their significant weight and negative aerodynamic impact—leading to increased fuel consumption and CO_2 emissions—according to its 2024 annual report [18], management is now actively exploring the implementation of new lightweight connectivity solutions. This initiative aims to enhance customer loyalty and generate additional revenue through the sale of internet access packages, as ignoring this passenger need risks competitive disadvantage in a market where connectivity is expected at all times.

For cabin crew, real-time aircraft connectivity opens unprecedented opportunities to improve service quality and promptly resolve in-flight issues. Flight attendants are equipped with specialized digital tablets (Crew Tablets) fully integrated with ground-based CRM systems, operations centers, and airline booking systems. This enables problem-solving on a "here and now" basis, rather than postponing actions until landing when negative impressions have already solidified. For example, in a typical scenario where a flight is delayed due to headwinds, adverse weather, or congestion at a hub airport, and a passenger risks missing a tight connection flight, a flight attendant can immediately check the real-time status of the next flight onboard.

Moreover, the system allows automatic rebooking of tickets for alternative flights, provides information about the new departure gate, or even issues electronic vouchers for hotel accommodation and meals if the connection is missed. Such a proactive crew approach, supported by digital tools, transforms a potentially negative experience of delay and stress into a vivid demonstration of care and professionalism. In service marketing, this phenomenon is known as the "Service Recovery Paradox", and as researchers Halpern and Graham [55] note, it can significantly increase customer loyalty to the airline brand, turning a critic into a promoter.

The next global megatrend is the deep, structural transformation of in-flight entertainment (IFE) systems. Traditional, bulky, and expensive systems with individual seatback screens (Seatback IFE), which dominated the market for the past two decades, are gradually evolving and, in the narrow-body regional travel segment, are effectively disappearing as a class. They are being replaced by a flexible, cost-effective, and technologically advanced BYOD (Bring Your Own Device) or Wireless IFE concept.

This technology involves deploying a high-speed onboard Wi-Fi network and a compact media server, through which entertainment content—including movies, TV shows, music, games, interactive 3D flight maps, and digital press—is streamed directly to passengers' personal smartphones, tablets, or laptops via a browser or a dedicated airline mobile app. The economic and operational rationale of this solution for airlines, especially those operating under a low-cost model like Wizz Air, is clear and indisputable.

Eliminating built-in screens, complex servers, individual control panels, and kilometers of copper wiring beneath the cabin lining reduces the aircraft's operating empty weight (OEW) by 500–700 kg. In the context of stringent efforts to reduce carbon footprint and save aviation fuel, this has a significant ecological and financial impact across an entire fleet, as highlighted in the Airbus Global Market Forecast [31]. Moreover, substantial costs associated with the regular maintenance of screens—often damaged due to vandalism or wear—and their expensive upgrades are entirely avoided, since passengers' personal devices are updated far more frequently than certified aviation equipment, which typically has a lifespan of 10–15 years.

From a psychological and hygienic perspective, modern passengers find it much more comfortable and safe to use their own devices with high-quality Retina displays, customized interfaces, and personal headphones than to touch often outdated resistive seatback screens used by hundreds of others before them.

At the same time, for premium network carriers such as Etihad Airways, the trend is toward a hybrid model: retaining large, high-quality 4K cabin screens while enabling full synchronization with passengers' personal devices. The "Second Screen" technology allows, for example, watching a blockbuster on the main screen while simultaneously viewing the flight map, reading news, or ordering drinks via a digital menu on a personal device, creating a multi-screen experience similar to that familiar at home [23].

A critically important strategic vector in the development of in-flight service technologies is the use of Big Data and Artificial Intelligence (AI) to achieve hyper-personalization of services. Airlines have historically possessed vast amounts of customer data: complete booking histories, seat preferences (window or aisle, front or rear of the cabin), special meal requests, records of complaints and call center interactions, loyalty program participation, and even social media behavior. However, for a long time, these valuable data sets remained a “dead weight” in disparate, technologically disconnected databases (data silos).

Digitalization enables the consolidation of this heterogeneous information into a unified cloud repository (Data Lake) and the creation of a single, dynamic Digital Passenger Profile, continuously updated in real time. Advanced machine learning and predictive analytics algorithms, as discussed by Gupta S. [58], analyze this profile and generate actionable recommendations for cabin crew. Before beginning service, a flight attendant can view not just the passenger's name at seat 14A but a rich contextual profile. For example, the system may indicate: “This is Mr. Petrenko, a platinum loyalty member who flies with us 10 times per year. Today is his birthday. On the last flight, his in-flight entertainment system malfunctioned, so we owe him an apology and a complimentary gesture. He typically prefers tomato juice without ice and vegetarian snacks.”

Armed with this information, the crew can provide service of a qualitatively higher level. Instead of a standard, impersonal question such as, “What would you like to drink?”, the attendant can address the passenger personally, offer birthday greetings, and serve the preferred beverage. Empirical research by Agarwal I. and Gowda K. R. [42] demonstrates that such personalized attention significantly increases the Net Promoter Score (NPS) by 15–20 points and substantially raises the likelihood of repeat ticket purchases from the same airline, even if the price is slightly higher than competitors. This confirms that, in the era of the digital economy, data has become the “new oil” for the aviation business.

The Internet of Things (IoT) is increasingly and pervasively entering the physical space of the aircraft cabin, transforming it into a Smart Cabin. This technology involves equipping almost every element of the interior with sensors that continuously exchange data with each other and the central control system. First, this applies to Smart Seats, as noted by Bogicevic V. and Yang W. [47]. Prototypes of business and first-class seats with embedded biometric sensors are already in development and undergoing certification. These sensors can continuously monitor passengers' physical condition: body temperature, heart rate, blood oxygenation, hydration level, and even external indicators of stress or fatigue. Based on these biometric data, the system can automatically adjust the environment to improve passenger comfort: subtly altering seatback recline to relieve spinal pressure, adjusting the stiffness of pneumatic cushions, modifying the intensity and spectral composition of individual lighting (circadian lighting to combat jet lag), or suggesting a glass of water via a discreet notification on the personal screen.

Second, IoT is revolutionizing in-flight kitchens and catering organization (Smart Galleys). Intelligent trolleys and food containers are equipped with passive RFID tags or load-cell sensors. This allows the onboard system to instantly inventory food, beverages, and duty-free items without any manual intervention. The flight computer knows, in real time, exactly how many portions of chicken, bottles of wine, or perfume vials remain at every second of the flight. This technological solution addresses the perennial issues of human error and inaccurate catering loading, significantly reducing crew workload (eliminating manual paper-based stock counts) and enabling the advanced concept of dynamic load management for return flights, which minimizes food waste and optimizes operational costs for the airline [53].

Another powerful commercial trend is the full automation and digitalization of in-flight retail (In-Flight Retail). This aspect is particularly critical for low-cost carriers such as Wizz Air, whose business model relies on aggressive maximization of ancillary revenue to offset low ticket fares. The traditional "voice-based" sales model, using paper catalogs that quickly wear out and become outdated, along with cumbersome trolleys moving slowly down the aisle, blocking passenger flow and causing inconvenience, is inefficient, slow, and outdated.

Modern digital technologies enable a shift to pre-order models and interactive digital ordering. Passengers can select and pay for meals, beverages, or duty-free items from the Sky Shop catalog at home, 24–48 hours before departure, via the airline's mobile app, or directly onboard by connecting to the aircraft's internal Wi-Fi portal through their smartphone. This ensures the availability of the desired product (eliminating disappointment from the common phrase "sorry, we ran out of sandwiches") and significantly accelerates the service process, as crew members simply deliver the pre-paid order directly to the passenger.

For onboard payment processing, flight attendants use modern mobile POS terminals (mPOS), often integrated into their work smartphones or tablets. These devices support all forms of contactless payment (NFC cards, Apple Pay, Google Pay, smartwatches), which is the most hygienic, secure, and rapid method of transaction in compliance with post-pandemic safety standards. Furthermore, digitalization allows airline marketers, as noted by Florido-Benítez [56], to implement real-time dynamic pricing strategies: if the analytics system detects a surplus of sandwiches nearing expiration and only 40 minutes remain before boarding, it can automatically send push notifications to passengers' phones offering a 50% discount ("Happy Hour"). This helps efficiently sell remaining stock, reduce write-offs, and increase total flight revenue.

Biometric technologies, which have become standard in airports over recent years (automated passport control via e-gates, boarding using Face ID within the IATA One ID initiative [28]), are now being actively considered as a tool for enhancing in-flight service. A promising direction is the use of facial biometrics for payment authorization ("Smile to Pay"). This eliminates the need to retrieve a wallet, card, or phone from carry-on luggage, which is particularly convenient in the confined space of economy-class seating. Biometric systems can also be effectively used for automated, error-free age verification when ordering alcoholic beverages, removing responsibility from the flight attendant, speeding up service, and preventing potential conflicts with underage passengers lacking identification. The implementation of such systems requires careful compliance with data protection legislation, particularly GDPR [17], as emphasized by cybersecurity experts.

A separate yet highly significant aspect of digitalization is its environmental dimension. Sustainability today is not merely a corporate trend but a strict imperative for the survival of the aviation industry under pressure from environmental regulators and public opinion (the phenomenon of flight shame). Digital technologies help make air travel more eco-friendly and responsible, as analyzed in detail by Ricci P. [59]. The complete elimination of paper documentation onboard has already become a reality for leading airlines. Electronic Flight Bags (EFBs) for pilots and digital manuals (e-Manuals) for cabin crew have fully replaced tens of kilograms of heavy paper charts and instruction booklets. This not only helps preserve forests but also significantly reduces the operating empty weight (OEW) of each aircraft, saving thousands of tons of aviation fuel annually across the fleet and reducing CO_2 emissions.

Furthermore, AI-based predictive analytics allows airlines to accurately calculate the required quantities of meals, beverages, and water for each specific flight, taking into account the time of day, day of the week, passenger demographics, and historical consumption data for the route. This prevents overloading the aircraft with excess provisions that would inevitably be wasted. According to the Wizz Air Sustainability Report 2023 [19], the implementation of AI-driven catering planning algorithms enabled the airline to reduce food waste by an impressive 18% within a year, contributing significantly to both ecological goals and operational cost optimization.

Changes have also affected the professional training and development of personnel. Virtual Reality (VR) and Augmented Reality (AR) technologies are actively integrated into training centers of leading airlines. Instead of costly, resource-intensive exercises on physical aircraft mock-ups, cabin crew can practice complex service procedures and emergency evacuations in VR headsets, fully immersing themselves in a virtual environment. This allows realistic simulation of even the most challenging scenarios (cabin fires, depressurization at altitude, aggressive or disruptive passengers) in a completely safe environment, building durable muscle memory and psychological resilience to stress. AR headsets can be used by instructors to overlay digital prompts and real-time evaluations during practical training. This enhances the quality and standardization of training and ensures that personnel are confident in using state-of-the-art onboard technologies, as noted by Meyer J. [57].

However, digital transformation brings not only obvious benefits but also new, serious challenges and risks, which must be carefully considered when designing and implementing onboard service technologies. The first and foremost challenge is cybersecurity. Transforming an aircraft into a fully connected digital entity exposes it to potential cyberattacks. Unauthorized access to the inflight entertainment system, leakage of VIP passenger data, or—worst-case scenario—interference with critical flight control systems via vulnerabilities in public Wi-Fi networks, represent real threats, not hypothetical ones. Consequently, airlines must invest heavily in layered cybersecurity systems, data encryption, and continuous threat monitoring. Cabin crew must be aware of basic cyber hygiene and know the procedures to follow if suspicious activity is detected onboard.

The second challenge is the social dimension of the “digital divide”. Not all passenger categories are willing, able, or willing to use exclusively digital interfaces. Elderly passengers, those with visual or hearing impairments, or individuals who deliberately avoid smartphones may feel discriminated against or excluded if an airline fully transitions to app-only service ordering. Therefore, the “high-tech, high-touch" concept described by He Z. [43] remains highly relevant. Technology should be viewed solely as a tool that assists cabin crew, freeing them from routine mechanical tasks (form-filling, cash handling, inventory management) so they can dedicate more quality time to live, empathetic interaction with passengers who need it. Human factors—a warm smile, genuine care, and eye contact—remain the only unique elements of service that cannot be digitized or replaced by an algorithm.

Scholars also emphasize the transformation of organizational culture and staff competencies in the context of Aviation 4.0. As noted in the studies of G.M. Yun and O.E. Sokolova [38; 40], the professional profile of cabin crew is undergoing substantial changes. In addition to traditional hard skills (safety, service, first aid) and soft skills (communication, stress resilience, foreign languages), modern flight attendants must possess a high level of digital literacy. They are expected to confidently use sophisticated professional tablets, troubleshoot typical passenger Wi-Fi connectivity issues, understand the principles of contactless payment systems, and interpret and analyze data within CRM platforms. This requires a comprehensive revision of recruitment programs, onboarding, and periodic staff training.

Another promising aspect is the use of wearable devices for crew members. Smartwatches or specialized wristbands integrated into the call system can vibrate to notify a flight attendant of a passenger request from a specific seat, replacing loud chimes that disturb the entire cabin, especially during night flights. This enables a more discreet, quiet, and comfortable service experience. These wearables can also passively monitor the crew member's physical fatigue and stress levels, alerting supervisors when a short break is necessary, thereby directly contributing to flight safety within the framework of a Fatigue Risk Management System (FRMS).

An analysis of strategies employed by leading market players reveals significant differences in philosophy and approach to digitalization. Traditional airlines, such as Etihad Airways, leverage technology primarily to enhance exclusivity and personalization. Examples include the use of VR headsets in premium lounges for virtual tours of aircraft cabins prior to purchasing an upgrade (upsell), or providing access to exclusive premium content onboard, such as live sports broadcasts or newly released films [23]. In contrast, low-cost carriers, such as Wizz Air, use technology mainly for comprehensive automation (self-service), process acceleration, and operational cost reduction. AI-based chatbots (e.g., the virtual assistant Amelia at Wizz Air) replace expensive call centers with live operators, while automated check-in and self-bag drop systems reduce the need for airport agents [20].

Nevertheless, a shared strategic objective across both models is the creation of a seamless travel experience, where transitions between stages of the journey (home → taxi → airport → aircraft → transfer → hotel) occur invisibly to the passenger, and all necessary information, documents, and services are accessible within a single mobile application.

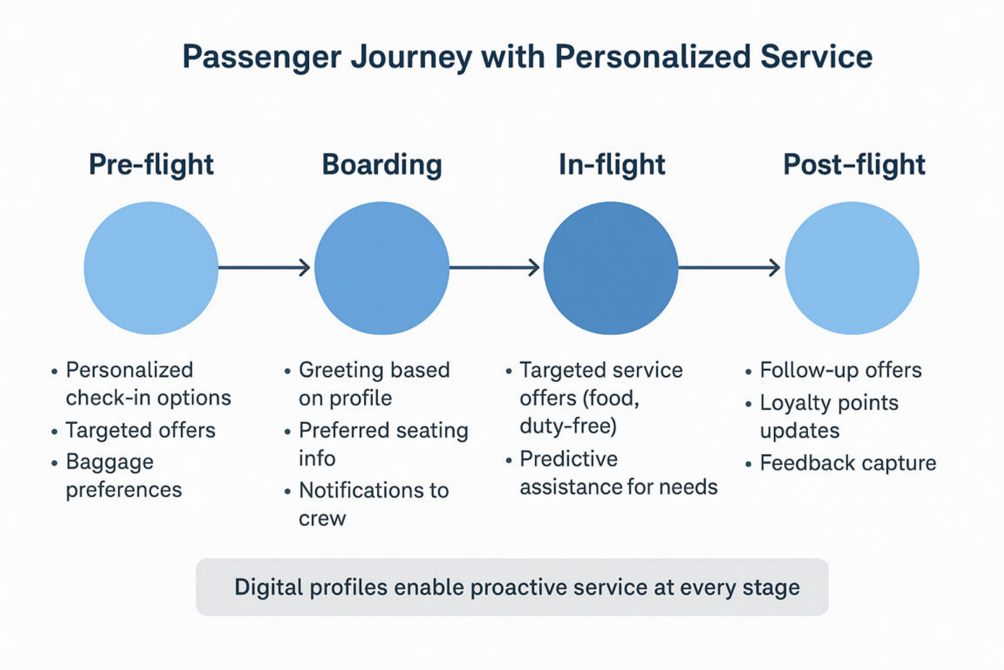

Fig 3.2. Passenger Journey

Thus, digitalization acts as a powerful catalyst for profound, tectonic changes in the technology of in-flight service. It transforms an isolated, analog service process—previously technologically disconnected from the ground—into a fully integrated component of a unified digital travel ecosystem. For airlines, this opens up vast, previously inaccessible opportunities to enhance operational efficiency, radically reduce costs, and generate new high-margin revenue streams. For passengers, it provides a fundamentally new level of comfort, control over their journey, and service personalization. However, the success of this large-scale transformation depends not only on the volume of investments in hardware and software but, above all, on the management's ability to reengineer outdated business processes and mentally prepare personnel to operate in new digital realities. Airlines that achieve an optimal balance between cold digital efficiency and warm human empathy will gain a decisive strategic advantage in the global aviation market of the future. A detailed study of these processes in the cases of Wizz Air and Etihad Airways in the following sections will allow the formulation of practical recommendations for the effective implementation of innovative service technologies in airline operations.

1.3. Features of Passenger Service Organization in Full-Service and Low-Cost Airline Business Models

The modern architecture of the global air transport market is characterized by a deep structural dichotomy, expressed in the coexistence and intense competition of two dominant business models: Full-Service Carriers (FSCs) and Low-Cost Carriers (LCCs). This economic dualism shapes not only pricing strategies and route networks but also fundamentally different approaches to in-flight passenger service technology. As highlighted in seminal works on aviation economics by V. Bilotkach [49, p. 45] and J. Wensveen [52, p. 112], service technology is a derivative of the chosen business model, as the level of service either functions as a tool for value creation (in the classical model) or as an object of cost minimization (in the low-cost model). Understanding these differences is critical for analyzing the operational practices of airlines with contrasting philosophies, such as Etihad Airways and Wizz Air.

The classical airline model, exemplified by the UAE national carrier Etihad Airways, is based on the “bundled product” concept. In this paradigm, the airline does not merely sell a seat from point A to point B; it offers a comprehensive transport solution, including a wide range of service components: checked baggage, in-flight catering, seat selection, access to entertainment systems, frequent flyer miles accrual, and flexible rebooking options. Service technology in FSCs is oriented towards maximizing passenger comfort at all stages of the journey, which requires complex logistics solutions and highly skilled personnel.

Category / Feature	Wizz Air	Etihad Airways
Business model / positioning	Low-cost / budget carrier — minimal base service, many add-ons	Full-service airline — more comprehensive service inclued
Baggage / Hand-luggage allowance (economy / standard fare)	Free: one small carry-on bag (max – 40 × 30 × 20 cm. ≤ 10 kg).´ With paid upgrade (eg. “WIZZ Prór-rity” or fare bundle) — can bring additional cabin bag (55 × 40 × 23.cm ≤ 10 kg)	Complimentary baggage allowances typical on long haul flights, economy (and pod cabin-service event ments
On-board service (meals / refreshments/ amenities)	Basic — food & drinks typically not included, passengers pay extra. Many amenities are optional / paaid	Inclusive/ comprenhensive — on long-haul flights economy (and above) gets meals/snacks
On-board comfort (seat, entertainment, extras)	Basic seats, minimal extras: fewer frills, comfort limited (stanoora) reviews often menton trade-offs	Higher quality of comfort, regular seat comforts, often more leg-room or adjustable seats ('long
Service / Customer care / flexibility	Very cost-focused, many extras (most extras (baggage, seat selection, priority, etc.) are add-ons or	Usually higher level of service with more included, staff ten-densto practice more useress

Fig. 1.3. Key aspects of service

A key feature of service technology in classical airlines is the highly differentiated service by class. For instance, Etihad Airways offers a unique class structure beyond the standard Economy and Business classes, operating First Class and the exclusive “The Residence” product (a three-room suite on the Airbus A380 with a personal butler). According to the Etihad Aviation Group Annual Report [22, p. 18], detailed Service Flows are developed for each class, differing not only in service assortment but also in communication protocols, timing standards, and even the number of crew members involved. While one flight attendant serves on average

40–50 passengers in Economy, the ratio in Business is 1:10–12, and in First Class, it is 1:3–4, enabling a truly individualized approach.

In-flight Catering in the full-service model is a complex production and logistics process. Unlike low-cost carriers, where the assortment is limited to long-shelf-life products, FSCs provide passengers with hot meals prepared in specialized catering facilities (e.g., Do & Co, LSG Sky Chefs) immediately prior to the flight. The crew's operational procedures include complex processes for receiving meals on board (verifying quantity, quality, and compliance with special meal requests — SPML), heating dishes in convection ovens under strict temperature control, table setting (premium classes use porcelain, glass, and metal cutlery), and staged service (aperitif, appetizer, main course, dessert). To implement this process on long-haul aircraft, Etihad Airways is equipped with fully functional galleys featuring espresso machines, toasters, and refrigerators. Flight attendants undergo specialized training in sommelier basics and fine dining service, as confirmed by the company's internal standards [25, p. 8].

An important element of classical service technology is the presence of In-Flight Entertainment (IFE) systems. On Etihad aircraft, each seat, including Economy, is equipped with an individual touchscreen offering access to hundreds of films, games, and TV programs via E-BOX. From a technological standpoint, this imposes additional responsibilities on the crew, including distributing headphones before takeoff and collecting them before landing, assisting passengers with system usage, and rebooting equipment in case of malfunctions. The availability of IFE is a critical factor for passenger comfort on long-haul operations, which form the backbone of network carriers' business.

The philosophy of the low-cost business model (LCC) is fundamentally different, as exemplified by the Hungarian airline Wizz Air. The economic essence of this model lies in total cost minimization (cost leadership) to offer the lowest possible fares. This is achieved through the "unbundled product" concept, where the base ticket price covers only the transportation itself, and any other services are considered ancillary services, provided for an additional fee. As noted by V.V. Lysenko [54, p. 115], this model fundamentally transforms the crew's operational procedures and the logic of in-flight service.

The first technological feature of the low-cost model is the use of a high-density passenger cabin configuration and the absence of service class divisions. On Wizz Air aircraft (Airbus A320/A321), only Economy is installed with a seat pitch of 28–29 inches, and seatbacks often do not recline. This simplifies the service procedure, as standards are uniform for all passengers, and crew members do not need to adapt service to different customer categories on the same flight. At the same time, this density requires flight attendants to work at high speed and efficiently manage a large flow of passengers in a confined space.

A fundamental feature of LCC service technology is the organization of in-flight catering according to the "Buy-on-Board" principle. Meals are not loaded individually for each passenger. Instead, the aircraft is stocked with a standard assortment of sandwiches, snacks, and beverages (Wizz Café), as well as duty-free products (Wizz Boutique). In this model, the flight attendant effectively transforms from a traditional server into a sales manager. The primary goal of service is not merely to feed passengers but to maximize revenue per flight. Crew efficiency is evaluated based on the spend per head, and flight attendants receive commissions on sales, providing a strong financial incentive. This requires the crew to possess skills in active selling, merchandising (correctly arranging products on the trolley), and handling POS payment terminals. According to the Wizz Air Annual Report [18, p. 42], revenue from ancillary services accounts for almost half of the company's total revenue, highlighting the critical importance of this operational stage.

Another critical factor in LCC technology is the aircraft turnaround time. To achieve high fleet utilization (12–13 flight hours per day), Wizz Air aims to limit ground time between flights to 25–35 minutes. This imposes extreme demands on crew performance. Within this brief period, flight attendants must not only disembark passengers from the previous flight and board new ones, but also complete security procedures and, importantly, tidy the cabin themselves. In low-cost models, airlines often forgo the services of cleaning companies at transit stops to save costs, placing the responsibility for garbage collection and resetting seat belts on the cabin crew. This significantly intensifies the workload of flight attendants compared to full-service carriers, where ground staff handle cleaning.

An important component of LCC technology is strict enforcement of cabin baggage rules. Since baggage is a significant source of revenue, Wizz Air's policy regarding bag dimensions is highly stringent. Enforcement occurs not only at the check-in desk but also at the gate and inside the cabin. Flight attendants must ensure that passengers without priority boarding place their items under the seat in front, freeing overhead bins for those who have paid for the service. This often becomes a source of conflict situations, requiring crew members to demonstrate stress tolerance and diplomacy [54, p. 116].

Comparative analysis also reveals substantial differences in the use of airport infrastructure, which impacts service technology. Full-service carriers, such as Etihad, utilize jet bridges, ensuring comfortable and safe boarding in all weather conditions. Low-cost carriers, seeking cost savings, more frequently use remote stands with bus or walking boarding, complicating crew operations as they must monitor passenger movement on the apron (for safety) and work under temperature variations at open doors.

However, as noted by researcher M. Kukukoner [55, p. 52], in recent years there has been a clear trend toward business model convergence, often referred to as "hybridization." On the one hand, full-service airlines, attempting to compete on price, have introduced "Light" fares on short- and medium-haul flights (without baggage and seat selection) and have moved to paid catering in Economy class (e.g., British Airways, Lufthansa on European routes). On the other hand, low-cost carriers aim to attract more affluent and business passengers by introducing service packages that approximate the comfort level of traditional carriers. Wizz Air offers the “Wizz Plus” fare, which includes priority boarding, larger hand luggage, checked baggage, and free seat selection (including extra legroom seats). This complicates the crew’s operational procedures in LCCs, as they now must identify passengers with different service entitlements and provide the corresponding service (for example, not reassigning passengers to paid seats if they have not purchased them).

Digitalization is implemented differently across the technological processes of different airline business models. For Wizz Air, digital technologies primarily serve as a tool for automation and self-service, reducing the need for personnel. Online check-in is mandatory (otherwise, a substantial fee is charged at the airport), and boarding passes are issued via the mobile application. This shifts the focus of ground staff from routine registration to document control (Visa Check) and handling non-standard situations.

For Etihad Airways, digitalization functions as a tool for personalization. The use of tablets with CRM data allows the crew to access passenger status, flight history, and preferences, creating an atmosphere of exclusivity and care (High-touch service).

It is important to separately consider aviation safety aspects. Despite fundamental differences in service, technological safety procedures are identical across both models, as they are regulated by unified international standards (ICAO, EASA) and national legislation [1; 2]. Pre-flight briefings (Safety Demo), cabin inspections for foreign objects, seatbelt compliance, and emergency procedures are conducted according to the same protocols in both Etihad and Wizz Air. O.M. Bilyakovich emphasizes in his handbook [37, p. 88] that compromises on safety are unacceptable for any business model. However, the higher workload intensity in LCCs (up to four flight legs per day) introduces additional crew fatigue risks, requiring airlines to implement effective Fatigue Risk Management Systems (FRMS).

The organizational structure of cabin crew management also reflects the differences between models. In network carriers, the structure is hierarchical, with a multi-level grading system (trainee, economy-class flight attendant, business-class attendant, first-class attendant, senior attendant, instructor, standards manager). Career advancement is slow and depends largely on years of service. In contrast, LCCs have a flatter structure, allowing for rapid career growth (one can become a senior flight attendant within 1–2 years if leadership qualities are demonstrated), but staff turnover is significantly higher due to intense workload and rigid schedules.

Cultural context also influences service technology. Etihad Airways, based in Abu Dhabi, integrates elements of Arab hospitality into its service standards: greetings such as “Marhaba”, serving Arabic coffee and dates, and particular attention to families with children. This requires Etihad’s multicultural crew to possess a deep understanding of cultural codes and adhere to strict etiquette. Wizz Air, as a pan-European airline with Central European roots, emphasizes a more democratic, dynamic, and youth-oriented style of communication. Grooming standards in full-service carriers tend to be more conservative and strict, whereas in LCCs there is greater flexibility (for example, Wizz Air allows tattoos if they are not on the face and permits more colorful makeup), aligning with the values of their target audience.

Handling of transfer passengers represents a distinct aspect of service technology. For Etihad Airways, which operates under a hub-and-spoke model, servicing transfer passengers is critically important. The service technology includes providing information about connecting flights onboard, issuing vouchers for transit hotels in case of long layovers, and enabling through-checking of baggage. Cabin crew must be knowledgeable about the infrastructure of the home airport (Abu Dhabi) to guide passengers effectively.

In contrast, Wizz Air operates under a point-to-point model and generally does not guarantee connections (except for certain services like Wizz Air Mix, which are managed via third-party partners). Consequently, Wizz Air cabin crew are not responsible for passengers’ onward journeys or baggage, simplifying the technological process but transferring risk to the passenger.

In summary, the service technology in full-service carriers (Etihad Airways) is resource-intensive, highly personalized, and focused on creating an exceptional experience, where every passenger interaction aims to exceed expectations. Meanwhile, the service technology in low-cost carriers (Wizz Air) is process-optimized, high-intensity, standardized, and commercially oriented, where the main objective is the safe and timely transport from point A to point B at minimal cost.

Under the influence of competition and digitalization, there is a growing mutual convergence of models: FSCs adopt efficiency measures from LCCs, while LCCs gradually enhance service to attract a wider audience. This hybridization sets new industry standards, requiring transportation management professionals to be flexible and capable of adapting technological processes to current market conditions. A detailed analysis of operational metrics and implementation specifics of these technologies in selected airlines will be presented in the second chapter of the master’s thesis.

Conclusions to the Theoretical Section

The first chapter of the master’s thesis provides a comprehensive and systematic analysis of the theoretical and methodological foundations, as well as the regulatory framework, governing passenger service in modern air transport. The research demonstrates that service technology constitutes a complex, multi-layered system operating at the intersection of rigorous engineering and aviation safety requirements and flexible, customer-oriented service management principles.

The theoretical foundation of service organization is based on understanding the dual nature of the aviation service, which combines a tangible transportation process with an intangible social interaction process. It is established that the effectiveness of this system depends on harmonizing regulatory requirements at four levels: global (ICAO standards), regional (EU regulations), national (Ukrainian legislation), and corporate. Analysis of key regulatory acts, including Annexes to the Chicago Convention, the Montreal Convention, and the Air Code of Ukraine, confirms that the national legal framework is fully aligned with international standards, providing the necessary foundation for integrating Ukrainian carriers into the global market.

At the same time, it was noted that the pace of technological development in the aviation industry significantly exceeds the rate of legislative updates, necessitating airlines to develop internal standards regulating the use of innovative digital tools.

A thorough analysis of contemporary trends in the aviation industry has demonstrated that the sector is undergoing a transition towards the "Aviation 4.0" paradigm, where digitalization is not an auxiliary factor but a determinant of competitiveness. The study established that the implementation of the "Connected Aircraft" concept, the use of big data for service personalization, and the automation of processes through the Internet of Things and biometric technologies are fundamentally reshaping the architecture of passenger service.

These technologies are transforming the role of the cabin crew from routine task executors into managers of the passenger experience, equipped with tools for real-time decision-making. Particular attention in the research was given to a comparative analysis of service technologies in airlines following different business models. It was found that the full-service model, represented by Etihad Airways, focuses on creating added value through service complexity, class differentiation, and emotional engagement of personnel. In contrast, the low-cost model, represented by Wizz Air, relies on process standardization, minimization of service time, and maximization of ancillary revenue.

However, the study identified a clear trend towards convergence of these models, where digital tools become a universal means of enhancing efficiency for both types of carriers. The results of this theoretical synthesis provide a solid scientific foundation for subsequent practical analysis of the selected airlines' operations and the development of project solutions aimed at improving their service technologies.

2. ANALYTICAL PART

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2. ANALYTICAL PART

2.1. General Characteristics and Analysis of the Operational and Economic Activities of Wizz Air and Etihad Airways

A comprehensive and in-depth study of passenger service technologies at the current stage of aviation development is impossible without a thorough systemic analysis of the operational and economic environment in which airlines function. The choice of Wizz Air and Etihad Airways as the subjects of this master's research is deliberate and methodologically justified, as these carriers represent two diametrically opposite, polar business models in contemporary global civil aviation — the European ultra-low-cost carrier (Ultra-Low-Cost Carrier — ULCC) and the Middle Eastern full-service network airline (Full Service Network Carrier — FSNC). Comparative analysis of their operations, strategic priorities, and key performance indicators enables the identification of how market positioning, current financial status, operational model, and corporate culture influence the formation of passenger service technologies and determine the vectors for innovation implementation.

Etihad Airways, founded by royal decree (Emiri) in July 2003, is the national carrier of the United Arab Emirates, with its headquarters and main hub located at the state-of-the-art Zayed International Airport (AUH) in Abu Dhabi. From its inception, the airline has positioned itself not merely as a commercial transport enterprise, but as a key strategic instrument in implementing the "Abu Dhabi Economic Vision 2030" — a state program aimed at radically diversifying the emirate's economy, reducing dependence on the oil and gas sector, and transforming Abu Dhabi into a global hub for elite tourism, international trade, culture, and aviation logistics. As noted by V. Bilotkach [49, p. 112], such airlines are often referred to as "superconnectors", as their business model is built on capturing global transit flows between the West and the East.

An analysis of the Etihad Aviation Group's 2023 financial statements [22, p. 4] indicates the successful and timely completion of an extensive five-year business transformation program, urgently initiated by new top management following a severe financial and operational crisis in 2016–2017. Whereas the previous decade's strategy was based on aggressive, extensive inorganic growth through the acquisition of minority stakes in loss-making European and Asian airlines (the so-called equity alliance strategy, including high-risk investments in Alitalia, Air Berlin, Jet Airways, and Virgin Australia), the current development phase is characterized by a rigorous, pragmatic focus on operational efficiency of the airline's core operations, complete divestment of toxic loss-making assets, and a shift towards sustainable, organic network growth.

For the 2023 financial year, Etihad Airways demonstrated a significant qualitative improvement across all key performance indicators, indicating the correctness and timeliness of its chosen course of recovery. The airline's total revenue amounted to AED 20.3 billion (approximately USD 5.5 billion), while operating profit reached a seven-year high of AED 1.4 billion (USD 394 million), confirming the success of the strategy focused on strict cost optimization while maintaining—and even enhancing—the premium level of service [22, p. 12]. The airline's passenger traffic increased by an impressive 40% compared to the previous year, reaching 14 million passengers, and the Passenger Load Factor (PLF) stood at 86%, one of the highest among network carriers operating primarily long-haul widebody fleets, which traditionally achieve lower PLF than low-cost carriers.

A strategic cornerstone of Etihad's business model is the efficient, maximized utilization of Abu Dhabi's unique geographic position as a natural transit hub connecting densely populated markets in Europe, Asia, Africa, and Australia. According to IATA [28, p. 45], approximately 65% of Etihad's passengers are transfer passengers, using Abu Dhabi Airport solely for connections without entering the city. This imposes specific, heightened technological requirements on service organization, including the need to guarantee minimum connecting times

(MCTs), ensure reliable and rapid interline baggage handling, and provide high-quality hotel services or access to comfortable lounges during extended layovers. The quality of transit-zone service often becomes a decisive factor for passengers when choosing an airline for long-haul travel, such as from London to Sydney.

Etihad Airways' fleet is among the youngest, most technologically advanced, and environmentally efficient in the world, directly impacting the airline's ability to implement advanced digital services on board and reduce unit operational costs. As of early 2024, the fleet comprises over 85 aircraft, primarily long-haul next-generation aircraft: Boeing 787 Dreamliner (-9 and -10 variants) and Airbus A350-1000. The choice of these aircraft types is the result of careful techno-economic analysis: the extensive use of composite materials in fuselage and wing structures, combined with modern engines (GEnx, Trent XWB), reduces fuel consumption and CO_2 emissions per passenger-kilometer by 20–25% compared to previous-generation aircraft such as the Boeing 777 or Airbus A330, a critical factor for competitiveness amid volatile global aviation fuel prices [30].

Additionally, these aircraft are factory-equipped with modern environmental control systems, maintaining higher cabin pressure (equivalent to lower altitude), optimal humidity, and clean air via HEPA filters, which has been shown to reduce passenger fatigue and jet lag. They are also fitted with Panasonic eX3 IFE systems and high-speed satellite connectivity, providing the hardware platform necessary for full implementation of the Connected Aircraft concept, as highlighted in the SITA report [24, p. 15].

A key image-building and operational event in 2023 was the return of four Airbus A380 double-decker aircraft to commercial service, deployed on major, high-demand premium routes to London Heathrow and New York JFK. The A380 features unique, exclusive products unavailable from competitors, such as the three-room "The Residence" with a private bedroom, living room, and shower, and the separate "First Apartments", enabling Etihad to maintain undisputed leadership in the luxury travel segment and establish a sustainable reputation as a world-class boutique airline setting new standards for in-flight luxury [23, p. 30].

At the other end of the European and global aviation market spectrum is Wizz Air — the largest and most dynamic low-cost group in Central and Eastern Europe. Founded in 2003 by a group of professionals led by József Váradi, the airline has rapidly evolved from a small local carrier into a pan-European giant, with shares listed on the prestigious London Stock Exchange (FTSE 250 Index). Wizz Air’s business model is classified by industry experts as Ultra-Low-Cost Carrier (ULCC), which emphasizes not just cost-saving, but extreme attention to controlling and minimizing expenses at every stage of the operational chain.

According to the official annual report of Wizz Air Holdings Plc for the 2024 financial year [18, p. 2], the airline continues to demonstrate phenomenal recovery and growth, transporting a record 62 million passengers, a 21% increase compared to the previous year. Total revenue reached a historic €5.07 billion, with a net profit of €365.9 million, signaling full financial recovery and the successful overcoming of the negative impacts of the COVID-19 pandemic and regional geopolitical instability.

A fundamental, defining feature of Wizz Air’s operational activity is its unique revenue structure, which differs significantly from the traditional model. Unlike Etihad and other full-service carriers, where the majority of revenue (80–90%) comes directly from ticket sales, ancillary revenue in Wizz Air accounts for approximately 45% of total income, with a steady upward trend. This includes revenue from checked baggage fees, priority boarding (Wizz Priority), seat selection, onboard food and merchandise (Wizz Café and Wizz Boutique), as well as commissions from partner cross-sales (hotel bookings, car rentals, travel insurance).

This specific revenue structure directly shapes the service technology: cabin crew and the airline’s digital platforms (website, mobile app) are highly optimized for active sales using cross-selling and up-selling techniques at every stage of the passenger journey — from the initial booking click to aircraft disembarkation. Wizz Air's CASK (Cost per Available Seat Kilometer) is among the lowest globally, approximately 3.8–4.0 euro cents [18], achieved through extremely high operational efficiency and aircraft utilization (average daily flight hours exceed 12.5 hours per aircraft), as well as maximum cabin density, which allows fixed costs to be distributed across a greater number of seats.

The Wizz Air fleet is strictly standardized (single-type) and consists exclusively of narrow-body aircraft from the Airbus A320 family. As of 2024, the group operates over 200 aircraft, with a fleet renewal strategy aimed at a complete, phased transition to the latest neo (New Engine Option) variants. The share of Airbus A321neo aircraft, which seat 239 passengers in a single-class configuration (the certification limit for this type), is continuously growing and already exceeds 50% of the total fleet.

This aircraft type is a true "game changer" for the company, as the new Pratt & Whitney GTF engines and aerodynamic improvements (sharklets) provide the lowest fuel consumption and CO2 emissions per passenger among all narrow-body competitors — approximately 20% lower than the previous-generation A320ceo. Full fleet standardization allows Wizz Air to minimize maintenance and repair costs (MRO), standardize pilot and cabin crew training (allowing crews to operate any aircraft without additional type-specific training), and simplify spare parts logistics and crew rotation planning. The absence of heavy onboard entertainment systems (screens, servers, wiring) and stationary galley equipment (as the service model does not include preparation of hot meals but only heating or serving cold snacks) further reduces aircraft weight by hundreds of kilograms and simplifies pre-flight preparation and cleaning processes.

The organizational structure of Wizz Air also significantly differs from the centralized structure of a national carrier. It is a multi-national holding company comprising several subsidiaries with separate Air Operator Certificates (AOCs) in different jurisdictions: Wizz Air Hungary (main operating company), Wizz Air UK (created for operations in the UK after Brexit), Wizz Air Malta (for operational optimization within the EU), and Wizz Air Abu Dhabi. The creation of a joint venture in Abu Dhabi with the state investment company ADQ is a bold strategic move that brought the European low-cost carrier to the fast-growing Middle Eastern market, creating direct competition with Etihad Airways on certain routes, while offering a product in a completely different price segment. This expansion into the East demonstrates the global ambitions of the brand and the blurring of traditional geographical boundaries for European LCCs [54, p. 118]. The flexible multi-AOC structure enables Wizz Air to manage resources extremely efficiently, relocate aircraft between bases based on demand, optimize tax liabilities, and secure traffic rights in a highly regulated international environment.

The route network is another key point of differentiation between the two studied airlines. Etihad Airways operates under a classic hub-and-spoke model, consolidating transit passenger flows from around the world through its single base at Abu Dhabi International Airport (AUH). Flight schedules are organized in bank structures to ensure minimal connecting times (2–3 hours) between incoming flights from the East (Asia, Australia) and outgoing flights to the West (Europe, America), and vice versa. This requires extremely precise coordination across all airport services, ground handling, and crew operations, as even a single inbound flight delay can create a domino effect, disrupting connections for hundreds of passengers and necessitating compensation and hotel accommodation.

Wizz Air, in contrast, employs a decentralized point-to-point model with an extensive network of over 40 operational bases across Europe and the Middle East. Aircraft and crews are permanently stationed at multiple airports, operating direct flights without returning to a central hub. This significantly reduces the risk of systemic cascading delays across the network and allows crews to return to their home base overnight (out-and-back operations), saving the airline substantial costs on per diem allowances and hotel accommodations, which is a key area of ULCC cost efficiency.

The analysis of human resources policy and labor productivity also reveals significant systemic differences dictated by the companies’ business models. In Wizz Air, the passengers-per-employee ratio is among the highest in global aviation, a direct consequence of total process automation, extensive outsourcing of ground handling, and the absence of an inflated administrative headquarters. Wizz Air cabin crew perform a much broader range of functions compared to their colleagues at full-service network carriers. In addition to standard safety and service duties, they conduct light cleaning and tidying during transit stops, collecting trash and organizing seat belts, and often handle boarding gate checks at certain airports. This allows for record turnaround times of 25–30 minutes, which is critical for maintaining high daily fleet utilization. In Etihad Airways, turnaround times for long-haul flights range from 90 to 120 minutes, reflecting the need for full professional cleaning by cleaning staff, loading multi-level catering, replenishing water, and servicing complex in-flight entertainment systems [35, p. 42].

A key aspect of operational activity and strategic development in recent years has been digital transformation, regarded by management as a primary efficiency driver. According to the SITA Air Transport IT Insights 2023 report [25], IT infrastructure investments became the top priority for airline executives. For Etihad Airways, this involves implementing advanced AI systems for deep passenger personalization (e.g., strategic partnership with Salesforce), deploying biometric facial recognition at Abu Dhabi airport (part of the large-scale government “Smart Travel” project), and developing a mobile app as the main channel for managing the entire passenger journey. For Wizz Air, digitalization is focused primarily on full automation of routine processes and promoting self-service for passengers to reduce reliance on costly call centers and check-in counters, the use of which incurs fees to handling agents. The company actively employs AI-powered chatbots (virtual assistant Amelia), automated claims processing systems, and sophisticated machine learning algorithms for dynamic pricing, maximizing revenue per seat (Yield Management).

The environmental, social, and governance (ESG) dimension has also become an integral part of the long-term business strategies of both carriers, in line with global sustainable development trends. Wizz Air aggressively positions itself as the "greenest airline in Europe", achieving the lowest CO2 emissions per passenger-kilometer (approximately 53 grams in 2023). This is achieved not through carbon credit purchases but through technological solutions: very high seat density (spreading emissions across more passengers), consistently high load factors, and the use of highly efficient engines. In its 2023 sustainability report [19], Wizz Air management emphasizes that environmental performance is not merely a marketing tool but a direct and effective way to reduce operating costs (less fuel consumption means lower fuel purchase costs and reduced environmental taxes under the EU ETS).

Etihad Airways, on the other hand, implements the ambitious "Greenliner" research program, using its Boeing 787 fleet as flying laboratories to test Sustainable Aviation Fuel (SAF), optimize flight trajectories to reduce carbon footprint, and explore new eco-friendly cabin materials. Both airlines actively declare and implement policies to eliminate single-use plastics onboard, requiring a fundamental shift in catering technology and the procurement of multi-use or biodegradable tableware and packaging (wooden utensils, paper cups, recycled materials).

The impact of global geopolitical factors on the operations of the studied airlines has been significant, but varied. The full-scale war in Ukraine had a major, shock-like negative effect on Wizz Air, which, until February 2022, was one of the largest foreign players in the Ukrainian market, maintaining major operational bases in Kyiv (Zhuliany) and Lviv. The airline was forced to urgently evacuate part of its fleet and personnel, completely suspend all flights to Ukraine and Russia, and rapidly redirect freed-up capacity to other markets (Italy, Albania, Romania, Saudi

Arabia). According to Lysenko V.V. [54, p. 116], the inherent flexibility and adaptability of the low-cost model allowed Wizz Air to adjust remarkably quickly and efficiently to the sudden loss of a key market, redeploying aircraft to new bases—a task that would have been far more difficult for a traditional network carrier with rigid hub infrastructure.

For Etihad Airways, the main geopolitical challenges involve the unprecedented growth of competition from nearby mega-hubs (Dubai with Emirates, Doha with Qatar Airways, Istanbul with Turkish Airlines), all aggressively vying for the same global transit flows, as well as the need to circumvent closed airspaces in the region, increasing flight times, fuel consumption, and crew working hours.

A comparative analysis of marketing strategies and loyalty programs highlights another critical difference in passenger retention tools. Etihad Guest is a classic, sophisticated Frequent Flyer Program (FFP), where miles are earned based on flight distance and booking class. It is deeply integrated with global partners (banks, hotels, car rentals) and allows miles to be redeemed for premium tickets, upgrades, or rewards in partner stores. The presence of elite status levels (Silver, Gold, Platinum) provides significant additional value, such as access to luxury lounges, priority check-in and boarding, and extra baggage allowance.

Wizz Air, by contrast, employs a fundamentally different, innovative approach: the paid Wizz Discount Club subscription. For a fixed annual fee, members receive guaranteed discounts (usually €10) on every ticket for themselves and a companion, as well as baggage discounts. This approach delivers immediate cash savings rather than accumulating virtual currency for future use, perfectly aligning with the psychology and needs of budget travelers. The airline also launched the Wizz MultiPass, a monthly flight subscription (effectively a transit pass), which represents a novel concept in airline distribution and brings air travel closer to the model of urban public transport.

An analysis of operational reliability (On-Time Performance – OTP) shows that both airlines face serious operational challenges but address them differently. For Etihad, the delay of even a single flight is critical, as it can disrupt the entire transit bank in Abu Dhabi, causing mass passenger losses. As a result, the airline maintains expensive reserve aircraft and crews to safeguard its schedule. Wizz Air, operating with minimal reserves to maximize cost efficiency, often experiences a "domino effect": a single morning disruption (due to weather or strikes) can cascade across the entire fleet for the day. In the summers of 2023 and 2024, the airline faced major operational challenges due to extensive unscheduled inspections of Pratt & Whitney GTF engines, forcing it to reduce schedules and lease aircraft on a wet-lease basis from other operators. While this negatively impacted punctuality and brand reputation, it allowed the airline to maintain its route network.

The cultural aspect also plays an important, albeit not always obvious, role in shaping the operational model and service standards. Etihad Airways, being the national carrier of a Muslim country, organically integrates relevant ethical and cultural standards into its operations: the mandatory availability of certified halal meals, the complete absence of pork dishes on the menu, and the presence of dedicated prayer zones (qibla) on electronic flight maps. The company's staff is highly international (representing over 150 nationalities), yet all undergo rigorous centralized training at a single aviation academy in Abu Dhabi to ensure a uniform high standard of hospitality that harmoniously combines traditional Arab respect with modern international service norms. Wizz Air is also a multicultural company, but its corporate culture is based on Western European values of dynamism, efficiency, openness, meritocracy, and rapid career growth.

Thus, the detailed and systematic analysis of production and business operations allows for a well-founded conclusion that Etihad Airways and Wizz Air represent two highly efficient and successful, yet fundamentally different, business systems in terms of "corporate DNA." Etihad is a complex, high-tech mechanism oriented towards quality, prestige, network effect, and the creation of a unique premium product, where high operational costs are consciously offset by high per-passenger yield and strategic importance to the state. Wizz Air is a highly efficient "flight factory" focused on scale, operational excellence, and absolute price leadership, where low margin per ticket is compensated by massive passenger volumes and significant ancillary revenues.

Despite these fundamental differences, both companies actively invest in digital technologies, fleet modernization, and data analytics tools to optimize their operations. The financial stability and profitability of both carriers in the post-pandemic period attest to the viability and efficiency of both models, provided there is professional management and constant adaptation to dynamic changes in the global market environment. For the purposes of this master’s thesis, a deep understanding of these characteristics forms a necessary foundation for the subsequent analysis of passenger service technology onboard (Subsection 2.2) and the development of project proposals for its improvement (Chapter 3). Any proposed innovations must be organically integrated into the existing business model: for example, implementing a sophisticated tablet-based personalization system would be a natural evolutionary step for Etihad but would require serious economic justification for Wizz Air to avoid violating strict aircraft turnaround timeframes and increasing non-productive costs. The analysis demonstrates that the potential for service improvement through digitalization exists in both cases, but the methods and tools for achieving these goals will differ significantly.

2.2. Analysis of Existing Passenger Service Technologies Onboard Aircraft of the Studied Airlines

A deep, systematic analysis of the technological processes of passenger service onboard Wizz Air and Etihad Airways aircraft reveals fundamental structural differences in the operational philosophy of these carriers, which are strictly determined by their belonging to diametrically opposed business models. While the previous subsection of the analytical part examined macroeconomic strategies and financial indicators, this subsection focuses on the micro-level — the detailed decomposition of technological operations, algorithms of direct crew-passenger interaction, ergonomics of work processes in confined spaces, and service standards. Service technology here is considered as a strictly regulated sequence of actions in time and space that encompasses the entire period of a passenger's presence in the airline's ecosystem: from the moment of crossing the gate to exiting the terminal at the destination airport. Scholars G. Cook and B. Billig in their foundational work Airline Operations and Management [51, p. 215] aptly define this process as a "service assembly line," where even the smallest disruption at any stage inevitably leads to a cascading decrease in the quality of the final product and passenger satisfaction.

The service technological cycle of the national carrier of the UAE, Etihad Airways, is built according to the classical "Full Service" principle and is characterized by extraordinary complexity, multi-component processes, high resource intensity, and significant time expenditures for preparation. The technological process begins well before the first passenger boards the aircraft. Preparing the cabin of a wide-body long-haul aircraft (e.g., Boeing 787-9 Dreamliner or Airbus A350-1000, which form the core of Etihad's modern fleet [23]) for a flight takes, according to regulations, between 60 and 90 minutes. During this critically important period, a professional cleaning crew boards the aircraft to perform deep cleaning according to strict standards: vacuuming the carpeted surfaces, wet cleaning and disinfecting all surfaces (tray tables, armrests, IFE screens), complete sanitation of lavatories, and replacing headrest covers.

In parallel with cleaning, a complex logistical process of catering loading occurs. Etihad's catering technology is an extremely intricate operation requiring precise execution: dozens of standardized containers and trolleys with various types of meals are loaded through dedicated service doors. In addition to the standard menu (which usually includes three hot meal options in economy class), a wide range of special meals (SPML — Special Meals), pre-ordered by passengers, is loaded:

children's meals, diabetic meals, gluten-free, vegan, Hindu, kosher, etc. Flight attendants responsible for the galley operations must personally verify that the actual number of loaded portions of each type matches both the catering invoice and the Passenger Load Sheet. Any discrepancy (e.g., a missing pre-ordered kosher meal) constitutes a critical error that could lead to serious conflicts on board, which is why verification is performed twice. Special attention during preparation is also paid to the technical functionality of the In-Flight Entertainment (IFE) system at every seat, as well as to the presence of individual comfort kits (headphones, sealed blankets, pillows), which are mandatory service attributes on Etihad's long-haul flights.

A radically different, diametrically opposite technological picture is observed in the operational activities of the European low-cost carrier Wizz Air. Here, service technology is strictly subordinated to a single economic goal — minimizing aircraft turnaround time, which, according to the company's internal standards, is only 25–30 minutes, an industry record for efficiency [18, p. 22]. Such a compressed schedule demands extreme work intensity from the cabin crew and the performance of functions entirely foreign to flight attendants of traditional carriers. Immediately after the last passenger of the previous flight disembarks, Wizz Air cabin crew put on gloves and carry out a "tidying" procedure: they quickly walk through the cabin, collecting large trash left by passengers, checking seat pockets (which in the new Airbus A321neo aircraft are deliberately smaller or relocated to the upper part of the seatback to speed up visual inspection), and cross-belt the seat belts. This is done not only to present a tidy cabin before the next boarding but also to prevent passengers from sitting on unfastened belts, which would delay the boarding process. Professional deep cleaning is performed only during overnight aircraft parking at the base.

Loading of products for sale (sandwiches, instant soups, snacks, beverages, perfumes) is not carried out before every flight but usually once a day (in the morning before the first departure) or upon returning to the base airport. This greatly simplifies logistics and reduces aircraft downtime but requires the Senior Cabin

Attendant to possess skills in careful planning and sales forecasting to ensure that the stock is sufficient for all four to six flight segments that the aircraft operates in a single shift.

The boarding stage also demonstrates fundamental, worldview-level differences in service technologies. At Etihad Airways, boarding is carried out in a strictly differentiated and phased manner: passengers requiring special assistance (PRM) and families with young children are invited first, followed by premium-class passengers (Residence, First, Business) and elite-status members of the Etihad Guest loyalty program, and only then — the main body of economy-class passengers (often by cabin zones, from the rear to the front, to avoid aisle congestion). Upon entering the aircraft, each passenger is personally welcomed with a smile by the Cabin Manager or a designated crew member, who checks the boarding pass and indicates the shortest route to the seat (left or right aisle on wide-body aircraft).

In Business Class, the technology provides for immediate personalized service: as soon as a passenger takes their seat, they are offered a welcome drink — freshly squeezed juice, water, or champagne — along with a hot towel service, even before the doors close. Cabin crew actively assist with storing hand luggage on overhead bins and hang jackets or coats in designated wardrobes. This technology creates an atmosphere of exceptional hospitality and personal attention from the first moments on board, but it is highly resource-intensive and time-consuming.

In contrast, boarding at Wizz Air is one of the most stressful and intense stages of the technological process for both crew and passengers. Due to the company's strict, financially motivated hand-luggage policy, flight attendants are forced to perform functions atypical for traditional cabin crew, acting as inspectors and enforcers. The technology requires a rapid visual assessment of passengers' baggage dimensions and quantities. If a passenger who has not paid for the "Wizz Priority" service attempts to bring a trolley bag instead of a small backpack, the flight attendant must stop them, explain the rules, and, if no payment is made, arrange for the bag to be checked into the hold (Gate Bag) with a significant fee collected via a mobile POS terminal directly at the aircraft door. This often causes conflicts, disputes, and delays the boarding process.

Furthermore, due to the extremely high-density seating configuration (239 seats on an Airbus A321neo), there is objectively insufficient space on the overhead bins to accommodate all passengers' belongings when fully loaded. The crew operates in an intensive "Tetris mode," actively and sometimes assertively relocating bags, compressing them, and instructing passengers to stow smaller items (outerwear, small backpacks) under the seat in front. This process is essential to ensure that all belongings fit in the cabin (to avoid delays caused by offloading excess luggage) and to guarantee on-time door closure — a key KPI for a low-cost carrier.

After take-off and reaching a safe altitude (when the captain turns off the "Fasten Seat Belt" sign), the main in-flight service phase begins. At Etihad Airways, even in economy class, the service technology provides a full hot meal included in the ticket price. The process begins with the distribution of pre-ordered special meals (SPML) to ensure passengers with allergies or dietary restrictions receive exactly what they ordered. This is followed by a full bar service using specialized service trolleys, offering juices, soft drinks, water, red and white wine, beer, and spirits. A notable detail emphasizing the FSC status is that even in economy class, metal cutlery (or high-quality reusable hard plastic) is often used, and printed or digital menus describing dishes are provided. The main hot meal is offered with a choice of typically three options (meat, chicken, vegetarian pasta).

The heating of meals in convection ovens in the galley requires strict adherence to temperature regimes and timing according to HACCP food safety standards: dishes must not be overcooked, cold inside, or overheated. After the main meal, a separate tea and coffee service follows. On ultra-long-haul flights (over 10–12 hours), the service schedule includes an additional mid-flight snack (sandwiches, pizza, popcorn, ice cream) and a second full hot meal prior to landing. The entire procedure is meticulously timed; for example, the first beverage service must start 20 minutes after take-off, and the collection of used trays must be completed no later than 40 minutes after the last portion is served to avoid cluttering the cabin.

In Etihad Airways' Business Class, the advanced "Dine on Demand" concept has been implemented, representing the pinnacle of in-flight service technology [22, p. 24]. This concept entirely eliminates fixed meal times for the cabin. Passengers have the right to order any dish from an extensive à la carte menu at any time during the flight, whenever they feel hungry. This fundamentally complicates the galley workflow, as the flight attendant cannot simply push a trolley down the aisle and distribute identical trays to all passengers. Each order is individually prepared in the galley (galley plating), artistically presented on fine porcelain, garnished with herbs or sauces, and served to the passenger on a table individually set with a white tablecloth, without the use of trays.

Such an approach requires crew members to possess high-level restaurant service skills, excellent memory, multitasking abilities, and strong coordination between the galley and the cabin. On Etihad flights, there is a dedicated role — the Food and Beverage Manager — who is a qualified expert responsible for quality control of meal preparation and professional wine recommendations to accompany the selected menu.

In contrast, Wizz Air's on-board service technology is based on the commercial concepts "Wizz Café" and "Wizz Boutique." Since food and beverages are not included in the ticket price, the crew's primary objective, after ensuring safety, is to maximize ancillary revenue generation. Service begins with a carefully designed marketing announcement over the Public Address system, highlighting special value offers (Meal Deals — e.g., a combo of "sandwich + drink + chocolate" at a discounted price). Service trolleys are arranged according to visual merchandising principles, with the most profitable and attractive items placed in the top drawer at eye level.

The sales process requires active, proactive offering by the cabin crew (“Would you like to add a hot coffee or tea to your croissant?”). Payments are predominantly cashless, processed via modern mobile POS terminals (mPOS) that accept contactless cards, smartphones, and smartwatches. A key technological feature of Wizz Air is that cabin crew prepare hot beverages (instant coffee, tea, quick soups) directly on the trolley or in the galley using boiling water from onboard boilers, as professional espresso machines are generally absent on A320-family aircraft to save weight, electricity, and maintenance time. Sandwiches and paninis are heated in high-speed ovens.

The efficiency of this service is evaluated based on two main metrics: service speed (to serve all customers within the limited flight time before descent) and average revenue per passenger (Spend per Head). According to [20], the complete upgrade of POS terminals in 2024 reduced the payment transaction time by 5 seconds per transaction, significantly increasing the throughput of the on-board “shop” and overall revenue.

Significant conceptual differences are also evident in the technology of in-flight entertainment services. Etihad Airways invests substantial resources in its proprietary E-BOX system. Each seat, including those in economy class, is equipped with a personal high-resolution touchscreen, a control handset, a USB port for device charging, and a universal power outlet. The service technology includes provision of individual headphones (premium-class passengers receive high-quality noise-canceling headphones) or standard headsets. Crew members are required to have technical support skills: they must be able to reboot a single seat or an entire block in case of a system freeze (reset procedure) and assist passengers, especially the elderly, in navigating the menu. Additionally, paid access to Wi-Fi and mobile connectivity is available on board (with limited free access for high-tier loyalty members). Cabin crew must be fully knowledgeable about tariffs and connection procedures to assist passengers. A substantial amount of children’s content (cartoons, games) is an important part of family service. Historically, Etihad operated a unique “Flying Nanny” program — a specially trained flight attendant, educated at the British Norland College and dressed in a bright orange uniform, who assisted parents in entertaining and calming children during long-haul flights using creative kits, puppet shows, and games. Although this program has been somewhat transformed in the post-COVID period, the strategic focus on family service remains a key technological feature of the airline.

In Wizz Air, entertainment technology follows an austere minimalist approach. Built-in screens are entirely absent, saving both weight and maintenance costs. The only traditional source of information and entertainment (aside from passengers’ personal devices) is the in-flight magazine, “Wizz Magazine,” which is increasingly transitioning to a digital format. The absence of a complex IFE system relieves the crew of the need to distribute and collect headphones — a time-consuming task — and to resolve technical issues with screens, allowing them to fully focus on commercial sales. However, as noted in the SITA study [26, p. 12], the global BYOD (Bring Your Own Device) trend is becoming increasingly relevant. Wizz Air is considering implementing a local wireless streaming server that passengers could access with their smartphones or tablets. This would require crew members to acquire new competencies in advising passengers on connecting to the internal Wi-Fi network.

Ensuring physical comfort and hygiene on board also exhibits distinct technological nuances. On Etihad Airways aircraft, premium-class lavatories feature full cosmetic amenities from luxury brands (e.g., Acqua di Parma), and cabin crew are required to check cleanliness and restocking every 15–20 minutes, completing a corresponding checklist on the door. Passengers on all long-haul flights, including economy class, are provided with individual amenity kits containing a toothbrush, toothpaste, sleep mask, and warm socks.

In contrast, Wizz Air lavatories provide only basic hygiene amenities (soap, paper). Crew inspections are less frequent, typically occurring after the main sales service, as the workload in the cabin during short flights is extremely high. Blankets and pillows are not provided even on night flights, which is standard for the low-cost model, although they can sometimes be purchased via the "Wizz Boutique."

The servicing of special passenger categories is governed by unified international regulations (notably EU Regulation 1107/2006), but its implementation differs technologically. Etihad Airways places considerable emphasis on unaccompanied minors (UM). The service technology stipulates that a dedicated flight attendant continuously monitors the child, provides toys, child meals, assists with lavatory use and entertainment, and personally hands over the child to a ground agent upon arrival. For passengers with reduced mobility (PRM), an on-board wheelchair is always available, and lavatories are equipped with assistive handrails. Wizz Air also accommodates PRM in accordance with European legislation; however, unaccompanied minor service (UM) is optional, paid, and not available on all flights. Due to the very dense seating configuration of the A321 cabin, servicing PRM can be physically challenging, so such passengers are typically seated by the window to avoid obstructing other passengers' access in case of emergency evacuation, as mandated by safety requirements.

An important, often underestimated component of service technology is communication standards and conflict resolution. Etihad Airways crew undergo extensive training in cultural sensitivity and etiquette, as the passenger flow at Abu Dhabi hub is highly international and multicultural. Language standards require the use of refined, formal English and Arabic. In conflict situations (e.g., dissatisfaction with seating or meals), a soft de-escalation strategy is applied, often involving "smoothing over" the issue through complimentary compensations such as awarding loyalty miles, offering a glass of champagne, or providing a box of chocolates.

In contrast, Wizz Air communication is more directive, clear, and concise, driven by the acute time constraints of short-haul flights. The primary language is standard English, supplemented by the language of the crew's home base. In case of rule violations (e.g., smoking in the lavatory, consuming personal alcohol, or aggressive behavior), Wizz Air crew follow a strict "Zero Tolerance" policy, immediately alerting authorities upon landing, without prolonged negotiation.

After flight arrival, the technological cycle concludes with passenger disembarkation. In Etihad, this is primarily conducted via jet bridges, with strict priority given to premium-class passengers (First and Business class disembark first through the front doors). Cabin crew personally bid farewell to each passenger, thank them for choosing the airline, and then carefully inspect the cabin for forgotten items (Lost & Found), handing them over to ground services.

In Wizz Air, disembarkation is often executed via both front and rear doors, using buses or walking on the apron, in order to maximize process speed. Crew members actively, sometimes assertively, urge passengers to move along, as each minute of delay in disembarkation reduces the precious turnaround time (tidying) for the next flight awaiting departure.

Analysis of independent service quality reports, including Skytrax ratings [32], shows that Etihad Airways consistently receives high scores (4–5 stars) for both "hard" (seating, food) and "soft" (staff performance) product quality, confirming the effectiveness of their "high-resource" service technology in retaining demanding, high-paying customers. Wizz Air, while predictably rated lower for comfort, demonstrates high operational efficiency in terms of reliability, process speed, and cost accessibility, attracting millions of price-sensitive passengers willing to trade service quality for savings.

A separate notable trend is the growing impact of digitalization on service technology in both companies. Etihad actively implements the Guest Experience system, based on the Salesforce platform, which allows the senior cabin crew to view the full profile of each passenger on a service tablet: their loyalty status, history of previous requests, and meal preferences. This enables a truly personalized approach (e.g., greeting a passenger on their birthday, offering their preferred newspaper, or apologizing for a prior flight delay). Wizz Air uses digital tools primarily to optimize onboard sales: crew tablets display real-time stock levels, individual sales targets, and enable inventory checks of the trolley in minutes via barcode scanning.

In summary, a detailed analysis of existing service technologies allows us to assert that Etihad Airways' service technology functions as a tool to create a deep emotional connection with the brand and justify the high ticket price. It is deliberately based on a certain resource redundancy (time, personnel, material support) to achieve impeccable quality. In contrast, Wizz Air's service technology is primarily a tool for generating additional revenue and ensuring maximum operational efficiency. It relies on strict standardization, maximal speed, and total cost minimization. At the same time, both airlines face common global challenges: the need to raise hygiene standards (as a consequence of post-COVID requirements), the inevitable digitalization of all processes, and adapting to changing passenger expectations, as travelers increasingly value the ability to manage their journey via smartphones. The identified fundamental differences and shared traits will serve as a solid basis for developing scientifically grounded recommendations for improving service technologies in the third, project-oriented chapter of the master's thesis, where the implementation of a universal digital platform will be proposed to enhance service efficiency for both network and low-cost carriers.

2.3. Service Quality Assessment and Identification of Issues in Passenger Interaction Processes

Assessing service quality in the aviation sector is an extremely complex management task that requires the application of comprehensive methodological approaches, as the very concept of air transport service quality is multidimensional and subjective. In academic studies by professors of the Department of Aviation Transportation Organization, notably O.P. Harazhi [36] and D.O. Shevchuk [32], service quality is viewed as a set of properties that determine its ability to meet established or anticipated passenger needs. A critical distinction is made between two components of quality: technical (operational), which can be objectively measured (punctuality, baggage integrity, safety), and functional (service-related), which is based on the passenger's subjective perception of interaction with the airline staff.

For the studied airlines — Wizz Air and Etihad Airways — the criteria for evaluating quality and issues in passenger interaction differ markedly due to the distinct nature of their business models. However, a common denominator remains: the necessity to minimize gaps between passenger expectations and the actual experience received.

The assessment of Etihad Airways' service quality is based on the classic SERVQUAL model, adapted to the specifics of premium air transportation. This model evaluates quality across five key dimensions: tangibles, reliability, responsiveness, assurance, and empathy. High ratings for Etihad in international rankings, including the "5-star" status from Skytrax [32], indicate that the airline achieves outstanding results in the tangibles category. The condition of the cabins of Boeing 787 and Airbus A350 aircraft, seat quality, cleanliness, crew uniform design, and food presentation meet the highest global standards.

However, a detailed analysis of passenger feedback and service quality reports reveals systemic problems in the areas of reliability and empathy. The main issue in passenger interaction at Etihad Airways is service inconsistency, which arises from the company's rapid expansion and the multicultural composition of the crew. Despite standardized training at the Abu Dhabi academy, the human factor remains a weak link. A passenger may receive impeccable service on the London–Abu Dhabi route with an experienced crew but encounter indifference or language barriers on the Abu Dhabi–Bangkok route. This variability in service quality is a critical problem for a premium brand, as customers paying high fares expect consistently excellent results regardless of the route or type of aircraft.

Another identified problem in Etihad Airways' passenger interaction processes is the difficulty of communication in non-standard situations. Analysis of complaints on specialized forums and social media shows that, in the event of schedule disruptions (flight cancellations, missed connections), ground staff and crews often act strictly according to protocol, without demonstrating sufficient flexibility or empathy, which contrasts with the declared values of hospitality. The technological complexity of Etihad's product (e.g., the "Dine on Demand" system in Business Class) sometimes works against the company: when the cabin is fully booked, the crew is physically unable to serve all passengers individually, leading to long waiting times for meals and passenger dissatisfaction. This indicates a problem of imbalance between marketing promises and the operational capabilities of personnel. Another challenging aspect is cultural adaptation of service. Although the airline is global, its roots and standards are based on Arab culture, which can sometimes lead to misunderstandings with passengers from other regions (e.g., regarding dress code or onboard behavior), requiring crew members to possess subtle diplomatic skills that not all employees have.

Assessing the quality of Wizz Air's services requires a completely different framework. For a low-cost carrier, the main criteria of quality are affordability, punctuality, and process simplicity. From a technical quality (reliability) perspective, Wizz Air demonstrates high performance: the modern fleet ensures a low number of technical failures, and the completion factor of flights, according to report [18], exceeds 99%. However, passenger interaction issues at Wizz Air are concentrated in the domain of functional quality and communication. The most acute problem is "service friction", arising from the aggressive monetization of ancillary services. The passenger's interaction with airline staff (both on the website and at the airport) is often perceived as a constant struggle, where the airline attempts to “catch” the customer in error (unprinted boarding pass, overweight baggage) and impose penalties. This creates an atmosphere of mistrust and hostility even before boarding.

Onboard Wizz Air aircraft, a key interaction problem is the conflict of priorities. Flight attendants, financially incentivized to sell products, often focus excessively on sales, neglecting basic passenger service requests (requests for water, seat assistance). The high work intensity and short turnaround times lead to crew fatigue, resulting in formal or even rude behavior toward passengers. Feedback analysis indicates that Wizz Air passengers frequently complain about the lack of basic courtesy and humanity, especially in stressful situations. Another significant problem is digital isolation of the customer. In an effort to reduce support costs, Wizz Air has heavily automated communication channels, replacing live operators with chatbots. In the case of complex issues (e.g., name errors, refund requests under EU Regulation 261/2004 [12]), passengers often cannot reach a human representative, creating feelings of helplessness and anger. This is a classic example of how digitalization, intended to increase efficiency, reduces the perceived quality of service due to the absence of emotional contact.

A common problem area for both airlines is expectation management during disruptions. Research by Halpern and Graham [55] shows that customer satisfaction (CSI – Customer Satisfaction Index) drops most significantly during flight delays and cancellations. For Etihad Airways, the main challenge lies in providing informational transparency: passengers frequently complain about the lack of timely updates regarding the reasons for delays and estimated departure times while remaining on board. For Wizz Air, the challenge is fulfilling the duty of care: at remote airports where the airline has no own staff, only handling agents, passengers are often left to manage the situation on their own, without receiving meal or hotel vouchers, constituting a direct breach of regulations and a source of reputational risk.

A deeper analysis of technological processes also reveals the problem of a "digital gap" in service delivery. Despite significant IT investments, the integration of passenger data into cabin crew operations remains imperfect. At Etihad Airways, even with tablets available, information on passenger status or previous complaints is not always updated in real time (due to connectivity issues in certain regions), leading to missed opportunities for personalization. For instance, a flight attendant may be unaware that the passenger in seat 3A recently experienced lost luggage on a previous flight, and overly cheerful behavior could unintentionally provoke irritation rather than loyalty. For Wizz Air, the problem lies in the fragmentation of the digital experience: the mobile app is convenient for purchases, but its in-flight support functionality is limited.

Ergonomics of interaction is another area of concern. Cabin densification, employed by both airlines (Wizz Air as a strategy, Etihad as a way to increase economy-class profitability), leads to passenger discomfort and complicates crew operations. Narrow aisles hinder trolley movement and passenger navigation, increasing service times and the risk of minor injuries. Reducing the number of lavatories relative to the number of passengers (particularly in the Airbus A321neo with Cabin Flex configuration) creates queues that obstruct galley operations and generate zones of constant conflict and discomfort. While this engineering solution is economically advantageous, it becomes a persistent source of lowered perceived service quality.

An important aspect of quality assessment is sanitary and hygiene safety, which has become a key parameter for airline choice post-COVID-19. Although both airlines claim high cleanliness standards, reality often diverges. At Wizz Air, the extremely short turnaround time (25 minutes) makes it physically impossible for the crew to thoroughly clean the cabin and disinfect surfaces, which passengers notice (crumbs on seats, trash in pockets), creating a perception of untidiness and reducing brand trust.

The analysis of interaction-related issues also includes a linguistic dimension. For international flights, English serves as the standard language; however, the proficiency of both passengers and crew can vary. At Wizz Air, which bases its crew across multiple countries (from Albania to the United Kingdom), situations occasionally arise where crew members communicate with each other in their national language, which passengers do not understand, potentially being perceived as disrespectful. At Etihad, the multinational composition of the crew is an asset, but it also creates challenges in team coordination, where differing cultural codes may lead to misunderstandings in service standards.

A significant problem remains feedback management. Airlines actively collect passenger feedback through NPS (Net Promoter Score) surveys, yet the response cycle is often too slow. Passengers report that their complaints frequently receive formalized “copy-paste” responses, indicating a lack of genuine intent to resolve issues. This highlights a gap between data collection and its operational use for process improvement. In this context, the implementation of artificial intelligence systems for sentiment analysis and automatic categorization of feedback issues is an urgent necessity, which has so far been only partially realized.

In summary, the analysis of service quality and interaction challenges suggests that the main pain points for Etihad Airways and Wizz Air lie in different areas but share a common root: imperfect communication and data management processes. For Etihad, the primary challenge is to ensure stability and personalization of high-standard service across a global network, overcome bureaucratic inertia, and improve responses during disruptions. For Wizz Air, the key task is to humanize service, reduce conflict arising from additional charges, and enhance passenger support accessibility during crisis situations.

The identified problems indicate that traditional quality management methods are no longer sufficient in the digital economy. There is a clear need to transition toward proactive Experience Management, based on predictive analytics and the integration of all touchpoints into a unified ecosystem. Addressing these issues—gaps between expectations and reality, communication barriers, and technological limitations—will form the foundation for the design solutions proposed in the third chapter of the master's thesis. This chapter will suggest implementing a comprehensive loyalty and service management platform, capable of mitigating the identified deficiencies and elevating passenger interaction to a qualitatively new level. The platform is intended to serve as a tool that combines operational efficiency with emotional intelligence, ensuring consistently high service quality regardless of the chosen business model.

Conclusions of the Analytical Section

In the second chapter of the master's thesis, a comprehensive analysis of the operational and service technologies of two leading global airlines — Wizz Air and Etihad Airways, representing diametrically opposed business models (ultra-low-cost carrier vs. full-service network carrier) — was conducted. The results of the study allow the following generalizations:

It has been established that service technology in airlines is a direct derivative of the chosen business model. For Etihad Airways, the service technology is based on the "package product" concept, where the high ticket price is justified by a wide range of included services (catering, baggage, entertainment), complex class differentiation, and an individualized approach to passengers. For Wizz Air, the service technology is subordinated to the goal of cost minimization and maximization of ancillary revenue, expressed through full process standardization, absence of service classes, and monetization of any additional options.

A comparative analysis of technological procedures revealed significant differences in operational efficiency. Wizz Air achieves record aircraft turnaround times (25–30 minutes) through crew labor intensification (performing cleaning and boarding control) and streamlined logistics (absence of complex catering). Etihad Airways operates with turnaround times of 90–120 minutes, necessary to maintain premium cleanliness and service standards, but this reduces daily fleet utilization.

Service quality assessment identified different natures of interaction-related issues. For Etihad Airways, the main challenge is ensuring consistency of high-level service within a multicultural crew and complex network structure, along with insufficient flexibility in handling non-standard situations. For Wizz Air, the key problem is service friction, caused by an aggressive policy of additional charges, combined with a lack of empathy in communication from an overburdened crew.

A common development vector for both airlines is digital transformation. Both carriers actively implement digital tools, albeit with different purposes: Etihad focuses on personalization (using CRM data on crew tablets), while Wizz Air emphasizes automation and self-service. However, a “digital gap” has been identified: existing IT systems do not always provide seamless real-time passenger profile data directly to cabin crew, reducing service effectiveness.

The analysis indicates that current service technologies require improvement in integrating loyalty management systems with onboard operational processes. The absence of a unified digital platform that combines passenger preference data with service management tools during the flight represents a bottleneck, limiting revenue growth and customer satisfaction. Addressing this issue will form the basis for the development of design solutions in the next chapter of the thesis.

3. DESIGN PART

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3. PROJECT PART

3.1. Development of a Personalized In-Flight Service Model Using Digital Passenger Profiles

In the context of rapid global digitalization and unprecedented intensification of competitive pressure in the airline industry, traditional, conservative passenger service models based on outdated principles of massification, unification, and standardization are rapidly losing their effectiveness and relevance. The modern passenger, whose consumption habits and expectations are shaped by advanced digital ecosystems of global technology leaders, expects a similar level of deep personalization, proactivity, and anticipation of needs from airlines.

However, as the detailed operational analysis presented in the previous chapters has convincingly shown, even leading global carriers such as Etihad Airways and Wizz Air still face a fundamental systemic issue — the "digital gap." This problem lies in the critical inability to efficiently leverage vast amounts of accumulated passenger data in real time, directly at the point of service, i.e., onboard the aircraft during the flight. Addressing this systemic challenge requires the development and implementation of a fundamentally new, innovative service model that seamlessly and organically integrates Big Data, Artificial Intelligence (AI), Machine Learning (ML), and corporate mobility technologies into a unified operational ecosystem.

This subsection proposes a conceptual, scientifically grounded model of personalized in-flight service using dynamic digital passenger profiles, which is universal and can be adapted for both traditional network carriers and low-cost airlines, taking into account the specifics of their respective business models.

The theoretical and methodological foundation of the proposed model is the modern marketing concept "Passenger 360", which envisions the creation of a holistic, comprehensive, panoramic view of the customer by aggregating, normalizing, and deeply analyzing data from all possible touchpoints throughout the customer lifecycle. In traditional service models, passenger information is fragmented across various departments: the reservation department holds data on itinerary and fares, marketing has access to email and click history, customer support maintains complaint and inquiry records, while the cabin crew, who directly interact with the passenger and have the greatest influence on the passenger experience, sees only the passenger's name, initials, and seat number in the Passenger Manifest. This information gap makes it impossible to deliver genuinely high-quality, personalized service.

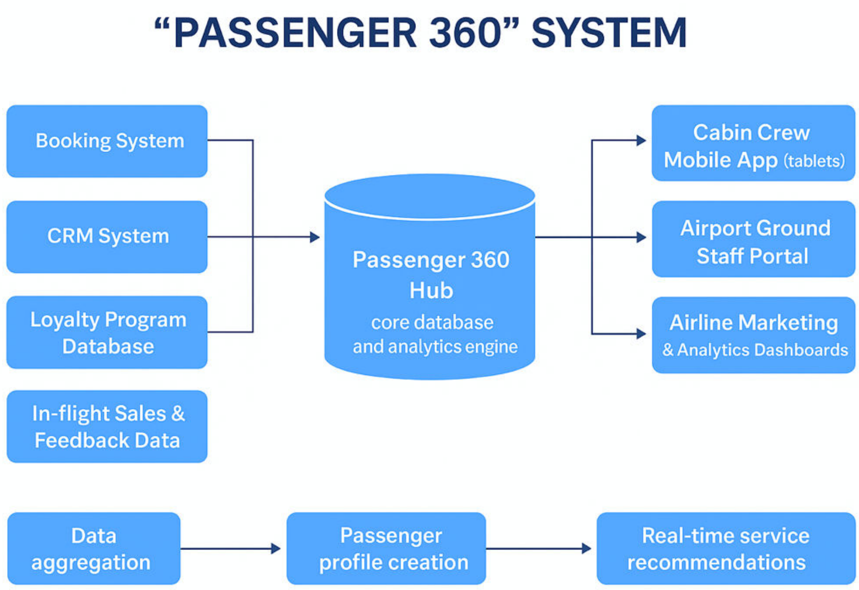

Fig. 3.1 Passenger 360 system

The proposed innovative model is based on the creation of a next-generation centralized cloud-based data repository — the Customer Data Platform (CDP). This platform collects, deduplicates, enriches, and structures information in real time from dozens of heterogeneous sources: Global Distribution Systems (GDS), internal booking inventory systems (PSS), loyalty program databases, social media, onboard purchase histories, and feedback systems. Based on these data, a Digital Twin of the passenger is created — a unique virtual profile containing not only static demographic data (name, age, gender, nationality) but, more importantly, dynamic behavioral characteristics and predictive metrics (preferences for food and beverages, price sensitivity, stress levels during flights, history of delays and received compensations, propensity for impulse purchases).

A key, critically important technological component of the proposed model is the mechanism for secure, instantaneous, and seamless delivery of this valuable analytical information directly to the service executor — the cabin crew. In traditional schemes, this information transfer occurs via printed Passenger Information List (PIL) documents, which are static, inconvenient for visual analysis, environmentally harmful, and often contain outdated data (e.g., they may not reflect last-minute seat changes or cabin class upgrades).

The proposed model envisions a complete elimination of paper-based materials and the implementation of specialized software — a Crew App installed on secure corporate tablets (iPads or industrial-grade Android devices). This application automatically synchronizes with the ground-based CDP platform before departure via high-speed, secure 4G/5G airport channels, and, where in-flight satellite connectivity is available (as on the Etihad Airways fleet), updates in real time during the flight.

The app interface provides an interactive aircraft seat map, where each seat is marked with an intuitive color-coded indicator reflecting the passenger's status, category, and current needs. Tapping on a seat icon opens an expanded passenger card containing specific, actionable service recommendations (Next Best Action), automatically generated by AI algorithms based on the passenger's digital profile.

The operational implementation of the model in-flight consists of five sequential stages, organically integrated into the cabin crew's standard operating procedures (SOP) without violating flight safety requirements. The first stage — Pre-flight Analytics — occurs prior to boarding. During the mandatory pre-flight briefing in the dispatch office, the Senior Cabin Crew Member (SCCM) receives a detailed analytical report on the upcoming flight directly to their tablet. Using advanced AI algorithms, the system automatically identifies and prioritizes passengers: VIPs, elite loyalty program members, passengers requiring special assistance (people with disabilities, unaccompanied minors, elderly passengers), and, critically for proactive risk management, passengers with a high predicted dissatisfaction risk (e.g., those who experienced significant delays on a previous flight, lost baggage, or recently left sharply negative reviews).

This functionality enables the cabin crew to plan their actions in advance, allocate resources, and assign areas of responsibility among team members even before the flight begins. For example, if a group of transit passengers, delayed on a connecting flight due to airline fault and reassigned to the current flight, is identified, the SCCM can preemptively prepare complimentary meal vouchers, comfort kits, or simply schedule time for personal apologies and explanations of subsequent steps — significantly reducing emotional tension in the cabin.

Stage Two — Personalized Greeting & Seating. During passenger boarding, cabin crew stationed at doors or along the aisles use tablets or miniature wearable devices (smartwatches, ring scanners) to instantly identify passengers. The system displays the passenger’s name, status, and preferred communication language. This allows the standard, formal, impersonal greeting of “Good day” to be replaced with a warm, sincere, and personalized welcome: “Welcome on board, Mr. Kovalenko! Thank you for choosing Wizz Air/Etihad once again for your journey.”

For Wizz Air, where boarding is traditionally rapid, chaotic, and stressful due to limited turnaround time, the model proposes an adapted, simplified version: highlighting on the scanning terminal screen passengers who have purchased additional services (priority boarding, extra legroom, musical instrument transport) in bright colors, enabling crew to proactively identify them in the crowd, assist them in quickly taking their seats, and properly stow irregular luggage — thereby avoiding departure delays and aisle conflicts.

Stage Three — Adaptive In-flight Service. This stage represents the conceptual heart and functional core of the proposed model. The system analyzes the passenger's detailed history of previous orders, persistent behavioral patterns, and the context of the current flight (time of day, duration, route, trip purpose) to generate individualized, targeted service recommendations.

For a full-service airline such as Etihad Airways, an in-flight service scenario might be as follows: a business-class passenger is approached by a cabin crew member who, seeing the labels "Vegan" and "Green Tea Lover" on the tablet, says: "Sir, we are aware of your culinary preferences and have specially prepared your favorite vegetable risotto and premium jasmine tea. Would you like them served now or later?" This creates a strong, memorable "wow effect" of anticipatory service and fosters a deep emotional connection to the brand.

For a low-cost carrier like Wizz Air, the emphasis is on increasing ancillary revenue conversion without intrusiveness. The system may detect that the passenger in seat 15C has an 80% probability of purchasing coffee and a sandwich on morning flights and suggests to the crew: "Offer the passenger in 15C a morning combo menu with a discount." Conversely, if the system identifies a passenger who never purchases anything and prefers to rest during the flight (category: "Do Not Disturb"), it advises the crew to avoid intrusive sales offers, thus enhancing overall passenger comfort.

Additionally, the model supports passenger self-service via their own devices (BYOD), connected to the local in-flight Wi-Fi network. Orders placed this way are automatically routed to the crew's kitchen tablet with exact seat assignment, eliminating the need for crew members to push heavy service trolleys along the aisles or make loud vocal announcements that could disturb other passengers.

Stage Four — Proactive Disruption Management & Service Recovery. This stage represents a critical strategic component of the model aimed at maintaining customer loyalty during inevitable operational disruptions. In the event of flight delays, severe turbulence, forced rerouting, or technical malfunctions of onboard equipment (e.g., inoperative inflight entertainment system at a specific seat or a broken tray table), the cabin crew immediately logs the issue through the Crew App. The system automatically generates instant compensation options based on pre-configured business rules and a compensation matrix, tailored to the passenger's status and Lifetime Value (LTV). This may include bonus miles, electronic vouchers for future flights, complimentary drinks, or access to premium content.

The crew can immediately issue compensation by simply scanning the passenger's boarding pass with their tablet. Information regarding the incident and the issued compensation is simultaneously transmitted to the central CRM system and the ground customer support team, eliminating the need for the passenger to file a complaint or call the contact center after arrival. This approach transforms a negative experience into a positive demonstration of corporate accountability and customer care.

Stage Five — Real-time Feedback Collection. Traditional paper surveys or follow-up emails sent a week after the flight have extremely low response rates and do not allow for real-time problem resolution. The proposed model enables instant, short feedback collection (via emoji or star ratings) directly onboard through the inflight entertainment interface or the passenger's mobile app. Crew members view these ratings in real time on their tablets as a Satisfaction Heat Map.

For example, if a passenger in seat 5A rates food quality, cabin temperature, or neighboring passenger behavior poorly, the senior flight attendant receives an immediate alert and can approach the passenger to delicately address the issue before the end of the flight (e.g., replace the meal, offer a blanket, or relocate the passenger to another available seat). This enables on-the-spot conflict resolution, effectively preventing potentially damaging negative reviews on social media post-flight.

Business Model Customization. Implementation of the model takes into account the specific business models of each airline. For Etihad Airways, the focus is on maximizing loyalty indices (NPS) and retaining high-margin premium customers. The crew interface must be information-rich, including details such as family member names, birth dates, preferred newspapers, and history of concierge requests. The system supports complex, multi-step service scenarios, such as coordinating individualized meal delivery in a “Dine on Demand” concept, where each order is prepared separately.

For Wizz Air, the model is adapted to prioritize speed, operational efficiency, and revenue maximization. The interface is designed to be extremely simple, intuitive, and fast, optimized for one-click transactions. Key functions include rapid identification of high-propensity buyers and effective management of onboard inventory. The system assists the crew in performing full trolley inventory checks in seconds (via tablet camera barcode scanning) and automatically generates replenishment orders for the next flight, avoiding shortages of popular items (e.g., water or fresh sandwiches) that often occur on evening flights and lead to revenue loss.

The technical implementation of the model is based on a modern, flexible cloud-based microservices architecture. The system core (backend) is hosted on secured airline servers (for example, on AWS, Google Cloud, or Microsoft Azure) and seamlessly integrates with the main Passenger Service System (PSS) via a secure API gateway. The client side (frontend) is implemented as native mobile applications for crew tablets (iOS/Android) and an adaptive web portal for passengers.

A critical fundamental concern in system development is cybersecurity and data protection. The model incorporates end-to-end encryption for all data transmission, mandatory two-factor authentication for crew access, and automatic guaranteed wiping of all cached passenger data from tablet memory immediately after flight completion and aircraft door closure, in compliance with strict GDPR and national regulations. Crew members only see the limited information necessary to perform their duties (principle of need-to-know), and features such as screenshots or data copying are programmatically blocked at the operating system level via Mobile Device Management (MDM).

Implementation of such a complex, multi-component model requires not only significant technical and financial investment but also profound changes in organizational culture and personnel training. Cabin crew must undergo intensive specialized training in digital literacy, data handling, and service psychology. They must learn to critically interpret system prompts while maintaining natural, sincere, and empathetic human interaction, avoiding robotic, scripted behavior. The Human-in-the-Loop concept ensures that technology provides only recommendations, while final decisions regarding actions, tone, and communication appropriateness remain with the professional, based on the passenger's real-time emotional state, onboard situation, and crew intuition.

A promising avenue for further development is integration with wearable devices. Crew smartwatches connected to the system can vibrate discreetly to indicate a passenger request or the arrival of a VIP customer, enabling a quieter, more comfortable, and less intrusive service, particularly important on night flights. Additionally, the system can monitor crew fatigue in the background (via heart rate and activity sensors), allowing the senior flight attendant to provide short rest breaks, thereby improving flight safety within the Fatigue Risk Management System (FRMS).

The economic feasibility of implementing the proposed model is supported by projected revenue growth and operational cost reduction. Revenue increases are achieved through higher average onboard spend, thanks to timely, accurately targeted offers tailored to passenger preferences, and enhanced Lifetime Value (LTV) due to greater loyalty and repeat bookings. Cost reduction comes from optimized catering loads (reducing food waste through accurate demand forecasting based on historical data) and significantly less unproductive administrative work for the crew. According to leading industry experts and consultants, implementing a full personalization system can generate an additional $1–$3 of net profit per passenger, which, at the scale of a major airline like Wizz Air (over 60 million passengers annually), represents a substantial sum, fully offsetting development and implementation costs within 12–18 months.

Thus, the developed comprehensive model of personalized in-flight service using digital passenger profiles represents a powerful strategic tool for the digital transformation of airline service. It effectively addresses the main shortcoming of modern mass aviation — the depersonalization of travel — restoring a sense of individual attention, respect, and care for each passenger, but now on a scalable technological level. For Etihad Airways, this model provides an effective, contemporary way to reinforce its status as a global leader in the premium segment, while for Wizz Air, it offers a unique opportunity to enhance sales efficiency and improve the emotional perception of the brand without violating the strict constraints of a low-cost business model. The model is flexible, modular, easily scalable, and ready for integration with future breakthrough technologies such as facial biometrics and augmented reality (AR), making it a promising and reliable solution for the long-term sustainable development of airlines in the digital era.

3.2. Implementation of an Automated Loyalty and In-flight Service Management System into Airline Operations

The practical implementation of the personalized service model developed in the previous subsection requires the creation of a clear, phased roadmap for deploying an automated loyalty and in-flight service management system within the operational processes of an airline. The transition from a theoretical concept to a fully functioning business process is a complex organizational and technical challenge, affecting virtually all airline departments, from the IT department and marketing service to the flight operations directorate and ground handling division. Global digitalization experience, as summarized in industry reports by SITA [26], indicates that the success of such projects depends only 20% on software quality and 80% on effective change management, business process reengineering, and staff adaptation to new working conditions. Therefore, the implementation process should be considered as a comprehensive strategic initiative, executed following project management methodologies and including technical integration, procedural reengineering, personnel training, and pilot operation.

The first and fundamental stage of implementation is the technical integration of the new automated system with the airline's existing IT landscape. Modern carriers typically operate a complex software ecosystem, with the Passenger Service System (PSS) — which includes inventory, booking, and check-in modules — at its core. For Etihad Airways, this is, for example, the Amadeus Altea system, while for Wizz Air, it is Navitaire New Skies [18]. The main technical challenge is to ensure seamless bidirectional data exchange between these often legacy systems and the new Customer Data Platform (CDP). This requires the development and configuration of secure API gateways to extract real-time data on passengers registered for a flight, enrich it with historical CRM data, and transmit the resulting digital profile to crew mobile devices.

A critically important aspect of technical implementation is ensuring reliable data transmission infrastructure to the aircraft. The aviation sector is unique in that aircraft spend a significant portion of time disconnected from ground communications. For Etihad Airways, whose fleet is equipped with satellite communication, the implementation strategy involves configuring data transmission channels via satellite. This requires installing onboard wireless servers to cache data and synchronize with the ground cloud. Channel throughput must be carefully tested, as transmitting "heavy" content (e.g., passenger photos for visual identification) can overload channels reserved for pilot operational use.

For Wizz Air, which currently operates in a semi-offline or offline mode to reduce costs, the technical challenge is compounded by the need to develop robust data synchronization protocols over 4G/5G cellular networks while the aircraft is at the gate. The system must be configured to ensure that within the short turnaround time (25–30 minutes), sales data from the previous flight are uploaded, and current passenger profiles for the next flight are downloaded. This requires installing secure Wi-Fi access points at home bases, which automatically connect to crew tablets as soon as the aircraft arrives at the stand.

The next stage concerns the hardware component of the project, which involves the procurement, configuration, and distribution of mobile devices for the crew. Device selection must be based on strict operational requirements: tablets should be shock-resistant, equipped with high-capacity batteries capable of lasting the entire shift (up to 12–14 hours), and compliant with aviation safety standards (i.e., causing no interference with navigational equipment). For Wizz Air, where the tablet also functions as a mobile point-of-sale (mPOS) terminal, it is critical to include a built-in or integrated module for reading bank cards and NFC tags.

The logistics of these devices present a separate challenge: procedures must be established for issuing tablets before flights, charging, sanitizing, and technical maintenance. For Etihad Airways, it is advisable to assign tablets individually to senior flight attendants, thereby increasing accountability, whereas for Wizz Air, given variable crew assignments and aircraft basing, a model where tablets are assigned to the aircraft (aircraft-assigned devices) may be more effective.

In parallel with the technical work, reengineering of standard operating procedures (SOPs) must take place. The introduction of a digital tool fundamentally changes the workflow of the cabin crew, making previous instructions obsolete. Sections of the Service Manual related to pre-flight preparation, boarding, and in-flight service need to be fully rewritten. For example, the pre-flight briefing procedure should be transformed: instead of reading paper summaries, the senior flight attendant should conduct an interactive review of the flight profile on the tablet, visually presenting the seating of VIP passengers and those with special needs. Boarding procedures must be augmented with a stage for passenger identification using digital profiles.

It is important to clearly define the situations in which crew should refer to the tablet to avoid the “screen fixation” effect, where the attendant focuses more on the device than on passengers. The new SOPs must harmoniously combine digital efficiency with eye contact and emotional engagement. Particular attention should be paid to procedures for non-standard situations (equipment failure, loss of connectivity) to ensure that technology does not become a risk factor.

The most challenging and time-consuming stage of implementation is training and personnel adaptation. The success of digitalization depends on how well flight attendants accept the new system and learn to use it effectively. A comprehensive training program must be developed, covering both technical aspects (menu navigation, data entry, minor troubleshooting) and psychological aspects (interpreting profile data, building personalized dialogue, ethics of handling private information).

For Etihad Airways, where service is based on empathy, training should focus on developing emotional intelligence in a digital environment: for example, how to use system prompts (“it is the passenger’s birthday”) in a way that appears sincere rather than mechanical. For Wizz Air, training should emphasize speed and efficiency: how to identify a high-propensity-to-buy passenger in 30 seconds of boarding and make a relevant offer. Effective training methods include virtual reality (VR) technologies, which allow the simulation of working with the tablet in a realistic cabin environment without removing the aircraft from service.

Additionally, it is important to establish an institute of Digital Champions—selecting the most loyal and technologically proficient flight attendants to act as change agents within their teams, assisting colleagues in mastering new tools and collecting feedback for developers.

Implementation inevitably involves cybersecurity and data protection issues, requiring the development and approval of new information security policies. The airline becomes the operator of large volumes of sensitive personal data, necessitating strict compliance with GDPR [17] and national legislation. This includes implementing two-factor authentication for tablet access, data encryption in transit and at rest, and configuring automatic deletion of passenger data after flight completion. Crew members must sign additional non-disclosure agreements (NDAs) and undergo training on responsibility for unauthorized data use (e.g., prohibition on photographing the tablet screen or discussing passenger information in public areas).

The system deployment process should be conducted in stages, beginning with a pilot project. For Etihad Airways, mid-haul flights (e.g., Abu Dhabi–London) represent an optimal testing ground, as they carry a high proportion of frequent flyers and business passengers. This allows for the evaluation of personalization algorithms and the reliability of satellite connectivity under real operational conditions. For Wizz Air, a pilot project is best launched at one of its hubs (e.g., Budapest or Luton), enabling the refinement of tablet exchange logistics and data synchronization during short turnaround times.

During the pilot period, it is essential to monitor key performance indicators (KPIs), including passenger satisfaction (NPS), onboard sales volume, service time per passenger, and the number of technical failures. The collected data will inform adjustments to the application interface and operational procedures before full-scale rollout across the network.

A critical aspect of implementation is the integration of the new onboard system with ground loyalty management processes. The system must not operate in isolation; it should become part of a closed-loop customer experience management. Data collected onboard (preferences, complaints, ratings) must automatically be transmitted to the central database and used to personalize post-flight communications. For example, if a Wizz Air passenger purchased perfume onboard, the marketing system can automatically send a discount offer on cosmetics before their next flight. If an Etihad passenger complains about an uncomfortable seat, the customer support team should receive this information immediately, allowing them to contact the passenger and offer compensation before any negative feedback appears on social media. Configuring such automated interaction scenarios requires close collaboration between IT, marketing, and operational departments.

A significant factor in successful implementation is managing employee resistance. Any changes to established procedures, particularly those increasing transparency and oversight (as the digital system makes flight attendants' work fully visible to management), inevitably provoke psychological resistance. Crew members may perceive tablets as an additional burden or a surveillance tool. Therefore, the deployment strategy must include a robust communication campaign explaining the benefits of the system for the crew: reduction of paperwork, simplified reporting, opportunities for higher earnings (through increased sales), and positive recognition from satisfied passengers. The incentive system should be revised to include bonuses for effective use of digital tools and high passenger satisfaction scores captured through the new system.

In the context of Wizz Air, implementation will also require a review of contractual arrangements with catering partners (Gate Gourmet, dnata, etc.). Automation of onboard ordering and inventory management enables a shift to a Dynamic Loading model, where the assortment and quantity of items on the trolley are adjusted according to the passenger profile of each flight. This requires catering partners to be flexible and capable of assembling trolleys based on individualized orders within short timeframes. Integration between the airline's IT systems and the catering partner's platform is necessary for automatic exchange of order and inventory data.

For Etihad Airways, a critical stage is the integration of the onboard system with the “Guest Experience” program. This involves configuring algorithms that allow flight attendants not only to access information but also to award miles or status during the flight for certain passenger actions (e.g., assisting the crew or as compensation for inconvenience). This transforms the flight attendant into a full-fledged loyalty manager, empowered to make decisions, which significantly enhances their status and authority in the eyes of passengers.

Project risk management must include contingency plans in the event of system failure. Despite the reliability of modern technology, tablets can run out of battery, freeze, or lose connectivity. Therefore, fallback procedures are mandatory. Crew members must be able to operate paper-based records and manual terminals if the digital system fails, ensuring that service continuity is maintained and flights are not delayed. These procedures should be regularly practiced during training sessions. Additionally, it is necessary to have spare devices and paper copies of critical documents (e.g., PIL, load sheet) onboard.

The final stage of implementation is the transition to industrial operation and the continuous improvement of the system. After deployment across the entire fleet, the work does not stop. It is essential to establish processes for data collection and usage analysis, error monitoring, and crew feedback collection to enhance the interface and functionality. Artificial intelligence technologies require ongoing learning: the more data that passes through the system, the more accurate its recommendations become. Therefore, the airline must create a permanent product support and development team responsible for releasing regular software updates, adding new features, and adapting the system to evolving business needs.

Thus, the implementation of an automated loyalty and onboard service management system is not a one-time event but a prolonged transformation process of the airline's operational model. It requires coordinated efforts from all departments, significant resources, and careful risk management. However, as demonstrated by industry leaders, successful project execution enables a qualitative leap in business efficiency: transforming service from a cost center into a revenue source, making customer loyalty a manageable asset, and rendering crew work more meaningful and productive. For both Wizz Air and Etihad Airways, despite differences in operational approaches, the ultimate goal of implementation is the same — the creation of a modern, digital, customer-oriented airline capable of winning in the competitive landscape of the future.

3.3. Justification of the Economic Efficiency of the Proposed Service Technology Enhancements

The implementation of innovative technological solutions in airline operations, particularly large-scale and complex systems such as the automated loyalty and onboard service management system based on passenger digital profiles developed in this study, requires a thorough, comprehensive, and in-depth economic justification. The aviation industry, as noted by leading economists V. Bilotkach [49, p. 78] and B. Vasig [50, p. 112], is historically characterized by high capital intensity, low operational margins, and extreme sensitivity to external shocks. In such conditions, any IT infrastructure investment must be considered not as a branding initiative, but as a business tool capable of generating measurable financial outcomes in the form of increased revenue or reduced costs.

To assess the economic efficiency of the measures proposed in this thesis, it is appropriate to apply investment analysis methodology, based on the calculation of dynamic efficiency indicators, including Net Present Value (NPV), Internal Rate of Return (IRR), and Discounted Payback Period (DPP), taking into account the specific business models of the airlines under study, Etihad Airways and Wizz Air.

The economic model of the project for implementing a digital service system consists of two main components: the expenditure side, which includes capital (CAPEX) and operational (OPEX) costs, and the revenue side, formed through direct revenue growth and indirect resource savings. Analyzing the cost structure allows the identification of the scale of necessary investments.

Capital expenditures (CAPEX) are the most significant at the initial stage and include the cost of software development or adaptation. This concerns both the backend, which must handle large datasets and integrate with existing Passenger Service Systems (PSS), and the frontend applications for crew tablets. The complexity of integrating with legacy airline systems is often underestimated, so the project budget must allocate substantial funds for the work of system architects and API gateway developers.

The second major CAPEX item is hardware procurement. For an airline of Wizz Air's scale, operating a fleet of over 200 aircraft, it is necessary to purchase at least 1,000–1,200 industrial-grade tablets (based on 5–6 devices per aircraft plus spares), charging stations, and protective accessories. For Etihad Airways, given its premium brand requirements, device costs may be higher.

The third CAPEX item is implementation costs, which include consultancy fees, the development of training materials, and the conduct of training sessions for thousands of cabin crew members.

Operational expenditures (OPEX) arise after the system is launched and are of a recurring nature. They include software licenses (SaaS — Software as a Service), cloud services for data storage and processing (e.g., AWS or Azure), technical support and regular application updates, as well as mobile data costs (roaming) for tablet synchronization across airports worldwide. A separate, critical OPEX item is cybersecurity. Given strict GDPR [17] requirements and high risks of personal data leaks, airlines must invest heavily in encryption systems, threat monitoring, and regular security audits.

Despite the considerable costs, the economic potential of the project is substantial, as demonstrated by an analysis of potential revenue sources.

For the low-cost carrier Wizz Air, the main driver of economic efficiency is Ancillary Revenue Maximization. The low-cost business model is based on the principle that the base fare only covers the cost of the flight, while profit is generated through the sale of additional services. Implementing a system of personalized recommendations on crew tablets enables a shift from passive sales (where passengers request items themselves) to active, targeted sales. According to SITA [26] research, the use of predictive analytics tools increases in-flight conversion rates by an average of 15–20%.

Assuming that the average spend per passenger increases by just €0.5 due to the crew’s accurate recommendation, and considering Wizz Air’s annual passenger traffic of 62 million [18], this would generate an additional annual revenue of €31 million. This amount significantly exceeds the annual operating costs of the system, indicating a high return on investment. Furthermore, the system allows for dynamic pricing of perishable items (e.g., sandwiches), enabling the sale of surplus inventory at discounted prices instead of disposal, further increasing revenue and reducing losses.

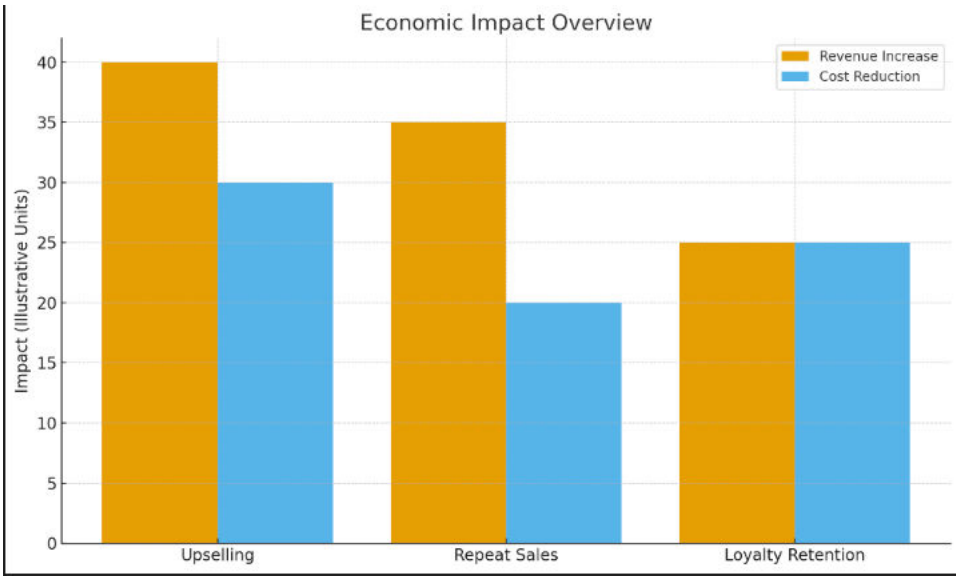

Fig. 3.3. Economic impact overview

Another source of direct economic impact for Wizz Air is the acceleration of service processes. The use of tablets for quick scanning of items and contactless payments reduces the time per transaction by 5–10 seconds. On short-haul flights lasting 1–1.5 hours, where the crew has a limited sales window, every second saved allows more passengers to be served. This eliminates the problem of “lost demand”, when passengers in the rear rows wish to purchase coffee but the crew cannot reach them before the service period ends. Increasing the throughput capacity of the on-board “store” by 10% directly translates into revenue growth. Additionally, automating inventory management and replenishment reduces crew workload, which in the long term may allow optimization of staff allocation or redeployment to other critical tasks, such as cabin cleaning, to ensure faster turnaround times.

For a full-service carrier like Etihad Airways, the structure of economic benefits is somewhat different and relies on the concept of Customer Lifetime Value (CLV/LTV). In the highly competitive Gulf premium market (Emirates, Qatar Airways), the Customer Acquisition Cost (CAC) is extremely high. Therefore, it is more cost-effective to retain existing customers than to acquire new ones. Implementing a personalization system that allows crew members to recognize passengers, greet them by name, and take their individual preferences into account is a powerful tool for enhancing loyalty. Studies show that a 5% increase in retention rate can lead to a 25–95% increase in profit. For Etihad, where a business-class ticket may cost several thousand dollars, retaining even a small number of high-value customers who might otherwise switch to a competitor due to poor service generates millions in preserved revenue.

Furthermore, the system enables soft upselling strategies: for example, offering an economy-class passenger a paid upgrade to a seat with more legroom directly on board, if available, generating pure marginal revenue without additional costs.

A significant factor in the economic efficiency for both types of airlines is the optimization of catering costs and reduction of food waste. Traditional meal planning is based on average load coefficients, forcing airlines to load extra portions “just in case” to avoid passenger complaints about limited choices. This often results in a large share of meals being discarded after the flight, representing direct losses. Implementing an AI-based analytical module that analyzes historical consumption data for specific flights, days of the week, and times of day allows demand to be forecasted with 90–95% accuracy. This enables a shift to precision loading. According to the IATA report [28], reducing food waste by 20% allows a mid-sized airline to save several million dollars annually. For Wizz Air, this means fewer unsold sandwiches being written off, while for Etihad it results in significant savings on expensive premium-class ingredients.

The environmental impact of implementing the system also has a clear economic dimension. Transitioning to digital technologies allows for the complete elimination of paper documentation on board: passenger lists (PIL), sales forms, flight reports, manuals, and logs. At the fleet level, this reduces the weight of each aircraft by 30–50 kg. In aviation, there is a direct correlation between weight and fuel consumption. A reduction of 50 kg for an aircraft performing 4–5 flights per day over a year results in savings of tons of jet fuel. Considering high fuel prices and the existence of CO_2 emission taxes (e.g., under the EU ETS), fuel savings become a significant source of ROI for the IT project. Moreover, improving the company’s environmental image positively affects its market capitalization and attractiveness to investors who focus on ESG criteria.

An important, though more difficult to directly monetize, effect is the improvement in Disruption Management. Flight delays and cancellations cost airlines billions of dollars annually, not only due to direct compensation payments under EU Regulation 261/2004 [12], but also due to lost future revenue from dissatisfied customers. An automated system that allows crew members to instantly issue electronic meal vouchers or rebook connecting flights directly on board significantly reduces passenger stress and dissatisfaction. This lowers the number of official complaints and lawsuits, which in turn reduces administrative costs for legal departments and customer support. Even a 10–15% reduction in call center workload results in significant payroll savings for operators.

The Payback Period calculation for a carrier like Wizz Air demonstrates high investment attractiveness. With an estimated development and implementation cost of €5–7 million (including equipment procurement) and annual operating expenses of €1–1.5 million, the project could reach the Break-even Point within 12–18 months of operation, solely through increased ancillary revenue and fuel savings. For Etihad Airways, the payback period may be somewhat longer due to the higher cost of developing more complex personalization algorithms, but the strategic effect in terms of brand equity growth and retention of market share in the premium segment is indisputable. It is important to note that a discounted cash flow (DCF) method is applied in this context, as project benefits are distributed over time and the value of money changes.

A Sensitivity Analysis allows the assessment of the model's robustness to changes in key parameters. The main risk factors include: lower-than-expected technology adoption by personnel (requiring additional training and motivation costs), technical connectivity issues (reducing real-time system efficiency), and potential changes in data protection legislation (which may restrict the use of passenger profiles). However, even under a pessimistic scenario, where revenue growth reaches only 50% of the planned level, the project remains operationally profitable due to cost-saving components (fuel and waste reduction). This indicates a high resilience of the proposed solution.

It is also important to consider the intangible assets generated by the system implementation. Having a modern digital service platform enhances the airline's attractiveness as an employer for the younger generation ("digital natives"), thereby reducing recruitment and staff retention costs. Furthermore, it opens up opportunities for new partnerships: by leveraging detailed passenger preference data, the airline can monetize these insights (in anonymized form) or offer partners (hotels, taxis, banks) highly targeted marketing campaigns, creating additional revenue streams not directly tied to air transport. In today's digital economy, data ownership and the ability to utilize it effectively are among the most valuable assets of any business.

The methodology for calculating the economic efficiency of the project should also account for synergistic effects. Integrating the onboard system with ground processes enables the creation of a seamless passenger experience. For example, if a passenger purchases perfume on board, this information is recorded in the CRM, and the next time, the marketing system can automatically send a personalized offer or discount on that product prior to departure. This increases touchpoint frequency with the customer and stimulates repeat sales. Such a cyclical value-creation process is impossible to achieve without a unified digital platform.

Thus, the economic justification for implementing an automated loyalty and onboard service management system demonstrates that the project is not an expense but an investment. It allows the transformation of traditional cost centers (crew, catering) into profit-generating units. For Wizz Air, economic efficiency is primarily achieved through sales intensification and operational optimization (scale), whereas for Etihad Airways, it is realized through increased customer margin and loyalty enhancement (depth). In the context of post-crisis recovery of the aviation industry, where every cost center and every dollar of revenue matters, digitalizing service operations becomes an indispensable path to ensuring long-term financial stability and competitiveness in the global market. The measures proposed in this study have a clear economic rationale, acceptable payback period, and low investment risk, making them recommended for practical implementation.

CONCLUSIONS

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Conclusions to the Project Section

In the third chapter of this master's thesis, a comprehensive set of measures aimed at enhancing passenger service technology on board aircraft through the implementation of an innovative personalization model was developed and scientifically justified. Based on an analysis of global best practices and the operational challenges of Wizz Air and Etihad Airways, a transition from a standardized service approach to an adaptive model based on dynamic digital passenger profiles was proposed.

A conceptual architecture of the "Passenger 360" system was designed, integrating data from multiple sources (reservation systems, loyalty programs, CRM) and making it accessible to cabin crew through a specialized mobile application on secure tablets. The system's algorithms for key flight stages were defined, ranging from pre-flight analytics and personalized passenger greetings to in-flight targeted offers and proactive disruption management. The proposed model addresses the "digital gap" and ensures service delivery tailored to individual passenger expectations, regardless of the airline's business model.

A detailed implementation roadmap for the automated loyalty and onboard service management system was developed, including technical integration with existing IT systems, reengineering of standard operating procedures, staff training in digital literacy, and cybersecurity assurance. The adaptation of the model for different airline types was also considered: for Etihad Airways, the focus is on deepening emotional engagement and retaining premium clients; for Wizz Air, the emphasis is on increasing ancillary revenue efficiency and operational speed.

The economic justification of the proposed measures confirmed their high efficiency. Calculations indicate that system implementation represents an investment-attractive project with a payback period of 12–18 months. The primary sources of economic effect include increased ancillary revenue through higher onboard sales conversion rates, enhanced customer lifetime value (LTV) through loyalty, and reduced operational costs due to optimized catering loading and elimination of paper-based documentation.

The implementation of the proposed solutions will enable airlines to achieve a qualitatively new level of service, strengthen their competitive positions, and ensure sustainable development in the digital economy.

In the third chapter of the master's thesis, a set of measures was developed and scientifically substantiated to improve passenger service technology on board aircraft through the implementation of an innovative personalization model. Based on the analysis of global experience and the operational challenges of Wizz Air and Etihad Airways, a transition from a standardized service approach to an adaptive model was proposed, which is based on the use of dynamic digital passenger profiles.

Based on the analysis conducted in the third chapter of the study, an innovative model for personalized passenger service on board aircraft was developed and substantiated, utilizing dynamic digital passenger profiles. The proposed model is based on creating a unified digital ecosystem that integrates data from all customer touchpoints and makes it accessible to the cabin crew via a tablet-based mobile application. System algorithms were developed for all stages of the flight: from pre-flight analytics and personalized passenger greetings to adaptive in-flight service and proactive disruption management. It was demonstrated that implementing such a model transforms the service process from reactive to proactive, enabling anticipation of customer needs and instant response to deviations.

For practical implementation, a detailed roadmap was developed for integrating the automated loyalty and in-flight service management system into airline operations. Technical requirements for integration with existing booking and check-in IT systems were defined, and necessary changes in organizational structure and personnel training processes were outlined. Special attention was paid to cybersecurity and the protection of personal data in accordance with the European GDPR regulations. A change management strategy was proposed to overcome staff resistance and foster a new digital service culture. Prospects for integrating the system with wearable devices were also considered to ensure discretion and comfort in service delivery.

Economic justification of the proposed measures, conducted using investment analysis methods, confirmed the high effectiveness of the project. Calculations showed that implementing the personalization system is economically feasible for both low-cost and traditional airline models. The main sources of economic effect were identified as increased additional revenue through higher in-flight sales conversion, increased customer lifetime value through enhanced loyalty, and reduced operational costs through optimized catering loads and reduced paper documentation. The estimated payback period for the investment is 12 to 18 months, which is an attractive indicator for the industry. In addition to direct financial benefits, the system's implementation generates significant intangible assets, improving brand reputation and enhancing the airline's investment attractiveness.

In summary, the study confirms that digital transformation of passenger service technology is an indispensable development path for modern airlines seeking to maintain and strengthen their market positions. The model developed in this master's thesis, along with practical recommendations for its implementation, can be used by aviation enterprises to modernize service processes, increase operational efficiency, and achieve a qualitatively new level of customer interaction. Implementing the proposed solutions will overcome the impersonality of mass air travel and enable the provision of high-quality, personalized, and safe service that meets the requirements of the digital era.

LIST OF REFERENCES

1. Air Code of Ukraine: Law of Ukraine dated 19.05.2011 No. 3393-VI. Official Bulletin of the Verkhovna Rada of Ukraine. 2011. No. 48–49. Art. 536. (Edition as of 01.01.2025).
2. On the State Program for Civil Aviation Security: Law of Ukraine dated 21.03.2017 No. 1965-VIII. Holos Ukrainy. 2017. No. 68.
3. On Consumer Rights Protection: Law of Ukraine dated 12.05.1991 No. 1023-XII. Official Bulletin of the Verkhovna Rada of the USSR. 1991. No. 30. Art. 379.
4. On Approval of the Rules for Air Transportation and Passenger and Baggage Handling: Order of the State Aviation Service of Ukraine dated 26.11.2018 No. 1239. Official Bulletin of Ukraine. 2019. No. 14. Art. 520.
5. On Approval of the Aviation Rules of Ukraine "Rules for Certification of Entities Providing Agency Services for Air Transport Sales": Order of the Ministry of Infrastructure of Ukraine dated 04.06.2019 No. 415.
6. On Approval of the Procedure for Granting and Revoking Rights to Operate Air Routes: Order of the State Aviation Service of Ukraine dated 24.10.2014 No. 686.
7. On Approval of the Procedure for Organizing and Conducting Flights in the Airspace of Ukraine: Order of the State Aviation Service and Ministry of Defense dated 11.05.1999 No. 268/137.
8. DSTU 8302:2015. Information and Documentation. Bibliographic Reference. General Provisions and Compilation Rules. Kyiv: SE "UkrNDNC", 2016. 17 p.
9. DSTU ISO 9001:2015. Quality Management Systems. Requirements (ISO 9001:2015, IDT). Kyiv: SE "UkrNDNC", 2016. 22 p.
10. Convention for the Unification of Certain Rules for International Carriage by Air (Montreal Convention). Montreal, 28 May 1999. ICAO Doc 9740.
11. Convention on International Civil Aviation (Chicago Convention). 9th Edition. ICAO Doc 7300/9. Montreal: ICAO, 2006.

12. Regulation (EC) No 261/2004 of the European Parliament and of the Council of 11 February 2004 establishing common rules on compensation and assistance to passengers in the event of denied boarding and of cancellation or long delay of flights. Official Journal of the European Union. L 46. 2004.
13. ICAO Doc 9944. Guidelines on Passenger Name Record (PNR) Data. First Edition. Montreal: ICAO, 2010.
14. ICAO Doc 9636. International Signs to Provide Guidance to Persons at Airports and Marine Terminals. Montreal: ICAO, 1995.
15. IATA Passenger Services Conference Resolutions Manual (PSCRM). 44th Edition. Geneva: IATA, 2024.
16. IATA Core Principles on Consumer Protection. Resolution of the 69th IATA Annual General Meeting. Cape Town, 2013.
17. Regulation (EU) 2016/679 of the European Parliament and of the Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data (GDPR).
18. Wizz Air Holdings Plc. Annual Report and Accounts 2024. Budapest: Wizz Air, 2024. 210 p. URL: https://wizzair.com (accessed: 20.11.2025).
19. Wizz Air Holdings Plc. Sustainability Report 2023. Budapest: Wizz Air, 2023. 85 p.
20. Wizz Air General Conditions of Carriage for Passengers and Baggage. Effective from 15 February 2024. Budapest: Wizz Air, 2024.
21. Wizz Air Group Environmental Policy 2024. Budapest: Wizz Air, 2024.
22. Etihad Aviation Group. Annual Report 2023. Abu Dhabi: Etihad, 2024. URL: https://www.etihad.com (accessed: 20.11.2025).
23. Etihad Airways. Sustainability Report 2023. Abu Dhabi: Etihad, 2024.
24. SITA. Passenger IT Insights 2024. Geneva: SITA, 2024. 28 p.
25. SITA. Air Transport IT Insights 2023. Geneva: SITA, 2023. 36 p.
26. IATA. Annual Review 2024. Montreal: IATA, 2024.
27. IATA. Global Passenger Survey 2023 Highlights. Montreal: IATA, 2023.
28. IATA. Food Waste Reduction Strategy. Montreal: IATA, 2023.

29. Boeing. Commercial Market Outlook 2024–2043. Seattle: Boeing, 2024.
30. Airbus. Global Market Forecast 2023–2042: Infrastructure and Services. Toulouse: Airbus, 2023.
31. Eurocontrol. Performance Review Report 2023: An Assessment of Air Traffic Management in Europe. Brussels: Eurocontrol, 2024.
32. Shevchuk, D. O. Organization of Transport and Transportation Management (Air Transport): Textbook. Kyiv: NAU, 2020. 456 p.
33. Yun, G. M., & Shevchuk, D. O. Logistics Management of Aviation Enterprises: Monograph. Kyiv: Kondor, 2018. 212 p.
34. Garazha, O. P. Service Quality Management in Aviation Enterprises: Lecture Notes. Kyiv: NAU, 2019. 84 p.
35. Lytvynenko, S. L. Passenger Transportation Technology: Methodical Recommendations. Kyiv: NAU, 2021. 36 p.
36. Sokolova, O. Ye. Strategic Management of an Airline: Textbook. Kyiv: NAU, 2020. 280 p.
37. Bilyakovych, O. M. Aviation Safety and Human Factor: Textbook. Kyiv: NAU, 2020. 180 p.
38. Methodical Recommendations for Master's Qualification Work / Compiled by O. P. Garazha, D. O. Shevchuk. Kyiv: KAI, 2025. 36 p.
39. Arefieva, O. V., & Miminoshvili, A. V. Aviation Transport Economics: Textbook. Kyiv: NAU, 2019. 320 p.
40. Zahorna, T. O. Economics and Organization of Enterprise Associations: Textbook. Kyiv: Center for Educational Literature, 2020. 288 p.
41. Halpern, N., & Mwesiumo, D. Airport service quality and passenger satisfaction: The impact of service failure. Research in Transportation Business & Management, 2021, Vol. 41, Article 100667.
42. Agarwal, I., & Gowda, K. R. The effect of airline service quality on customer satisfaction and loyalty. Materials Today: Proceedings, 2021, Vol. 37, pp. 1341–1348.

43. He, Z. From Check-in to Take-off: How Digitalization Reshapes Airport Service Quality. Journal of Aviation, 2025, Vol. 12, pp. 45–58.
44. Bogicevic, V., & Yang, W. The role of service robots in airports: Technology readiness and efficacy. Tourism Management, 2023, Vol. 94.
45. Merkert, R., & O’Fee, B. Managerial perceptions of incentives for and barriers to the use of electric aircraft. Transportation Research Part D, 2024, Vol. 116.
46. Wittmer, A., & Rowley, E. Customer value of seat selection in air travel. Journal of Air Transport Management, 2022, Vol. 102.
47. Efthymiou, M., & Njoya, E. T. The impact of delays on passenger satisfaction and loyalty. Journal of Air Transport Management, 2019, Vol. 78, pp. 96–103.
48. Garrow, L. A., & Lurkin, V. Airline Operations and Scheduling. Transportation Science, 2021, Vol. 55, No. 1, pp. 1–9.
49. Bilotkach, V. The Economics of Airlines. 2nd Edition. Manchester University Press, 2021. 312 p.
50. Vasigh, B., & Fleming, K. Introduction to Air Transport Economics: From Theory to Applications. Routledge, 2021. 450 p.
51. Cook, G. N., & Billig, B. Airline Operations and Management: A Management Textbook. Routledge, 2023. 480 p.
52. Wensveen, J. G. Air Transport Management: An International Perspective. 10th Edition. Ashgate, 2023. 560 p.
53. Wittmer, A., & Bieger, T. Aviation Systems: Management of the Integrated Aviation Value Chain. Springer, 2021.
54. Lysenko, V. V. Prospects for the Development of Low-Cost Carriers in Ukraine: The Wizz Air Case. Problems of the Systemic Approach in Economics, 2021, Issue 2(82), pp. 112–118.
55. Halpern, N., & Graham, A. Airport Marketing. 3rd Edition. Routledge, 2021.
56. Florido-Benítez, L. The impact of mobile marketing on airport service quality. Journal of Airline and Airport Management, 2022, Vol. 12(1).

57. Meyer, J. Workforce management in the age of airline digitalization. International Journal of Aviation Management, 2023.
58. Gupta, S. AI and ML in Aviation: Case studies of Etihad and Emirates. Journal of Big Data Analytics in Transportation, 2023.
59. Ricci, P. Sustainability in low-cost carriers: The Wizz Air case. Green Aviation Journal, 2023.
60. Skytrax. The World's Top 100 Airlines of 2024. URL: https://www.worldairlineawards.com (accessed: 20.11.2025).