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Improving quality of logistics services of dry ports within Eurasian transport corridors (Based on the case study "Khorgos Gateway")

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CONTENTS

NORMATIVE REFERENCES

References to the following standards are made in this dissertation:

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2. President of Kazakhstan K.-J. Tokayev's State of the Nation Address "Kazakhstan in a new reality: time for action", September 1, 2020.
3. "National Export Strategy of the Republic of Kazakhstan" for 2018-2022. Decree of the Government of the Republic of Kazakhstan dated August 26, 2017, No. 511.
4. State Program for Infrastructure Development for 2020 – 2025 "Nurly Zhol". Decree of the Government of the Republic of Kazakhstan dated December 31, 2019, No. 1055.
5. The state program "Digital Kazakhstan. Decree of the Government of the Republic of Kazakhstan dated December 12, 2017, No. 827.
6. On accession to the Intergovernmental Agreement on Dry Ports. Decree of the Government of the Republic of Kazakhstan dated December 23, 2015, No. 1043.

NOTATIONS AND ABBERVIATIONS

CCTV	Closed Circuit Television
CCWAEC	China-Central Asia-West Asia Economic Corridor
EAEU	The Eurasian Economic Union
EDI	Electronic Data Interchange
EPR	Enterprise Resource Planning
ESCAP	Economic and Social Commission for Asia and the Pacific
EU	European Union
EWCITC	Europe-Western China International Transport Corridor
GCI	Global Competitiveness Index
GIS	Geographic information system
GPS	Global positioning system
ICT	Information and communications technology
IoT	Internet of things
IPA	Importance-Performance analysis
ISO	The International Organization for Standardization
LPI	The International Logistics Performance Index
LPI	Logistics Performance Index
NELBEC	New Eurasian Land Bridge Economic Corridor
NEAL-NET	The Northeast Asia Logistics Information Service Network
OBOR	The One Belt One Road
RFID	Radio Frequency Identification
RFID	Radio-frequency identification
SERVQUAL	Service quality
TEN-T	Trans European Transport Network
TEU	Twenty-foot Equivalent Unit
TQM	Total quality management
TRACECA	Transport Corridor Europe-Caucasus-Asia
UN	The United Nations
UNCTAD	The United Nations Conference on Trade and Development
UNESCAP	The United Nations Economic and Social Commission for Asia and the Pacific
WEF	The World Economic Forum
WMS	Warehouse Management System
WoS	Web of Science

INTRODUCTION

General description of thesis. This thesis is devoted to developing ways to improve the quality of logistics services in dry ports of the Eurasian transport corridors in the context of digitalization based on the case study "Khorgos Gateway".

The relevance of the topic. Sustainable world trade growth in recent decades has significantly influenced the development of transportation and global supply chains in terms of multi- and inter-modality and intensified competition between land- and sea-based transport corridors. In the conditions of the geopolitical crisis, special attention is paid to the problems of developing logistics centres, terminals, and hubs within the trans-Eurasian land transport corridors between Europe and China. Conversely, the Fourth Industrial Revolution (Industry 4.0) poses new challenges for countries to comprehensively transform their logistics infrastructure using digital technologies. Improving the quality of logistics services within international transport corridors is necessary to serve existing trade flows. It is crucial for landlocked transit countries such as Kazakhstan.

The Strategy "Kazakhstan-2050: new political course of the established state" emphasizes that a critical direction is developing transit potential, which is expected to increase transit traffic through Kazakhstan. It was also planned to form transport and logistics hubs in the world's nodal transit points for global infrastructure integration [1].

In the Message of the President of the Republic of Kazakhstan, Kassym-Jomart Tokayev, dated 9 January 2020, special attention was paid to developing the transport and logistics complex. Aiming to increase the competitiveness of Kazakhstan planned to implement infrastructure projects and improve service and transit routes [2].

The goal of "The Nurly Zhol State Infrastructure Development Program for 2020-2025" is to promote economic growth and improve living standards by creating an efficient and competitive transport infrastructure by developing transit and transport services and improving the technological and institutional environment [3]. Based on the infrastructural support of the territories and transport links, the program's objective is to facilitate the attractiveness of the transit through Kazakstan.

Currently, digital technologies play a crucial role in improving the quality of logistics services in forming Logistics 4.0 and the global Covid-19 pandemic. The State Program "Digital Kazakhstan" aims to ensure the further growth of the transport and logistics industry. It is planned to introduce an intelligent transport system that will increase the transit potential and improve transport security through prompt information processing [4].

In ensuring the uninterrupted organization of freight traffic in the Eurasian space, one of the tasks is to develop digital transport corridors. In the address to the Heads of the Member States of the Eurasian Economic Union, Kassym-Jomart Tokayev noted that it is necessary to thoroughly and fully use the potential of cross-border transport arteries and logistics hubs [5]. He proposed intensifying work on developing mutually beneficial joint projects that link the Eurasian integration association with the "One Belt One Road" initiative. He also noted the full use of the

potential of the "Khorgos Gateway" on the border of the Republic of Kazakhstan with the People's Republic of China.

Against this background, without adequately functioning the logistics infrastructure and ensuring the quality of logistics services, it is impossible to increase the Eurasian transport corridors' attractiveness in Industry 4.0. To fully utilize Kazakhstan's transit potential, developing a "soft" logistics infrastructure is essential. However, studies have not been conducted on the issue of improving the logistics service quality of dry ports in Kazakhstan. Thus, the research of dry ports within land-based corridors on the "New Silk Road" will remain relevant and highly significant.

The degree of elaboration of the research topic. The study is based on the foreign and domestic economic and logistics literature achievements of the logistics services quality assessment of logistics and transport infrastructure.

Researchers who have contributed to the understanding and development of the dry port concept are the following: Roso [6], Rodrigue [7], Notteboom [8], Beresford [9], Witte [10], Wiegmans [11], Ng [12].

The most exciting provisions are the conceptions on the development, formation, and effective functioning of logistics centres, ports and hubs, and transport corridors. In this field, research was provided by Harris, Wang Y., Wang H. [13], Wei, Sheng, and Lee [14], Jeevan, Chen, and Lee [15], Fechner [16], Banomyong [17], Ishfag[18], Regmi and Hanoka [19].

Theoretical and methodological problems of service quality assessment were considered in the studies of many foreign scholars: service quality criteria – Parasuraman [20], quality assessment of service ports and intermodal terminals – Kolanovich, Dundovich, Yugovich [21], Thai [22], Hemalatha, Dumpala, Balakrishna [23], Almotairi [24], Gogas, Adamos, and Nathanail [25], assessment of the efficiency of transport and logistics facilities –Ha [26], Hu [27], logistics service quality - Saura and others [28].

However, all international and regional studies have characteristics associated with a particular country's logistics system's functioning. Evaluation of the quality of logistics services in many developed countries aims to assess seaports and intermodal terminals. At the same time, Kazakhstan has fundamentally different dry ports and terminals that do not have access to the sea.

In general, empirical studies have studied the dynamics of dry ports in the western, developed regions in the UN and Western Europe [29], Malaysia [15], [30], China [31], [9]. The quality of logistics services of dry ports in trans-Eurasian transport corridors has not been studied previously. Previous studies of the quality of logistics services in ports have dealt with the assessment of seaports [32], container and intermodal cargo terminals [23], [33], and the analysis of port performance [34].

Among domestic scholars, the problems of technological modernization of the Great Silk Road were considered in the works of Sabden [35], the assessment of the transport and logistics potential of the regions – Raimbekov [36]; transport and logistics systems and the development of transit potential – Bodaubayeva [37], the automation of management of the transportation process in railway transport -

Iztileuova [38], the formation and development of an integrated transport and logistics system - Syzdykbaeva [39] the development of the regional transport and logistics centres system - Tulendiev [40], transportation and transit potential – Imasheva [41], evaluation of the efficiency of the logistics market –Tyshkanbaeva, Mukhanova [42]; development of the logistics infrastructure of the distribution network of Kazakhstan – Zhumatayeva [43] and others.

An in-depth literature review revealed a lack of research on the quality of logistics services in dry ports. In this regard, developing an assessment tool for evaluating dry ports with digitalization aspects and recommendations for developing Eurasian transport corridors is necessary.

Purpose and objectives of the study. The aim of the thesis is to examine theoretical and methodological approaches to the evaluation of dry ports and to develop recommendations for improving the quality of logistics services in the digitalization within the Eurasian transport corridors based on the case study "Khorgos Gateway". This goal is achieved by performing the following tasks:

- to study the theoretical foundations of the dry port concept in the context of the formation and development of land-based transport corridors;
- to study foreign practices of development of dry ports and transport corridors in the context of digitalization and to identify digital technologies that contribute to improving the quality of logistics services;
- to study methodological approaches for monitoring and ensuring the quality of logistics services and develop indicators and sub-indicators for assessing the quality of logistics services of dry ports;
- to assess the impact of technological, innovative development and digital technologies on the improving of quality of logistics services;
- to analyze the transit potential of Kazakhstan in the Eurasian transport corridors and the application of digital technologies in the sector of transport and warehousing;
- to evaluate the quality of the logistics service of "Khorgos Gateway" dry port;
- to develop the main directions for improving the quality of logistics services of dry ports based on digital transformation;
- to propose recommendations for including dry ports of Kazakhstan in international transport networks with improving logistics services.

The object of research is the logistics services of dry ports within land-based transport corridors.

The subject of research is the optimization processes associated with improving the quality of logistics services of dry ports in terms of digitalization.

Theoretical and methodological base of research. The study's theoretical and methodological basis comprises the conceptual foundations of the formation of dry ports, foreign and domestic scientists' studies on the quality of logistics services, the development of transport and logistics infrastructure, and transport corridors.

The methodological basis of the dissertation is based on the explanatory sequential research design and includes general scientific methods (analysis and synthesis, induction, deduction), empirical methods (quantitative and qualitative

methods) and statistical methods of data analysis. In the study of the quality of the logistics services of dry ports, the following methods were used: bibliometric network analysis, content analysis, correlation-regression analysis, the SERVQUAL method, and the importance of analysis. Empirical data were collected through expert interviews and surveys. VOS viewer and SPSS 25 programs were used to analyze and visualize qualitative and quantitative data.

The information base of the research. The information base of the study is the regulatory and legislative acts of the Republic of Kazakhstan and other countries, statistical data of the United Nations (UN), the World Bank, the Eurasian Economic Union (EAEU), the Bureau of National Statistics of the Agency for Strategic Planning and Reforms of the Republic of Kazakhstan, the National Center for Scientific and Technical Information, monographs and dissertations of Kazakhstani and foreign scientists, international scientific databases Scopus, Web of Science, Springer.

The following scientific findings are obtained based on the result of the research:

- the term "dry port of continental transport corridors" proposed by the author is based on the generalization of conceptual approaches and practices for the development of dry ports;
- based on the study of foreign experience of developing dry ports, digital corridors, and network bibliometric analysis identified modern intellectual technologies and aspects of improving the quality of logistics service are determined;
- based on the international standards and methodological approaches developed parameters for service quality and assessment tools for the quality of logistics service of dry ports;
- a correlation and regression analysis of the impact of technological, innovative development, and digital technologies on improving the quality parameters of the logistics service were carried out;
- based on the assessment of the quality of logistics services of the dry port "Khorgos Gateway", recommendations for the further development of the dry port were proposed;
- recommendations have been developed to improve the quality of the logistics service of dry ports based on ensuring the quality of service, digital transformation, and integration into international logistics networks.

The main scientific provisions for defense:

1) A dry port in continental transport corridors is a logistics node (terminal, centre, hub) in a land transport corridor and provides a wide range of transport and warehouse services, as well as other value-added services while ensuring the quality of service and digital transparency of the processes.

2) The role of digital technologies in improving the quality of logistics services with the provision of operational data, ensuring transparency of the supply chain, optimizing logistics processes, establishing a flexible connection between products and services, and facilitating instant communication between various stakeholders in the provision of logistics services are substantiated.

3) A systematic approach to assessing the quality of the logistics service of dry ports in international transport corridors is defined, which implies complexity: at the macro level, an assessment of the factors influencing the logistics service, at the meso level - an analysis of the country's transit potential and application of digital technologies, at the micro level - an assessment of the quality of the logistics service of the dry port. An assessment tool for evaluating the quality of the logistics service of dry ports has been developed, which consists of the following parameters: availability of physical infrastructure, operations and processes quality, management and staff quality, appropriating price for the service quality, comprehensive use of ICT, multimodality, and providing value-added services.

4) Based on the correlation-regression analysis of secondary data, it was revealed that the innovational development, the level of technological readiness of the country and digital technologies have a positive effect on improving the quality of logistics services: trade and transport infrastructure, competence and quality of logistics services, the efficiency of customs clearance processes and cargo tracking.

5) The analysis of the transit potential and the case study of the dry port "Khorgos Gateway" showed that the high level of logistics services will be achieved due to the digital modernization of the transport and logistics infrastructure. In developing logistics and economic corridors in the Eurasian space, the development of dry ports of international significance and technological, digital modernization of cross-border infrastructure (stations, customs, ports, terminals) would increase the transit potential of countries.

6) Developed recommendations on improving the quality of logistics services of dry ports and Eurasian transport corridors based on (1) ensuring the quality of logistics services with the introduction of the ISO international service quality standard and the provision of value-added services; (2) digital transformation based on the digital audit of the dry port, the introduction of digital technologies, the development of an integrated information system/platform; (3) integration into regional, international transport networks based on the development of a "soft" infrastructure of transport corridors, involvement in the regional and global chain, development as a logistics hub.

Correspondence to directions for the development of science or state programs. Theoretical and methodological results obtained during the dissertation research contribute to the implementation of the "State program of infrastructural development "Nurly Zhol" for 2020-2025" and the development of work plans to improve the quality of logistics services, digital transformation of transport and logistics infrastructure objects in the Republic of Kazakhstan.

The theoretical and practical significance of research results. Theoretical developments of the dissertation research can be used in the preparation of educational and methodological programs in the specialities "Logistics" and "Management" and applied in the development of the educational program in the discipline "Logistics infrastructure of international transport corridors (LIMTK4309)". The practical significance of the research is that the conclusions and recommendations of the thesis can be used in the digital transformation and

improvement of the quality of the logistics service of the transport and logistics infrastructure of the Republic of Kazakhstan (Appendix A), in the development of the dry port "Khorgos Gateway" (Appendix B). **The connection of this work with the priority direction of the development of science and other research works.** The dissertation work was carried out in the course of the implementation of domestic and international projects: 1) Program-targeted financing of the Ministry of Science and Higher Education of the Republic of Kazakhstan "Kazakhstan's path to a knowledge-intensive economy based on the third technological modernization: strategy, models and mechanisms for development" (No. 0118RK01076, 2018-2020), subprogram 1.1 Exports in Kazakhstan: mechanisms and priorities (Appendix C); 2) The project "Small ports of the South Baltic as a gateway to an integrated sustainable European transport system" of the European Project Center of the University of Applied Sciences Wismar (Germany), activities 3.2 Development of international digital audit tools for small ports (Appendix D); 3) Research project "The impact of new information technologies on improving the quality of logistics services and the prospects for the development of the port" within the framework of the annual research fellowship for doctoral students of the German Academic Exchange Service (DAAD) (Appendix E).

Approbation of the research results. The results of the study were reported and discussed at foreign, international and republican conferences, including the 19th International Conference on Reliability and Statistics in Transport and Communications "RelStat-2019" (Riga, Latvia), International Scientific and Practical Conference of the Institute of Economics of the CS MSHE of the Republic of Kazakhstan (Almaty, Kazakhstan), VI Kazakh-German Forum on Logistics (Almaty, Kazakhstan), International Scientific and Practical Conference "Marketing and Logistics: Modern Challenges and Trends in the Age of Information Technology" (Almaty, Kazakhstan), XXIII International Scientific and Practical Conference of young scientists and students (Almaty, Kazakhstan).

Publication of research results. The results of the research were published in 11 editions, including 2 articles published in the international journals indexed in the Scopus and Web of Science databases, 3 of them are from the list of recommended by the Committee for Control in the Sphere of Education and Science of the Ministry of Science and Higher Education of the Republic of Kazakhstan; 5 - the main results of the thesis were reported and discussed at international and foreign scientific conferences, 1 - subsection in the monograph.

The structure of the dissertation. The work consists of a table of contents, notation, abbreviations, an introduction, three chapters, a conclusion, and references. It also contains 33 tables, 46 figures, 11 appendices and 140 sources.

1 THEORETICAL AND METHODOLOGICAL APPROACHES TO DRY PORT LOGISTIC SERVICE QUALITY ADVANCEMENT

1.1 The dry port concept in the development of land-based transport corridors

The strengthening of land transport routes in the global supply chain during the recent pandemic and geopolitical conditions necessitates developing an appropriate logistics infrastructure. The logistics infrastructure includes transport corridors, hubs, ports, terminals, logistics centres, warehouses, and other transportation elements at the local, regional, and international levels.

Fechner agrees that infrastructure is essential for developing national logistics systems. He defined it as land and water routes, airports, seaports, and/or telecommunication networks located in a specific area. According to Fechner, a systematic logistics approach implies linear and nodal infrastructure as the logistics system's main components [16]. Nodes in the national logistics system operate as points of entry or exits for transported goods. They can also provide logistics operations, such as handling, transhipment, storage, and delivery. Examples of nodes are ports, warehouses, logistics centers, and packing/sorting facilities. Thus, it is essential to provide the national logistics system with appropriate infrastructure, including material and technical procedures for goods [44].

Traditionally, "a port" is related to maritime transport infrastructure, where seaports are the central shipping nodes. With the load on the seaports, additional infrastructure was built on the land. These transport and logistics facilities were called inland ports. In this regard, the formation and development of inland ports originate from the expansion of seaports. They are considered in the context and connectivity with seaports. The first mention of such ports was in 1982 in the United Nations Conference on Trade and Development document, "Multimodal Transport and Containerization. Ports and Container Depots" [45].

Furthermore, such logistics infrastructures were considered "customs clearance depots", "inland clearance depots (or inland customs depots) ", and "inland freight terminals" [46].

A widely used definition of a dry port in the literature belongs to Roso. She defined a dry port as "an inland intermodal terminal directly connected to seaport(s) with high capacity transport mean(s), where customers can leave/pick up their standardized units as if directly to a seaport" [47].

Rodrigue and Notteboom pointed out that an inland port has a level of integration with the maritime terminal and supports more efficient access to the inland market for inbound and outbound traffic. They highlighted three fundamental characteristics of an inland node:

1) an intermodal terminal, either rail or barge, that has been built or expanded;
2) a connection with a port terminal through rail, barge, or truck services, often through a high-capacity corridor;
3) an array of logistical activities that support and organize the freight transited, often co-located with the intermodal terminal [7].

In a global context, the development of land transport corridors should be considered more broadly. Significantly, the acceleration of delivery times, the development of continental transport corridors, an increase in container traffic, and other factors influence the formation of land-based dry ports. They are far from the sea, especially in Asian countries such as China and landlocked states. In addition, the rapid industrial development of industry, urbanization, global supply chains, and many other factors determine the need for the conceptual development of the definition of "dry port".

Globalization boosts freight volumes at global, regional, and local levels and brings challenges to seaports and their inland transport networks [48]. This is because globalization is impossible without supporting an efficient supply chain with unimpeded cargo flow through the sea. Dry ports with an integrated intermodal transportation network need high-quality freight flow management with low inventory costs, more reliable delivery time and distribution. In this regard, dry ports become an essential part of an inland trade transportation and distribution system.

A dry port was broadly defined in the "Intergovernmental Agreement on Dry Ports". A dry port of international importance refers to a land-based location as a logistics center connected to one or more modes of transport for the handling, storage, and regulatory control of goods moving in international trade, as well as the implementation of applicable customs controls and formalities [49].

Dry ports have various aspects in different contexts, and their roles vary from country to country and region. Dry ports also vary in scale, complexity, and area of specialism [50].

Nevertheless, the term dry port is supported by many researchers as it reflects scholars' broad understanding of this concept [11]. To understand the essence of dry ports, it is necessary to study the classification, making it possible to highlight the functional features of dry ports. Based on the literature review, the following systematization criteria were given by Khaslavskaya and Roso: location and functions, development direction, maturity level, dedication, the geography of operations, and transportation mode (Table 1) [51].

Table 1 – Classification criteria of dry ports

Classification criteria	Types of dry ports	Researchers
1	2	3
Location and functions	Close, midrange, distant Seaport-based, city-based, border-based	Roso et al. Beresford et al.
Development direction	Outside-in, inside-out Bidirectional Land-driven, sea-driven	Wilmsmeier et al. Added by Bask et al. Monios

Continuation of table 1

1	2	3
Maturity level	Pre-, start-up, growth phase	Bask et al.
Dedication	Shared (or public), dedicated to particular enterprises or cargoes	Ng and Cetin, Feng et al.
Geography of operations	Domestic, international	Do et al.
Transportation mode	Rail-based, barge-based	Rodrigue and Notteboom.
Note: [51]		

The long-term viability of dry ports depends on the following core attributes: the geographical location where there were sufficient demands and access to high-capacity corridors; the ability to provide efficient and sophisticated value-added services; the ability to integrate with seaports and shipping lines [52].

Beresford et al. classify dry ports into seaport-based dry ports, city-based dry ports and dry border ports. The classification relates to the location, function, and local economic environment. Each group faces a diverse suite of institutional challenges. Seaport-based dry ports capture more cargo flowing along the inland supply chain and relieve capacity constraints at the seaport. A mid-range dry port (trans-loading terminal) is set in the middle point between a seaport and its end market and works as a consolidation point for various rail services. City-based dry ports focus primarily on the day-to-day provision of logistics services. They are positioned within a larger logistics cluster that serves production and consumption. Border dry ports are transhipment centres or custom clearance services with long distances to seaports (2000 km) [50].

It should be noted that the development of dry ports has its own characteristics. Based on the literature review, over the past 25 years (1992-2017), the authors define three periods of dry port development: regionalization, diversification, and contextualization [10, 11] (Table 2).

Table 2 – Periods of dry port development

Periods	Main issues for research	Keywords
1	2	3
1) regionalization (1992–2005)	-needing of inland port; -construction and different methods of affecting an infrastructural setting	freight village, construction, appraisal, viability and feasibility
2) diversification (2006–2011)	- the development of maritime logistics and development/need for inland ports; - the linkage and importance of inland ports on logistics and supply chains; - introduces (conceptually) an inland port; - (and competition between authors) the building theories on the characteristics of inland ports	dry port, inland terminal, inland port, supply chain, logistical system, locational characteristics, port, implementation,

Continuation of table 2

1	2	3
	(e.g., ‘outside-in vs inside-out’, the locational attributes of inland ports); - implementation of the operation and governance of inland ports	operation, outside-in, inside-out
3) contextualization (2012–2017)	- sectoral issues affect the efficient governance of inland ports; -global issues impact the operation and governance of dry ports; -impact-related topics, i.e., inland ports and the surrounding urban/regional environments; - geographically focusing, especially on emerging economies.	institutions, green portfolio, impact, planning, regional growth, inland port-city relationship, emerging economies, developing countries
Note - [10, 11]		

Thus, scientists have developed various approaches to defining the concept of a dry port. It is noteworthy that researchers agree that inland ports are more than just an extension of seaports. A comprehensive analysis of dry ports' development, management, and spatial organization is still lacking [10, 11].

Studying the transport and logistics trends and ports' overall development is necessary to further develop the dry port concept. The primary trend in logistics is service orientation. With the development of an integrated approach to logistics services, the logistics market is rapidly emerging. Based on the Western European classification, it is customary to distinguish five levels of logistics services:1PL, 2PL, 3PL, 4PL and 5PL, where numbers indicate how deeply the company is involved in the supply chain [53]. Along with transportation and warehousing, starting from 3PL, there are value-added logistics services, which include the following services: packaging, labelling, assembly, purchasing, distribution, manufacturing, finance, customs clearance, and another customer service [54]. Value-added services are performed at distribution centers, logistics, and transport infrastructure warehousing facilities.

Also, in terms of the formation of Industry 4.0, the development of the concept of Logistics 4.0 calls for new challenges in providing logistics services. Logistics 4.0 is essential to the flow of information in real time and the automation of logistics operations using digital technologies. Authors underline that the providing Logistics 4.0 services companies improve the quality of their services by ensuring fast speed, improved reliability, reduced operation cost, and enhanced efficiency [56].

Since it is impossible to consider the development of dry ports separately from seaports, dry ports and seaports are equal participants in the supply chain and transportation process. Flynn and Lee proposed a new port classification into the following five levels (Table 3) [56].

Table 3 – Levels of port development

Level	Types of port	Influence area	Cargo weight
Level One	Cargo ports	Local port	Very small port
Level Two	Logistics ports	Regional port	Small port
Level Three	Supply chain management (SCM) ports (bilateral e-ports)	National port	Medium port
Level Four	Globalized E-ports	Continental port	Large port
Level Five	Customer-centric community ports	Global port	Very large port
Note: [56]			

The 5th Generation Port (5GP) concept is grounded on conceptual development and supported by empirical evidence. The significant progression of a 5GP is that it is a customer-centric community port with 5 aspects: service, reliability, technology, sustainability, cluster, and hub (Figure 1). Furthermore, eight features and twelve criteria are identified for each aspect [57]. These features are characteristic of all modern infrastructures, logistics, and economic and business objects.

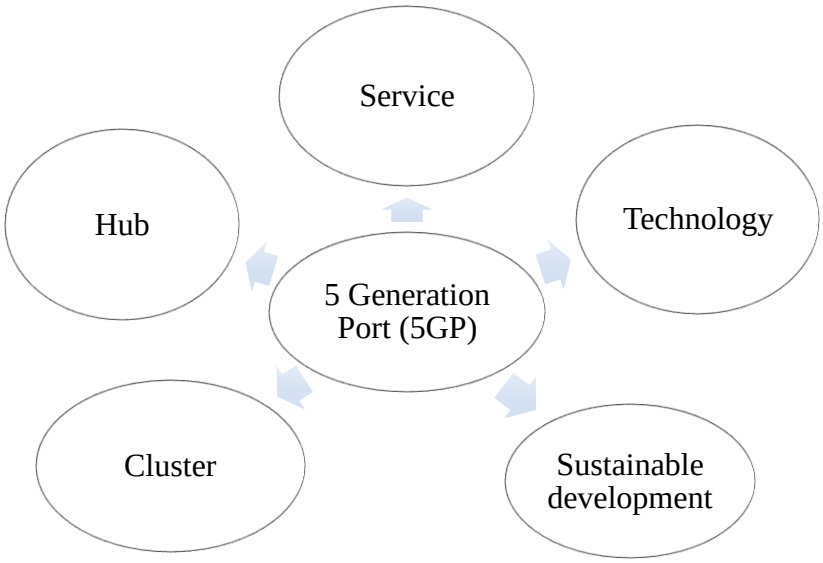


Figure 1 - Main aspects of 5 Generation Port
Note: Developed by the author based on [57]

The development of the port concept has various aspects: economic, geographical, technological, global trade transformation and container ship fleet development. All of those aspects have influenced the seaports over time. In general, port infrastructure has the following phases of development (Figure 2):

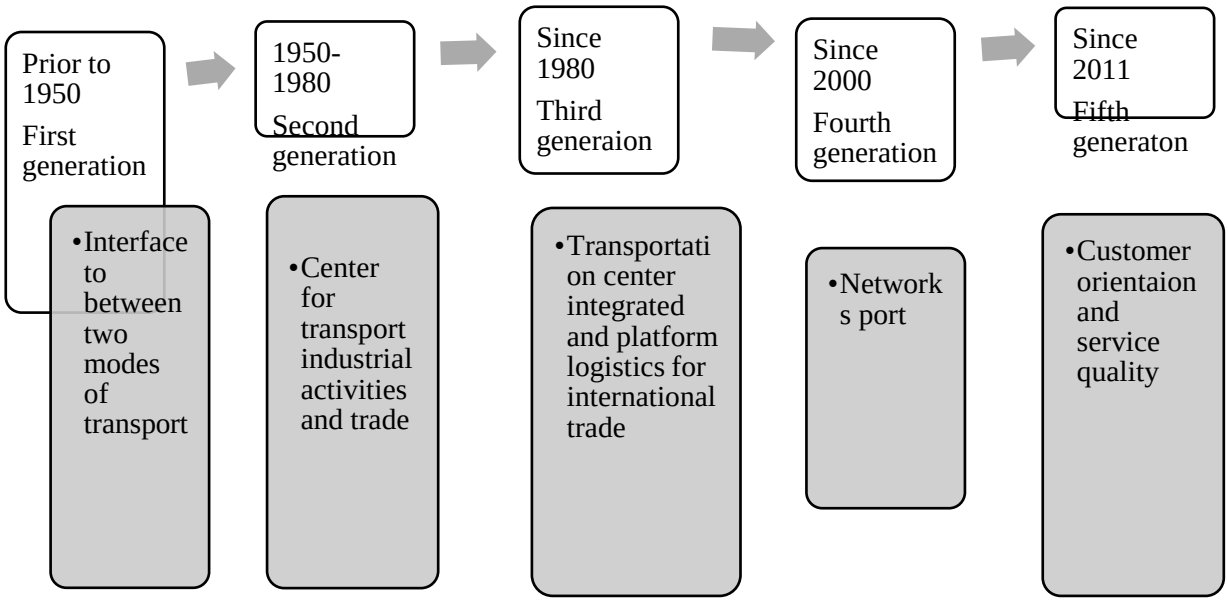


Figure 2 – Development port concept over time
Note – Developed by the author based on [58]

One of the crucial factors in the development of transport and logistics infrastructure is technology. Remarkably, since 2000, networks and customer-orientated ports have improved port operations and processes using information and communication technologies. In general, in the development of scientific paradigms in logistics, it can be noted that the logistics of services is an important area.

In creating a competitive advantage in supply chains, smart service delivery plays a critical role in modern logistics processes. In these cases, the intelligent logistics service system comprises many stakeholders that communicate quickly and more effectively through cloud computing; real-time knowledge and information exchange; allowing cost reduction; resource democratization; co-creating value and innovation and ensuring flexibility and scalability [59].

The smart development of a port is determined by high technologies, enhancing port operation efficiency and improving its ability to respond to changes in the market environment [60].

Molavi, Lim, and Race broadly examined the innovative port concept and evaluated an intelligent port index developed for domains and subdomains of smart ports. Their classification is included four main activities: operations, environment, energy, safety and security [61].

It should be noted that digitalization is inherent not only in the port infrastructure but also in the development of the logistics sector in general. In this context, dry port creators must consider current transport, logistics and industry trends.

Thus, developing the dry port concept should consider digitalization and service orientation trends. In terms of development 4-5 pl and Logistics 4.0, it is crucial the providing value-added and intelligent services. The formation and

development of dry ports at the international level should be regarded as transport corridors since dry ports operate through continental transport corridors. The land-based transport corridors, primarily global, transcontinental logistics and economic corridors, function through logistics infrastructures such as dry ports and terminals.

Therefore, with regional leading, dry ports of international importance can become a logistics hub – the central node of land-based transport and logistics corridors. The dry ports are connected by direct transport or transshipment port in port transportation networks. It has led to the formation of hub-and-spoke networks in the regional logistics infrastructure. Cargoes from the original ports are usually consolidated at the hub and shipped to various destination logistics centers.

There are two types of hub-and-spoke transportation: pure and extended. The pure hub-and-spoke transportation network is characterized by transshipment in which direct transport between ports is excluded. All cargo must be transported through a hub port. The extended hub-and-spoke transportation network consists of direct transportation between ports and transshipment via the hub port [62].

Wei, Sheng, and Lee optimized the two-stage logistics transportation network in the regional port cluster. They combined hub-and-spoke transportation systems among regional ports with consolidation and dispersing transportation systems between ports and their hinterlands (Figure 3) [14].

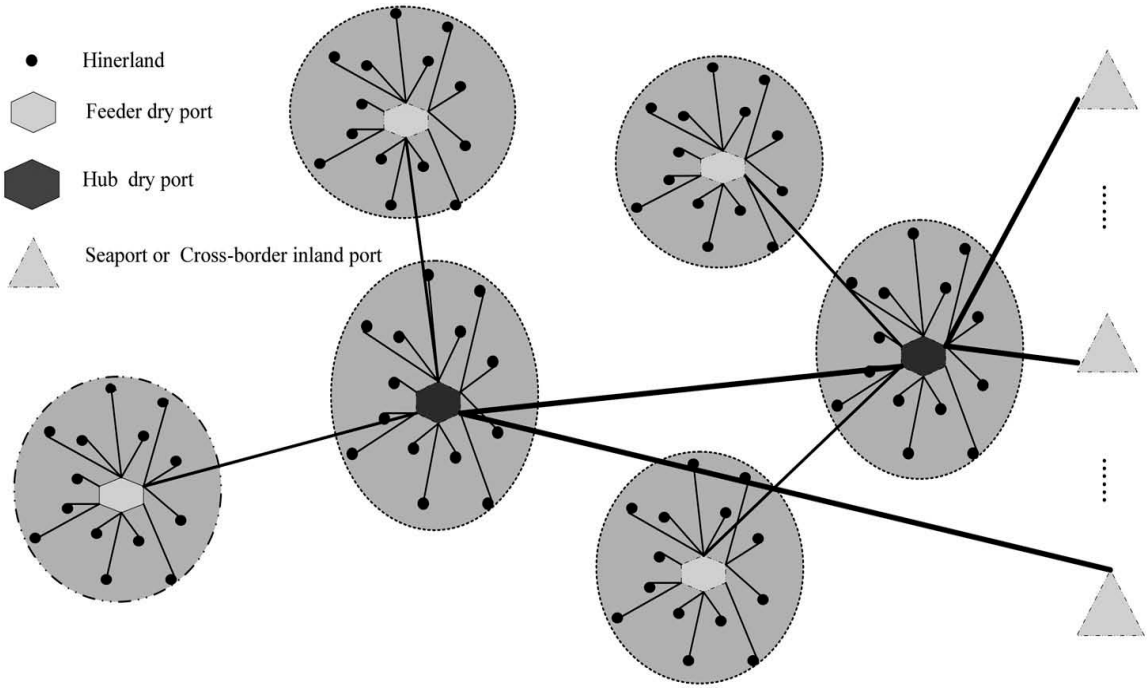


Figure 3 – Schematic diagram of the dry-port-based hub-and-spoke network
Note – [14]

Ishfaq and Sox designed an intermodal logistics network with consideration for hub delays. A modelling framework for an intermodal logistics hub operation was developed using a queuing system approach. This framework describes a classification scheme for individual shipments routed through unloading, consolidation, break-bulk, and loading operations [18].

The term «dry port» has come to be used to refer to the essential nodes in the transportation network. This connectivity is released based on transport corridors, defined as the transport and logistics complex, which integrates various types of transport. The formation and development of transport corridors are considered in the following stages: transport corridors, multimodal transport corridors, logistics corridors, and economic corridors (Figure 4) [63, 64].

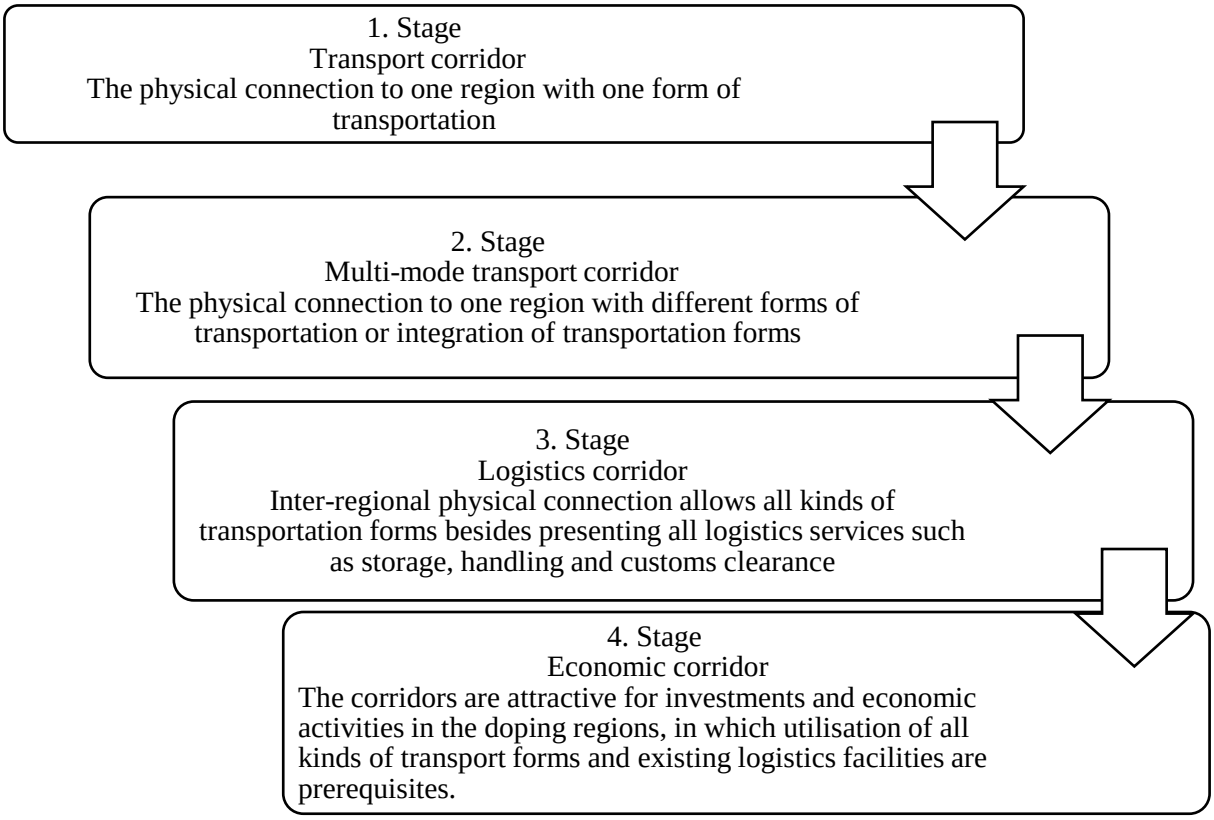


Figure 4 – The development stages of International Corridors Stage Corridor Definition

Note – Developed by the author based on [63, 64]

International networks are formed based on transport corridors. In the first stage, transport corridors are built that physically connect certain regions. Further, in certain areas, there is a need to carry out multimodal transportation using various modes. Different types and transport routes are combined into one corridor. Thus, multimodal corridors are formed. The third stage's logistics corridors are the corridors that provide the connection between the logistics centers (hubs) in specific regions [65]. For example, in transport and logistics facilities (logistics hub, port, terminal, center), various services are provided, such as storage, processing and customs clearance, etc. Based on the connection between them, logistics corridors are developed. Further, economic corridors are formed based on trade and production relations.

Keser underlined that the "economic corridors are the most advanced" among international transport networks. The further development of transport corridors as logistical and economic corridors depends on investments in physical and

institutional infrastructure. [63]. In this regard, for the development of corridors, improving the quality of transport infrastructure logistics services is one of the priority areas of development.

According to the "Trade and Transport Corridor Management Toolkit", a corridor has three main dimensions: infrastructure, services and institutions for coordinating corridor activities. In its most common, a trade and transport corridor has an international gateway: ports, airports, or land borders (dry ports and terminals) (Figure 5) [66].

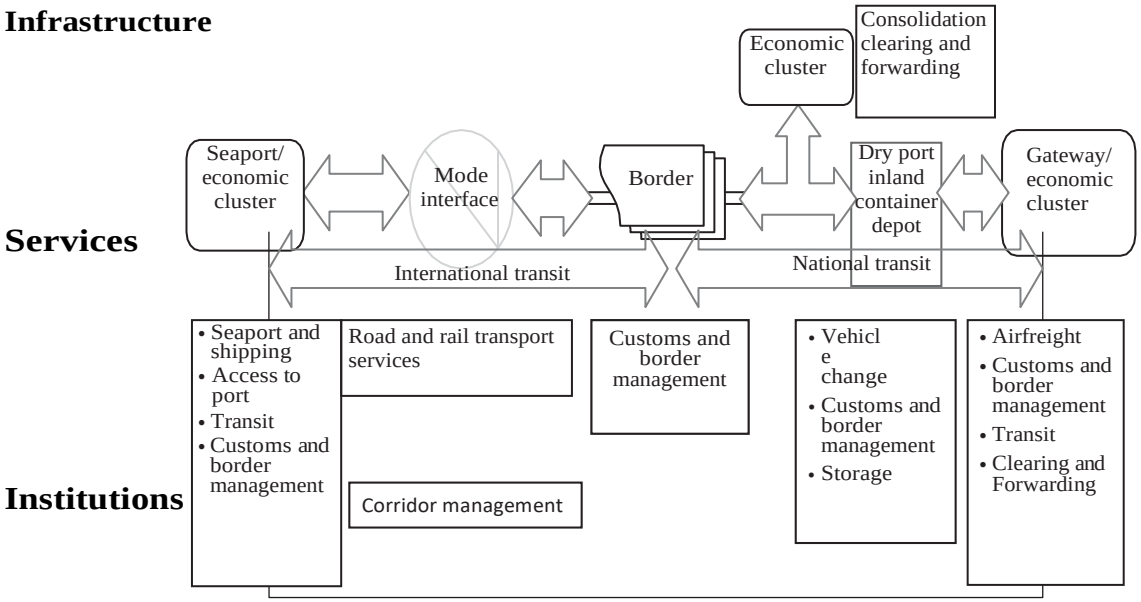


Figure 5 – Components of a Trade and Transport Corridor

Note: [66]

Currently, the international transport corridors located in the continents of Asia and Europe can be analyzed in three categories: European Transport Corridors: Pan-European Transport Networks, (Trans European Transport Network TEN-T, Trans-European North-South Motorway Network-TEM, The Trans-European Rail Network-TER); Asian Transport Corridors: Asian Highway Network, Trans-Asian Railway Network-TR; Eurasian Transport Corridors: Euro-Caucasus-Asia Transport Corridor (TRACECA).

The vital role of dry ports or logistics hubs in transit countries has also been highlighted in the "One Belt One Road" (OBOR) initiative by the Chinese government. In this context, Kazakhstan's "Khorgos Gateway" dry port may be a strategic node in the transport corridor framework from China to Europe through Eurasia, Central Asia, Turkey, and the Persian Gulf countries.

The development of intermodal transport corridors is essential in serving the existing trade flow (e.g., products from the food processing, tobacco industry, chemical raw materials, chemical production, and equipment manufacturing industries) [65].

It is even more critical for landlocked countries since intermodalism could improve the inland area’s connectivity to ports, markets, and production centers.

However, infrastructure development along the intermodal transport corridors has not reached the same level in many regions of Central Asia.

There are still additional barriers to cross-border movement in Central Asia due to physical and non-physical bottlenecks. These inefficiencies in the transport system hurt economic development, particularly in landlocked and transit-developing countries like Kazakhstan. It makes the time required to cross borders in Central Asia unpredictable. Moreover, unofficial payments are often cited as one reason for increased transportation costs. In this regard, ICT, Radio Frequency Identification (RFID), and satellite positioning systems can facilitate the secure movement of goods across borders and help reduce the time needed for processing cargo and border clearance and transportation costs. ICT can also help assess real-time freight location information along a particular corridor [24].

Thus, the study of the conceptual and theoretical foundations of the development of dry ports along transport corridors allows making the following conclusions:

- dry ports are transport and logistics infrastructure with or without linkages to seaports;
- dry ports are the central nodes of international land-based transport, logistics, and economic corridors;
- the development of dry ports must be considered the digitalization processes (using digital technologies and real-time knowledge and information exchange) and the formation of additional value-added logistics services (packaging, labelling, assembly, purchasing, distribution, manufacturing, finance, customs clearance, and other forms of customer services).

These highlighted aspects allow us to develop a definition. A dry port of continental transport corridors is a logistics node (terminal, centre, hub) and provides a wide range of transport and warehouse services, as well as other value-added services, while ensuring the quality of service and digital transparency of the port processes.

It should be concluded that the study of dry ports has scientific validity and practical significance. The effective functioning of transport, logistics, and economic corridors depend on developing logistics infrastructure. Terminals operate in transport corridors, logistics centers in logistics corridors, and hubs and clusters in economic corridors. Creating the appropriate logistics infrastructure is necessary to further develop the Eurasian transport corridors. Terminals based on free economic zones should be developed as industrial, transport, and logistics hubs and clusters, which requires the development of the quality of logistics services.

Thus, this study considers dry ports of international importance as the logistics terminals, centre and hubs in transport corridors and networks. The study of the quality of logistics services of dry ports in terms of digitalization is a new research area. The development of dry ports should be carried out synchronously with seaports, technological challenges, and scientific paradigms in logistics. Particularly in customer focus, a global pandemic it is relevant to investigate the quality of logistics services of dry ports. Especially land-based transport corridors and dry ports

have great potential in developing logistics and economic corridors through Eurasian space.

To fully understand the functioning of modern dry ports in transport corridors, it is necessary to study foreign experience in developing dry ports and digital transport corridors. Also, the study of foreign experience and literature analysis allows us to identify digital technologies that affect the development of the quality of logistics services in the context of the formation of Logistics 4.0.

1.2 A foreign experience in dry ports development and digital technologies of improving logistics services quality

This subsection examines the experience of forming and developing dry ports' logistics services in Europe, the United States of America (the USA), and China. Furthermore, the digital transformation of logistics infrastructure by improving the quality of logistics services at seaports and forming a digital transport corridor will be considered. This subsection also highlights digital technologies' role in enhancing quality logistics services.

The literature analyses made it possible to study the dynamics of dry ports in the western, developed regions (especially in the USA and Western Europe) and in Asia (China).

In Europe (the western part), inland terminals are formed by integrating port terminals with railway shuttles and barge services. European dry ports have different names: "platformes logistiques" in France, "Güterverkehrszentren (GVZ) " in Germany, "Interporti" in Italy, "Freight Villages" in the UK, "Transport Centers" in Denmark and "Zonas de Actividades Logisticas" (ZAL) in Spain. A large concentration of inland terminals can be found around the Rhine/Scheldt delta, a gateway to Europe with a combined container throughput of 28.2 million TEU in 2019. Also, almost every European port has an inland terminal strategy to ensure traffic safety within the country [67].

Benchmarking dry European ports based on 40 physical, technical, and other parameters, like positioning in TEN-T, green logistics, security management, urban logistics, etc. These criteria identified TOP-20 European ports: Interporto Quadrante Europa (Verona), GVZ Bremen, GVZ Nürnberg, GVZ Berlin, Großbeeren, Plaza Logistica Zaragoza, Inrterporto Nola Campano, Interporto Padova, Interporto Bologna, GVZ Leipzig, ZAL Barcelona, lnterporto di Torino, BILK Logistics Centre (Budapest), Interporto Novara, CLIP Logistics (Swarzedz), Delta 3 Dourges (Lille), GVZ Berlin West Wustermark, Cargo Center Graz, GVZ Südwestsachsen, DIRFT Daventry [29].

The European dry ports analysis shows that the service facilities include: filling stations, catering, custom offices, truck washing stations, social facilities, truck repair stations, central temperature-controlled warehouses, and other services (Figure 6).

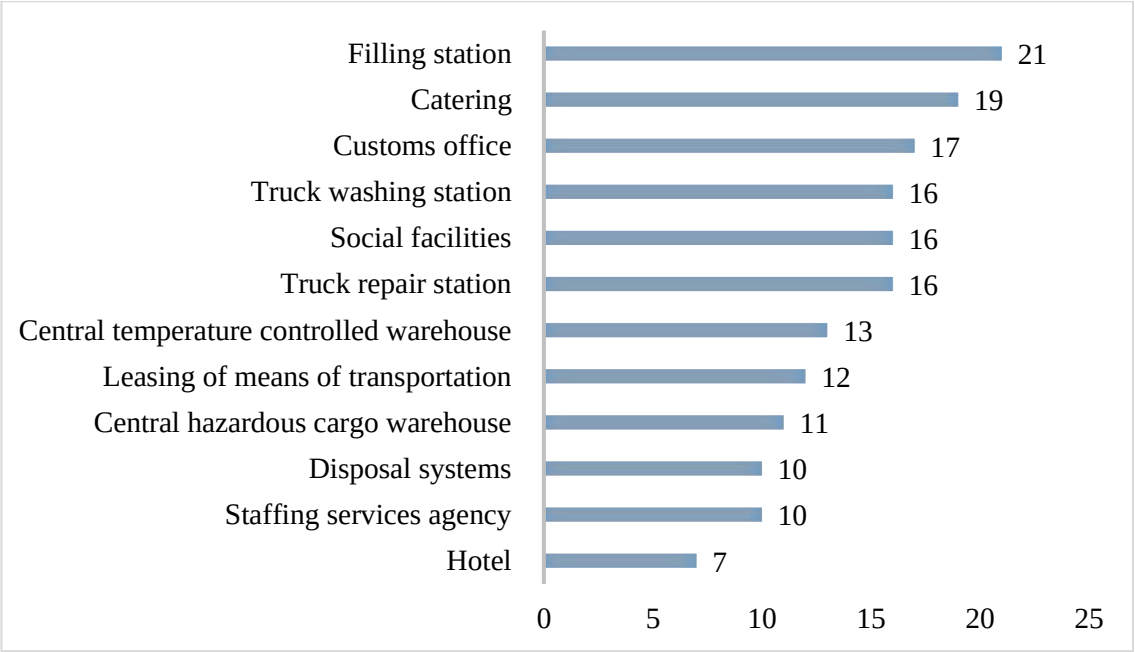


Figure 6 – Europe dry ports' service facilities
Note - [68]

Comparative analysis of dry ports in Italy, Spain, and Germany shows that the development of dry port companies (or owners) focuses on supporting territory planning, attracting new tenants, and marketing [68]. Most of all, companies in Italy pay great attention to keeping the implementation process and the operational phase (Table 4).

Table 4 – Intensity of European dry port's tasks

	Average Italy	Average Spain	Average Germany
Supporting the planning process of the area	9,6	9,0	9,4
Acquisition of new tenants	9,2	8,7	8,6
Location marketing (participation in trade fairs, etc.)	9,7	9,3	8,1
Support of the implementation process/operating phase	9,2	8,6	6,5
The organization of capacity compensation (for example, sharing energy, telecommunication, material etc.)	7,9	6,7	5,2
Logistics-consulting activities	7	6,3	4,9
Cooperation in research projects	8,1	3,2	4,9
Development and rental of logistics facilities	7,6	6,8	4,7
Organization of (further) training (for example, through seminars)	8,4	7,8	3,5
Total average	8,5	7,4	6,2
1-low task intensity; 10-high task intensity Note – [68]			

In the USA, dry ports are inland terminals – extensions of seaports located in the Atlantic, Persian, and Pacific regions, satellite terminals, and inland loading

centers (such as Chicago or Mexico). Moreover, inland ports carry out customs clearance of goods and play the role of cross-border trade hubs.

Dry ports in the United States have their own characteristics. This transport and logistics infrastructure functions as logistics, trade, transportation hubs, and clusters. For instance, the main attributes of the development of the dry ports of the American Midwest are:

- transportation centers (licensing and compliance activities);
- multipurpose business centers (temporary office space, seminar, and trade show facilities);
- port of entry for customs clearance and inspection; public warehouse services (general and special commodities);
- bonded warehouse services (tariff and tax postponement);
- intermodal transfer facility for containers;
- foreign trade zones (e.g., tariff shelter, light assembly, and distribution);
- travel plaza (food service, fueling, and rest areas);
- single source for federal and state transportation agencies (e.g., US DOT, IA DOT);
- single source for federal and state trade support agencies (e.g., Departments of Commerce, Treasury, Agriculture);
- information clearinghouse or library for transportation and trade publications;
- Internet Web site(s) providing transportation and trade information [69].

A case study on four intermodal railway infrastructures in the Memphis area shows the vertical and horizontal efficient organization of dry ports (Figure 7). In inland terminal development, the public sector is responsible for the horizontal business climate, infrastructure services etc.;. In contrast, the private sector is responsible for the vertical infrastructures: cranes, equipment, warehouses, etc. [70].

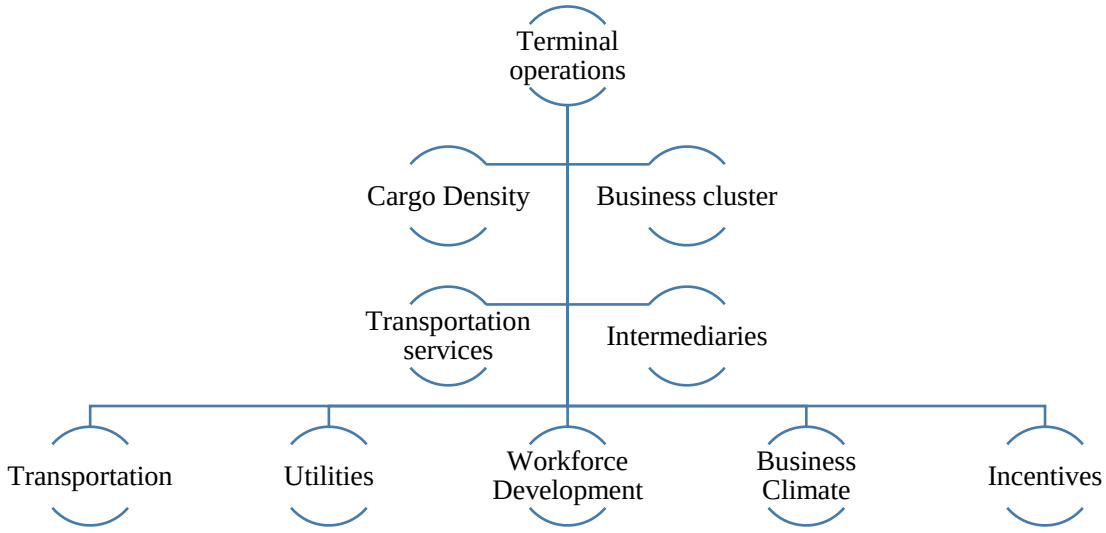


Figure 7 – Horizontal and vertical climates of dry ports in the United States
Note – [70]

Memphis International Port is the fifth largest inland port in the United States and a designated Foreign Trade Zone (FTZ) [71]. The primary commodities comprise coal, food and farm products, petroleum, crude materials, chemicals, and manufactured goods. More than 150 industries serve the International Port of Memphis [72].

Kansas City, Missouri, can be considered the most advanced inland ports initiative in North America. It is one of the largest hubs for warehousing, distribution, and manufacturing operations in the United States. Furthermore, multimodal transportation – air, rail, road and water – provides Kansas City with the infrastructure of a world-class logistics hub [73].

Recently, inland ports in China and other central Asian countries such as South Korea, Thailand, and India have actively developed. The first dry port in China was Shijiazhuang dry port constructed as a Tianjin seaport satellite terminal in Beijing in 2002. Currently, there are several dry port clusters: the northeast dry port cluster that relies on Dalian; the Mideast cluster, which contains 16 provinces and regions led by Tianjin; the southeast cluster built for ports in Jiangsu and Zhejiang province. Three modes of construction are used in China's dry port development:

1) coastal port as the main construction body – 16 dry ports around Tianjin;
2) inland city as the main construction body – Xi’an International Port District;
3) coastal port and inland city as combined construction bodies – Dalian dry port [74].

The amount of dry ports in China has reached more than 100, including Tianjin, Qingdao, Dalian, Yingkou, Ningbo, Shenzhen, Xiamen, Lianyungang, etc. [75].

Analysis of the characteristics of the Chinese dry port showed the development models of the dry port in China. In particular, some of the dry port functions (such as customs clearance, rail, dry port ownership structure, and mutual competition between dry ports) are unique factors that differentiate them from other dry ports in the world [48].

The construction model of Chinese international dry ports aimed to compete for the initiative in the source of goods from inland regions (Ningbo Port and Tianjin Port), to develop the local economy on land areas (Xi'an dry port and Nanchang dry port), to meet the needs of the development of coastal ports and inland Dalian areas (Shenyang, Changchun, Harbin).

In the formation and development of the logistics services of dry ports, integrating the logistics infrastructure into the supply chain is essential. The conceptual model of an integrated supply chain strategy consists of integrative information (communication and information flow structure) and integrative technology (IT facility structure) [24. c. 23]. Thereby, ICT facility structure and integrative information are used by supply chain subjects to make various transport operations more efficient and offer improved services (Figure 8).

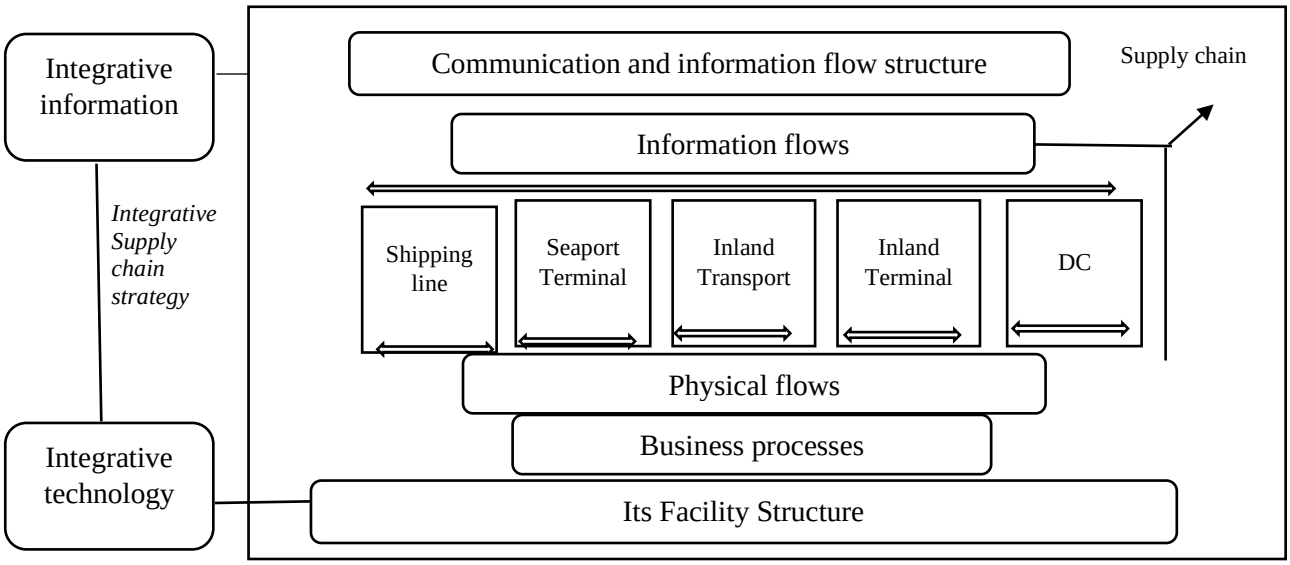


Figure 8 – A conceptual model for managing the information flow supporting hinterland transport

Note – [24]

In moving to "fourth-generation ports" in digitalization, the development of dry ports of seamless supply chain networks is the main issue of inland infrastructure. A brief flow chart of inland intermodal transportation includes information trading between the inland shipper, vehicles, dry port/central station, transportation by train, marshalling station, terminal yard, pier, and ship. Collaborative services platform for inland intermodal transport function as information collection, information processing, and information services (Figure 9) [74].

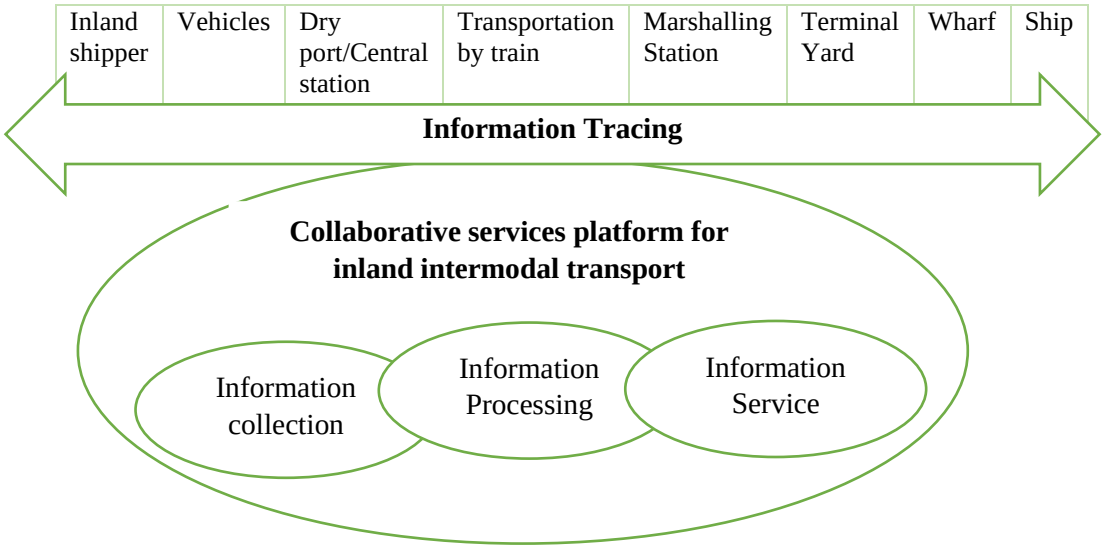


Figure 9 – Brief flow chart of inland intermodal transportation

Note – [74]

Applying real-time container and other cargo tracking systems based on information technology could increase the reliability and security of goods transport operations between dry ports and seaports. Thus, allowing the simplification of customs and other control formalities at dry ports. In real-time, a computer program must track the entering, exiting, and accepting of containers for storage and cargo. The goods' location can be determined from when they leave the seaport territory, warehouses, or shipper, until the arrival of the shipment to the dry port territory and takes it to storage. A computerized control system container yard should help determine the exact location of the container is stacked [76].

It should be noted that many seaports have successfully undergone a digital transformation and provide services using the digital technology of Industry 4.0. Digital transformation of seaports has three procedure stages: paperless, automated, and smart procedures [77]. Many countries have been investigating smart port infrastructure. In particular, the Internet of things (IoT) is crucial for redesigning and improving the effectiveness and efficiency of a wide range of business processes in seaports (Port of Hamburg) [78]. Implementing an IoT and cloud-based digital twin for real-time decision support in port operations enables seamless integration of port operations [79].

In the literature, various authors highlighted areas of interest where smart technologies can be applied: infrastructure, cargo handling, intermodal traffic, customs and collections, safety and security, energy, and the environment. They also identified the goals of such areas and port stakeholders directly concerned: port authorities and operators; terminal operators; shipping lines; logistic companies; cargo owners; rail operators; barge operators; customs [80]. The empirical results show that the port’s digitalization and adoption of environmentally friendly technology significantly improve the container port's capacity, energy efficiency, and sustainability in the development shipping collaboration model [81].

International experience shows that improving transport and logistics infrastructure services is achieved by developing digital transport corridors. The digital transport corridor collects, processes, and consolidates information about vehicles, cargo, and shipping documents at all transport and technical operations stages [82].

The Cross-Border Paperless Trade Database of ESCAP presents various international digitalization projects of international trade based on electronic data and documents. The analogue of digital transport corridors' formation is the Northeast Asia Logistics Information Service Network (NEAL-NET) (Figure 10). The participants are a maritime institution, container terminals, a university, and the third-party provider of China, Japan, and the Republic of Korea. The main task of NEAL-NET is to define the interface standards of each public logistics node. Then, promote the logistics nodes to rebuild their interfaces according to these standards to realize cross-node data sharing [83].

Figure 10 – The Northeast Asia Logistics Information Service Network (NEAL-NET)

Note – [83].

The digital transport corridor components include national and supranational e-Logistics platforms. At the national level, e-Logistics platforms can carry out the collection, processing, and provision of the system of consolidated information on the condition of the cargo and accompanying documents in the process of transportation from its inception to the destination. It also facilitates the electronic interaction of residents of the system when organizing and carrying out transportation, monitoring and controlling vehicles, cargo, and operations with them. It also provides analytical data to residents and regulatory authorities on transit, export, import, and domestic freight traffic [84].

Logistics infrastructure plays an essential role in the development of international digital corridors. Primarily, smart ports, intelligent terminals, and smart warehouses are formed under Industry 4.0. In the digital aspect, innovative port development by Deloitte has five phases: analogue port, monitor port, adopter port, developer port, and smart port (Figure 11) [85]. In the intelligent port, within the various world platforms driven by insights, cooperation increases the value proposition, connection, and sharing of information across geographical borders.

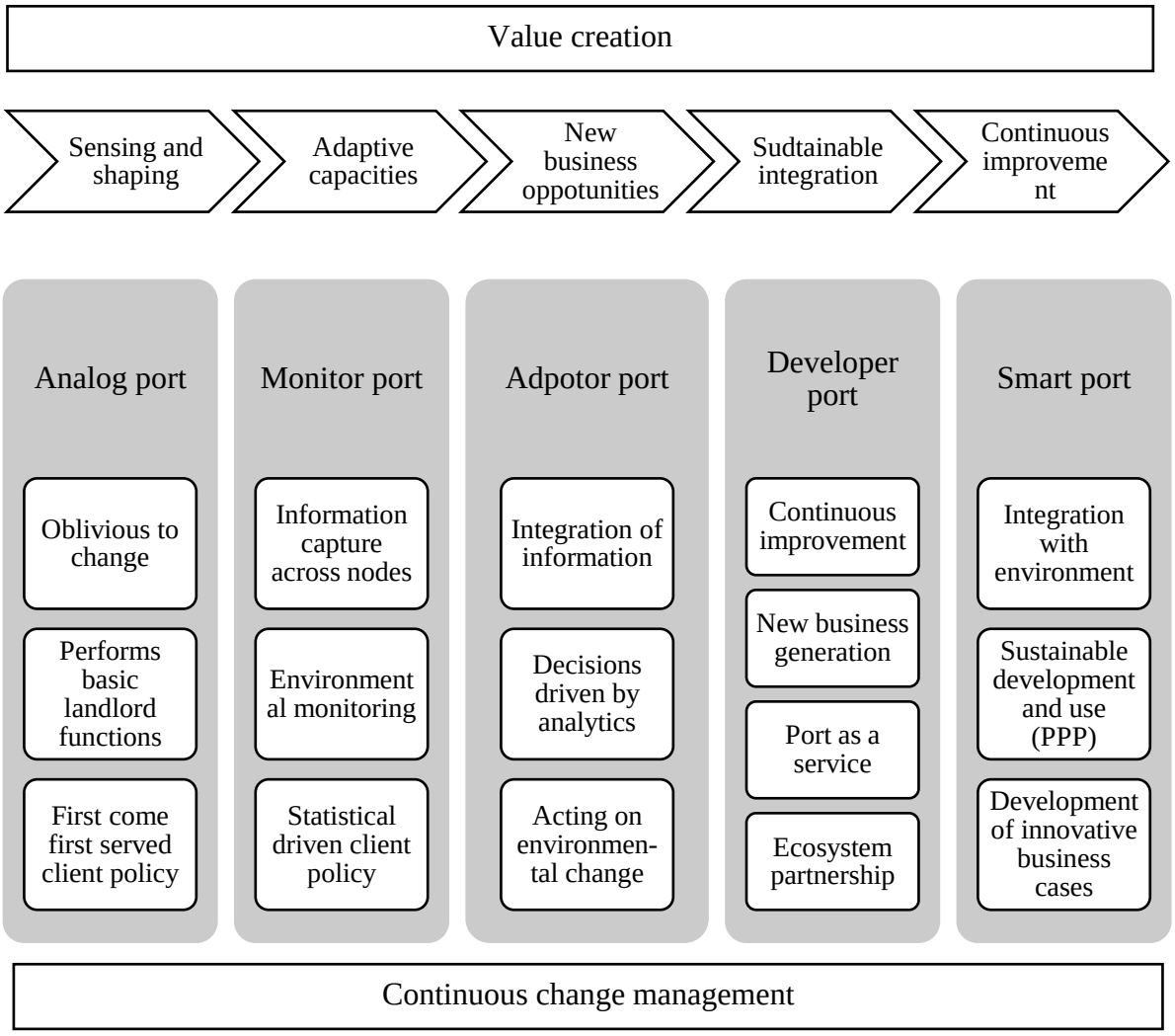


Figure 11 – Phases of smart port development
Note –[85]

Thus, the analysis of the development of dry ports in the world, the experience of digitalization of seaports, and the formation of digital transport corridors predetermines the further outcome of dry ports' logistics service through Eurasian transport corridors. In determining the factors for improving the quality of logistics services, it is essential to study technological trends and digital technologies in providing logistics services and an efficient organization of the supply chain in Industry 4.0 [86].

A systematic bibliometric analysis of the current information and communication technologies on logistics services quality allows for defining research questions for further research steps. The literature review highlighted the noticeable increase in ICT and logistics service quality research publications (2008–2019, databases Scopus and Web of Science). Analyzing the relationships of keywords allows us to conclude that logistics service and ICT are interrelated areas in Industry 4.0 [87].

Literature content analysis enables us to single out the preliminary information and communication technologies used in logistics services and underline impacted aspects in improving logistics service quality (Figure 12).

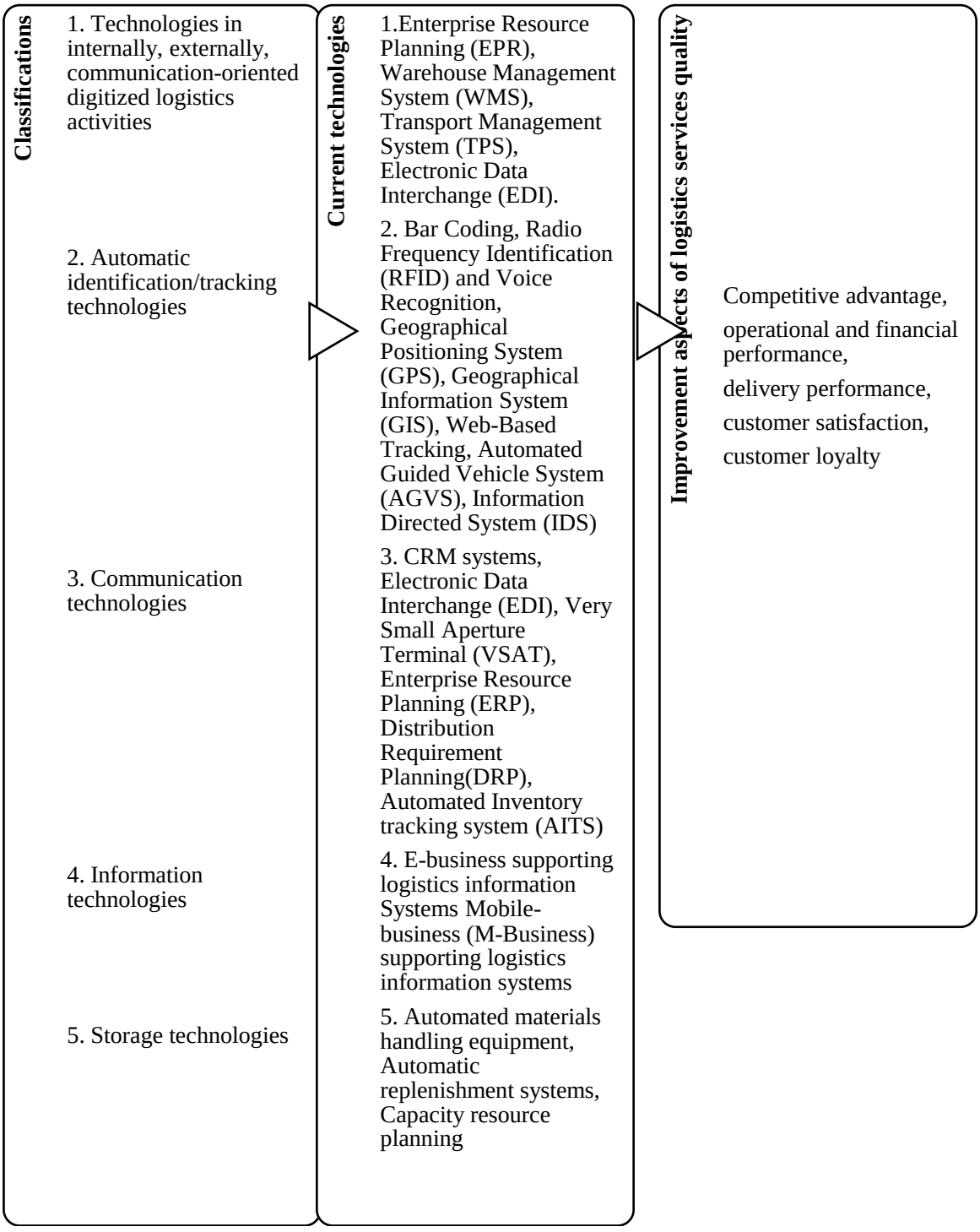


Figure 12 – The information and communications technologies and improving logistics service quality parameters

Note – Developed by the author based on [88-92]

The analysis highlights the impact of information and communications technologies on logistics service on the following main dimensions: competitive advantage in strategic management, operational and financial performance, delivery performance, service quality, customer satisfaction and customer

loyalty[87]. Furthermore, it identified new logistics technologies in the conditions of Industry 4.0 and their aspects of influence in improving logistics service quality (Figure 13).

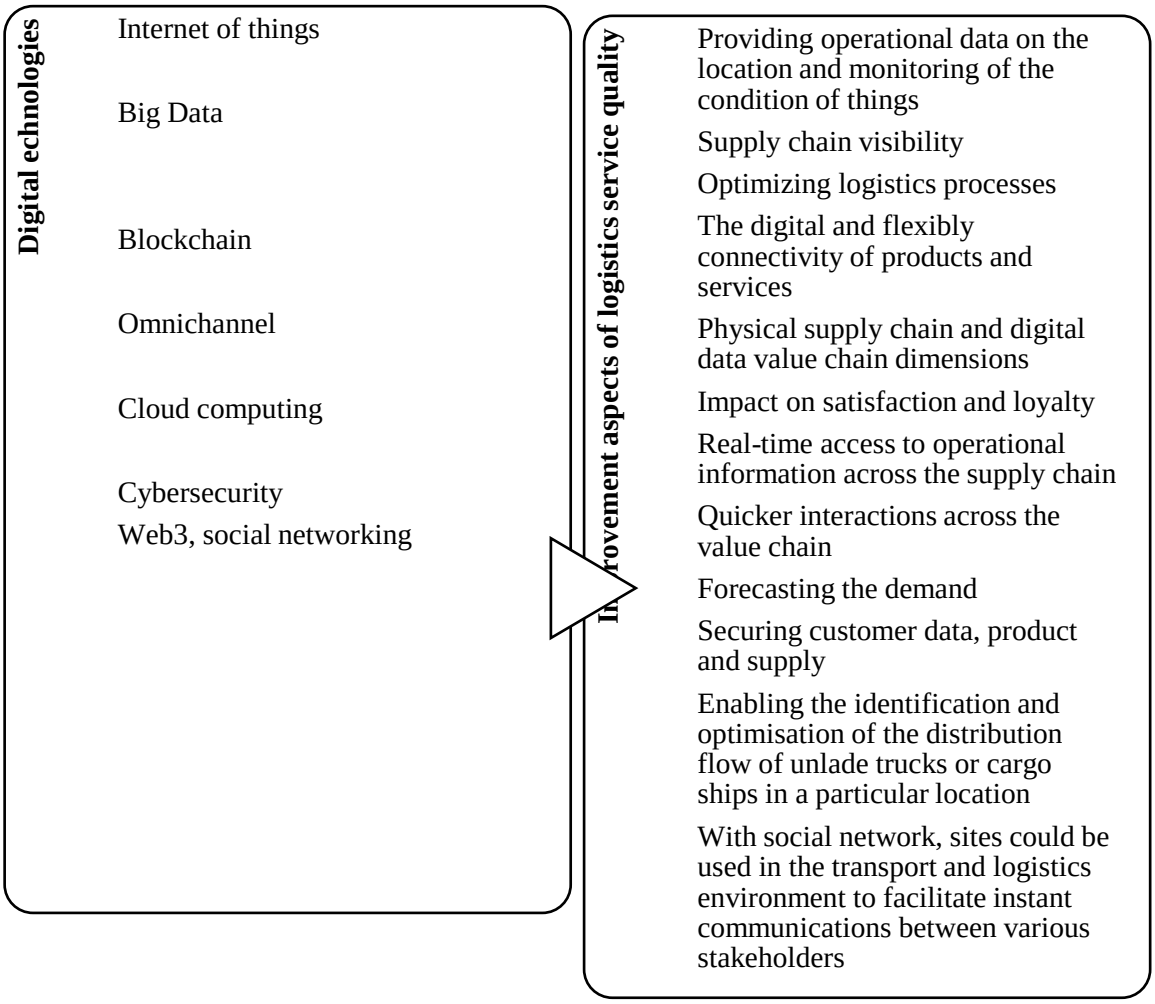


Figure 13 – The technologies of Industry 4.0 and their impact aspects on providing logistics service

Note – Developed by the author based on [93-97]

The bibliometric network analysis allows us to conclude that appropriately using information and communication technologies improves logistics service quality [87].

Furthermore, it needed to define the current technologies in dry ports. Modern digital technologies can be applied at dry ports to handle cargo, manage traffic, deal with customs, ensure safety, and monitor energy use [98]. The existing solutions can be described by the field of application, smart technologies, and implementation results (Figure 14).

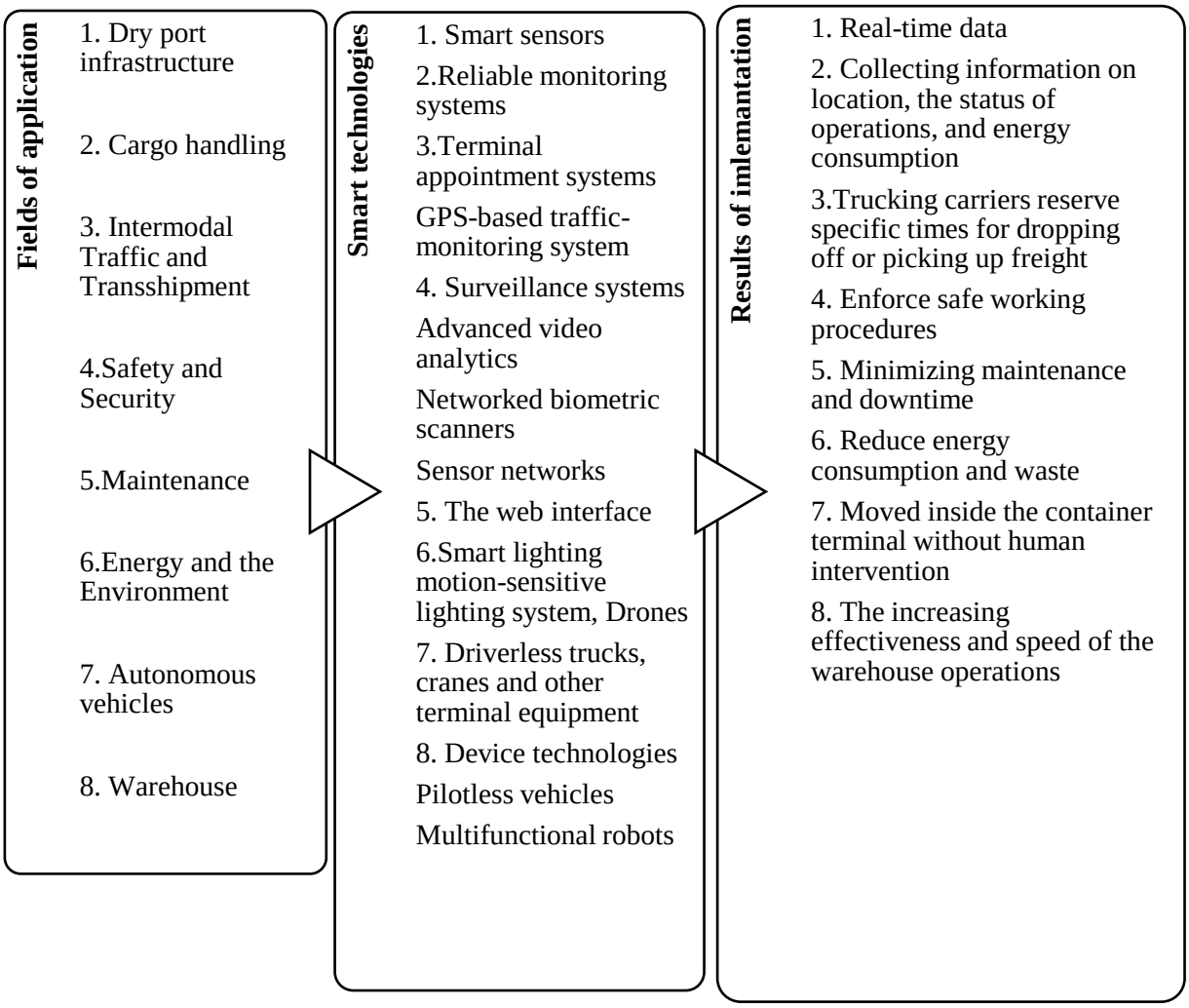


Figure 14 – The smart technologies for dry ports
Note – Developed by the author based on [98]

It should be noted that it needs to empirically study the identified results of implementing smart technologies in dry ports.

To sum up, the literature analysis shows that information and communication technologies in Industry 4.0 have moved to a new level of digitalization. Digitalizing logistics processes form the 4^{th} to 5^{th} generation logistics and introduces new service requirements. In this regard, it is necessary to introduce new technological solutions to logistics infrastructure to improve the quality of logistics services. It is essential to enhance the quality of the logistics service based on modern technologies, the integration of information systems with the corporate strategy for managing logistics services; corresponding choice of technologies for organizing a logistics service; automation of processes and operations associated with leaving and unloading, warehouse management, order formation and delivery, etc.

There are specific research gaps in the empirical study of the technologies regarding the dry port logistics service quality improvement. Logistics service quality and digital technologies are studied mainly within seaports. A new research direction is studying dry port logistics services quality in digitalization and its development as a logistics hub in international transport corridors. It is essential to improve logistics services in developing the logistics infrastructure as a hub. Another significant aspect is to provide logistics services in digitalization and pandemic conditions using smart technologies. This research aims to create a dry port concept of international importance within transport, logistics, and economic corridors, the assessment tool of dry port logistics service quality, and ways of improving the digitalization of dry port logistics service quality.

Based on the literature review, the following research questions were emphasized:

- How do technological and innovational development (individual technologies, digital technologies) affect the improvement of logistics services parameters?
- What parameters and assessment criteria can be appropriate for assessing the quality of logistics services in dry ports?
- What are the prospects for improving the quality of logistics services of dry ports within transport corridors in the context of digitalization?

So, the foreign experience shows that dry ports provide a wide range of logistics and additional services: filling stations, catering, custom offices, truck washing stations, social facilities, truck repair stations, central temperature-controlled warehouses, and other services. Furthermore, dry ports carry out customs clearance of goods and function as logistics, trade, transportation hubs, and clusters. Based on integrative information technologies, seamless supply chain networks develop. This way, the regional digital logistics platforms integrate into the digital transport corridors. The formation of digital transport corridors, including dry ports and other transport and logistics infrastructures, makes it possible to organize international cargo transportation effectively. In terms of digitalization, developing an intelligent port using digital technologies in port operations and processes is essential. Based on ICT and digital technologies (Internet of things, Big Data, Blockchain, Cloud computing, Cybersecurity, Web3, Omnichannel, and social networking), providing logistics services improve competitive advantage, operational and financial performance, delivery performance, customer performance satisfaction, and customer loyalty. Furthermore, the study of methodological approaches to assessing logistics services' quality allows for developing the assessment tool for evaluating the dry ports in transport corridors.

1.3 Methodological approaches for assessing dry port logistics service quality

This section examines the methodological approaches to determining the quality of logistic services at the macro, meso and micro levels. Based on this, tools for evaluating the quality of the dry port's logistics services are developed and proposed.

Developing research tools for assessing the quality of logistics services in dry ports should be considered the parameters of the service quality model (SERVQUAL), standards of the International Organization for Standardization (ISO), and Total quality management (TQM). In addition, the author's research on this issue allows a more in-depth study of the methodological approaches to assessing logistics service quality.

SERVQUAL is a standard method for assessing service quality. Parasuraman et al. developed the gap analysis model to measure the influence of service quality based on the integrated view of the consumer-company relationship. This model provides five generic dimensions of service quality: tangibility, reliability, responsiveness, assurance, and empathy (Table 6) [20].

Table 6 – SERVQUAL's dimensions

Dimensions	Description
Tangibility	Physical facilities, equipment, and appearance of personnel
Reliability	Ability to perform the promised service dependably and accurately
Responsiveness	Willingness to help customers and provide prompt service
Assurance	Knowledge and courtesy of employees and their ability to inspire trust and confidence
Empathy	Caring, individualized attention the firm provides customers
Note – Compiled by the author based on [20]	

The standards of logistics enterprise rating are based on the ISO 9001 quality management system certification. ISO 9001:2015 «Quality management systems – Requirements» is the only standard that includes certification requirements. This latest version is based on the quality management principles: customer focus, leadership; engagement of people; process approach; improvement; evidence-based decision-making, and relationship management. The application of the process approach in a quality management system enables understanding and consistency in meeting requirements, considering processes in terms of added value, effective process performance, and process improvement based on the evaluation of data and information [99].

Total Quality Management (TQM) has five fundamental aspects: customer focus, planning process, management process, and improvement process; upon reaching this last element, the cycle repeats, beginning with a customer focus. Customer satisfaction information is collected in various ways, including focus groups, customer interviews, and/or detailed user specifications [100]. Thus, over the past two decades, safety and reliability have become increasingly important to the

extent that they can be synonymous with or fully integrated with quality.

Celik studied the compliance level of the International Safety Management (ISM) code with the ISO 9001:2000 to structure an integrated quality and safety management system (IQSMS) for shipping operations [101]. He developed the following main conformity assessment attributes: management responsibility, resource management, product realization, measurement, analysis, and improvement (Table 7).

Table 7 – Quality management system and general requirements for shipping operations

Quality management system	General requirements
Management responsibility	Documentation requirements Management commitment Customer focus Quality policy Planning Responsibility, authority, and communication Management review
Resource management	Provision of resources Human resources Infrastructure Work environment
Product realization	Planning of product realization Customer-related processes Design and development Purchasing Production and service provision Control of monitoring and measuring devices
Measurement, analysis and improvement	General Monitoring and measurement Control of nonconforming product Analysis of data Improvement
Note – Compiled by the author based on [101]	

The debate on quality and safety issues for ports worldwide has never been as intense as in recent years. However, service quality certification differs from management system certification, so there is a vast distinction between «service» and «product». Therefore, the logistics industry needs certification standards to meet the logistics service quality characteristics and strengthen the certification standards system’s construction (Table 8).

Table 8 – Standards of logistics service quality certification

Logistics service quality of the process		Logistics service quality of the results	
Communication quality	Communication skills and experience of staff Understanding of customer needs Responding to customer demand	Order fulfilment quality	Delivered to the designated location Logistics distribution of goods is consistent with the order Use the quality of goods is consistent with customer needs Delivered
Information quality	Information availability Information adequacy The convenience of the ordering process	Time quality	Delivered by commitment time the entire waiting time for the logistics service
Order processing Quality Order processing Quality Error processing quality	The speed of order response The efficiency of order operational	Logistics quality of goods	Goods soundness Circulation and processing quality
Note – Compiled by the author based on [102]			

Chlomoudis et al. investigated contemporary issues for quality and safety/security systems integration within the port industry. They also empirically assessed the penetration of quality and safety international standards in the central Greek ports [103].

The research conducted by the authors on this issue allows a deeper study of methodological approaches to assessing the quality of logistics services. Thus, the quality-of-service parameters and the principles of the above standards enable the development of the necessary measurements to determine the quality of service for dry ports.

Before developing a research tool, it is necessary to study the volume of research carried out to assess the quality of logistics services in terms of technological development. Literature on the quality of services and technological readiness of ports is devoted to working in seaports, container terminals and dry ports. The quality of logistics services in a port is assessed within the port performance index, and port service quality is evaluated by adapting SERVQUAL for ports. Empirical research uses quantitative and qualitative methods (Appendix F).

Traditionally while assessing port logistics services, the focus has mostly been paid on seaports. The following authors reviewed the quality of service in seaports. According to Kolanović, Dundović, and Jugović, port service quality may also be

considered based on the following aspects: technical-technological, port organization and management, and customers [21].

Thai's model of port service quality consists of the following six quality dimensions: resources, outcomes, processes, management, image and social responsibility (ROPSIS):

1) resource-related quality dimension: physical resources, financial resources, condition of facilities, equipment, location, infrastructure, etc.;

2) outcome-related: the services being received by the customers, for instance, service accomplishments such as the on-time delivery of a shipment or the price of service offered;

3) process-related: factors regarding the interaction between employees and customers, for example, how customers perceive the behaviour of staff in dealing with customer requirements;

4) staff's knowledge of customer wants and needs, as well as the application of technology to improve customer service;

5) management-related: the selection and deployment of resources in the most efficient way to ensure (meet, or even exceed) customer needs and expectations, knowledge, skills, and professionalism of employees and their understanding and transforming customer needs and requirements into what they want;

6) image/reputation-related relates to the overall perception of customers about the service organization; social responsibility-related: involves the ethical perception and operations of an organization to behave socially responsibly [22].

Few researchers have addressed the service quality issue in container and intermodal freight terminals. Hemalatha, Dumpala, and Balakrishna evaluated the factors affecting the container terminal operator's service quality [23]. Almotairi et al. analyzed how information and communication technology (ICT) supports maritime containers' hintjeevanerland transport [24]. Gogas, Adamos, and Nathanail provided a comparative analysis of two urban intermodal freight transport terminals focusing on last-mile distribution. By pairwise comparison of two different supply chain exchanges, a decision support tool is developed for terminal operators and their customers and partners, namely, shippers, forwarders, transport companies, users, or customers [25].

In addition, the quality of the service port is being studied in evaluating the port performance. Ha, et al. developed a measurement instrument for port performance in container transport logistics (CTLs) by taking various port stakeholders' perspectives. The dimensions relate to the following:

1) effectively and efficiently in its core functions, e.g., vessel operation, cargo operation, and other activities regarding container transfer or transit from ports to vessels and different transport modes (or vice versa) in the container terminal area (core activities);

2) reliable internal resources (e.g., intangible assets such as human resources) to improve an organization's effectiveness and/or efficiency (supporting activities);

3) satisfaction of port users with port/terminal services delivered and service price (user satisfaction);

4) integration with container logistics chain (container logistics integration);

5) information and communication integration by collaborating with logistics channel members (information/communication integration) [26].

Chang et al. investigated the relationship between factors and the efficiency of Chinese dry ports in China. Variables in DEA analysis are:

1) Inputs: dry port area (m2), current assets (thousand RMB), fixed assets (thousand RMB);

2) Outputs: comprehensive services throughput (TEUs), container management services throughput (TEUs), transport services throughput (TEUs), and freight forwarding services throughput (TEUs).

Variables in Tobit regression analysis include: economic status (in GDP per capita), large scale (Dummy), service (No.), long haul (Dummy), reliance on the rail (%), customs function (Dummy), Seaport ownership, competition (No.) [48].

Previous studies of logistics service quality of ports have dealt with assessing seaports, container and intermodal freight terminals, and port performance.

Moreover, the literature review allows us to highlight the following aspects:

- in the framework of the assessment of the quality of logistics services, it is necessary to pay attention to the resources of the organization (dry port): tangible and intangible resources;

- the evaluation criteria of the SERVQUAL need to be adapted to the dry port operations and processes;

- a dry port should be considered in the context of transport and logistics corridors.

This work evaluates the parameters mentioned in a single conceptual approach framework. It allows for a comprehensive assessment of the quality of transport and logistics services of dry ports within international transport corridors.

The research strategy of the dissertation involves the transition from quantitative to qualitative data. Based on a statistical analysis of data at the macro and meso levels, the most critical parameters that need to be taken into account in the case study at the micro level will be determined. The Explanatory sequential design is a mixed methods design that includes a two-stage data collection project in which quantitative data are collected in the first stage. Then it analyzes the results are used to plan (or develop) a second qualitative stage of the study. [104].

As part of the dissertation research, a statistical analysis of secondary data was carried out. It quantitatively substantiated the impact of technological, innovative development and digital technologies on the quality parameters of the logistics service, thereby determining the directions for improving the quality of the logistics service. Further, in the development of tools and the assessment of the quality of logistics services in the dry port of «Khorgos Gateway», the results of quantitative statistical analysis were taken into account.

In this study, the logistics service of dry ports will be assessed in transport corridors through countries based on international transport corridors. In this regard, with an integrated approach, the study aims to evaluate the logistics service at three levels: macro, meso and micro-levels (Figure 15).

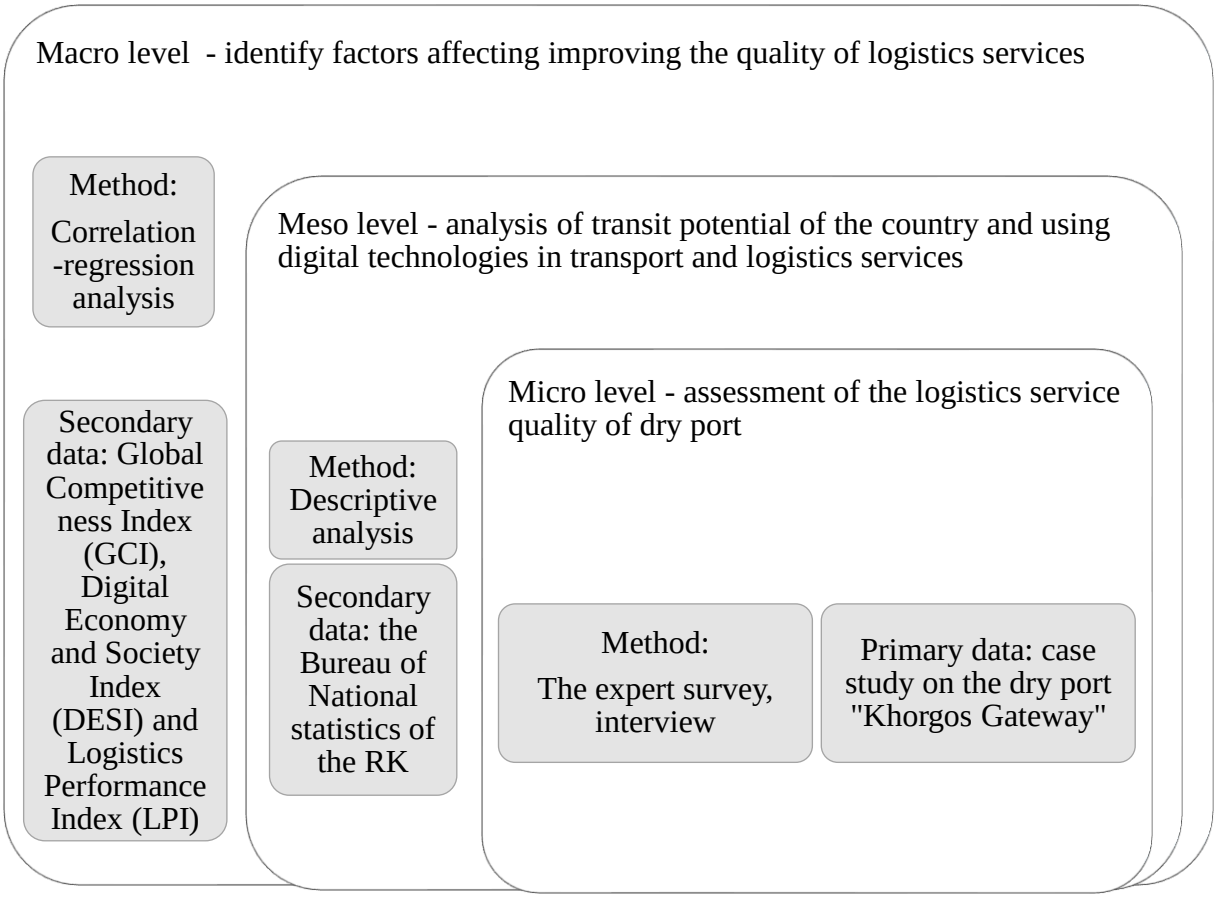


Figure 15 - The research design of assessing logistics services quality
Note – Developed by the author

1. *The logistics services' impact factors are assessed at the macro level* based on correlation and regression analysis (sub-section 2.1). A literature analysis of the influencing factors in improving the efficiency of logistics and the quality of logistics services showed that technological, innovational development and digitalization are deterrent factors [86, 87]. Furthermore, within the empirical studies, the following hypotheses are formulated:

H1. Technological readiness and innovation have a positive impact on logistics performance [105, p. 150];

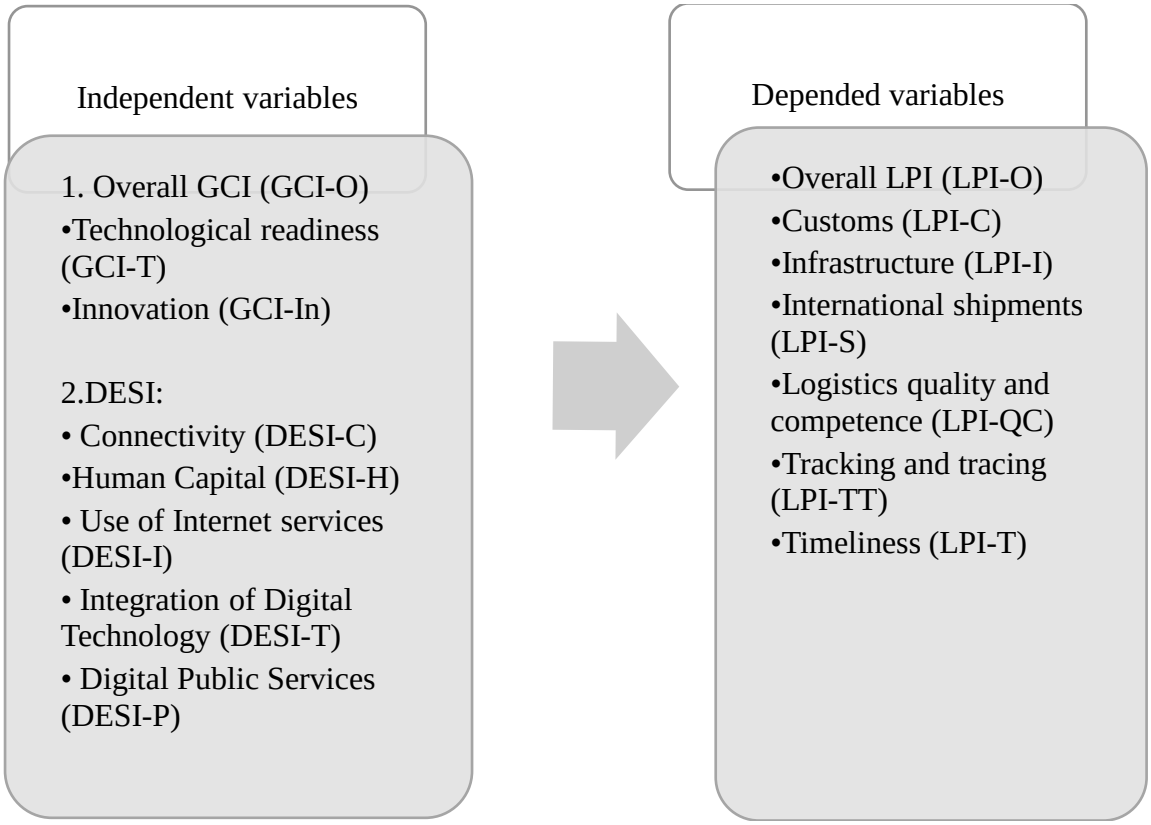
H2. Digitalisation positively impacts logistics performance [106, p. 210].

For statistical verification of these hypotheses, an analysis was made based on secondary data to determine logistics services development's most critical influencing aspects in digitalization and formation of Industry 4.0, Logistics 4.0 [105, 106]. Secondary data was used from Global Competitiveness Index (GCI), Digital Economy and Society Index (DESI) and Logistics Performance Index (LPI). The choice of LPI is justified by the parameters of this index represent the quality of the logistics service at the macro level. Also, sub-indices of the GCI, such as technological readiness and innovation at the country level, determine the development of information and communication technologies and their application at the state level. For depth analysis of digitalization processes on logistics services, we used DESI. One restriction of this research is that index (DESI) asses digital

technologies in European countries. However, it helps us to statistically verify our hypothesis at the macro level.

The empirical study of the Global Competitiveness Index (GCI), Digital Economy and Society Index (DESI) matrix corresponding pillars matter for the Logistics Performance Index (LPI) and its dimensions.

In the first analysis, independent variables are overall GCI and sub-dimensions: technological readiness and innovation. In the second analysis, sub-dimensions of DESI: connectivity, human capital, use of Internet services, integration of digital technology, and digital public services. Depended variables in both studies are overall LPI, customs, infrastructure, international shipments, logistics quality and competence, tracking and tracing, and timeliness (Figure 16).



The pooled regression approach was selected to reveal the effects of technological readiness, innovation and digitalisation on logistics performance. For the statistical analysis, the software program SPSS Statistics 25 was used. The usual linear model can be described as follows:

$$Y_{it} = B_1 + B_2 \cdot X_{1,it} + B_3 \cdot X_{2,it} + \cdots + u_{it} \quad (1)$$

Y_{it} is the endogenous variable, X_j is the explanatory variable, and B_j is the coefficient. B_1 presents the intercept term, and u_{it} is a time-varying random component. The country index is i, and the time index is t.

2. A descriptive analysis of the transit potential of the country and using digital technologies in transport and logistics services at the meso level is provided based on secondary data through the indicators. It includes the volume of transit

cargo by all modes of transport, the volume of transit cargo by direction, the share of transit shipping by type of transport, export of services and transport services, the volume and income of transit shipping by rail, transportation of goods in containers, the number of active legal entities in the field of transport and warehousing, income from auxiliary transport activities of enterprises etc. (sub-section 2.2).

3. At the micro-level, the "Khorgos Gateway" dry port's quality of logistics services is evaluated based on the developed assessment tool [107]. (sub-section 2.3).

Based on the literature review, the *dry port's logistics services quality assessment tool consists of the following parameters: the availability of physical infrastructure; reliability, safety and security, timeliness of operations and processes; the responsiveness of management and staff; appropriating prices; the extensive use of ICT applications; multimodality and value-added services availability* (Figure 17).

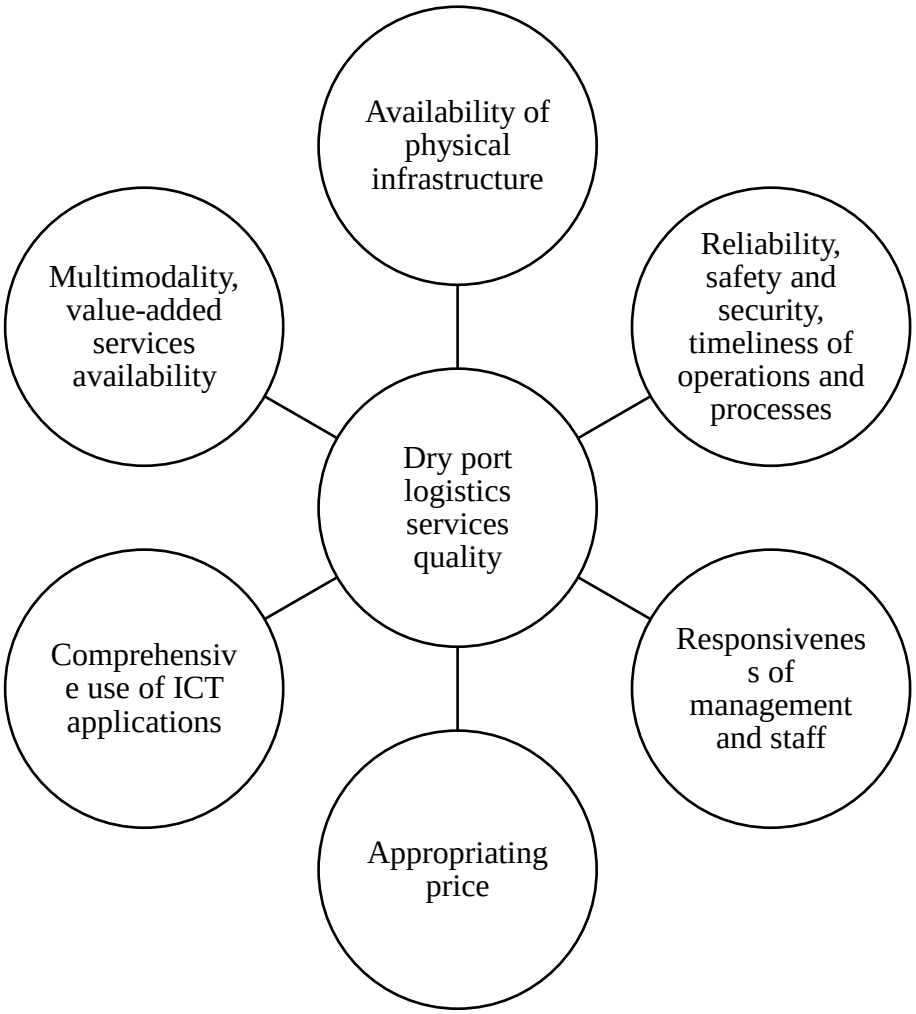


Figure 17 – Components of logistics services quality of dry port
Note –Developed by the author

In developing subdimensions for assessing the dry port's logistics service quality, the indicators were adapted from the ROPMIS model and used as port performance indicators in container transport logistics. Finally, the dry port service quality assessment tool consists of 37 subdimensions in the table below (Table 9).

Table 9 – Dimensions and sub-dimensions of dry port's logistics service quality assessment tool

Dimensions	Sub-dimensions	Authors
1	2	3
Availability of Physical infrastructure (PI)	Availability of Material handling equipment (gantry cranes, reach stackers, stackers, forklifts, etc.) (I_1) Availability of different types of warehouses(I_2) Proper functioning of facilities (I_3)	Hemalatha, Dumpala, Balakrishna [23]
Operations and processes (OP)	Ease of ordering procedures (OP_1) Custom control convenience (phytosanitary, veterinary, border, quarantine controls) (OP_3) Quick loading/unloading processes (OP_4) Punctuality of arrivals/ departures within defined (OP_5) Transparency of shipping processes (OP_6) Consumer service satisfaction with time (OP_7) Safety of operations/procedures (OP_8) A clear policy on warranty and security (OP_9)	Ha et al. [26] Hemalatha, Dumpala, & Balakrishna [23]
Management and staff (MS)	Providing enough information to customers` enquiries and requests by port operators (M_1) Accuracy of Port operators on documentation and information (M_2) Reflecting on collected feedback to improve services (M3) The management's valuing customer's specific requests and requirements (M_3) Evaluating or assessing customers' future needs (M_4) The port staff's competency to meet customer's service demands (M_5)	Ha et al. [26] Thai [22] Bienstock, Royne [91] Hemalatha, Dumpala, Balakrishna, [23]
Appropriating price for the service quality (PS)	Availability of price information (P_1) A fixed price for services (P_2) Reasonability price for services (P_3)	Ha et al. [26] Hemalatha, Dumpala, Balakrishna [23]
Comprehensive use of ICT (ICT)	Planning and ordering via internet-platform or website (ICT_1) Providing all the necessary information on port services through the website (ICT_2) Availability of updated information, including cargo/container photos and videos on the corporate website or other platforms (ICT_3) Having a fixed online schedule for receiving and departing containers (ICT_4) Availability of control on documentation processes (custom, phytosanitary, veterinary, border, quarantine control) via the corporate website or other platforms (ICT_5) Supply chain visibility: terminal coverage with GPS, RFID, CCTV, e-PoDs, camera surveillance systems etc. (ICT_6)	Servera-Francés D., Gil-Saura I., Fuentes-Blasco M. [108], [109]

Continuation of table 9

1	2	3
	Integration into a single information system of all procedures (customs, freight forwarders, port processes) (ICT_7) Inclusion of the port in the international port information community (ICT_8)	
Multimodality, value-added services (MS)	Connection and distance to primary railway network (MM_1) Connection and distance to the primary motor-way network (MM_2) Connection and distance to the primary airport (MM_3) Connection to primary to regional transport and logistics terminals/centers (MM_3) Connection to primary international logistics centers, hubs (China, Russia, Asia, Central Asian and European countries) (MM_4) Handle different types of cargo (S_1) Additional services for cargo delivery to the final consumer (S_2) Providing a «package of services» (from customs clearance to delivery to the client) (S_3) Labelling, Packing, Order picking up, Bar Coding, Custom setting (S_4)	Ha et al.[26]
Note – Developed by the author [107]		

Based on the assessment tool, an expert survey was conducted to clarify the importance of the main dimensions and subdimensions. The necessary data were collected using a poll questionnaire. The questionnaire consisted of 37 attributes considered suitable by the authors for defining the port service quality (Appendix G). The mailing list for panel experts was created with 75 samples, including the academic sphere representatives (science, education, research, consulting), port and terminal administration (directors, managers, employees, etc.), logistics, and transport companies. It was then administered by post with a follow-up mailing two weeks after the first. Finally, 19 completed questionnaires were returned, making the response rate 25.4%.

Experts were asked to indicate the importance of parameters to assess the logistics services quality of dry ports. Respondents' attitudes were measured using the five-point Likert scale, ranging from 1 – not important to 5 –very important. Experts were from China, Russia, Kazakhstan, Malaysia, and other European countries.

Finally, weights were identified, and vital factors and indicators were highlighted. Aiming to determine the indicator's weight, a calculation was made using the scoring method. It allows determining each subdimensions proportion in the final hand equal to one (100%). To identify the objective weight coefficient for each dimension, the author used the method of weighted average and equivalent coefficients according to formula 2:

$$m_i = \frac{1}{n}\sum_{i=1}^{n}\frac{h_{ix}}{\sum_{x=1}^{k} h_{ix}} (2)$$

where n is the number of experts, h_{ix} is the expert's weight (x) for the i^{th} dimension. Based on the calculations, the values of the average weights were obtained for the measurements and sub-dimensions.

Weights of criteria and indicators are calculated based on expert estimates and according to the formula. Thus, the dimensions have the following coefficients: the weight of physical infrastructure availability (PI) is 0.083, operations and processes dimensions (OP) – 0.228, management-related (MS) – 0.158, the appropriated price for service quality (PS) – 0.079, extensive use of ICT applications (ICT) – 0.215, multimodality and value-added services (MS) – 0.236. Between subdimensions, comparatively, the following sub-indicators have a high level of weights: safety of operations/procedures (OP7) - 0.031, consumer service satisfaction with time (OP6) - 0.030, clear policy on warranty and security (OP8) - 0,030, having the fixed online schedule for receiving and departing containers (ICT4) - 0,029, the port staff's competency to meet customer's service demands (M6) - 0.029 and connection to primary international logistics centers, hubs of China, Russia, Asia, Central Asian and European countries (MM5) - 0.029, ease of ordering procedures (OP1) - 0.029 (Appendix H).

Furthermore, this tool with the weights was used to assess the logistics service quality of the «Khorgos Gateway» dry port. The evaluation's target population was 50 respondents: dry port «Khorgos Gateway» customers, cargo owners and their representatives – freight forwarders and logistics service providers. The semi-structured interview was used to evaluate port users' expectations and perception of logistics service quality based on subdimensions (with a scale of 1-5) and commented on their assessment by providing answers to additional questions (Appendix I).

We used the service quality gap score - perception score minus expectation score. The perceived satisfaction a customer expects from a firm is referred to as a customer's expectation. In contrast, a customer's absolute pleasure from a firm's services is termed customer satisfaction [33].

The reliability was tested based on expert panel data. The correlations of the average values of criteria weights were evaluated. Overall reliability statistics of 37 dimensions are 0.893. Cronbach's Alpha was calculated using SPSS 25. Indicators of each dimension are presented in Table 10.

Table 10 – Reliability statistics of dimensions

Dimension	Cronbach's Alpha*	N of sub-dimensions
1	2	3
Availability of Physical infrastructure (I)	0,376	3
Operations and processes (OP)	0,519	8
Management-related (M)	0,765	6

Continuation of table 2

1	2	3
Appropriating price for the service quality (P)	0,784	3
Comprehensive use of ICT applications (ICT)	0,792	8
Multimodality, value-added services (MS)	0,836	9
* Cronbach's Alpha was calculated using SPSS 25		

To sum up, in assessing the quality of the logistics service and the quality of dry ports in international transport corridors, it should be evaluated in the three levels:

- considering the logistics services' impact factors based on correlation and regression analysis at the macro-level;
- at the meso level, analyzing the country's transit potential and level of using digital technologies in transport and logistics based on descriptive analysis;
- assessing the logistics service quality of dry ports at the micro-level.

In developing a tool for assessing the quality of logistics services in a dry port, SERVQUAL criteria, ISO standards, port performance analysis, and other aspects of logistics infrastructure research should be considered. The main components and subcriteria for assessing the logistics service quality of dry ports were developed based on the study of various methodological approaches. Thus, the presented integrated approach will be applied in evaluating the quality of the logistics service of dry ports of international importance within transport corridors.

The first section concludes that the dry ports are the central logistics infrastructure of land-based corridors. A dry port of international importance in continental transport corridors is the central node of international land-based transport, logistics, and economic corridors (centre, terminal, logistics hub), which provides a wide range of transport and storage services, as well as other value-added services while ensuring the quality of service and digital transparency of the port processes. The foreign experience shows that dry ports develop as logistics, industrial, and transport hubs in international transport corridors and with digital platforms and technologies included in the global chain. In assessing the quality of the logistics service, the quality of dry ports in international transport corridors should be evaluated at three levels: considering the logistics services' impact factors based on correlation and regression analysis at the macro-level; at the meso level, analyzing the country logistics and transit potential based on descriptive analysis; assessing the logistics service quality of dry ports at the micro-level. Assessment tool of the quality of the logistics service of a dry port includes 6 dimensions (availability of physical infrastructure; reliability, safety, timeliness of operations and processes; efficiency of management and personnel; correspondence of the price to the quality of service; comprehensive application of ICT; multimodality and availability of additional services) and 37 sub-dimensions.

Further, in section 2, research will be conducted based on secondary and primary data within the developed research design.

2. MODERN STATE OF QUALITY OF LOGISTICS SERVICES OF DRY PORTS IN EURASIAN TRANSPORT CORRIDORS

2.1 Eurasian transport corridors and evaluation of improving factors for the logistics services quality

This subsection provides an analysis of the current state of the development of transport and logistics in Eurasian countries. It also assesses the impact of technological readiness, innovation and digitalization on logistics development parameters based on the international indices Global Competitiveness Index (GGI), Digital Economy and Society Index (DESI) and Logistics Performance Index (LPI) data through countries.

Before assessing the impact of technological development on the quality of logistics services, it is essential to analyze the current state of transport and logistics in the Eurasian Economic Union (EAEU) countries. The member states of this international organization of regional economic integration are the Republic of Armenia, the Republic of Belarus, the Republic of Kazakhstan, the Kyrgyz Republic, and the Russian Federation [109]. It should be noted that these countries are the «builders» of the Eurasian continental bridge between Europe and China.

The freight traffic volume of transport modes across the EAEU in 2021 increased compared to 2005 and amounted to 12,474 million tons. Due to the pandemic, there has been a decrease after 2019 (Figure 18).

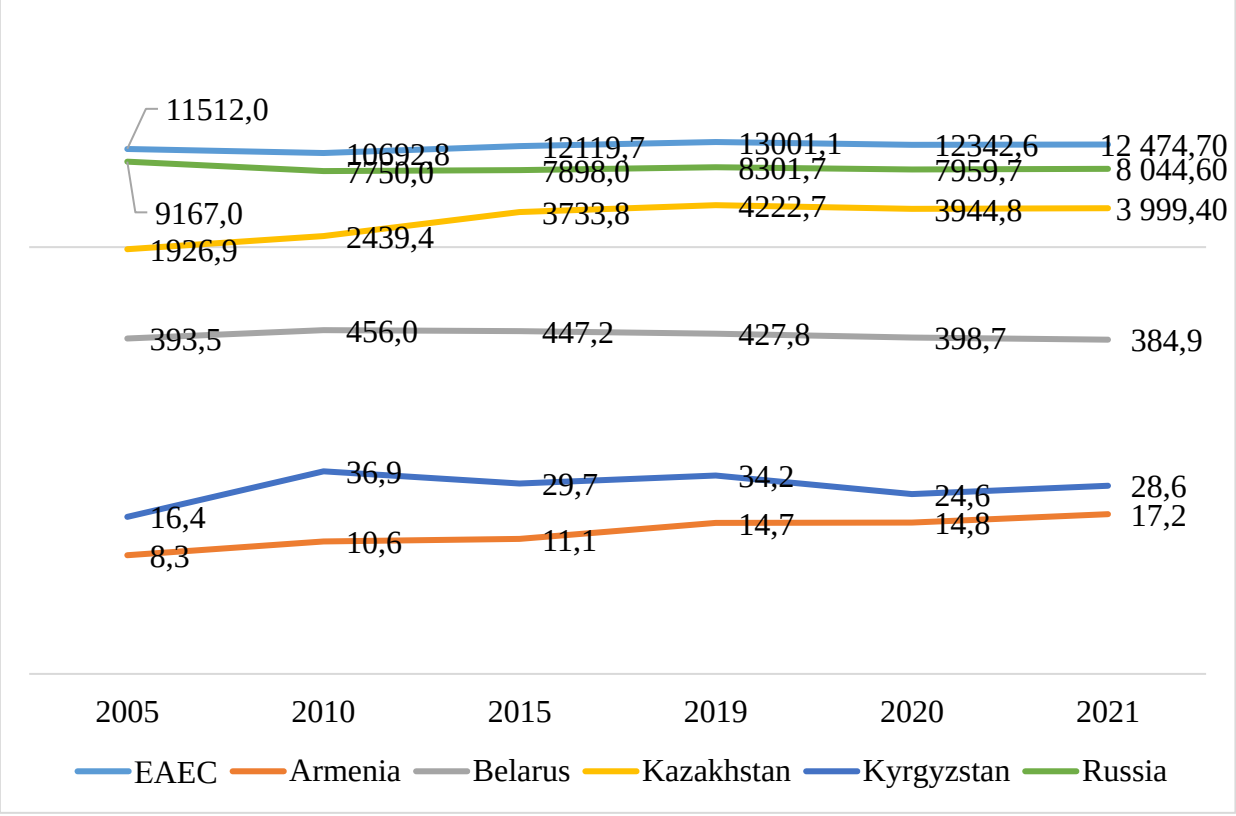


Figure 18 – Transportation of goods by mode of transport (all modes of transport), million tons

Note – Developed by the author based on [110]

In railway transportation in the EAEU countries, there is a decrease in cargo transportation volume in 2021 compared to 2020. Kazakhstan and Kyrgyzstan show an increase in this indicator (Table 11).

Table 11 – Transportation of goods by rail

	2005	2010	2015	2019	2020	2021
EAEU	1625,1	1723,9	1799,4	1 946,60	1 891,00	1 834,00
Armenia	2,6	3,1	2,5	3,2	3,2	3,1
Belarus	125,1	139,9	131,4	145,5	125	128,6
Kazakhstan	222,7	267,9	341,4	397	402,3	416,1
Kyrgyzstan	1,7	1,0	1,3	2,2	2	2,1
Russia	1273,0	1312,0	1329,0	1 398,60	1 358,50	1 284,10
Note – Compiled by the author based on [110]						

Eurasian land routes run along railways (Table 12). Therefore, the analysis of railway transport shows the big picture. According to the monitoring the quality of provided transport services on railway transport [111], the following key points can be noted:

- the density of the transport network (public) of railway is high in the Republic of Belarus (26.4 km / 1000 km2), and due to the larger area, it is low in the Republic of Kazakhstan (5.89) and the Russian Federation (5.05), the weakest in Kyrgyzstan (2.2);

- the operational length of railway tracks (km / 1,000 people) is the highest in the Republic of Kazakhstan (0.87), and the electrification of railway lines reaches 100% only in the Republic of Armenia, which has a positive effect on the cost of transportation in the republic and its ecology; high-speed railway lines are available only in the Russian Federation, but their length is relatively short (0.004 km / 1000 people);

- empty mileage of cars in the EAEU countries is high, reaching 39.8%-47.8%;

- the coefficient of renewal of the freight car fleet is high in Armenia and Belarus (7.23% and 3.15%, respectively);

- the «oldest» public railway freight transport fleet in the Republic of Armenia and the Kyrgyz Republic (36.7 and 34.8 years, respectively).

The data indicates that for improving the logistics service quality in Eurasian countries, it is necessary to modernize the railways and related infrastructure technologically.

Table 12 – The main Eurasian land-based transport corridors

Corridors	Territories
1	2
Northern Eurasian corridor	China–Russia–Europe via the Far East and Eastern Siberia in Russian Federation, including the First Transport Belt: Tyumen–Omsk–Novosibirsk–Krasnoyarsk–Irkutsk; and the

Continuation of table 12

1	2
	Second Transport Belt: Irkutsk–Chita–Khabarovsk–Vladivostok
Central Eurasian corridor	China–Kazakhstan–Russia–Europe, through Kazakhstan and the Russian Federation
Trans-Asian corridors	Western China–Kazakhstan–Azerbaijan–Georgia–Turkey–EU; Western China–Kazakhstan–Turkmenistan–Iran; and Urumqi–Aktau–Baku–Poti–Port of Constanța, Burgas
North-South transport corridor	the Eastern Route, Western Route, and the Central Trans-Caspian Route
Note – Compiled by the author based on [112]	

The main transport corridors of the Eurasian space between Europe and China are the Northern Eurasian corridor, Central Eurasian corridor, Trans-Asian corridor, North-South transport corridor, and Eurasian transport corridors through EAEC (Figure 19).

Figure 19 – The main Eurasian transport corridors
Note –[113]

The transport and logistics infrastructure along the Eurasian transport corridor include railway stations, terminals, transportation and logistics centers, warehouses, etc. According to the Intergovernmental Agreement on Dry Ports [114], the main facilities on the status of "dry port" of international importance in Eurasian are presented in Table 13.

Table 13 – Dry ports of EAEC countries

Country	Dry ports
Armenia	Akhuryan Logistic Center, Gyumri Airport, Karmir Blur/ Apaven Cargo Terminal, Zvartnots International Logistic Center
Belarus*	Logistic centre "Great Stone" (Minsk), Transport and logistics centre (TLC) "Kolyadichi" (Minsk)
Kyrgyzstan	Alamedin (Bishkek), Osh (Osh)
Kazakhstan	Continental Logistics Transport and Logistics Centre (Nur-Sultan), Astyk Logistics (Nur-Sultan), KTZE-Khorgos Gateway Dry Port (Almaty Region), Continental Logistics Shymkent Transport and Logistics Centre (Shymkent)
Russian Federation	Janino Logistic Park (Saint Petersburg Region), Multimodal Logistic Complex «Rostov universal port» (Rostov-on-Don Region Railway Port), «Baltiysky», Shushary (Saint Petersburg, Leningrad Region), Terminal Logistics Centre «Kleshchiha» (Novosibirsk), Terminal Logistics Centre «Doskino» (Nizhny Novgorod Region) and etc.
Note – 1. Compiled by the author based on [114] 2. Belarus has not yet agreed on the Agreement, data from open sources	

In assessing the quality of the logistics services of the Eurasian region's transport and logistics infrastructure, it is essential to analyze the position of member states in the international Logistics Performance Index (Figure 20). This index is measured based on six dimensions: customs performance, infrastructure quality, timeliness of shipments, quality of logistics services, tracking, and tracing [115].

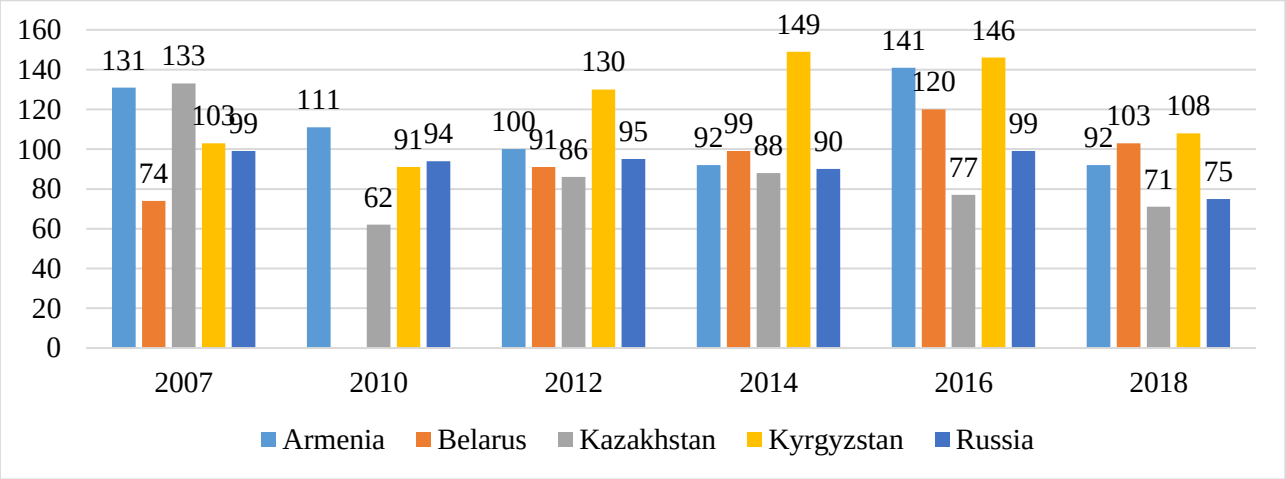


Figure 20 – Positions of the EAEU member states in the ranking of the LPI
Note – Developed by the author based on [115]

Since 2010, the country's overall indicator of this rating has been improving [44]. The Republic of Kazakhstan's position among the EAEU states is also favorable (Figure 20). Coefficients are presented in Table 14.

Table 14 – Score of the EAEU member states in the ranking of the LPI

Country Name	2008	2010	2012	2014	2016	2018
Armenia	2,14	2,52	2,56	2,6	2,2	2,61
Kazakhstan	2,83	2,83	2,69	2,6	2,7	2,81
Belarus	2,53	-	2,61	2,6	2,3	2,57
Russian Federation	2,37	2,61	2,58	2,6	2,5	2,76
Kyrgyz Republic	2,35	2,62	2,35	2,2	2,1	2,55
Note – Compiled by the author based on [115]						

Nevertheless, it should be noted that according to this sub-indicator of the quality of logistics services, countries have low coefficients and poor places in the rating.

To fully represent global technological and innovative development and increase logistics services, including the Eurasian countries, the different countries are included in the analysis [105]. The study sample embraces 29 countries with high, upper-middle, lower-middle, and low-income economies (Table 15).

Table 15– Income group of countries and sample overview

Income group	No. countries	%	Sample	Countries
High-income economies	80	36,7	11	Australia, Belgium, Chile, France, Germany, Italy, Japan, Latvia, Singapore, Switzerland, United States
Upper middle-income economies	60	27,5	8	Argentina, China, Kazakhstan, Malaysia, Mexico, Russian Federation, Thailand, Turkey
Lower middle-income economies	47	21,6	6	Egypt Arab Rep., India, Indonesia, Kyrgyz Republic, Pakistan, Ukraine
Low-income economies	31	14,2	4	Chad, Niger, Tajikistan, Uruguay
Total	218	100,0	29	

Source: Compiled by the authors [105]

The available panel data concerning the selected variables during the period under investigation (i.e., 2007-2018 databases from WEF and World Bank) was formed with a total unit of analysis of 174.

Positive correlations were detected between technological readiness and logistics performance, as well as innovation and logistics performance (Table 16).

Table 16 – Results of correlations between LPI-O and GCI-T, GCI-In

		GCI_T	GCI_In
LPI_O	Pearson Correlation	0,843**	0,856**
	Sig. (2-tailed)	0,000	0,000
	N	174	174
**. Sig. at the 0.01			

Additionally, in the further discourse, the relationship between indices (LPI-O and GCI-T, GCI-In) was further analysed by regression analysis (Table 17).

Table 17 – Model Summary of regression analysis LPI-O and GCI-T, GCI-In

Model	R	R Square	Adjusted R Square	Std. The error of the Estimate	Durbin-Watson
1	0,888[a]	0,789	0,787	0,277587	0,886
a. Predictors: (Constant), GCI_In, GCI_T b. Dependent Variable: LPI_O					

The received R Squared measure is 0,789, suggesting that the predictor variables of GCI can explain about 78% of the variation (LPI-O). On the other hand, the Durbin-Watson value has a value of 0,886, which is between the two critical values 1.5 <d <2.5, which means there is no linear autocorrelation.

ANOVA shows the F-criterion of this model, which assesses the significance of the coefficient of determination. It is 320.251 and has a statistically significant level of 0.000 <0.005.

Table 18 – ANOVA of regression analysis LPI-O and GCI-T, GCI-In

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	49,354	2	24,677	320,251	0,000[b]
	Residual	13,176	171	0,077		
	Total	62,530	173			
a. Dependent Variable: LPI_O b. Predictors: (Constant), GCI_In, GCI_T						

The corresponding regression equation has the following form (cf. coefficients in Table 19):

$$LPI\_O_{it} = 1.107 + 0.220 \cdot GCI\_T_{it} + 0.308 \cdot GCI\_In_{it} + u_{it} \qquad (3)$$

Table 19 – Results of regression analysis of LPI and selected GCI pillars

	B	Std. Error	Beta	T	Sig.
(Constant)	1.107	0.086		12.868	0.000
GCI-T	0.220	0.032	0.426	6.769	0.000
GCI-In	0.308	0.039	0.503	7.986	0.000
Note – 1. Compiled by the author 2. R Squared = 0.789 (Adjusted R Squared = 0.787); Dependent Variable: LPI-O					

The model's reliability was assessed using graphical analysis (for normality and equality of the variance of the distribution of residuals) (Figure 21). The histogram of this regression model shows that the distributions of the residuals are closer to normal.

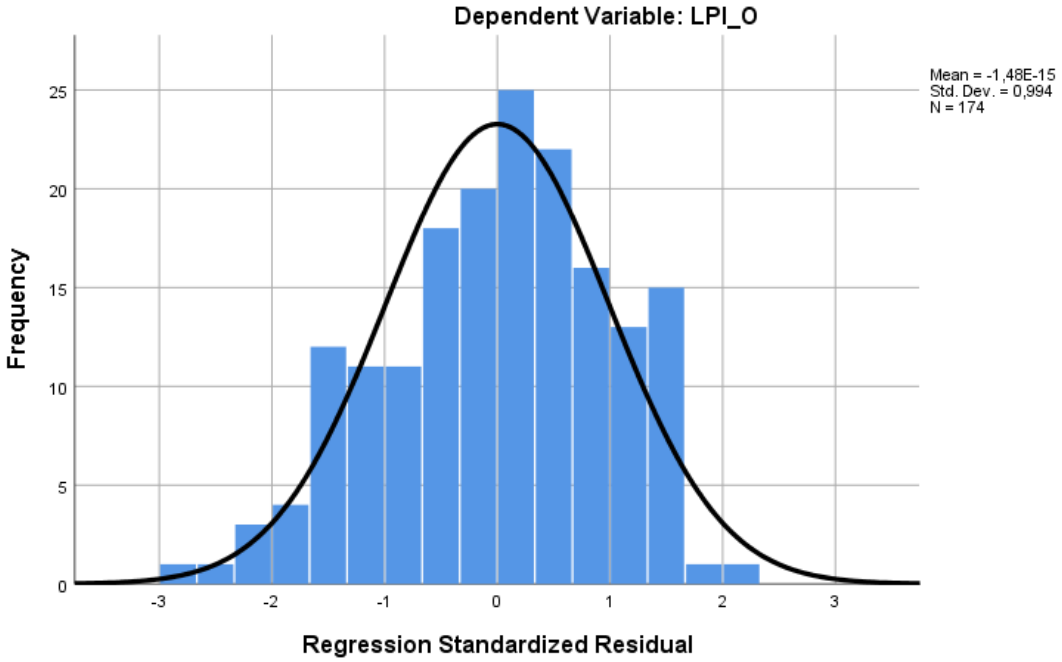


Figure 21 – Histogram of regression standardised residual

After identifying the positive impact of technological readiness and innovation on the logistics service's efficiency, these parameters' impact on the LPI sub-indices was further evaluated. Positive correlations were found between the two indices and the corresponding logistics sub-indices (Table 20).

Table 20 – Results of correlations between LPI and GCI pillars

	GCI_O	GCI_T	GCI_In
LPI_O	0,886**	0,843**	0,856**
LPI_C	0,868**	0,844**	0,852**
LPI_I	0,886**	0,845**	0,871**
LPI_S	0,808**	0,759**	0,758**
LPI_QC	0,887**	0,831**	0,865**
LPI_TT	0,872**	0,834**	0,836**
LPI_T	0,845**	0,792**	0,803**
** Sig. at the 0.01			

Thus, according to the results of the regression analysis, it was revealed that the innovation potential (GPI-B) and the level of technological development (GPI-T) positively affect the following indicators in the provision of logistics services: the quality of trade and transport infrastructure (LPI-I, R Squared = 0.806); competence and quality of logistics services (LPI-QC, R Squared = 0.790); efficiency of customs clearance processes (LPI-C, R Squared = 0.785); the ability to track shipments (LPI-TT, R Squared = 0.762); the frequency of receipt of items by the consignee at the planned or expected time (LPI-T, R Squared = 0.695); ease of organizing supplies at

competitive prices. (LPI-S, R squared = 0.628). Detailed results are presented in summary table 21.

Table 21 – Results of regression analysis of LPI dimensions and selected GCI pillars

		B	Std. Error	Beta	t	Sig.	
Technological readiness and innovation on customs	(Constant)	0,729	0.093		7.838	0.000	R Squared = 0.785 (Adjusted R Squared =0.783); Dependent Variable: LPI-C
	GCI-T	0.244	0.035	0.440	6.931	0.000	
	GCI-In	0.319	0.042	0.486	7.659	0.000	
Technological readiness and innovation on infrastructure	(Constant)	0.501	0.102		4.904	0.000	R Squared = 0.806 (Adjusted R Squared =0.804); Dependent Variable: LPI-I
	GCI-T	0.251	0.039	0.393	6.513	0.000	
	GCI-In	0.413	0.046	0.544	9.016	0.000	
Technological readiness and innovation on international shipments	(Constant)	1.545	0.096		16.097	0.000	R Squared = 0.628 (Adjusted R Squared =0.624); Dependent Variable: LPI-S
	GCI-T	0.181	0.036	0.417	4.992	0.000	
	GCI-In	0.212	0.043	0.412	4.926	0.000	
Technological readiness and innovation on logistics quality and competence	(Constant)	0.936	0.091		10.268	0.000	R Squared = 0.790 (Adjusted R Squared =0.788); Dependent Variable: LPI-QC
	GCI-T	0.199	0.034	0.364	5.788	0.000	
	GCI-In	0.366	0.041	0.564	8.974	0.000	
Technological readiness and innovation on tracking and tracing	(Constant)	1.048	0.098		10.664	0.000	R Squared = 0.762 (Adjusted R Squared =0.759); Dependent Variable: LPI-TT
	GCI-T	0.250	0.037	0.450	6.723	0.000	
	GCI-In	0.304	0.044	0.463	6.920	0.000	
Technological readiness and innovation on timeliness	(Constant)	1.753	0.097		18.140	0.000	R Squared = 0.695 (Adjusted R Squared =0.691); Dependent Variable: LPI-T
	GCI-T	0.195	0.036	0.405	5.345	0.000	
	GCI-In	0.267	0.043	0.467	6.165	0.000	
Note – 1. [105] 2. In the models, the Durbin-Watson values are between two critical values, 1.5 <d <2.5, which means there is no linear autocorrelation. The F-test of the models has a statistically significant level of 0.000 <0.005.							

Further analysis was carried out at the country level to determine the relationship between the indicators. Based on the correlation and regression analysis results, we have established the impact of technological readiness and innovation on the development of logistics services. This conclusion is confirmed in the country analysis. Figure 22 clearly shows that the higher the competitiveness of a country, the higher the logistics efficiency and vice versa. Low-income countries show average

index ratios: LPI-O - 2.4, GCI-O - 3.6. High-income countries show average high index performance index coefficients: LPI-O = 3.8, GCI-O = 5.2. Among the EAEU countries, Kazakhstan and Russia are moderate in both indices (between 2.5 and 3.0). Kyrgyzstan has a below-average technological readiness and logistics development (Figure 22).

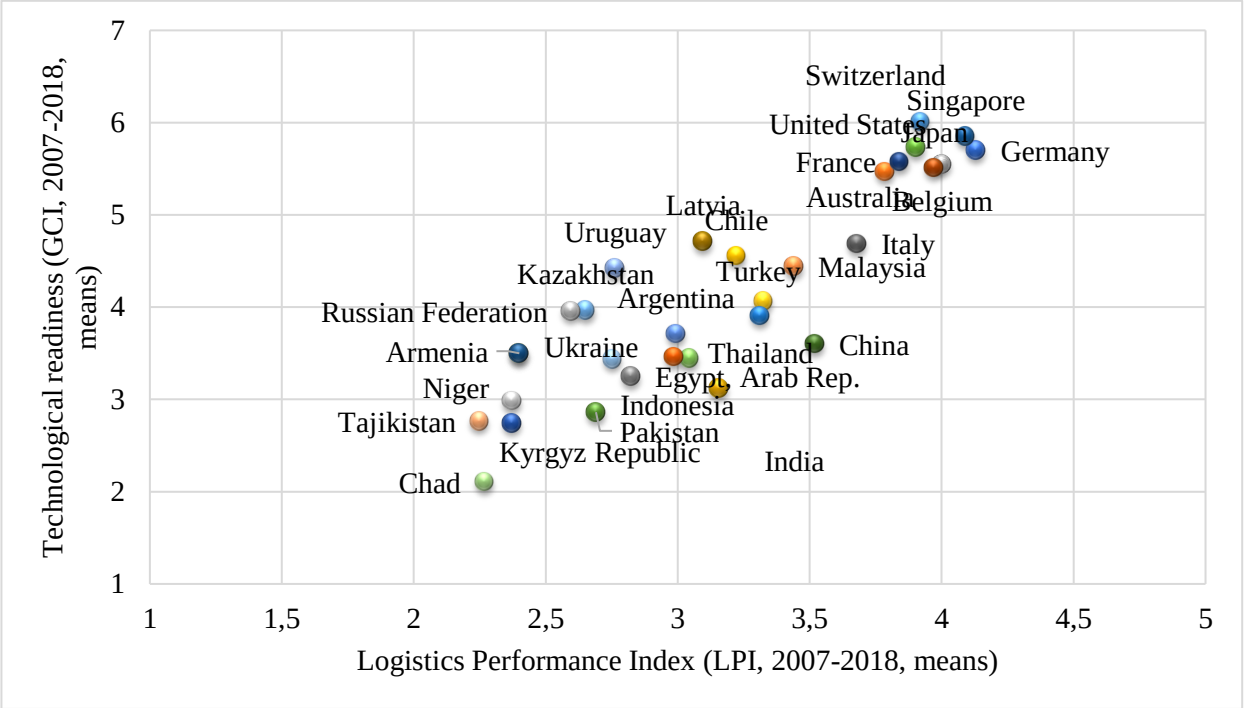


Figure 22 – Technological readiness in comparison to logistics performance
Note – Developed by the author [105]

The identified trend can be observed by comparing the country's innovative potential and the efficiency of the logistics service. Innovatively developed countries have the highest coefficients for both indices. The less developed countries have average and low scores in both areas (Figure 23).

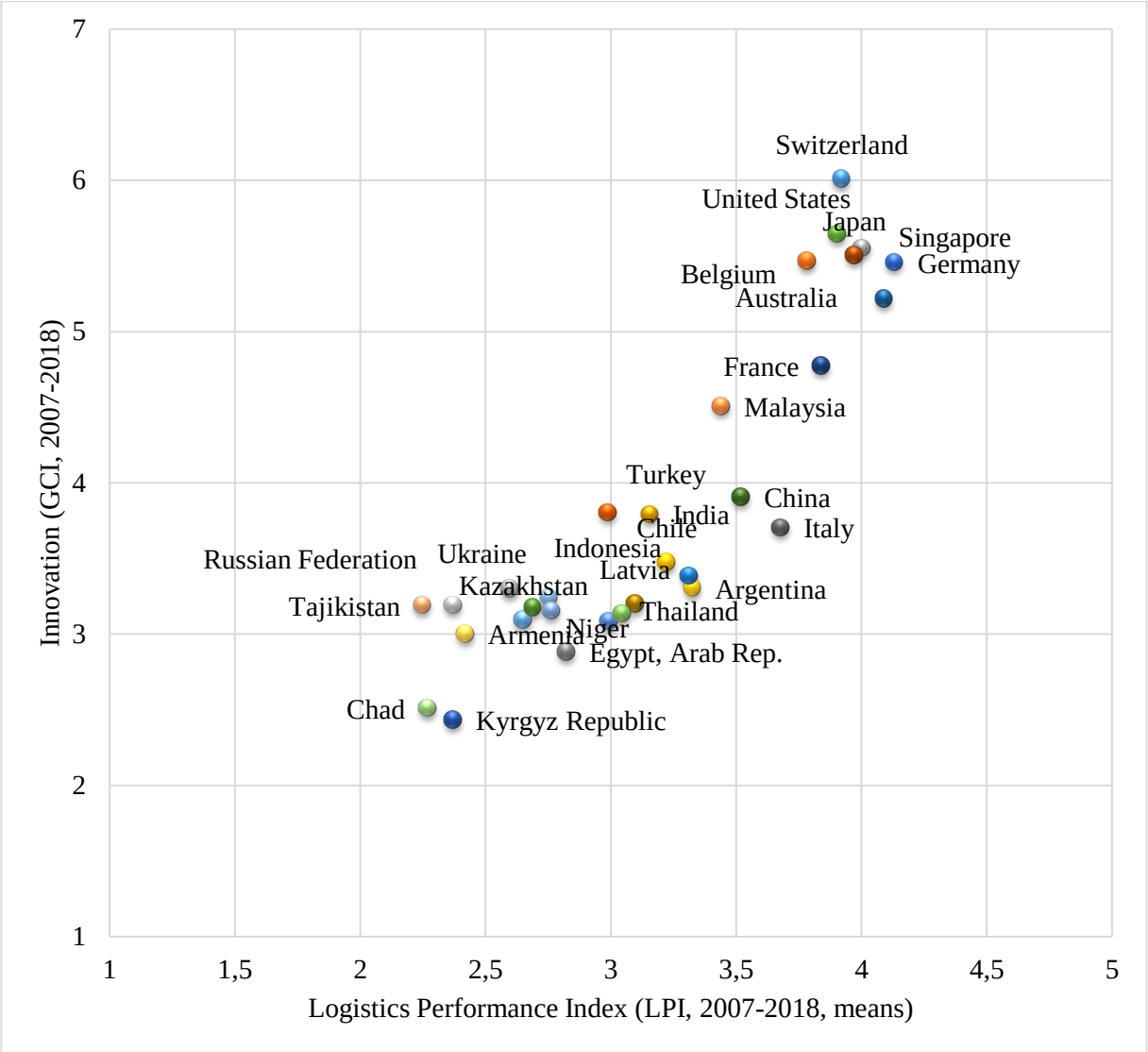


Figure 23 – Innovation potential in comparison to logistics performance
Note – Developed by the author [105]

Accordingly, the country analysis results demonstrate that the country's technological readiness and innovation potential are significant drivers for logistics performance in terms of the formation and development of Logistics 4.0.

Detailed results regarding digital technologies were found in assessing the impact of the Digital Economy and Society Index (DESI) sub-indices on improving parameters of logistics efficiency (e.g. logistics infrastructure and service quality) [106].

The correlation analysis showed a high relationship between the DESI and LPI. Further, multiple regression analysis between the sub-indices made it possible to determine the most influential aspects of digitalization for improving the logistics service.

From the DESI sub-dimension connectivity, logistics service is more affected by fixed broadband coverage (1a1, B=0,020, Sig.=0,004), 4G coverage (1b1, B=0,017, Sig=0,000) and broadband price index (1e1, B=0,009, Sig.=0.003).

From the DESI sub-dimension human capital, ICT specialists (2b1, B=0,222, Sig.=0,000) play a leading role in improving logistics performance.

From the use of Internet services: professional social networks (3b6, B=0,019, Sig.=0,003) positively affect logistics services.

From the sub-dimensions of integration of digital technology social media (4a2, B=0,033, Sig.=0,050), big data (4a3, B=0,076, Sig.=0,022), e-Commerce turnover (4b2, B=0,102, Sig.=0,003) are critical parameters in improving logistics performance [106, p. 211-212, tables 5-8].

The regression analysis between sub-indexes of DESI and LPI found the following evidence:

- customs is determined by the integration of digital technology components: electronic information sharing, SMEs selling online, cloud; as well as by human capital component: ICT specialists;
- infrastructure is determined by the use of internet services elements: shopping, and professional social networks; as well as integration of digital technology components: SMEs selling online, electronic information sharing, selling online cross-border;
- international shipment is determined by connectivity components: fixed broadband coverage, 4G coverage and broadband price index;
- logistics competence and quality are determined by the use of internet services component: professional social networks; as well as by integration of digital technology components: electronic information sharing, SMEs selling online;
- tracking and tracing is determined by integration of digital technology components: electronic information sharing, SMEs selling online; as well as by human capital component: ICT specialists;
- timeliness is determined by the use of internet services: shopping and professional social networks [106, p.213].

Thus, empirical analysis confirms the hypotheses regarding the impact of technological readiness, innovation, and digitalization on logistics performance. It allows us to conclude the level of technological readiness, the innovation potential of a country and using digital technologies form the basis for enhancing the quality of logistics services. Conversely, Industry 4.0 depends on logistics efficiency and timely smart provision of the necessary input factors, quality, and place requirements. It can be further noted that investments in information technology and innovations are crucial for enabling Logistics 4.0 and developing transport and logistics infrastructure.

To sum up, the analysis of traffic volume of transport modes, infrastructural conditions, and railway transportation in the EAEU countries indicates that it is necessary to carry out technological modernization of the railways and related logistics infrastructure to improve the quality of Eurasian logistics services. Furthermore, the regression analysis results show that innovation potential, technological development level and digital technologies affect the improving logistics services: quality of trade and transport infrastructure, the competence and

quality of logistics services, the efficiency of customs clearance processes, and track and trace consignments.

Investing in technological, innovative and digital development is essential. Digitalizing logistics infrastructure (such as sea and dry ports, terminals, logistics centers, corridors, etc.) significantly improves LPI indicators (customs, infrastructure, international transport, logistics quality and competence, tracking and tracing, timeliness). Transport corridors and dry ports should be developed considering the improvement of the quality of logistics services based on technological, innovative and digital tools. It should be noted that the development of the logistics infrastructure of international transport corridors affects the development of the country's transit potential. Furthermore, based on statistical data, Kazakhstan's transit potential will be analyzed, and an application of ICT in the provision of logistics services will be highlighted.

2.2 Analysis of Kazakhstan's transit potential and application of ICT in the provision of logistics services

This section provides a descriptive analysis of statistical data on transit traffic through the transport infrastructure of Kazakhstan and the use of digital technologies in the provision of services in the field of transport and warehousing.

The acceleration of delivery times increases the attractiveness of the Eurasian continental transport corridors. The sea lines currently carry out most mutual deliveries between the European Union and China. However, according to experts, in the future, land routes through the Eurasian corridor can switch to themselves some part of the volume of freight traffic between China and Europe. Also, in the context of the geopolitical crisis, special attention is paid to the corridors passing through Central Asia (bypassing Russia).Over the past 5-10 years, many international freight carriers, ports, cargo terminals, railway stations and warehouses have adapted their vehicles for organizing container transport. Furthermore, in recent years, freight traffic from China to Europe by rail through transit countries has doubled [111]. Also, in the context of the Covid19 pandemic, rail transportation was particularly relevant [116]. Based on the cooperation of different countries' customs departments on railways and forming a "Single declaration, inspection and departure policy, " faster customs clearance and transportation of goods in a shorter period have been achieved. For example, it takes only 13 days to deliver cargo to Duisburg (Germany) from Chongqing (China) along the Eurasian corridor (before the pandemic period). In comparison, 45-60 days are required for sea transport [117].

Kazakhstan is included in the international transport and logistics network through the following transport corridors by rail and road based on logistics hubs, terminals, seaports, transport, and logistics centres (Table 22).

Table 22 – Main transport corridors that pass through the territory of Kazakhstan

Corridors	Territories of countries, cities	Nodes (railway stations, ports)
1	2	3
Northern Corridor of the Trans-Asian Railway	China - Kazakhstan - Russia, Belarus, Poland, Germany / Western Europe	to Dostyk - Astana - Petropavlovsk
South corridor	Southeast Europe - China and Southeast Asia via Turkey, Iran, Central Asian countries and Kazakhstan	on the section Dostyk / Khorgos - Almaty - Shu - Arys - Saryagash
The Central Corridor of the Trans-Asian Railway	Central Asia-North-Western Europe	on the Saryagash-Arys-Kandagach-Ozinki section
The Trans-Caspian International Transport Route (TCITR)	Eastern Europe - Central Asia via the Black Sea, Caucasus, and the Caspian Sea	on the section Dostyk / Khorgos - Almaty - Aktau

Continuation of table 22

1	2	3
Transport Corridor Europe-Caucasus-Asia (TRACECA)		
North-South	Northern Europe- passes to the countries of the Persian Gulf through Iran	seaport Aktau - Anzali - Bandar Abbas
Western Europe - Western China	China - Kazakhstan - Russia	Khorgos - Almaty - Shymkent - Kyzylorda - Aktobe
Note – Developed by the author based on [118].		

The international transit cargo transportation is implemented within the Eurasian transport corridors framework, especially– The New Eurasian Land Bridge (NELB) across these countries: China, Kazakhstan, Russian Federation, Belarus, and the Netherlands play the central role. Thus, in comparison with traditional sea routes, the Economic Corridor of the New Eurasian Land Bridge (NELBEC) becomes more attractive for the transportation of high-tech products with high added value, such as automotive components, pharmaceuticals and cosmetics, and food products from the manufacturing centers of China to Europe [119].

The main advantages of land corridor rail transportation are the railway schedule's accuracy, shorter delivery times (before the pandemic: 10-14 days, while by sea, it takes 20-22 days), and environmental friendliness. Moreover, in the context of the Covid19 pandemic, rail transportation was particularly relevant. It played an essential role for items where speed of delivery is critical, such as electronics, automotive components, pharmaceuticals, and food.

In general, the volume of transit traffic in Kazakhstan is increasing yearly. The main modes of transport are rail and road transport. However, technological and institutional bottlenecks exist in developing the country's transport and logistics infrastructure.

During the pandemic, the main reason for the accumulation of goods at the Dostyk / Alashankou and Altynkol / Khorgos railway border crossings is the limitation of the reception of trains from China. Moreover, there are internal problems in organizing the effective functioning and technological modernization of border stations, terminals, and logistics hubs and improving logistics services' quality.

In terms of geopolitical crisis, within the framework of Trans-Eurasian land-based transport corridors, especially the Middle Corridor - The Trans-Caspian International Transport Route, has attracted particular attention. It runs through Kazakhstan, the Caspian sea, Azerbaijan, Georgia and European countries.

Kazakhstan's place in international rankings shows that, in general, the country's logistics system is developing progressively: there is a high volume of investment in the logistics infrastructure, increased transparency and efficiency of customs administration; the market is open to foreign companies; there is a high degree of integration into the world economy, etc. However, it is noteworthy to highlight the weaknesses in the country's logistics system: the logistics potential of

Kazakhstan, as a transit country, is not fully utilized; foreign experts note the low quality of the logistics service provision; needs in delivery time optimization; the lack of relevant logistics specialists capable of providing services at a high professional level; the necessity of the internal transport infrastructure improvement; shortage of storage space, etc.

The development of logistics infrastructure is one of the essential factors in the country's economic growth [120]. The "Strategy Kazakhstan-2050" emphasizes the need to create infrastructure centers to "cover" remote regions with insufficient population density with vital and economically necessary infrastructure facilities by forming the infrastructure of a modern transport system [1]. In addition, the main task of the Nurly Zhol State Infrastructure Development Program for 2020-2025 is facilitating the attraction of "Great Transit" and the implementation of export policy through the development of an efficient transit, export and logistics infrastructure and increasing the technological, scientific, methodological and resource provision of the infrastructure complex [3].

Developing the potential and export of transport and logistics services is a strategically important state direction [121]. Over the past 20 years, considerable investments have been made in the country's transport and logistics infrastructure. It is evidenced by the implemented investment projects within the Western China-Western Europe highway construction framework, the "One Belt One Road" Chinese government's initiative.

However, it should be noted that transport and logistics infrastructure investments have not yet contributed significantly to developing the country's economy. Kazakhstan ranked 90th in 2018 for the quality of logistics services and competence in the International Logistics Performance Index (LPI) [115]. It negatively affects business activity and the inflow of foreign investment into the economy due to the lack of proper functioning of the transport and logistics system and ensuring the quality of logistics services. It is challenging to implement investment projects. This problem is especially acute in the formation of export-oriented industrial enterprises.

The transport and logistics infrastructure and service quality play a central role in increasing export and transit potential. The continuous growth of world trade is interconnected with the efficient functioning of global supply chains. The researchers have studied the impact of the quality of the country's transport and logistics services on trade: exports and imports. They determined the relationship between logistics performance indicators (customs, infrastructure, international transportation, quality and competence of logistics services, tracking, and timely delivery) and the country's exports and imports. According to the results of the studies, it was revealed that the general transport and logistics indicators have a positive effect and are statistically significantly related to the level of development of the country's export and imports [122-124]. Thus, continuous investment in infrastructure and improving the quality of transport and logistics services positive affect the country's transit potential.

According to Vardomsky, the demand for transit services is continuously growing, and the market for these services is expanding accordingly. The volume of

transit traffic is directly dependent on the number of states in the world, the volume of world trade, the share of highly processed products in it, and the share of transport (transit) cost in the cost of goods transported [125].

The demand for transit services through Kazakhstan is determined by the situation in Russia and China, the rapid growth of the Caspian countries, and Central Asian states. Kazakhstan borders Russia's industrialised regions in the north: West Siberian, Ural, and the Volga. It is connected to them by a relatively dense transport network inherited from the Soviet era. To the southeast, Kazakhstan is adjacent to the rapidly growing Xinjiang Uygur Autonomous Region of China. The growth of Kazakhstan's mutual trade relations and their trade with third countries, primarily with the European countries and China, leads to increased transit traffic through Kazakhstan. With the rapidly growing volume of mutual trade between the European Union and China, the geopolitical crisis is essential in enhancing Kazakhstan's transit potential. According to experts, the possibility of the Kazakhstan transport market is not fully utilized [41].

In this regard, the relevance and need for the development of transport and logistics infrastructure service quality, including dry ports of international importance in the context of technological modernization, is conditioned by two aspects: firstly, infrastructure facilities participate in the supply chain and affect the formation of prices – the cost of the product; secondly, in terms of transit, the export of transport and logistics services is a profitable sector of the economy. In this regard, it is of prime importance for transport logistics to reduce logistics costs in the final price of products. Thus, it is necessary to introduce innovative technologies in the transport and logistics industry to increase service quality.

The geographical position of the country, the growth of world trade, the implementation of the "One Belt One Road" initiative by the Government of China, opportunities within the Eurasian Economic Union, the competition of transportation between "land" and "sea", acceleration of cargo transportation and delivery of goods, investments in transport and logistics infrastructure on the part of China and Kazakhstan, interests on the part of Europe – all this necessitates the development of the country's transit potential with an increase in the quality of the logistic service of land ports, terminals, stations and other infrastructures along the Eurasian corridors. Consequently, the transport and logistics industry can bring foreign exchange earnings into the budget, the country's GDP. However, it must be competitive in price and quality with the world services market.

Along with financial expertise, it is necessary to carry out the logistics expertise of new industrial facilities in Kazakhstan: considering the territorial location and distance of the facility between regional transport corridors, highways, railway stations, terminals, ports, hubs, airports, and other criteria. Furthermore, industrial facilities should provide the need for the domestic market and be export-oriented.

Aiming to improve the transit potential of Kazakhstan's transport and logistics infrastructure, it is necessary to develop dry ports, cross-border railway stations, and other facilities. Kazakhstan's transport and logistics potential are mainly used to

export raw materials. Conversely, utilising the transport and logistics infrastructure and geographical opportunities to ship Kazakhstani products is crucial. Thus, the revival of the Silk Road through Kazakhstan's territory implies developing countries' transit potential, the diversification of the manufacturing industry, and the growth of the export of local products to world markets.

Having highlighted the essential areas of improving the quality of service for dry ports of international importance necessary to analyze the potential of Kazakhstan's transit and logistics infrastructure [126].

According to the statistical data, since 2015, there has been an increased volume of transit cargo through Kazakhstan (Figure 24). In 2021, the total volume of transit cargo amounted to 13,6 million gross tons.

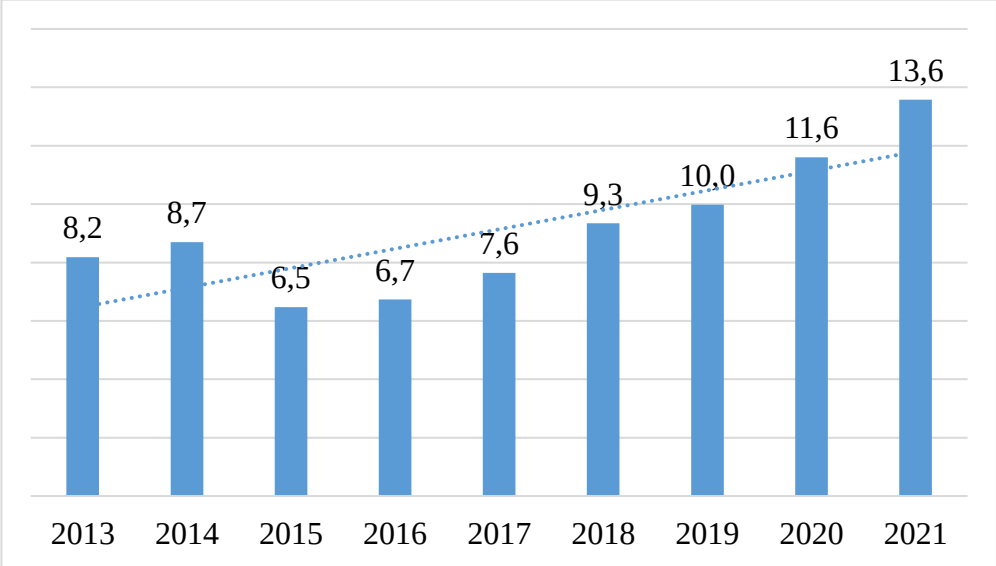


Figure 24 – The volume of transit cargo by all modes of transport (million gross, tons)

Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan

The top transit cargo volume directions included Asia - EU countries, Asia - EAEU countries, and EU countries - EAEU countries.

The primary transit transport through Kazakhstan is railway and composition of vehicles. In 2021, their share in the total volume of transit traffic was 78,1 % and 20,0%. Other vehicles had a small share of total transit traffic through Kazakhstan (Figure 25).

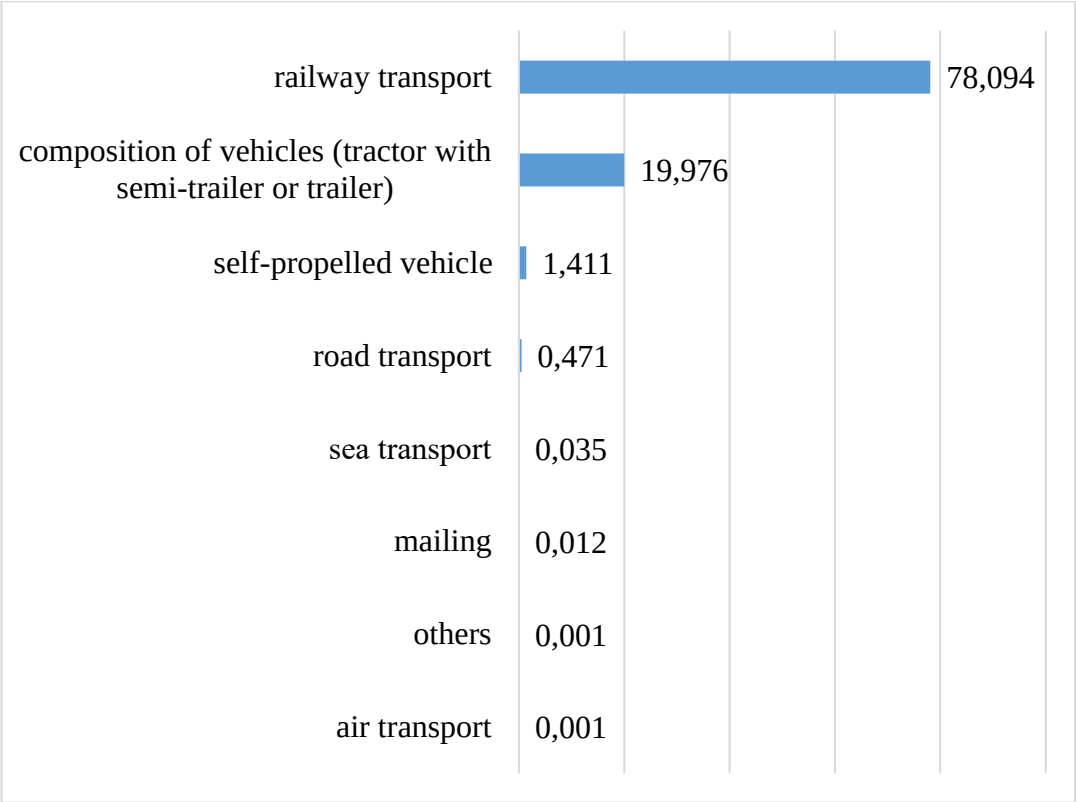


Figure 25 – Share of transit shipping by type of transport, 2021, %

Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan

In the face of global challenges and Industry 4.0, diversification of transport and logistics services in Kazakhstan is required. Similarly, transportation and logistics services in Kazakhstan are not competitive in the global services market. The bulk of the transport and logistics services export is transported by pipeline and rail.

There has been an increase in volume and revenue from rail transit traffic. For example, if in 2015 the volume of transit railway traffic amounted to 13,954.5 thousand tons (or 156,782.9 million tenges), this figure in 2021 reached 21000,0 thousand tons (or 424900,0 million tenges) (Figure 26).

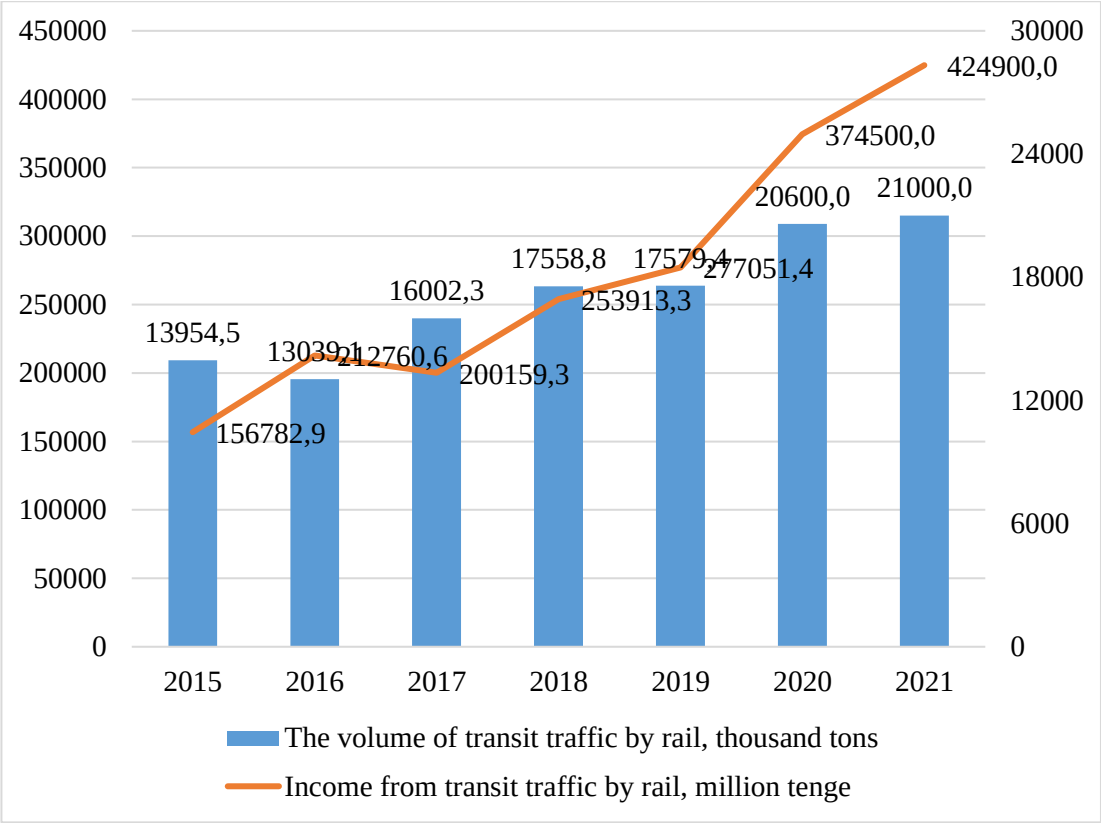


Figure 26 – The volume and income of transit shipping by rail

Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan

The table 23 clearly shows the yearly growth in the carriage of goods in containers in international directions. The containerised cargo volume increased from 14,2 thousand tons in 2010 to 11957,3 thousand tons in 2021. The primary growth since 2017 has been in international traffic (Table 23).

Table 23 – Transportation of goods in containers by all types of transport, thousand tons

	2010	2015	2016	2017	2018	2019	2020	2021
international	14,2	27	75	5001,3	5669,3	7606,8	9984,5	11957,3
intra-republican	16,6	13,8	635,7	148,2	225,4	449,8	303,8	264,2
suburban	12,6	242,6	50,7	25,9	6	15,7	57,2	0,8
urban	38,9	161,6	0,3	27,3	169,6	155,9	22,5	10,3
Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan								

In the context of the geopolitical crisis, transportation along the North-South transport corridors and the central corridor of the Trans-Caspian International Transport Route (TITR) has intensified. There is an increase in the volume of container traffic on TITR (Figure 27)

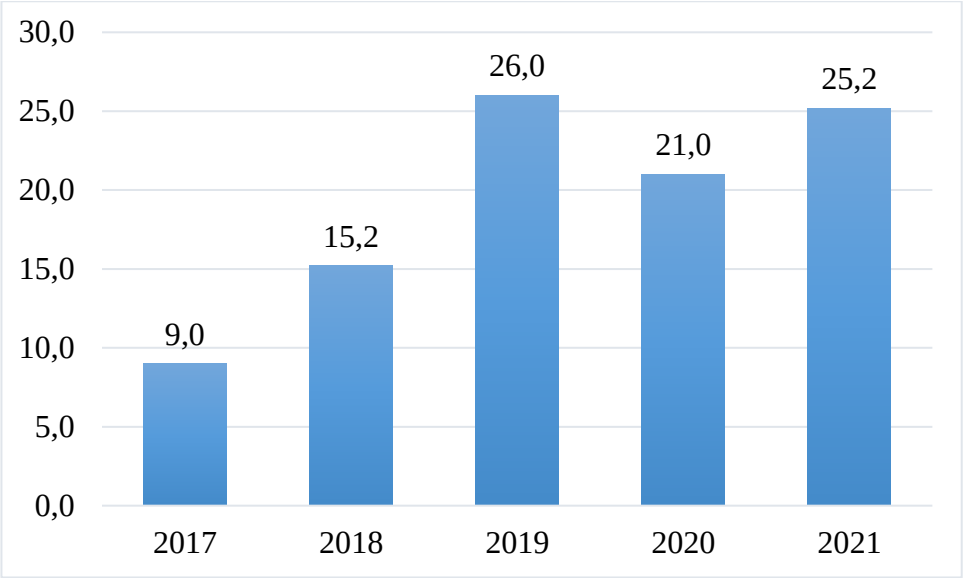


Figure 27 – The volume of container traffic on TITR, thousand TEU

Note – Developed by the author based on data from the International Association "Trans-Caspian International Transport Route"

The development of logistics infrastructure positively affects the growth of freight and goods turnover. Every year in Kazakhstan, the number of legal organizations in transport and warehousing is increasing. If in 2000, the number of transport and logistics enterprises amounted to 3573, then in 2021, this figure was 13 395 (Figure 28).

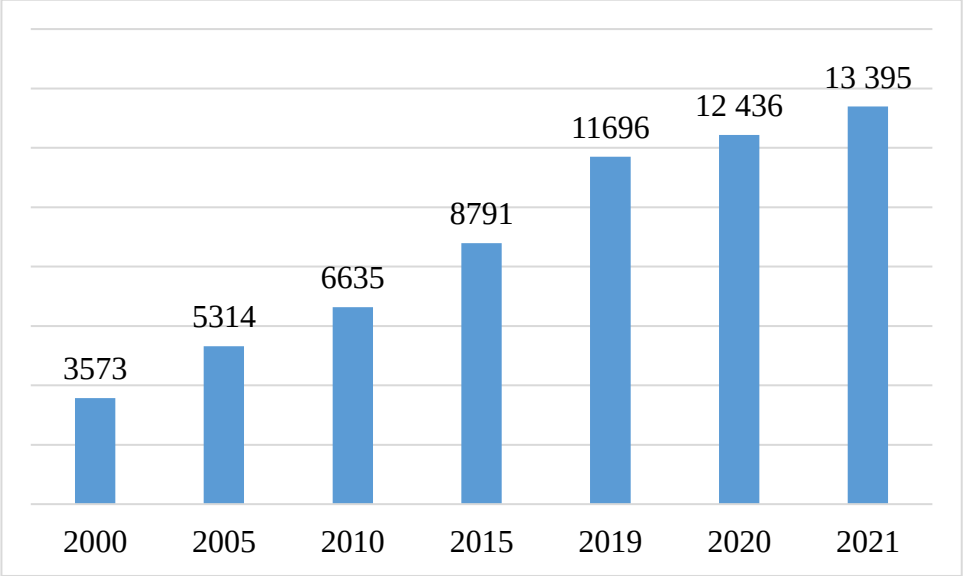


Figure 28 – The number of active legal entities of the Republic of Kazakhstan in the field of transport and warehousing

Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan

Since 2016, there has been a stable income level from the auxiliary transport activities of enterprises. However, there is a decrease in storage services for liquid or gaseous cargo. Generally, there are high incomes in grain storage services (due to

their export volume) and low indicators in refrigerated cargo storage services (Figure 29).

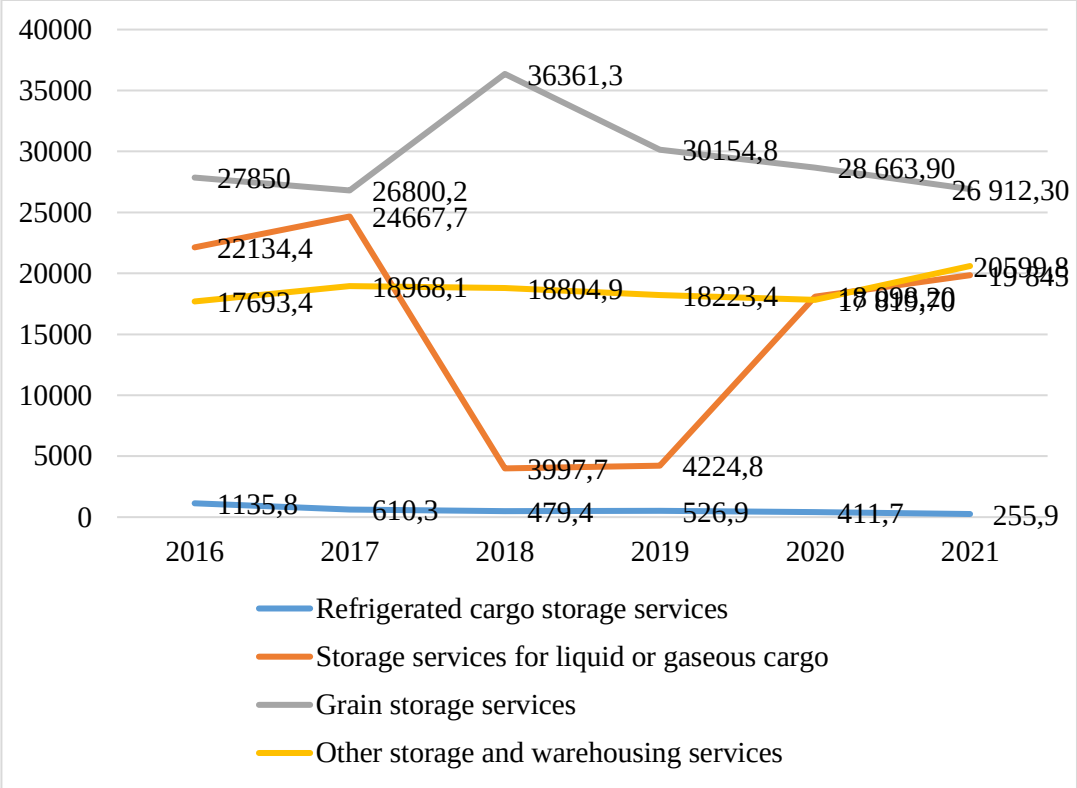


Figure 29 – Income from auxiliary transport activities of enterprises for 2016-2021, in a million tenge

Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan

In 2021, according to the leading indicators of ICT use by type of economic activity - transport and warehousing, the number of reported enterprises in the Bureau of National Statistics was 18359. According to enterprises, the level of provision of computers is 35,6%. The story of Internet accessibility is 29,9%. 29,9% of enterprises use cloud IT services, 4,7% use digital technologies in manufacturing, use robotics, 0,5% analyze big data, and 0,3% (Figure 30).

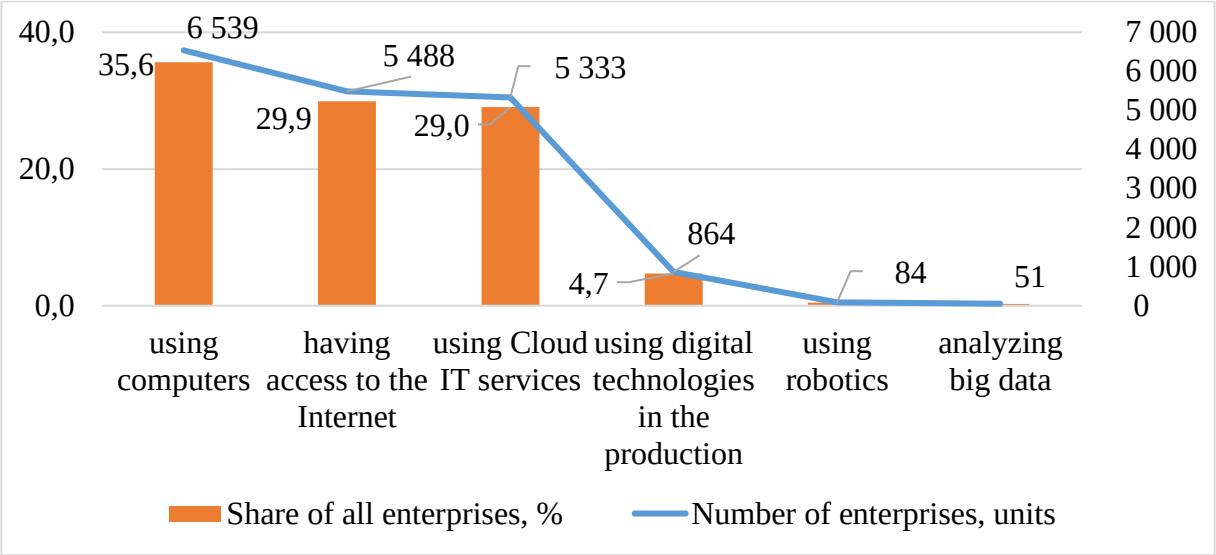


Figure 30 – Main indicators of ICT use in transport and warehousing, 2021

Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan

The electronic invoice Internet portal was the most widely used information technology for transport and storage (5390 units) in 2021. In addition, Internet resources and automated internal business processes are available in some enterprises (612 units). However, finding organizations that use printing (3D printers) services provided by other companies (35 units), RFID technology (61 units) and their 3D printers (35 units) is sporadic (Figure 31).

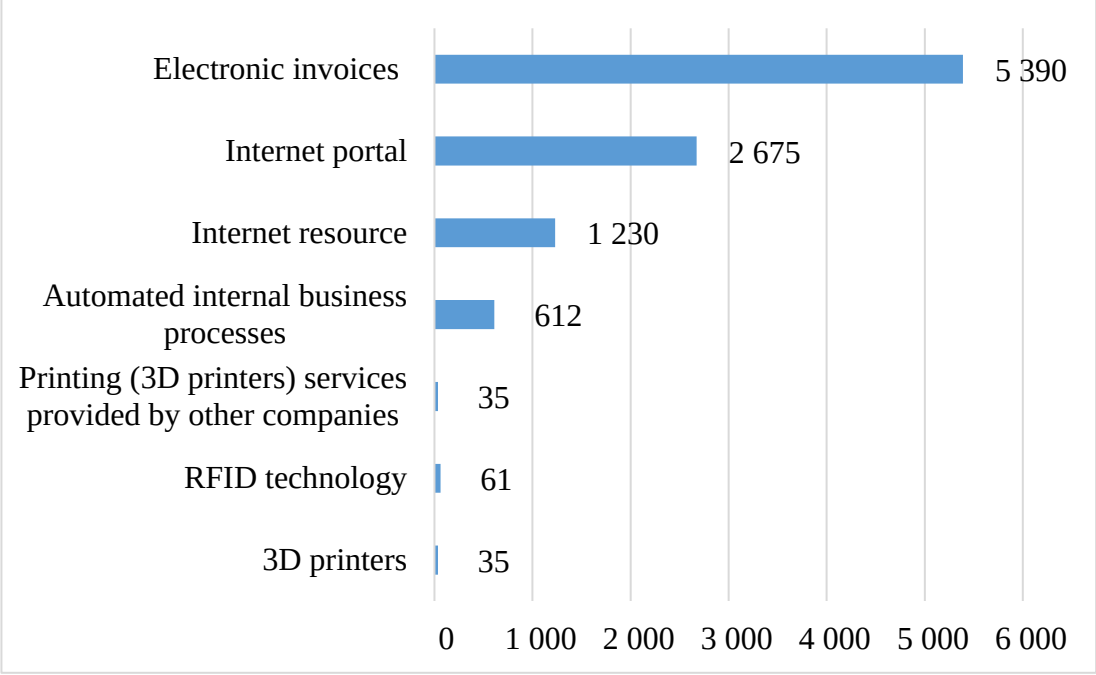


Figure 31 – The number of organizations using information technology systems for transport and warehousing, units in 2021

Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan

Enterprises use the Internet to interact with customers, partners and other stakeholders through social networks - 1706. A small proportion of enterprises receive orders for goods and services over the Internet (551) and order goods and services (647). Also, the share of organizations integrated into international Internet booking systems is 65 units (Figure 32).

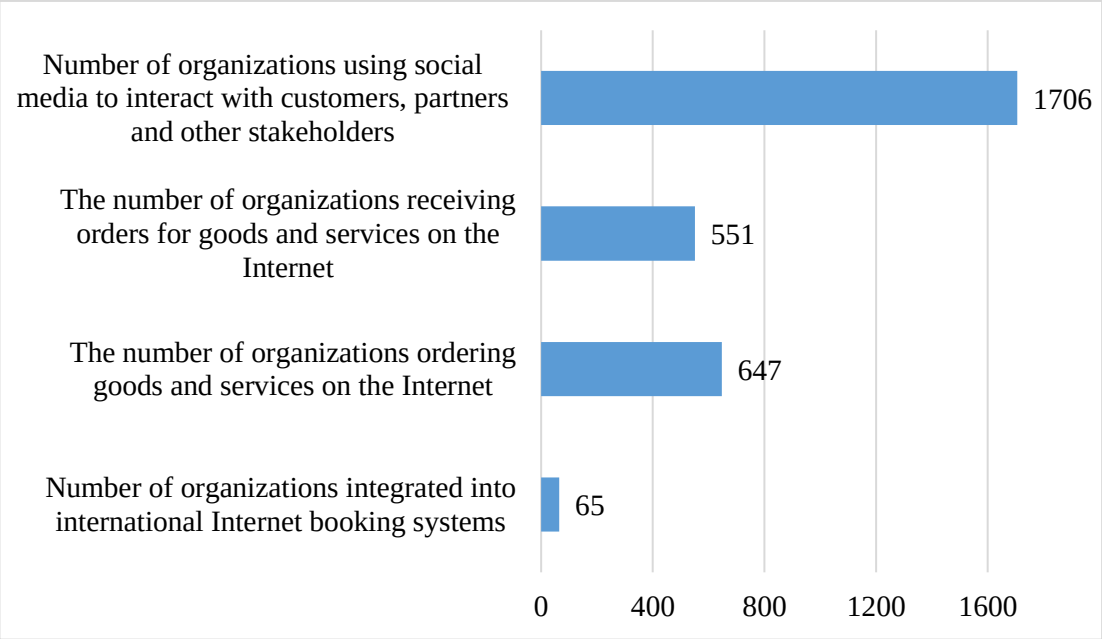


Figure 32 – Internet use by organizations for transport and warehousing, units 2021

Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan

The number of organizations using robotics for transport and warehousing is 36 organizations: 18 industrial robots and 18 service robots. Companies in the field of transport and logistics use the services of third-party organizations and specialists related to information technology – 81,8 % of all ICT costs. The cost of purchasing software based on a license agreement is 6096,2 million tenge – 17,5%. A negligible share of ICT cost is independent software development within the organization (0,4%) and employee training related to the development and use of ICT (0,3%) (Figure 33).

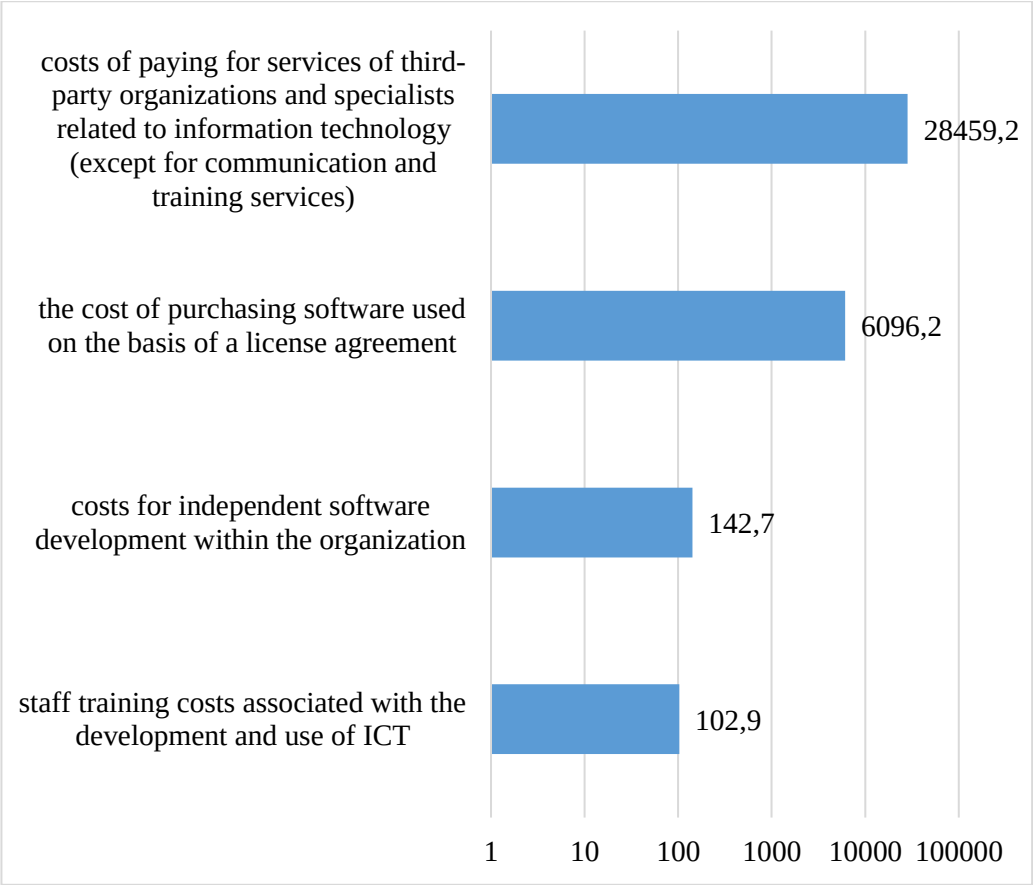


Figure 33 – Costs of organizations for ICT for transport and warehousing, 2021

Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan

In transport and warehousing, employees are computer literate and undergo computer literacy training. In general, the need for ICT specialists is 254 people — the number of organizations with ICT specialists is 387 (Figure 34).

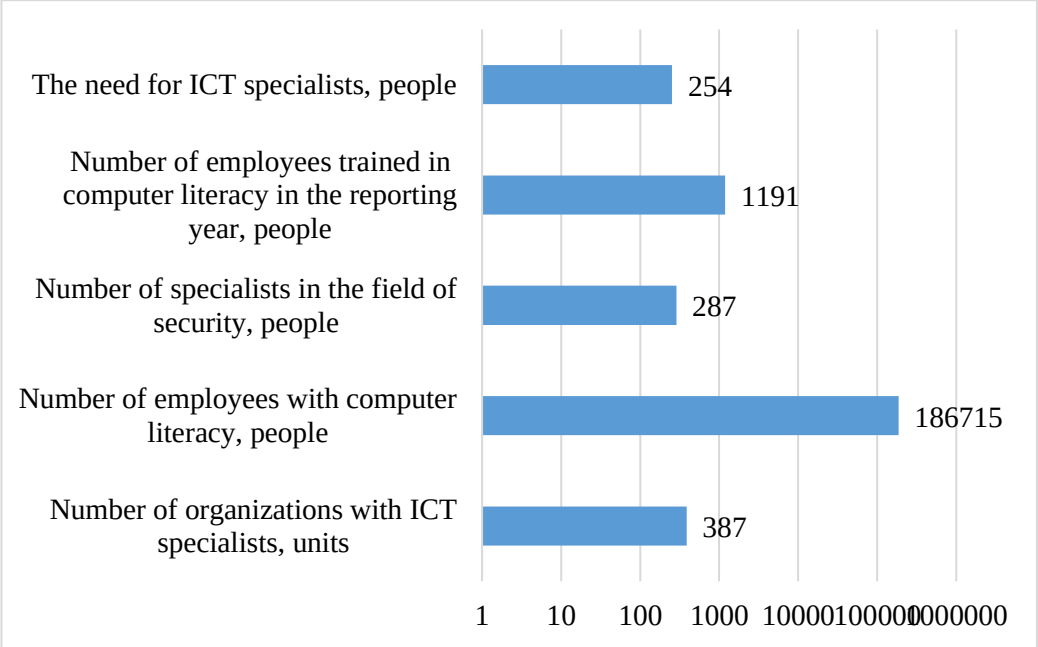


Figure 34 – ICT specialists and knowledge for transport and warehousing in 2021

Note – Developed by the author based on data from The Bureau of National Statistics Agency for Strategic planning and reforms of the Republic of Kazakhstan

Kazakhstan's logistics infrastructure is represented by seaports, dry ports, terminals, transport and logistics centers, warehouses, and other facilities. In international transport, border stations, border crossings, terminals, and transportation and logistics centres are essential. Primarily, it is crucial to develop logistics hubs of global importance. Also, the development of transport and logistics infrastructure has a positive effect on regional economic development [36, 40]. In addition, the formation of transport and logistics infrastructure adapted to the modern logistics system and goods movement technology, development of a multi-level integrated transport and logistics system increases the competitiveness of the economy [39, 43].

The analysis of the statistical data indicates the growth of the volume of transit cargo by all modes of transport and directions, export of transport services, transportation of goods in containers, the number of active legal entities in the field of transport and warehousing, income from auxiliary transport activities of enterprises and it show that Kazakhstan has great transit potential. At the same time, the main problems are associated with a high percentage of physical deterioration of the railway transport infrastructure [37, 38], and a low level of using digital technologies in providing transport and logistics services [127]. Analysis of secondary data on the use of ICT in transport and warehousing enterprises shows that the central part of the organization is provided with computers and has access to the Internet. The level of use of digital technologies such as (3D printers), RFID technology, robotics, and Big data analysis is deficient. Among the actively used information systems are electronic invoices and an Internet portal. Internet use in providing online ordering services and goods and services is low. Social networks are used to interact with customers, partners, and other stakeholders. Also, the level of investment by companies in software or information system development and employee training is low. Companies use third-party IT services. There is a demand for ICT specialists.

To sum up, the country's geographical position and geopolitical conditions, the growth of world trade opportunities within the «One Belt One Road» initiative and the Eurasian Economic Union, strengthening of the role of land transport corridors – all these factors necessitate the development of transport and logistics services and the country's transit potential. Proceeds from transit traffic, the country's transport and logistics industry can be one of the economy's profitable sectors for the government budget. In this case, the national logistics infrastructure must be competitive in price and quality. Improving the logistics service quality of main transportation and logistics nodes in international transport corridors is necessary. The following subsection will assess the logistics service quality of the "Khorgos Gateway" dry port.

2.3 Assessment of the quality of the logistics service of the dry port "Khorgos Gateway"

Kazakhstan's central position in Eurasian allows for being a transcontinental transport bridge for cargo flows between the main macroeconomic poles (the EU and the Asia-Pacific region). In this regard, the "Khorgos Gateway" dry port, situated so far from the sea and connected to China's and Kazakhstan's railways, plays a significant role between China and Europe within land-based transport corridors [126]. "Khorgos Gateway" is a cross-border-based dry port. Several new container routes have been launched through the Altynkol station using the KTZ Express Dry Port infrastructure. These are new services Jinhua (PRC) - Baku (Azerbaijan), Xi'an (PRC) - Izmit (Turkey) along the TMTM route, Chengxiang (PRC) - Zhodino (Belarus), Jinan Nan (PRC) - Gypjak (Turkmenistan), Turkmenbashi (Turkmenistan) - Qingdao (PRC), as well as a regular container service Altynkol – Moscow [128].

The dry port was opened in 2016, and its operators included "KTZ Express", "COSCO Shipping Corporation Ltd", LLC "GK Lianyungang Port". The total area is 129,8 hectares, with 18,000 containers per day, 6 loading-unloading places at the terminal, a total area of 2 warehouses of 10,000 m2, 180 outlets of power supply at the terminal for cargo with temperature requirements, and 25 km of sidings. Port provides carriage and container operations, transhipment, terminal processing, and additional logistics services (Table 24).

Table 24 – Information and location of "Khorgos Gateway" dry port

Opening year	November 2016
Operator	«KTZ Express», «COSCO Shipping Corporation Ltd», LLC «GK Lianyungang Port»
Total area	129,8 hectares. Container area:193 986 m2; (18 thousand containers)
Capacity of berth	540 thousand TEU
Services	carriage and container operations, transhipment, terminal processing, additional logistic services

Note – Compiled by the author based on [129]

The "Khorgos Gateway" dry port has a good performance in terms of throughput and cargo turnover. The dynamics of growth in freight turnover volume for 2017-2022 are shown in Figure 35.

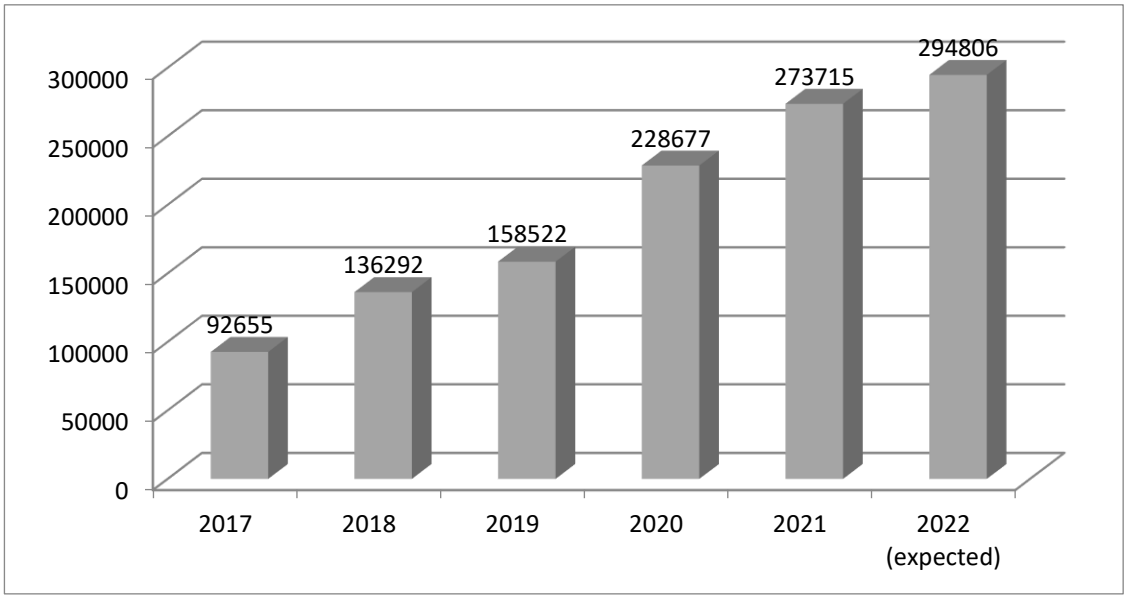


Figure 35 – Cargo turnover of the port for 2017-2021, TEU
Note – Compiled based on the data by the administration of the "Khorgos Gateway"

The port handles mainly containers, and general cargo, including steel, pipes, machinery, and packaged cargo. The port's actual workload is 50%, 365 days a year, and 24 hours a day. The port has low rates of warehouse loading. If in 2017, the average value of the occupancy of warehouse premises of classes A, B, and C was 10.0%, then in 2021, this figure was 13.0%. Nevertheless, it should be noted that the workload of class B warehouses is growing. For example, in 2017, it amounted to 29.0% and in 2021 to 35,0% (Figure 36).

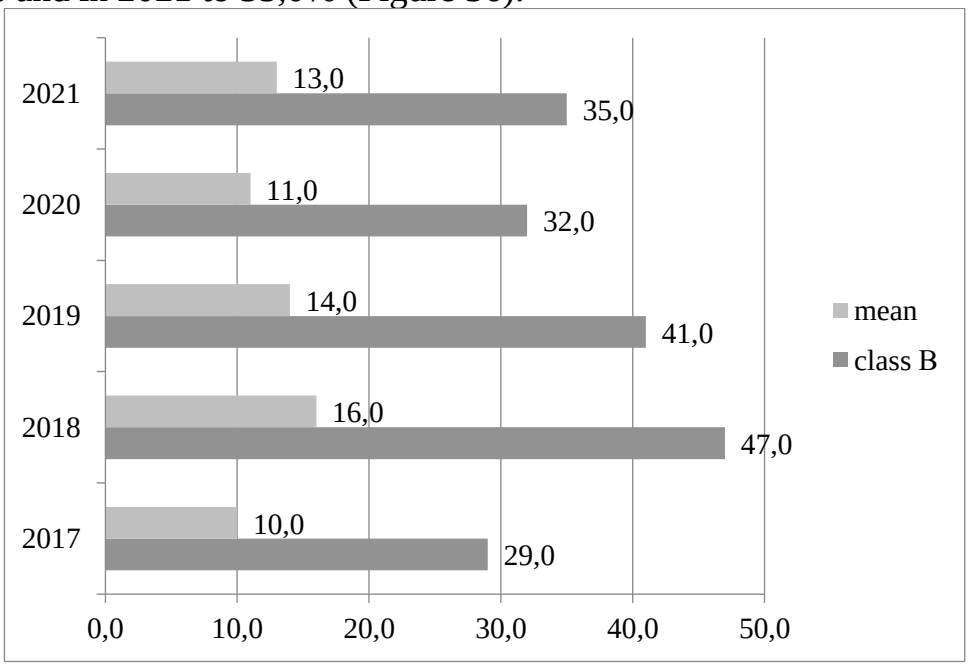


Figure 36 – The workload of the warehouse from 2017 to 2021

Note – Compiled based on the data by the administration of the «Khorgos Gateway»

The average wagon loading/unloading time for one composition is 1 hour and 20 minutes. The average transit time (total time between arrival and departure) of cargo, depending on the supply of empty wagons in the port, is a minimum of 12 hours and a maximum of 10 days.

The results of the evaluation of the quality of logistics services based on developed research tool through customers of dry port "Khorgos Gateway", cargo owners and their representatives: freight forwarders and logistics service providers show that the dry port has a low-level of extensive use of ICT applications (ICT) – 2,65 (Table 25).

Table 25 – The calculation results

Dimensions	Weights (Expert panel)	Evaluation "Khorgos Gateway" (Logistics providers)	Dry port's logistics service quality index
Availability of Physical infrastructure (I)	0,08	3,47	0,29
Operations and processes (OP)	0,23	3,40	0,77
Management and staff (M)	0,16	3,27	0,52
Appropriating price for the service quality (P)	0,08	3,12	0,25
Comprehensive use of ICT applications (ICT)	0,22	2,65	0,57
Multimodality, value-added services (MS)	0,24	3,09	0,75
Overall			3,15
Note: Compiled by the author based on empirical research			

The port has good performance on the availability of physical infrastructure (I) (3,47), appropriating the price for the service quality (P) – 3,12. Considering the weights (based on the expert panel survey), their index will be the lowest compared to the other indicators – 0,29 and 0,25, respectively. Comparatively, the port has high indexes of operations and processes (OP) were 0,77 and multimodality, value-added services (MS) were 0,75. The list continues to index the extensive use of ICT applications (ICT) (0,56) and management-related (M) (0,52).

It should be noted that the overall quality index of the logistics service for the "Khorgos Gateway" dry port was 3,15 (slightly above average). This index should be considered separately for each dimension and subdimension. Then the weak and strength of the dry port can be generally determined [107].

The following graph was built based on the port users' (logistics providers) assessment. The chart shows the indicators of the level of importance of subdimensions (axis x – by weighting factors on a scale of 0-1) and evaluation of the quality of service of "Khorgos Gateway" (axis y – the scale of 1-5) (Figure 37).

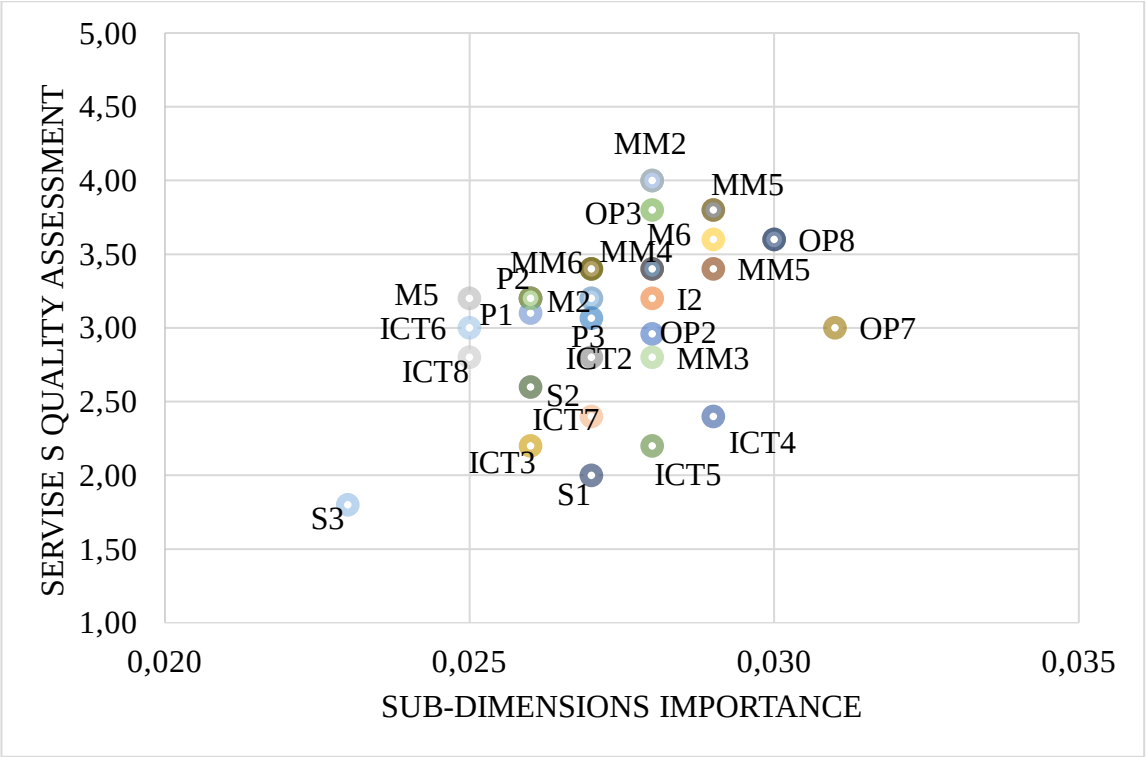


Figure 37 – A case study "Khorgos Gateway" (by sub-dimensions)
Note: Compiled by the author based on own research [107]

The dry port has a low rate of additional services (S1-S3) and the use of ICT in port processes and the provision of services (ICT3-ICT8). The port is multimodal at a sufficient level (MM2, MM5). According to some port operations and processes, the service is satisfactory (OP3, OP8). Nevertheless, it should be noted that some port operations and price management-related dimensions are below an acceptable level. The detailed indexes with weights for each sub-dimension are presented in Table 26.

Table 26 – Results of calculation of logistics services quality indexes for each sub-dimension

Sub-dimensions	Weights	Mean	Std. Deviation	Weights *Mean
1	2	3	4	5
I1	0,028	4,00	1,73	0,11
I2	0,028	3,20	1,48	0,09
I3	0,027	3,20	1,30	0,09
OP1	0,029	3,80	0,84	0,11
OP2	0,028	2,96	1,21	0,08
OP3	0,028	3,80	0,45	0,11
OP4	0,026	3,20	0,84	0,08
OP5	0,026	3,20	0,84	0,08
OP6	0,030	3,60	0,55	0,11
OP7	0,031	3,00	0,71	0,09
OP8	0,030	3,60	0,55	0,11
M1	0,027	3,40	0,55	0,09
M2	0,027	3,20	0,84	0,09

Continuation of table 26

1	2	3	4	5
M3	0,023	3,40	0,55	0,08
M4	0,027	2,80	0,45	0,08
M5	0,025	3,20	0,45	0,08
M6	0,029	3,60	0,55	0,10
P1	0,026	3,10	0,78	0,08
P2	0,026	3,20	0,84	0,08
P3	0,027	3,07	0,96	0,08
ICT1	0,028	3,40	0,55	0,10
ICT2	0,027	2,80	1,30	0,08
ICT3	0,026	2,20	1,30	0,06
ICT4	0,029	2,40	1,34	0,07
ICT5	0,028	2,20	1,30	0,06
ICT6	0,025	3,00	1,23	0,08
ICT7	0,027	2,40	1,52	0,06
ICT8	0,025	2,80	1,10	0,07
MM1	0,028	4,00	0,71	0,11
MM2	0,028	4,00	0,71	0,11
MM3	0,022	2,80	1,30	0,06
MM4	0,028	3,40	1,14	0,10
MM5	0,029	3,80	0,84	0,11
MM6	0,027	3,40	1,52	0,09
S1	0,027	2,00	1,23	0,05
S2	0,026	2,60	1,34	0,07
S3	0,023	1,80	1,30	0,04
	1,00			3,14

In the next step, gap scores are calculated based on the logistics providers' expectations and perception evaluation scores. The gap score is the difference between the perception and expectation scores. The expectation scores indicate how customers want services to be offered, whilst perception scores indicate how customers perceive the actual quality of service rendered. Thus, the lower the expectation (perception) score, the lower the expectation of customers (quality of service received).

Concerning the dimension, it is evident that all perception scores are lower than expected, resulting in negative gap scores. The higher service quality gap scores of − -2,3 for Comprehensive use of ICT applications, -1,6 for Appropriating price for the service quality, and Multimodality, intermodality, value-added services, -1,5 for Availability of Physical Infrastructure, Operations, and processes (Table 27).

Table 27 – Service quality expectation and average perception scores by dimensions

Dimensions	Expectation scores	Perception scores	Gap scores
Availability of Physical infrastructure (A)	5,0	4,5	-1,5
Operations and processes (O)	4,8	3,3	-1,5
Management-related	4,9	3,3	-1,6
Appropriating price for the service quality	4,8	3,1	-1,7
Comprehensive use of ICT applications	4,9	2,7	-2,3
Multimodality, intermodality, value-added services	4,8	3,2	-1,6
Overall scores	4,8	3,2	-1,7

Regarding the sub-dimensions, the higher gap scores -3.2 for Labeling, Packing, Order picking up, and Bar Coding. Custom setting -2,8 for Transparency of shipping processes, for Availability of control on documentation processes (custom, phytosanitary, veterinary, border, quarantine control) via the corporate website or other platforms, Additional services for cargo delivery to the final consumer, -2,6 for Integration into a single information system of all procedures (customs, freight forwarders, port processes), Availability of updated information, including cargo/container photos and videos on the corporate website or other platforms, -2,4 for Having the fixed online schedule for receiving and departing containers, Providing a "package of services" (from customs clearance to delivery to the client), -2,2 for Evaluating or assessing of customers future requirements and Inclusion of the port in the international port information community (Figure 38).

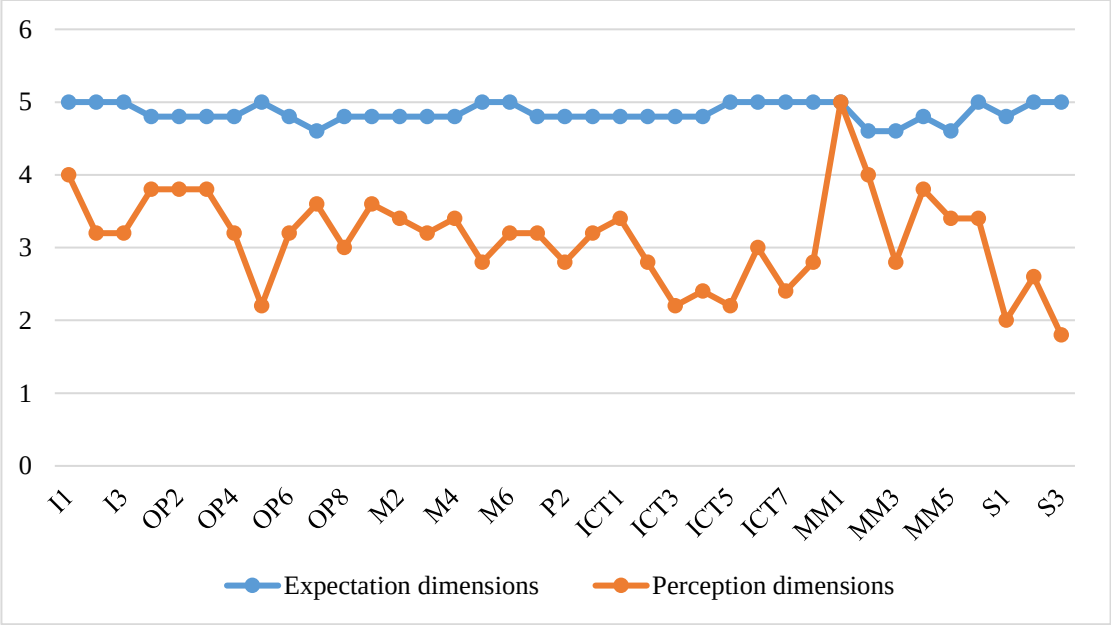


Figure 38 – Service quality expectation and average perception scores for each sub-dimension

Note: Compiled by the author based on own research

The results show a low gap score of -1 for sub-dimensions for Availability of Material handling types of equipment (gantry cranes, reach stackers, stackers,

forklifts, etc.), Ease of ordering procedures, Custom control convenience (phytosanitary, veterinary, border, quarantine controls), Quick of loading/unloading processes, Connection to primary to regional transport and logistics terminals/centers, Safety of operations/procedures, - 0,6 for Connection and distance to primary motorway network. 0,0 - Connection and distance to the primary railway network.

Table 28 – Service quality expectation and average perception scores by sub-dimensions

Sub-dimensions	Expectation dimensions	Perception dimensions	Gap scores
I1	5	3,2	-1,8
I2	5	3,2	-1,8
I3	4,8	3,8	-1
OP1	4,8	3,8	-1
OP2	4,8	3,8	-1
OP3	4,8	3,2	-1,6
OP4	5	2,2	-2,8
OP5	4,8	3,2	-1,6
OP6	4,6	3,6	-1
OP7	4,8	3	-1,8
OP8	4,8	3,6	-1,2
M1	4,8	3,4	-1,4
M2	4,8	3,2	-1,6
M3	4,8	3,4	-1,4
M4	5	2,8	-2,2
M5	5	3,2	-1,8
M6	4,8	3,2	-1,6
P1	4,8	2,8	-2
P2	4,8	3,2	-1,6
P3	4,8	3,4	-1,4
ICT1	4,8	2,8	-2
ICT2	4,8	2,2	-2,6
ICT3	4,8	2,4	-2,4
ICT4	5	2,2	-2,8
ICT5	5	3	-2
ICT6	5	2,4	-2,6
1	3	4	5
ICT7	5	2,8	-2,2
ICT8	5	5	0
MM1	4,6	4	-0,6
MM2	4,6	2,8	-1,8
MM3	4,8	3,8	-1
MM4	4,6	3,4	-1,2
MM5	5	3,4	-1,6
MM6	4,8	2	-2,8
S1	5	2,6	-2,4
S2	5	1,8	-3,2

In visiting a dry port and conducting observations, interviews with port administrators, the following problems were identified: the port is not automated at a sufficient level, especially in digitalization. There is no integrated unified system where stakeholders can observe the whole process in the port: the customs officers have their system, "Kazakhstan Temir Zholy" (the national operator of the railway network in Kazakhstan) works with an Automated control system of contractual, commercial work (ACSCCW), brokers and freight forwarders have their own programs, etc.; there is no single system (where stakeholders can observe port processes) and an online schedule, lack of the ability to track cargo. There are problems with «inspections» of documents and cargo. There is no transparent railway carriage departure system or online schedule. There is no "package of services" (from paperwork to the organization of delivery to the recipient). The carrying capacity of the Altynkol station (through which cargoes from China to Kazakhstan and back pass) is low; it does not meet international requirements: there are single-track rails, there is no opportunity for "manoeuvres" and so on. It holds cargo in the dry port.

Within the interview following recommendations were suggested by port users: premature check-in of arriving cargo, available information about the time of freight passing through the terminal; port compliance with international requirements; the reliability of the system; selected services for SMEs; clear organization of the dry port, the presence of contacts of all responsible persons, the possibility of speeding up the process, if necessary; the online documentation.

The case study "Khorgos Gateway" shows it is necessary to develop the port's quality of service regarding information and communication support for port operations and processes. Based on the assessment quality of logistics services, the practical recommendations for further development of "Khorgos Gateway" dry port might be summed up as follows: introduction of a unified, integrated information system, where all stakeholders (shippers, customs, freight forwarders, logistics and transport companies, port administration) can receive the required information in real-time; organize a package of services for clients (starting from filling out the necessary customs documents to delivery to the final consumer); equip the dry port with the adequate modern technologies to ensure supply chain visibility, e.g. terminal coverage with GPS, RFID, CCTV, e-PoDs, camera surveillance systems etc.

It has been noted in previous studies assessing the effectiveness of transport corridors and seaports. Coto-Millán, Pesquera, and Castanedo highlight the importance of technological change and its impact on ports' competitive structure [20]. A properly designed, computerized container control system increases the operating efficiency of the terminal. However, the primary services provided by such systems are the following: faster discharging and loading of containers; increased productivity through the faster turnaround of containers; better monitoring of the storage of containers (leading to increases in stacking area's capacity); high-level of the accuracy of information; and high level of consistency of the information given to various parties in the chain of transport [22].

Correspondingly, there is a demand for additional services: providing a "package of services", the organization of delivery to the final consumer, and

additional value-added services. Along with these, it is necessary to speed up and automate the processes associated with the documentation.

The intensive growth in demand for container transportation, including transit through Kazakhstan to Europe, Central Asia, and the Persian Gulf, necessitates the development of the quality of logistics services for the "Khorgos Gateway" dry port.

The results of this study indicate that "Khorgos Gateway" dry port has a low rate of the index of the following additional services: handling of different types of cargo, other services for cargo delivery to the final consumer, provision of a package of services (from customs clearance to delivery to the client); labelling, packing, order picking up, barcoding, custom setting. Additionally, it was obtained that there is a low level of information and communication technology supporting port operations and processes.

The evidence from this study suggests that port users are satisfied with the quality of service of port personnel and the physical infrastructure and operations at the port. However, customers have complaints about the speed of service provision.

This study's prospect is to collect data on other global (China, Russia, Europe) dry ports along with transport and logistics corridors that pass through the "Khorgos Gateway".

Concluding section 2, it can be highlighted that technological readiness is an essential aspect of logistics services development. A high level of logistics service is achieved through sufficient investment in the transport and logistics sector's technological modernization. The effect of dry ports of international importance and the modernization of cross-border infrastructure (stations, customs, ports, terminals) increases the country's transit potential. In ensuring uninterrupted cargo transportation in the international direction, it is necessary to improve the logistics service quality of dry ports by forming industrial and logistics, transport, and logistics hubs with the digital transformation of transport and logistics processes.

3. IMPROVING THE QUALITY OF LOGISTICS SERVICES OF DRY PORTS IN TERMS OF DIGITALIZATION

3.1 Ways of improving the quality of logistics services of dry ports with digital transformation

Based on the assessment of factors for the development of logistics performance, analysis of the country's transit potential, and evaluation of the quality of the logistics service of the "Khorgos Gateway" dry port allow us to identify the main directions for improving the quality of the logistics service of dry ports in the Eurasian transport corridors. Thus, improving the quality of the logistics services of dry ports in international transport corridors in the context of Industry 4.0 is based on:

1) ensuring the quality of logistics services with the implementation of international service quality standards and other criteria of Logistics 4.0;

2) digital transformation based on the modernization of business processes in the port with the introduction of digital technologies, the development of an integrated information system/platform;

3) integration of regional international transport networks in the formation of global supply chains, ensuring the continuity of international cargo transportation during the Covid19 pandemic period, geopolitical crisis, and participation in the construction of logistics and economic corridor development within the logistics hub (Figure 39).

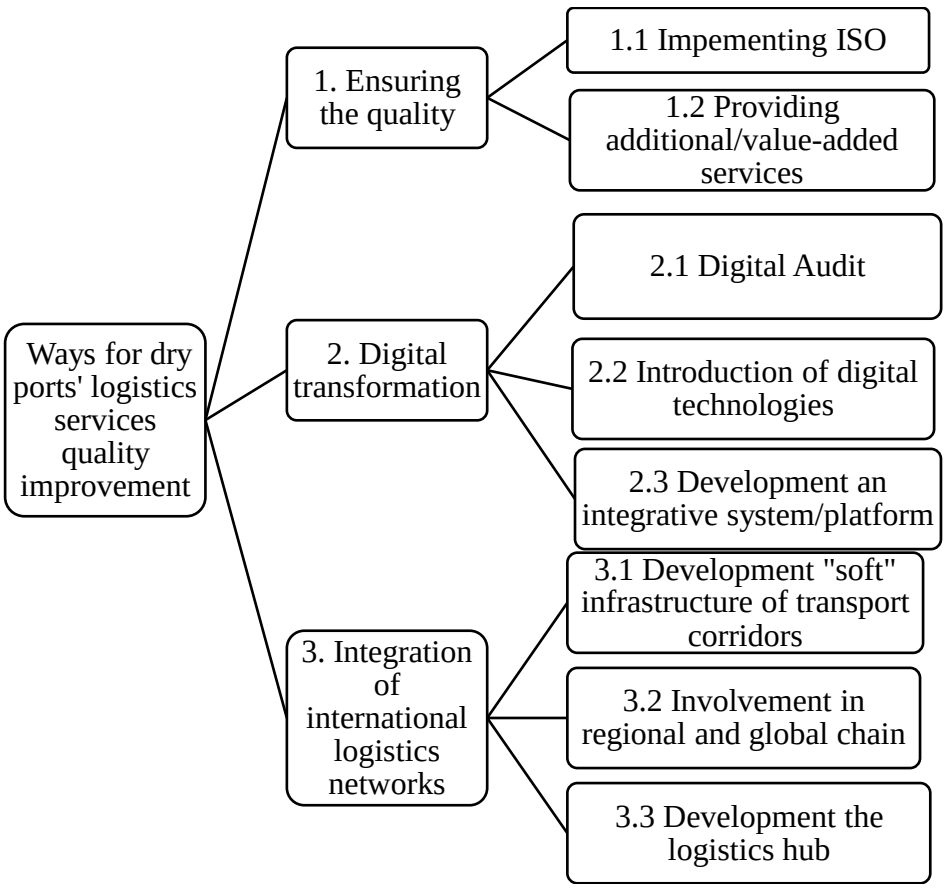


Figure 39 – Ways for dry ports' logistics services quality improvement

Note – Developed by the author

1. Ensuring the quality of logistics services.

1.1 Implementing ISO. Service quality standards should be introduced in the provision of transport and logistics services. Based on the basic principles and mechanisms of the "ISO 9001:2015 Quality management systems" [130], the components of developing the quality of logistics services in dry ports have been developed (Figure 40).

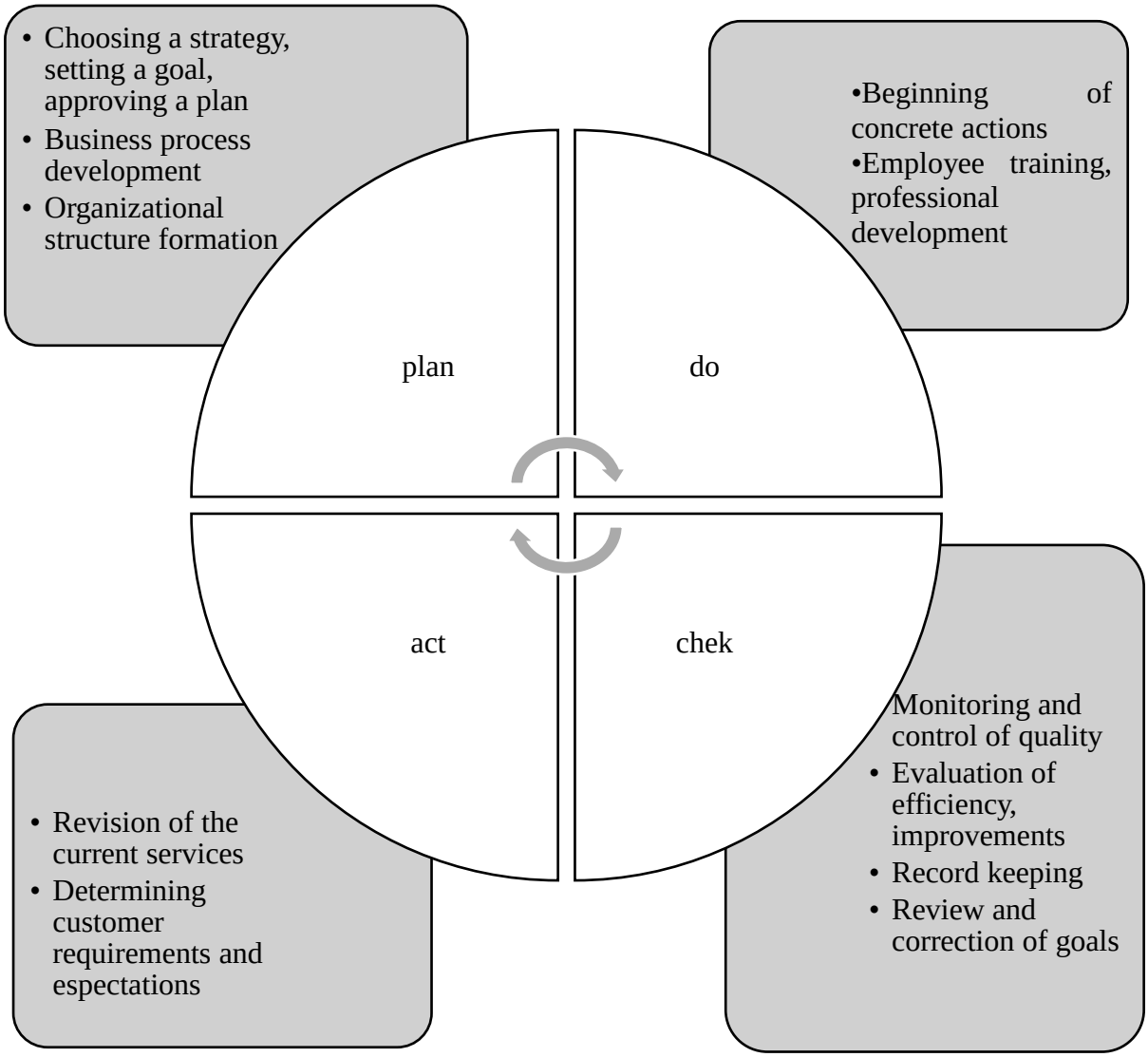


Figure 40 - Components of ensuring the quality of logistics services in dry ports based on ISO 9001:2015

Note – Developed by the author based on [130]

According to the service quality management, Figure 41 presents detailed measures for each service provision stage. Primary activities are adapted to the processes and operations of the dry port. Depending on the port development's purpose and objectives, these activities can be specified and supplemented.

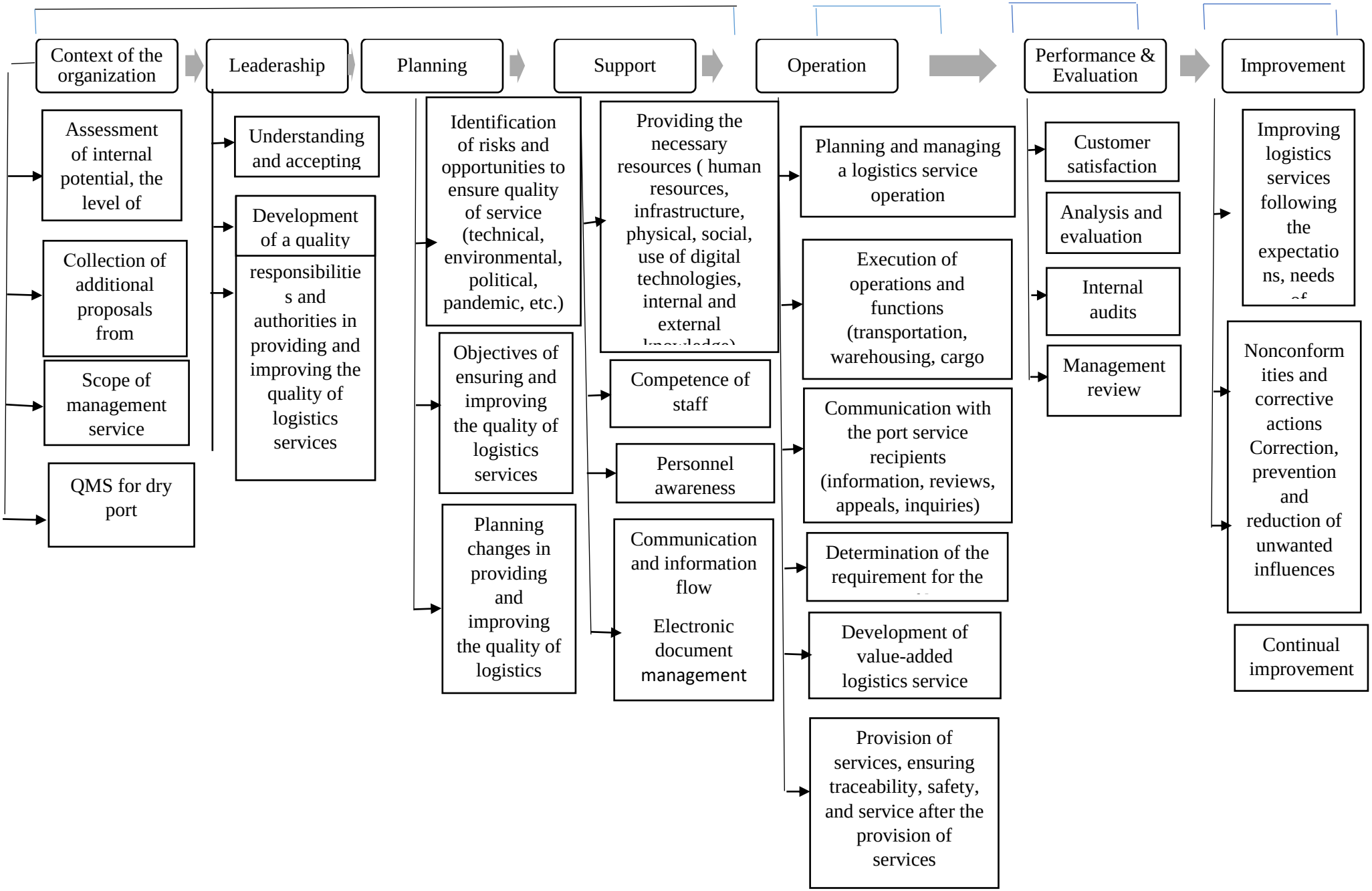

Context of the organization
Leaderaship
Planning
Support
Operation
Performance & Evaluation
Improvement
Assessment of internal potential, the level of
Collection of additional proposals from
Scope of management service
QMS for dry port
Understanding and accepting
Development of a quality
responsibilitie s and authorities in providing and improving the quality of logistics services
Identification of risks and opportunities to ensure quality of service (technical, environmental, political, pandemic, etc.)
Objectives of ensuring and improving the quality of logistics services
Planning changes in providing and improving the quality of logistics
Providing the necessary resources (human resources, infrastructure, physical, social, use of digital technologies, internal and external
Competence of staff
Personnel awareness
Communication and information flow
Electronic document management
Planning and managing a logistics service operation
Execution of operations and functions (transportation, warehousing, cargo
Communication with the port service recipients (information, reviews, appeals, inquiries)
Determination of the requirement for the
Development of value-added logistics service
Provision of services, ensuring traceability, safety, and service after the provision of services
Customer satisfaction
Analysis and evaluation
Internal audits
Management review
Improving logistics services following the expectatio ns, needs
Nonconform ities and corrective actions Correction, prevention and reduction of unwanted influences
Continual improvement

Figure 41 - Improvement of logistics services quality of dry ports based on ISO 9001:2015

Note – Developed by the author based on [130]

1.2 Providing additional/value-added services. In the formation of Logistics 4.0, it is essential to pay special attention to further service development. It ensures the complexity of services, which is a necessary condition for ensuring the quality of service. *New generation dry ports should provide a full range of transport and logistics services and additional services*, such as assembly and packaging of the order, labelling, packing, order picking up, barcoding, custom setting, information flow and communications, ensuring the supply chain visibility, online ordering procedures, banking/insurance/financial services and other social services (hotel, catering, truck washing station) (Table 29).

Table 29 – A dry ports' services in development logistics

Service	Logistics 1.0	Logistics 2.0	Logistics 3.0	Logistics 4.0
1	2	3	4	5
Trans-shipment Handling (loading/unloading) container, breakbulk	+	+	+	+
Warehousing		+	+	+
Transport by road	+	+	+	+
Transport by rail	+	+	+	+
Transport by air			+	+
Customs inspection and clearance (phytosanitary, veterinary, border, quarantine controls)			+	+
Freight forwarding and cargo consolidation services			+	+
Product distribution				+
Container light repairs			+	+
Cargo escort Cargo insurance			+	+
Ships charter and freight forwarding			+	+
Banking/insurance/financial services				+
Assembly and packaging of the order				+
Labelling, Packing, Order picking up, Bar Coding, Custom setting				+
Information flow and communications				+

Continuation of table 29

1	2	3	4	5
Supply chain visibility				+
Online ordering procedures				+
Other social services (hotel, catering, truck washing station)				+
Note – Developed by the author				

2. Digital transformation.

2.1 Digital audit is based on assessing the level of digitalization and quality of service management. Digitalization has become increasingly popular for transforming and disrupting business models in various transport and logistics sectors in recent years. In terms of global value chain formation, the digital transformation of vehicle and logistics infrastructure has scientific and practical importance. In this case, the digitalization of dry ports' logistics processes generates considerable interest in Industry 4.0. Within the case study, an assessment of the level of digitalization and quality of service management of the "Khorgos Gateway" dry port was carried out together with the Union of Transport and Logistics Organizations and Associations "KAZLOGISTIC" (Appendices A, B).

Based on the parameters of the port development and digital auditing tool for ports [132], the following indicators were used in the assessment tool:

1. General indicators include port capacity, cargo turnover, port load, warehouse load, loading/unloading process, time, passage (total time between arrival and departure) of cargo in the port, infrastructure and technological equipment, and security.

2. Port policy on port digitalization.

3. Application of information and communication technologies in port processes and operations.

4. Possibilities of using digital technologies in port processes and operations.

5. Service quality management system.

6. Human resources.

7. Multimodality and other aspects of the development of the port as a hub (Appendix J).

According to the estimated parameters, the average score for assessing service management quality and digitalization was 2.9 (min 1, max 5). The assessment showed that the port has good infrastructure and technological equipment indicators, safety (4.8), and human resources (3.0). The port is multi-modal and has prospects for developing the port as a hub (3.7). In terms of implementing the management system and quality of service, the port has a level of 2.2. Also, the port has low indicators for ICT application in port processes and operations (2.7), port digitalization policy (2.5), and opportunities for using digital technologies (1.8) (Figure 42).

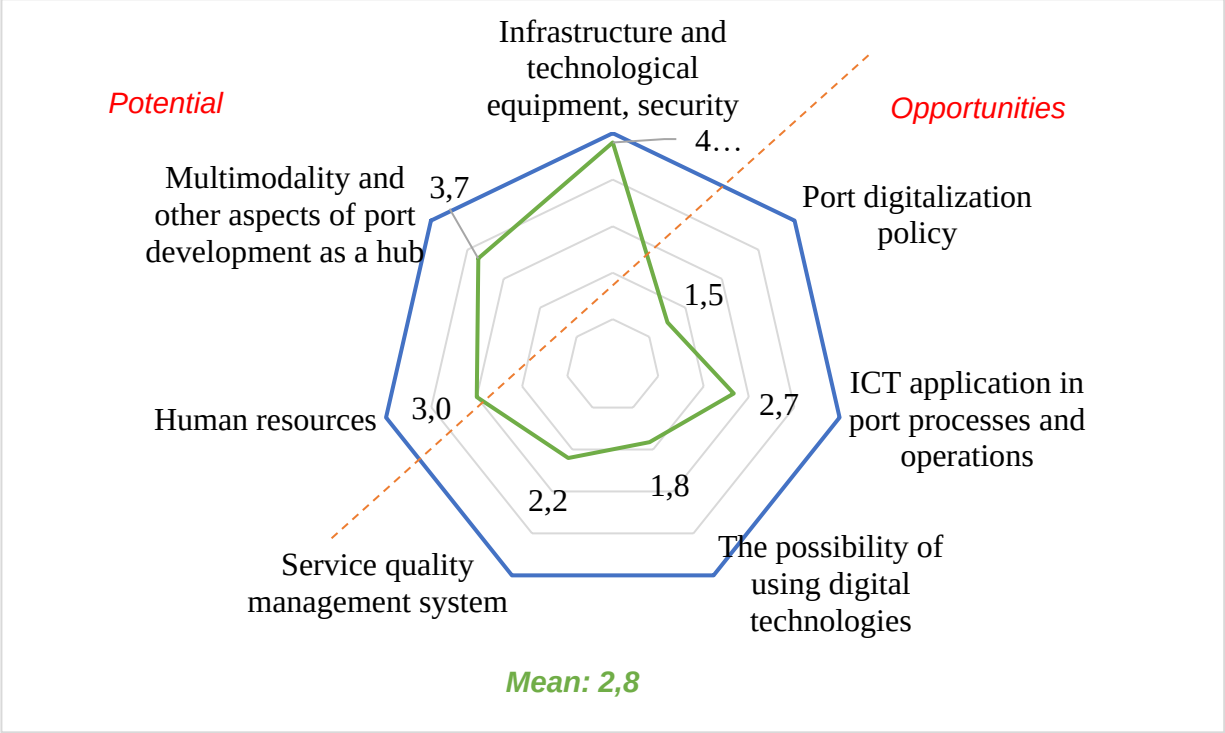


Figure 42 - Indicators of the dry port on the assessment of potential and opportunities and service quality management

Note – Developed by the author based on own research

A digital audit allows us to identify the potential and opportunities of a dry port in the context of digitalization and take specific measures for further development.

2.2 Introduction of digital technologies. Nowadays, in the "Khorgos Gateway" dry port, the Lian Yun Gang E-Port Information Development Co. Ltd developers are implementing works to introduce the operating system of the TOS-KG terminal. According to the Action Plan for the TOS-KG implementation, the developers completed the project in terms of the main module of production operations as the planning of production processes, unloading/loading/reloading containers, unit and general cargo, accounting of containers in the railway and container site, integration with the automated control system of the station "Altynkol". The automatic revenue accounting system and EDI data exchange system have been completed and are being tested. The developers began to design a management system for temporary storage warehouses. The next stage of development is the WEB portal for clients. Since the commissioning (07/01/2019) of the module's trial operation for production operations, more than 161 thousand containers have been overloaded using the TOS-KG terminal operating system.

As a means of digital technologies, the port comprehensive use web communication tools such as websites and social media pages (Table 30).

Table 30 – The web communication tools of dry port "Khorgos Gateway"

Types of resource	Web address
Website of dry port	https://khorgosgateway.kz/
Pages of the dry port in	https://www.instagram.com/khorgosgateway/

social media	https://www.facebook.com/KhorgosG/?fref=ts
	https://www.linkedin.com/company/khorgos-gateway
	https://www.youtube.com/channel/UCTBwWQtuLRKby9mIK4lPT8g
Note – Compiled by the author based on web resources	

It is planned to use Drones (Air, Land), Autonomous Solutions (Terminals, Cranes, Vehicles)—CPS (Cyber- Physical Systems), Mobile Data Access for Employees. In specific processes Smart Enterprise-Resource Planning-System, Smart Port-Community-System, Localisation Technologies (GPS, RFID, etc.), Sensors (Humidity, Temperature, etc.) are already being used. In general, many digital technologies are unavailable and not planned for use. The indicators for each digital technology are presented in Figure 43.

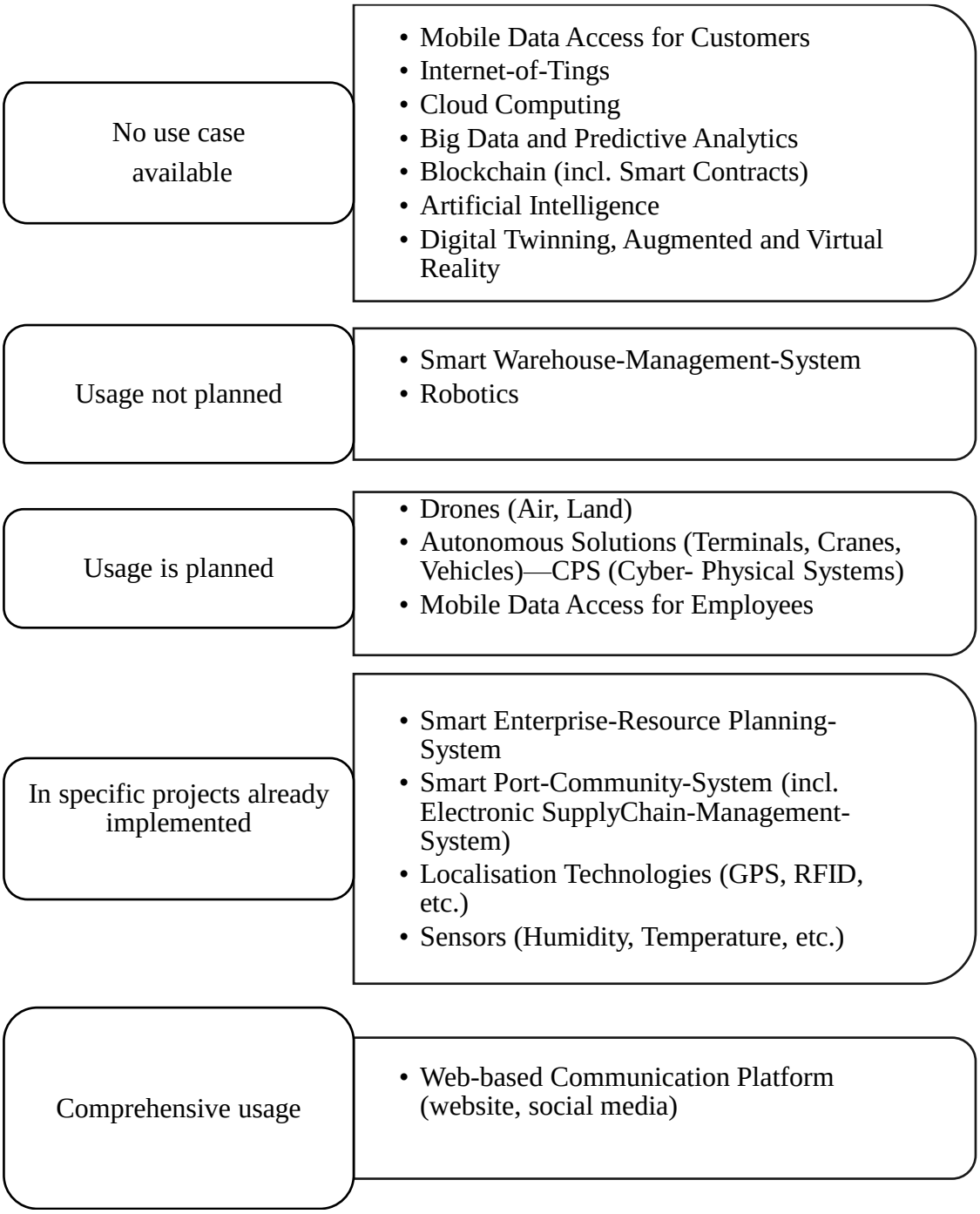


Figure 43 - Application possibilities of the following digital technologies and systems in dry port processes and operations of "Khorgos Gateway»

Note – Compiled by the author based on the case study

Considering the results based on the fifth-generation port concept model [55] and the digital readiness index assessment towards smart port development [133], it can be concluded that the "Khorgos Gateway" dry port is a logistics and monitor port (Figure 44).

The dry port has prospects of becoming an SCM port (i.e., the port's supply chain management). Its location in international transport corridors and containerization growth makes it possible for the port to develop as a global logistics hub and smart port. The development of additional logistics services expands the port's capabilities to be customer-oriented: participation in delivery "to the door". The noted prospects for port development are associated with digital evolution. "Monitor-port" means that some processes in the port are automated, and port administrators, operators, and other related organizations (stations, logistics providers, etc.) have their information platforms and databases. They have also begun to digitize them individually. In order, respectively, information and related data are exchanged through specific channels.

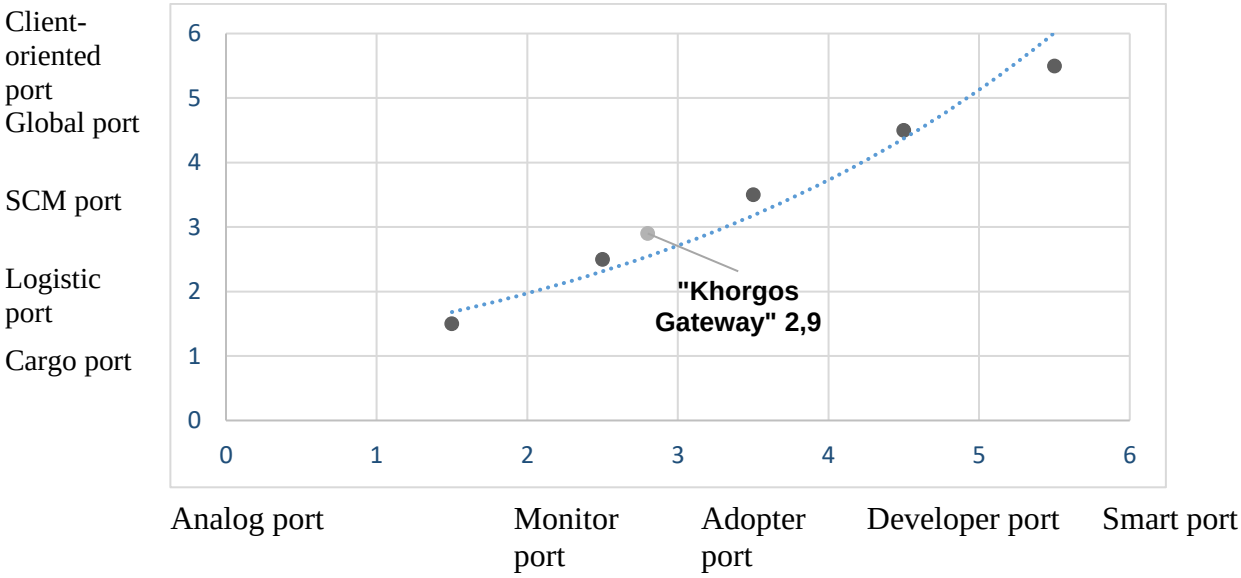


Figure 44 - Stages of port development and the level of digitalization

Note – Developed by the author based on [57, 133]

The next level of port digitalisation is an "Adopter Port". The directly involved organizations (port administration, operators, stations, customs, logistics providers, consignees, etc.) must integrate their (information) systems to improve communication. Consequently, developing a single digital environment has several advantages, such as better coordination and reduced waiting times for all vehicles, ensuring transparency of port processes and operations [133]. The development of

logistics services allows the dry port to integrate into the regional and international supply chains.

There is necessary to improve digital services continuously: connecting all stakeholders through an information platform, real-time data exchange, etc. The characteristics of each port model, the digitalization phase, and the logistics service quality are presented in Table 31.

Table 31 – Description of port models, digitalization phases and the level of quality of logistics services

Level of logistics	Port's Model	Phases of digitalization	Logistics service quality
1	2	3	4
Logistics 1.0	Cargo port	Analog port	Low level of service quality
	Provision of loading and unloading services	Automation does not exist. The port has no or less knowledge about digitalization and, thus, does not know how to change or is unwilling. Furthermore, the port usually performs landlord functions. Regarding customers, the first-come-first-serve policy is generally applied	The port provides some transport services. Infrastructure is low. Port logistics management is weak. Information support is missing. The port is not multimodal and does not provide additional services. It is necessary to develop the port in all directions
Logistics 2.0	Logistics port	Monitor port	The average level of service quality
	Multiple services (warehouse, etc.)	Individual automation in the port might emerge. Port authorities, operator and related organizations in the port's proximity maintain their processes and databases and start digitalising them individually. Accordingly, information and relevant data are captured across specific nodes. The port environment is monitored. Regarding the customers, a statistics-driven policy is driven	The port is functioning, but the logistics service quality is shallow. It is necessary to take all measures for the formation and development of the port. In general, the port provides services, but it is necessary to improve the quality of logistics services, including all directions: infrastructure, management, price, information support, multi-modal and additional services
Logistics 3.0	SCM port	Adopter port	The high average level of service quality
	Establishing a connection with industrial, export-	Information integration with participants in the transportation process, industrial facilities	The port development level is average. Nevertheless, it requires improving the quality of logistics services in certain areas, considering the recipient service's interests. In

Continuation of table 31

1	2	3	4
	oriented objects Providing additional services for transport and logistics operations (bilateral e-ports) – Two-way flow of information		particular, the port should be developed in the light of new technological solutions, ensuring the port's competitiveness in transport and logistics with additional value-added services.
	Global port	Developer port	High level of service quality
	Global information and the environment flow and standards Compliance with the quality of services with international standards	A single digital environment for all participants in the transportation process	The port provides services at a global level. The port development and status of logistics service quality are good. The port may well be the transport and logistics hub of the region and the central hub of international transport, logistics and economic corridors.
Logistics 4.0	Client-oriented port	Smart port	Very high level of service quality
	Integrated port user's multifaceted business requirements and port stakeholder's needs	Full integration of physical and digital port environments Digital availability of port services	The port provides smart services. The port development and level of logistics service quality are excellent. The port is the central hub of digital transport corridors
Note – Developed by the author based on [132, 133]			

2.3 Development of an integrative system/platform. Dry port digital transformation necessitates the development and implementation of an integrated information system/platform, where all interested stakeholders (shipper, customs, forwarders, logistics and transport companies, port administration) can send and receive the required information in real-time and perform all logistics and transport operations (Figure 45).

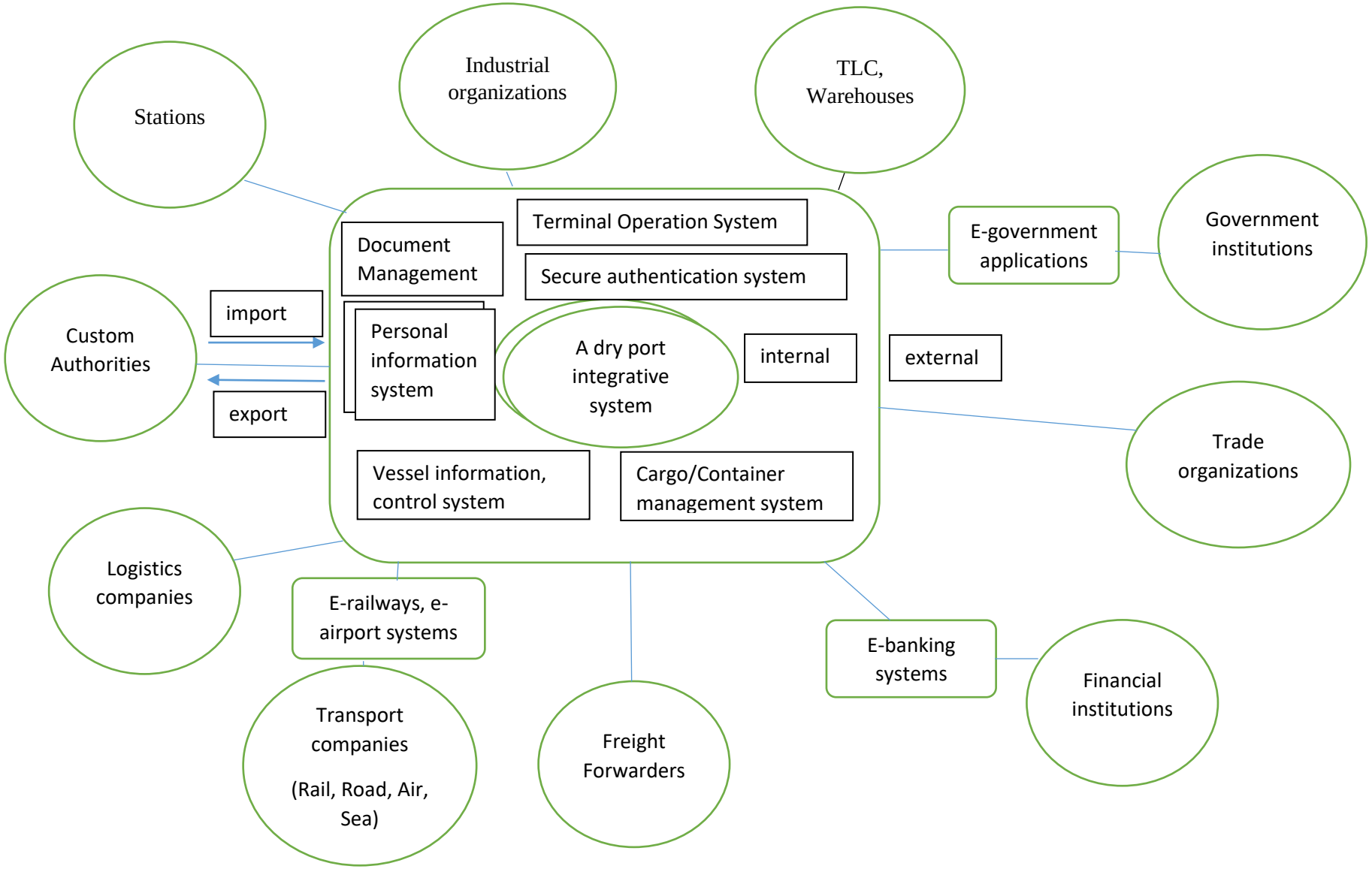


Figure 45 - A dry port integrative system of providing logistics services

Note – Developed by the author

Thus, the digital transformation of the dry port enhances the quality of logistics services. On the one hand, it is essential to understand that digital technologies are just tools. For their practical use in port processes and operations, it is necessary to implement service quality management. Digitalization and implementation of a service quality management system allow the dry ports to develop as logistics hubs of international importance in the formation of Logistics 4.0.

3.2 Recommendations on the inclusion of dry ports of Kazakhstan in the system of the international transport network

The fourth industrial revolution (Industry 4.0) poses new challenges for countries to comprehensively transform transport and logistics infrastructure using digital technologies. These technologies play an essential role in providing logistics and transport services. For example, geographic information systems (GIS) and big data technologies are necessary for balancing and managing the supply and demand of material resources, etc., in the context of the Covid-19 pandemic [134].

3. Integration of international logistics networks

3.1 Involvement in regional and global logistics and transport networks. Further integration into the international transport and logistics industry is required to develop the role of Central Asia, including Kazakhstan, on the New Silk Road as a land bridge and a transit country. Nevertheless, in the formation and development of global supply chains, the Kazakhstani economy should be competitive in developing export-oriented enterprises and the corresponding transport and logistics infrastructure in digitalization.

The main directions of integration into international logistics are to further strengthen the alliance with international forwarders and railways in Europe, Russia, and China to promote regular consolidated services organized by international forwarders or railways through and into Central Asia. It is also essential to consolidate regular trains into a smaller number of terminals with a large terminal (with a capacity of 100,000 TEU and more) and to create a continuous system of "tracking and tracing" for goods in transit [135].

On April 8, 2016, Kazakhstan joined the Intergovernmental Agreement on Dry Ports of the United Nations Economic and Social Commission for Asia and the Pacific [136]. The following transport and logistics facilities of Kazakhstan are presented as dry ports of international importance: Continental Logistics Transport and Logistics Centre, Nur-Sultan; Astyk Logistics, Nur-Sultan; KTZE-Khorgos Gateway Dry Port, Almaty Region; Continental Logistics Shymkent Transport and Logistics Centre, Shymkent. Within the framework of this Agreement, it is planned to promote and develop an integrated international system of intermodal transport and logistics in Asia in the conditions of an increase in international freight traffic, strengthening of interconnection and unimpeded global movement of goods, contributing to increasing efficiency and reducing costs of transport and logistics. The Eurasian Economic Union (EAEU) is supposed to "comprehensively and thoroughly use the potential of cross-border transport arteries and logistics hubs"[5]. The strategically important directions for the development of the Eurasian transport corridors are:

- intensification of work on the development of mutually beneficial joint projects that ensure the linkage of the Eurasian Integration Association with the "One Belt One Road" initiative;
- conjugation of national commodity distribution systems of the member states, including through the creation of Eurasian wholesale and logistics complexes;

- make full use of the potential of the "Khorgos Gateway" on the border of the Republic of Kazakhstan with China;

- formation of the International Center for Trade and Economic Cooperation "Central Asia" on the border of the Republic of Kazakhstan with the Republic of Uzbekistan;

- accelerating the introduction of digital technologies in the field of transport, in particular, the use of modern IT solutions in customs regulation, tax administration, veterinary supervision, and other industries;

- ensuring the successful functioning of the Integrated Information System of the EAEU.

It is also expected to intensify and systematize the work on establishing a dialogue with the EC, the Association of Southeast Asian Nations (ACEAH), and the Comprehensive Regional Economic Partnership (RCEP).

Developing the quality of logistics services for the transport and logistics infrastructure of land routes along the Eurasian transport corridors is vital.

In cooperation with the mentioned international institutions and organizations, one should:

- to form information integration in the organization of transportation processes along the Eurasian transport corridors;

- integrate dry and seaports, logistics hubs of international importance;

- to develop uniform standards for ensuring the quality of logistics services for ports and corridors and other work on institutional support for cooperation between the EU and the EAEC.

Promising areas of cooperation with the EU are the formation and development of environmentally friendly – "green transport corridors" (GTC), the use of digital technologies such as the Internet of things (IoT), Industry 4.0, blockchain technology and smart contracts. They enable new forms of communication and cooperation along the transport corridors, forming logistics clusters in the Eurasian transport corridors [112].

In addition, as a regional hub in the Eurasian continent, Kazakhstan joined the World Logistics Passport (WLP) in 2020 [137]. It involves creating opportunities for businesses and governments to actively improve existing trade routes and develop new directions. Thereby contributing to integrating emerging markets into global trade and logistics systems. It should be noted that the key logistics hub of Kazakhstan is the city of Almaty since its strategic location and the region's transport and logistics infrastructure potential allows for an increase share of Kazakhstan's trade between China and Europe.

Thus, as one of the Eurasian-content transit countries, Kazakhstan should develop transport and logistics infrastructure and improve the quality of logistics services along international routes. In implementing international transit cargo transportation within the Eurasian transport corridors, logistics hubs, and dry ports are the main hubs for global and regional cargo transportation.

Analysis of the dry port capabilities and the study of foreign experience in the transport and logistics infrastructure allows to development of recommendations for

improvement of the Republic of Kazakhstan's transport and logistics infrastructure to inclusion in the system of the international transport network.

The international transport network is a set of technical means, personnel, and control systems transport on the routes of communication between two or more countries, the totality of goods, passengers and vehicles circulating through them to meet the economy and population needs in transportation in a single technological and commercial legal space. Accordingly, the international transport network scale can be space, global, intercontinental, and continental. They can be of one type (sea, river, road, rail, air) or mixed [138].

To further integrate Kazakhstan into the international transport network, it needs to ensure uninterrupted cargo flows in the transit directions, including the global supply chain, develop containerization, and improve the logistics service quality of Eurasian transport corridors and logistics infrastructure of Kazakhstan. In addition, it is essential to increase the efficiency of the Eurasian transport corridors in digitalization, improving the «soft» infrastructure. The digitalization of transit traffic directly affects the speed of transportation of goods in international directions.

3.2 Development of the "soft" infrastructure of transport corridors. «Soft» infrastructure in international transport corridors is defined as a set of customs, procedures, cargo documents, digitalization, single window systems, technical regulations and standards, investment rules, licenses, export credits, insurance, etc. Moreover, it takes many forms: the transit country's government sets the structure of tariffs for carriers for using specific auto and rail routes. The second most common element of «soft» infrastructure is service; it includes numerous private modes of transport and forwarding, logistics, insurance, storage, supply and maintenance, and hotel companies. Also, researchers in this type of infrastructure include social, cultural, educational, and other spheres that will create a comfortable environment, such as transit corridors. In general, along with the "hard" infrastructure, the absence or underdevelopment of any of the "soft" infrastructure elements may disrupt Kazakhstan's transit corridors' smooth operation (Figure 46).

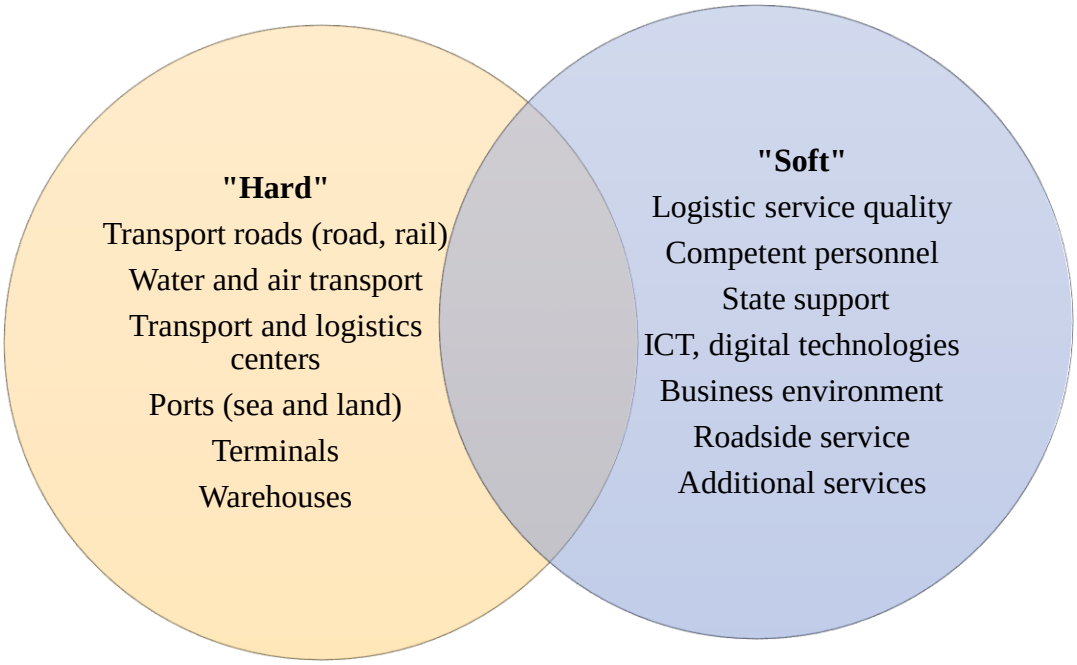


Figure 46 - "Hard" and "soft" transport and logistics infrastructure
Note – Compiled by the author

Critical indicators of soft infrastructure are presented in Table 32.

Table 32 – Indicators of "soft" infrastructure

Options	Essential elements
1	2
Logistic service quality	Proper functioning of infrastructure, equipment Reliably and accurately perform a service Timeliness of services Correspondence of the price to the level of quality of services Responsiveness - willingness to help customers and prompt service The knowledge that provides confidence and courtesy of employees, as well as their ability to inspire confidence, individual attention
Staff competence	Availability of knowledge and experience necessary for effective activity in each subject area (each direction has its indicators of competence)
Governmental support	Programs, projects, legal frameworks, tax and tariff conditions, effective, transparent functioning of customs, etc.
ICT and digitalization	Availability of modern ICT technologies Technical absorption rate Internet use in business processes Government priorities in ICT
Business environment	Transparency of government support Business confidence in the state Regular export support Anti-corruption measures

Continuation of table 32

1	2
Roadside service	Security Emergency Service (Emergency Management, Emergency Telephone Service) Road signs, lighting Amenities (hotel, food, public toilet, medical centre, parking lot, recreation area, shopping pavilion, service station and wash station, gas station) Communication services (telephone, mail, internet). Additional services: vehicle rental, sale of life and vehicle insurance policies, etc., laundry and dry-cleaning services, clothing and footwear repair.)
Note – Compiled by author	

Experts of the Eurasian Development Bank proposed the following recommendations for developing soft infrastructure along the International North–South Transport Corridor in Eurasian space: harmonisation of border crossing procedures, including customs formalities; through rates and coordination of tariff policies; improvement of payment, mutual settlement, and insurance mechanisms; digitalisation of shipping documents and procedures; coordination mechanism for corridor management; a marketing policy designed to attract new traffic [139].

In general, recommendations for developing the "soft" infrastructure along the Eurasian transport corridors were systematized, and appropriate levels can be identified (Table 33).

Table 33 – Recommendations for the development of «soft» infrastructure along the Eurasian transport corridors

Level	Participant	Recommendation
1	2	3
Macro-level	European Union countries, China, EAEU	International project for the development of "soft" infrastructure, digitalization, and the formation of unified digital platforms along the Eurasian transport corridors
Meso-level	Government, Ministries, and Industry Associations of the Republic of Kazakhstan	Program for the digitalization of transport and logistics infrastructure using Industry 4.0 technology (or adjustment of the Digital Kazakhstan program) Intersectoral programs for the formation and development of industrial logistics, IT transport and logistics clusters, hubs Service sector development program (including transport and logistics services). Assessment of opportunities for introducing digital technologies Training of ICT personnel in the field of transport and logistics Development of mechanisms for the implementation of international standards in the field of transport and logistics

Continuation of table 33

1	2	3
Micro-level	Companies, logistics providers, forwarding, and transport companies	Consolidation, provision of complex services Integration with industry, manufacturing enterprises Development of 3pl-4pl providers
Note – Compiled by the author		

Also, for the development of transport and logistics infrastructure, it is necessary:

- to develop an industrial and technical base, infrastructure, and information systems supporting the transport and logistics systems of the country;
- to improve operating systems of document circulation and customs clearance procedures;
- to increase the level of interaction and information communication between participants in the transportation process and consumers;
- to create a unified regulatory framework, adoption of modern laws in the field of transport and logistics;
- to introduce modern logistics technologies for transport and forwarding activities.

Thus, the logistics infrastructure in the context of the development of global supply chains and digitalization should be developed, considering containerization, digitalization and client orientation.

2.3 Development as the hub

The development of transport corridors is based on the practical functions of the logistics infrastructure. The primary nodes of transport networks are transport and logistics hubs. The Republic of Kazakhstan's dry ports and terminals provide services for loading and loading, transportation, and warehouses' filling level is low. According to world standards, these ports can be classified as 2nd generation ports. Many world ports belong to this category, including dry ports and hubs. They are interconnected with the industrial and economic development of the country. Nevertheless, the «Khorgos Gateway» dry port has prospects of developing as a logistics hub.

The logistics hub should be distinguished from hubs or internal terminals. The inland port forms an international inland economic center. At the same time, the hub should be a more specialized platform for global logistics services. The hub must also meet high operational standards, relatively mature overseas operations, and play a role in cargo distribution, consolidation, transport, and trade integration.

Thus, for the development of ports, terminals, transport, and logistics centers in Kazakhstan, it is necessary:

- to improve the industrial facilities' supply chain management;
- to provide value-added services and additional cargo operations (re-assembly of changes, change of transport documents, storage or stamps, or other services);
- to consolidate cargo, cooperating with SMEs;

- to ensure transparency of transport and logistics operations through information and communication, including using digital technologies;

- to introduce international standards of service quality focused on customer focus, regular collection of proposals, etc., ensuring the quality of logistics services involves continuous improvement of the quality of services with a permanent collection and supply of services.

It should also be noted that international seaports, dry ports, and logistics centers are not limited to transport and logistics services. Recently, the overseas trends of the smart port industry also include social and environmental perspectives. During the Fourth Industrial Revolution, global logistics centers attempt to introduce innovative technologies and the Smart Port concept.

The Smart Port concept is designed to improve automation, optimize logistics and energy efficiency, and create an environmentally friendly environment through high-tech ICT and artificial intelligence in transport and logistics [140]. For example, using blockchain technology in the inter-terminal transportation system, the port authority and transport companies in real-time can share and exchange the necessary information to check the availability of available warehouses, thereby simplifying the process of transporting goods.

Practical recommendations for the further development of the "Khorgos Gateway" dry port as a logistics hub are:

- to equip the dry port with modern technologies to ensure the visibility of the supply chain, for example, coverage of GPS terminals, RFID, CCTV technologies, electronic PoD video surveillance systems, etc. In the world commodity market, many processes are already automated and require a high level of quality of service using digital technologies;
- to introduce service quality management, increasing the competence of IT personnel in digital technologies;
- to develop the port as a logistics hub, cargo consolidation, and development of additional services;
- to integrate with industrial facilities, participation in supply chain management;
- to develop the strategy, the concept of "Khorgos Gateway – Smart dry port".

The port is also located in the FEZ "Khorgos Eastern Gate". It has a perspective as the development of an industrial and transport cluster. In the future, the airport's construction will positively affect the outcome of multimodality and the region’s economy.

Thus, dry ports of international importance in land-based transport corridors have the prospect of developing as logistics hubs. Kazakhstan can integrate into global transport networks and trade hubs through the transport and logistics infrastructure. Developing "hard" and "soft" logistics infrastructure is crucial in integration processes. It is also necessary to take measures at the macro, meso and micro levels to improve logistics services' quality. Dry ports must be the driver for the smooth operation of land-based transport corridors.

CONCLUSION

1. The study of the conceptual and theoretical foundations of the development of dry ports along transport corridors allows making the following conclusions: dry ports are transport and logistics infrastructure with or without links to seaports; dry ports are the primary nodes of international land transport, logistics, economic corridors; the development of dry ports must be considered the digitalization processes (using digital technologies and real-time knowledge and information exchange) and the formation of an additional value-added logistics services (packaging, labelling, assembly, purchasing, distribution, manufacturing, finance, customs clearance, and other forms of customer services). These highlighted aspects allow the development of a definition of dry ports of international importance in continental transport corridors. A dry port in continental transport corridors is a logistics node (terminal, centre, hub) in a land transport corridor and provides a wide range of transport and warehouse services, as well as other value-added services, while ensuring the quality of service and digital transparency. The effective functioning of transport, logistics, and economic corridors depend on developing logistics infrastructure. The development of dry ports should be carried out synchronously with seaports, technological challenges, and scientific paradigms in logistics. Especially in customer focus, a global pandemic, it is relevant to investigate the quality of the logistics service of dry ports since land-based transport corridors, and dry ports have great potential.

2. International experience shows that dry ports have the perspective of developing as a logistics and industrial transport hub in international transport corridors and participating in the global supply chain. Therefore, it is necessary to create additional services, improve the quality of logistics services, and introduce international standards and digital technologies. The formation of digital transport corridors with the participation of dry ports and seaports, station, transport and logistics centres makes it possible to organize international cargo transportation effectively. New generation dry ports should provide a full range of transport and logistics services and additional logistics and other added-value services, such as banking/insurance/financial services, assembly and packaging of the order, labelling, packing, order picking up, barcoding, custom setting, information flow and communications, ensuring supply chain visibility, online ordering procedures and other social services (hotel, catering, truck washing station).

3. The foreign experience shows that dry ports provide a wide range of logistics and additional services, and the regional digital logistics platforms integrate into the digital transport corridors. The formation of digital transport corridors, including dry ports and other transport and logistics infrastructures, makes it possible to organize international cargo transportation effectively. The bibliometric network and content analysis show that information and communication technologies in Industry 4.0 have moved to a new level. Digitalizing logistics processes form the 4^{th} to 5^{th} generation logistics and introduces new logistics services requirements. To improve the logistics service quality, it is necessary to introduce new technological

solutions into logistics providers' activities. The information and communications technologies ensure competitive advantage, operational, financial and delivery performance, customer satisfaction, the customer loyalty. Digital technologies (Internet of things, Big Data, Blockchain, Omnichannel, Cloud computing, Cybersecurity, Web3, social networking) improve the following aspects of logistics service quality: providing operational data, supply chain visibility, optimizing logistics processes, flexible connectivity of products and services, facilitate instant communications between various stakeholders etc. In dry ports, digital technologies can be applied in dry port infrastructure, cargo handling, intermodal traffic and transhipment, safety and security, maintenance, energy and the environment, autonomous vehicles, and warehousing.

4. Assessment of the quality of logistics services for dry ports in international transport corridors should be executed at three levels based on an integrated approach: assessing the logistics services' impact factors based on correlation and regression analysis at the macro-level, at the meso-level, analysis of the country logistics and transit potential based on descriptive analysis; assessing the logistics service quality of dry ports at the micro-level. Developed the assessment tool of dry port logistics service quality is considered the SERVQUAL criteria, ISO standards, port performance analysis, and other logistics infrastructure study aspects. Dry port's logistics services quality assessment tool consists following parameters: availability of physical infrastructure, operations and processes quality, management and staff quality, appropriating price for the service quality, comprehensive use of ICT, multimodality, and providing value-added services.

5. The analysis of the traffic volume of transport modes and infrastructural condition of railway transportation in the EAEU countries indicates that in improving Eurasian's quality of logistics services, it is necessary to modernize technological railways-related logistics infrastructure. The country analysis results demonstrate that the country's technological readiness and innovation potential are significant drivers for logistics performance and, thus, Logistics 4.0. The regression analysis results show that innovational, technological development levels and digitalization the most affect the quality of trade and transport-related infrastructure, the competence and quality of logistics services, the efficiency of customs clearance processes, and the ability to track and trace consignments. Significantly, to improve the LPI indicators (customs, infrastructure, international shipments, logistics quality and competence, tracking and tracing, timeliness), dry ports and other infrastructures should be developed, taking into account the improvement of the quality of logistics services based on technological and innovative tools, digital technologies. Especially in the provision of services and the development of transport and logistics infrastructure, electronic information sharing, selling online, cloud-computing, ICT specialists, professional social networks, integration of digital technology components, fixed broadband coverage, 4G coverage and broadband price index etc., are of great importance.

6. Analysis of country transit and logistics potential based on secondary data (through the following indicators: the volume of transit cargo by all modes of

transport, the volume of transit cargo by directions, the share of transit shipping by type of transport, the volume and income of transit shipping by rail, transportation of goods in containers, the number of active legal entities in the field of transport and warehousing, income from auxiliary transport activities of enterprises) show that Kazakhstan has a significant transit and logistics potential. At the same time, the main problems are associated with a high percentage of physical deterioration of the railway transport infrastructure, a low level of use of digital technologies in the provision of transport and logistics services, and the lack of transparency in the mechanism for managing transport and logistics processes. The level of use of digital technologies such as (3D printers), RFID technology, robotics and Big data analysis is insufficient. The volume of transport and logistics companies' investments in developing software or information systems and training employees is low.

7. The country's geographical position and geopolitical conditions, the growth of world trade, opportunities within the "One Belt One Road" initiative, and the Eurasian Economic Union, strengthening the role of land transport corridors, necessitates the development of transport and logistics services and the country's transit potential. Revenues from transit traffic can make the country's transport and logistics industry one of the economy's profitable sectors for the country's budget. Subsequently, it must be competitive in price and quality. Thus, improving the logistics service quality of main transportation and logistics nodes (like ports and terminals) in international transport corridors is necessary.

8. Technological readiness and digitalization are an essential aspect of logistics services development. A high level of logistics service is achieved through sufficient investment in the transport and logistics sector's technological modernization. The effect of dry ports of international importance and the modernisation of cross-border infrastructure (stations, customs, ports, terminals) increases the country's transit potential. In ensuring uninterrupted cargo transportation in the international direction, it is necessary to improve the logistics service quality of dry ports by forming industrial and logistics, transport and logistics hubs with the digital transformation of transport and logistics processes.

9. The results of the case study indicate that "Khorgos Gateway" dry port has a low rate of the index of the following additional services: handle of different types of cargo, providing other services for cargo delivery to the final consumer, providing a package of services (from customs clearance to delivery to the client); labelling, packing, order picking up, barcoding, custom setting. Also, it was obtained that the information and communication technologies supporting port operations and processes have a low level. The evidence from this study suggests that port users are satisfied with the quality of service of port personnel and the physical infrastructure and operations at the port.

10. Practical recommendations for the further development of the "Khorgos Gateway" dry port are: implementation of an integrated information system in which all interested parties (shippers, customs, forwarders, logistics and transport companies, port administration) can send and receive the necessary information in real-time; equip the dry port with modern technologies to ensure the visibility of the

supply chain such as coverage of GPS terminals, RFID, CCTV technologies, electronic PoD video surveillance systems, etc. In the world commodity market, many processes are already automated and require a high level of quality of service using digital technologies; introduction of service quality management, increasing the competence of IT personnel in digital technologies; development of the port as a logistics hub, cargo consolidation, development of additional services; integration with industrial facilities, participation in supply chain management; development of the strategy, the concept of "Khorgos Gateway – Smart dry port". The port is also located in the FEZ "Khorgos Eastern Gate". It has a perspective as the development of an industrial and transport cluster. In the future, the airport's construction will positively affect the outcome of the multimodality of transportation and the general improvement of the region.

11. Based on the assessment of factors for the development of logistics efficiency, analysis of the country's transit potential, and evaluation of the quality of logistics services of the "Khorgos Gateway" dry port, it is possible to identify the main directions for improving the quality of logistics services of dry ports on the Eurasian transport corridors. Ways for dry ports' logistics services quality improvement in international transport corridors in the context of Industry 4.0 are based on ensuring the quality of logistics services with the implementation of international service quality standards and other criteria of Logistics 4.0; digital transformation based on the digital audit of the dry port, the introduction of digital technologies, development of an integrated information system/platform; integration of regional, international transport networks based on development "soft" infrastructure of transport corridors, involvement in a regional and global chain, development as the logistics hub.

12. Dry ports of international importance in land-based transport corridors have the prospect of developing as logistics hubs. Kazakhstan can integrate into global transport networks and trade hubs through the transport and logistics infrastructure. Developing "hard" and "soft" infrastructure is crucial in integration processes. It is also necessary to take measures at the macro, meso and micro levels to improve logistics services' quality. Dry ports should become drivers of economic growth in the region, ensuring the continuity of export-import freight traffic on land-based transport corridors in the context of digitalization.

13. In the context of geopolitical turbulence, transportation routes in the Eurasian transport corridors are being restructured. There is a reorientation of cargo flows to the southern corridors through the Caspian Sea: the North-South transport corridor, the Trans-Caspian international transport route, the Europe-Caucasus-Asia (TRACECA) transport corridor. This is evidenced by the statistical data on the growth in the volume of freight traffic along these corridors. Trans-Caspian routes cover the following transport and logistics infrastructure facilities of Kazakhstan: dry ports, terminals and stations on the border (Khorgos, Dostyk) of Kazakhstan with China, to the Caspian Sea ports "Aktau", "Kuryk" and TLC in the cities of Astana, Almaty, Shymkent, etc., railway, road routes and airlines. It should be noted that in the context of growing interest along the trans-Caspian corridors, transportation

problems arise due to bottlenecks. Suppose there are problems related to soft and hard infrastructure on the land (dry port "Khorgos Gateway", Dostyk terminal and other terminals) and sea part. In that case, it is necessary to develop hard sea infrastructure: ships, terminals, and container hub construction. Also on the agenda are issues related to soft infrastructure - end-to-end tariff setting and cargo declaration, the use of integrated digital tools and the organization of transit cargo consolidation, etc. A favourable condition is that the Caspian countries and corridor participants are interested in further developing these routes.

14. It should be noted that the European Union and China were initially aimed at diversifying routes in the direction between China and Europe. For Kazakhstan, this is an opportunity to increase the country's transit potential and develop the country's transport and logistics infrastructure. In this case, the formation of a transport and logistics trade hub in the Caspian region will positively influence the diversification of the country's economy. All these noted aspects of the development of the Eurasian transport corridors in the context of the geopolitical crisis require a separate study.

15. The following restrictions can be singled out as limitations of the research carried out within the framework of the dissertation: the absence and/or secrecy of statistical data on some indices and indicators. During statistical analysis, the latest data on the Logistics Performance index was for 2018. In the future, it is planned to use other indices for analysis that evaluate the development of logistics services by country. Air cargo and pipeline data were not available in the transit potential assessment. In this regard, a detailed analysis of these positions could not be done.

16. The prospect of this study is to collect data on other dry ports in China, and Central Asian countries, along with transport and logistics corridors between Europe and China, based on the developed tools for assessing the quality of logistics services, service management and the level of digitalization. Also, these tools can be used to evaluate transport and logistics facilities in Kazakhstan: terminals, ports, logistics centers and warehouses. The applied perspective of the dissertation work is the development of an online tool for assessing the level of digitalization, a digital map of the transport and logistics infrastructure. As for the study of transport corridors, in the future, it is planned to research the formation of digital, green, multimodal transport corridors along the Eurasian routes. Also, based on this work, further empirical research to assess the barriers to the development of trans-Caspian routes in the context of the geopolitical crisis will allow the formation of sustainable multimodal routes along land transport corridors and maritime infrastructure.

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APPENDICES
APPENDIX A

KAZLOGISTICS
СОЮЗ ТРАНСПОРТНИКОВ КАЗАХСТАНА

Союз транспортных и логистических организаций и ассоциаций «KAZLOGISTICS»
Республика Казахстан, 010000, город Нур-Султан, ул. Д. Кунаева,6, Блок А., каб. 429
Тел: +7(7172) 600438, 600437, Факс: +7(7172) 600441, e-mail: info@kazlogistics.kz
www.kazlogistics.kz
«KAZLOGISTICS» кәсіптік және логистикалық ұйымдар мен қауымдастықтар одағы» заңды тұлғалар бірлестігі
Қазақстан Республикасы , 010000, Нұр-Сұлтан қ., Д. Қонаев к-сі, 6, А блогі, каб. 429
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The Union of transport and logistics organizations and associations «KAZLOGISTICS»
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№ 1678
«23» ноября 2020 г.

В Диссертационный совет
по группе специальностей «6D050600 – Экономика»,
«6D051300 - Мировая экономика»,
«6D051700 - Инновационный менеджмент,
«6D090900 – Логистика (по отраслям)»,
«6D051800-Управление проектами»,
«6D051000-Государственное и местное управление (ГиМУ)»

050040, г. Алматы, пр. аль-Фараби, 71

Акт
о практическом применении результатов диссертационного исследования

Настоящим подтверждаем, что результаты диссертационного исследования Молдабековой А.Т. на тему «Improving quality of logistics services of dry ports within Eurasian transport corridors» (based on the case study «Khorgos Gateways»)» были изучены и использованы в проведении оценки уровня цифровизации и качества менеджмента сервиса по сухому порту «Khorgos Gateways».

Разработанные инструментарии в рамках диссертации позволяют оценить проблемы и возможности цифровой трансформации транспортно-логистической инфраструктуры Республики Казахстан, результаты которого предполагается направить в Министерства индустрии и инфраструктурного развития; цифрового развития, инноваций и аэрокосмической промышленности Республики Казахстан и будут рекомендованы при разработке Комплексного плана развития отраслей транспорта на 2021-2030 годы.

Генеральный директор **Е. Абсатов**

М.Толеген
тел. 8 701 578 32 97

APPENDIX B

ТОО «KTZE-Khorgos Gateway»
БИН 091240002498
Вх.нис/Исход. № 815
«04» 12 2020 г.

В Диссертационный совет по
группе специальностей «6D050600 – Экономика»,
«6D051300 - Мировая экономика»,
«6D051700 - Инновационный менеджмент,
«6D090900 – Логистика (по отраслям)»,
«6D051800-Управление проектами»,
«6D051000-Государственное и местное управление (ГиМУ)»

050040, г. Алматы, пр. аль-Фараби, 71

Справка
о практической актуальности результатов диссертационного исследования

Настоящим подтверждаем, что «Результаты кейс-стади по сухому порту «Khorgos Gateways» по оценке уровня цифровизации и качества менеджмента сервиса», проведенное в рамках диссертационного исследования Молдабековой А.Т. на тему «Improving quality of logistics services of dry ports within Eurasian transport corridors» (based on the case study «Khorgos Gateways»)» с учетом комментариев по пункту 2.2 (подпункты 1,2) в окончательном Отчете исследования и диссертации, является практически актуальным в условиях цифровизации транспортно-логистических процессов.

В частности, практические рекомендации по повышению качества логистического сервиса и цифровизации портовых операции и процессов могут быть рассмотрены в дальнейшем развитии сухого порта «Khorgos Gateways».

Генеральный директор
ТОО «KTZE-Khorgos Gateway» **И. Манабаев**

APPENDIX C

ҚАЗАҚСТАН РЕСПУБЛИКАСЫ
БІЛІМ ЖӘНЕ ҒЫЛЫМ
МИНИСТРЛІГІ
ҒЫЛЫМ КОМИТЕТІНІҢ
«ЭКОНОМИКА ИНСТИТУТЫ»
РЕСПУБЛИКАЛЫҚ МЕМЛЕКЕТТІК
ҚАЗЫНАЛЫҚ ҚӘСІПОРЫНЫ

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РЕСПУБЛИКАНСКОЕ
ГОСУДАРСТВЕННОЕ
КАЗЕННОЕ ПРЕДПРИЯТИЕ
«ИНСТИТУТ ЭКОНОМИКИ»
КОМИТЕТА НАУКИ
МИНИСТЕРСТВА ОБРАЗОВАНИЯ
И НАУКИ РЕСПУБЛИКИ КАЗАХСТАН

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19.02.21 № 02-13-09

В Диссертационный совет по
группе специальностей «6D050600 – Экономика»,
«6D051300 - Мировая экономика»,
«6D051700 - Инновационный менеджмент,
«6D090900 – Логистика (по отраслям)»,
«6D051800-Управление проектами»,
«6D051000-Государственное и местное управление (ГиМУ)»

050040, г. Алматы, пр. аль-Фараби, 71

Акт
о внедрении результатов диссертационного исследования

Настоящим подтверждаем, что научные результаты диссертационного исследования Молдабековой А.Т. на тему «Improving quality of logistics services of dry ports within Eurasian transport corridors» (based on the case study «Khorgos Gateways»)» были использованы в разработке научной программы «Казахстанский путь к наукоемкой экономике на основе третьей технологической модернизации: стратегия, модели и механизмы развития» (ПЦФ МОН РК №0118РК01076, 2018-2020 гг.).

В частности, по заданию «Диверсификация и рост высокотехнологичного экспорта Казахстана: механизмы и приоритеты» были применены результаты диссертации: анализ потенциала экспорта транспортно-логистических услуг; исследование направлений экспорта транспортных услуг; развитие индустриально-логистических парков на основе цифровизации.

Заместитель директора по науке
Института экономики КН МОН РК,
к.э.н. доцент **А.Ж. Панзабекова**

000426

APPENDIX D

From:
Associate Prof. Dr. Anatoli Beifert
Wismar Business School / Wismar University
Philipp-Müller-Str.14, 23966 Wismar
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anatoli.beifert@hs-wismar.de

To:
Deutscher Akademischer
Austauschdienste.V.DAAD
Kennedy-Allee 50
53175

Letter on confirmation on academic advising

Dear Madam
Dear Sir,

This is to confirm on academic advising of research project of PhD student Aisulu Moldabekova.

I had the pleasure to meet with Ms. Moldabekova personally in the framework of her PhD internship at Wismar University and to be a supervisor of her research. The research subject has a working title: "The impact of new information technologies on improve quality of logistics services and port development perspectives". The topic is relevant not only for Kazakhstan but for all countries accessing global supply chain including Europe. Sustainable growth of world trade in recent decades has significantly influenced development of transportation and global supply chains in terms of multi- and inter-modality as well as intensified competition between land- and sea-based transport corridors. According to research in the framework of Trans-Eurasian land-based transport corridors, the concept of dry ports has being gaining a special attention. Important role of such dry ports or logistic hubs in transit countries has been also highlighted within "One Belt One Road" (OBOR) initiative of the Chines government. In this context, dry port "Khorgos Gateway" in Kazakhstan may be seen as a strategic node in the framework of transport corridor from China to Europe, through Eurasia, Central Asia, Turkey and the Persian Gulf countries. Ms. Moldabekova has produced a substantial work plan, the research is topical and covers most important relevant issues. Ms. Moldabekova has been also involved in a number of other relevant research project (e.g. INTERREG VB, INTERREG VA Programme) that are being implemented by EU Project Center at Wismar University.

The level of Ms. Moldabekova's English for conducting research in Germany may be evaluated as proficient. Knowing Ms. Moldabekova personally I am convinced that she has assiduity and tenacity to conduct a one year's research stay abroad. Her scientific capabilities have been proven. Ms. Moldabekova is invited for a 10-month stay at Wismar University for intensive research on the topic of her research subject.

I would be grateful, if further research stay in Germany (here: at Wismar University) may be supported or financed by DAAD.

Sincerely,
Associate Prof. Dr. Anatoli Beifert
Head of European Project Center
Wismar Business School / Wismar University

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APPENDIX E

DAAD Deutscher Akademischer Austauschdienst
German Academic Exchange Service

DOCUMENT OF AWARD

The German Academic Exchange Service (DAAD) is a joint organization
of the universities and other institutions of higher education in the Federal Republic of Germany.
Supported from public funds, the DAAD promotes international academic cooperation,
especially through the exchange of students and academics.
DAAD scholarships are awarded by selection committees comprising a panel of independent academics.

Arquitecta Aisulu Moldabekova

has been awarded a scholarship by the DAAD for further study and training.

I would like to congratulate you on your award and wish you every success for your further studies. It would give me great pleasure, if you would maintain contact with your academic partners and the DAAD after completion of your scholarship.

Bonn, 05/06/2020

Prof. Dr. Joybrato Mukherjee
President of the DAAD

This document will only come into effect in connection with a letter of award (Stipendienzusage) from the DAAD office.

APPENDIX F

Methods and observations of assessing port logistics services

Methods	Investigated parameters	Data sample	Observations	Authors
1	2	3	4	5
Questionnaire, Factor analysis	The port service quality concept in compliance with stakeholders and their requirements within the context of port service quality	142 port service customers	The port service quality concept has been explained through the complexity ensuing from principal features or services themselves: intangibility, heterogeneity, and production and consumption inseparability	(Kolanović, Dundović, & Jugović, 2012) [21] [140]
Survey, Factor analysis,	This study investigates the concept of Port Service Quality (PSQ) and examines its influence on customer satisfaction in the port sector.	175 members of the Singapore Shipping Association and Singapore Logistics Association	It is found that PSQ is a four-dimensional construct and that the relationship between PSQ and customer satisfaction is positively significant.	(Thai, 2015) [104]
Attribute Hierarchy Model (AHM), TOPSIS and GRP methods	Evaluation of service quality of container terminal operators	25 customers of 12 container terminal operators in India	Service quality dimensions will have the most significant positive influence on customer satisfaction.	(M. Hemalatha, n.d.) [23]
Qualitative methods	How integrative information is used by various partners information systems to make transport operations more efficient and offer improved service.	The 12 interviewees were selected to represent both small and large actors of different types of Swedish hinterland rail transport.	The simplification of the practical operations at the terminal and the network's communication capabilities.	(Almotairi, Flodén, Stefansson, & Woxenius, 2011) [24]
The questionnaire, Factor analysis,	Factors that influence the service quality of	450 sample customers of the port	The service quality variables have been clustered into Quick	(Hemalatha, n.d.)

SERVQUAL methodology	dry ports from port users' perceptions		Response, Track service, Distribution service, Infrastructure, Reputation, Good operations and Equipment & Facilities	
Importance-Performance analysis (IPA)	Port Performance	4 Container terminals in South Korea 138 – terminal operators 203 – Port users 25 – Port administrations	Port performance indicators in container transport logistics	(Ha, Yang, & Lam, 2019) [26]
Data Envelopment Analysis (DEA) Tobit regression analysis	Port Performance	Panel data of eight dry ports invested and operated by Ningbo Port Corporation. The data covers a six-year the period from 2011 to 2016.	The high efficiency of dry ports can be explained by rational utilization of local transport resources and stable increase of outputs.	(Chang et al., 2018) [48]
Questionnaire survey, The Analytic Hierarchy Process (AHP) Fuzzy Multiple Criteria Decision-Making methods	The performance of intermodal city logistics terminals		Multi-criteria assessment framework: Management policy, Organizational and institutional structure, Supply-side performance, Terminal properties, Level of service	(Gogas, Adamos, & Nathanail, 2017) [25]

APPENDIX G

Panel expert's questionnaire for assessing criteria of logistics service quality of dry ports

Brief description

Dear Sir or Madam,

I am carrying out research to evaluate logistics service quality and development prospects of dry ports and terminals (on the border of Kazakhstan and China - in the stations «Dostyk» and «Altynkol»).

In the framework of Trans-Eurasian land-based transport corridors, the concept of dry ports has been gaining special attention. The important role of such dry ports or logistic hubs in transit countries has also been highlighted within the «One Belt One Road» (OBOR) initiative of the Chines government. In this context, dry port «Khorgos Gateway»in Kazakhstan may be seen as a strategic node in the transport corridor framework from China to Europe, through Eurasia, Central Asia, Turkey and the Persian Gulf countries.

I am asking if you could help me with my research by completing the attached questionnaire. This questionnaire asks you about the importance of parameters for assessing the port's logistics service quality. The survey will take approximately 7 minutes. All data will remain confidential and anonymous. If you would like to receive the survey's main findings, please leave your e-mail at the end of the electronic form.

We appreciate your kind cooperation!

Your inputs will positively contribute to assessing of logistics service quality of dry ports!

If you have any further questions regarding the questionnaire or the study, please do not hesitate to contact: kazsocium01@gmail.com

Researcher: Aisulu Moldabekova

Affiliation: al-Farabi Kazakh National University, Almaty

Your field of activity:

1. Port and terminal administration: director, manager, employee, etc.
2. Science, education, research, consulting
3. Logistic company
4. Transport company
5. Other:

Your country of residence:

China
European countries
Russian
Kazakhstan
Central Asian countries
Other:

INSTRUCTIONS: Please assess how important for your opinion is the provision of the following services by the port.

1-Not important, 2 - Of little importance, 3 - Slightly important, 4 – Important, 5 - Very important

Availability of Physical infrastructure	
Availability of Material handling equipments (gantry cranes, reach stackers, stackers, forklifts, etc.)	1 2 3 4 5

Availability of different types of warehouses for storage of goods	1 2 3 4 5
Appropriately functioning of facilities	1 2 3 4 5
Operations and process-related	
Easiest of ordering processes	1 2 3 4 5
Custom control convenience (phytosanitary, veterinary, border, quarantine controls)	1 2 3 4 5
Quick of loading/unloading processes	1 2 3 4 5
Punctuality of arrivals / departures within defined time	1 2 3 4 5
Transparency of shipping processes	1 2 3 4 5
Consumer service satisfaction with time	1 2 3 4 5
Safeties of operations and process	1 2 3 4 5
Clear policy on warranty and security	1 2 3 4 5
Management-related	
Providing enough information to customers` enquiries and requests by port operators	1 2 3 4 5
Accuracy of port operators on documentation & information	1 2 3 4 5
Reflecting on collected feedback for improve services	1 2 3 4 5
The management's valuing customer's specific requests and requirements	1 2 3 4 5
Evaluating or assessing of customers future requirements	1 2 3 4 5
The port staff's competency in meet customer's service demands	1 2 3 4 5
Appropriate service price	
Availability of price information	1 2 3 4 5
Fixed price for services	1 2 3 4 5
Reasonability price for services	1 2 3 4 5
Comprehensive use of ICT applications	
Planning and ordering via internet-platform or website	1 2 3 4 5
Providing all the necessary information on port services by website	1 2 3 4 5
Availability of updated information, including cargo/container photos and videos on the corporate website or other platforms	1 2 3 4 5
Having the fixed online schedule for receiving and departing containers	1 2 3 4 5
Availability of control on documentation processes (custom, phytosanitary, veterinary, border, quarantine control) via corporate website or other platforms	1 2 3 4 5
Supply chain visibility: terminal coverage with GPS, RFID, CCTV, e-PoDs, camera surveillance systems etc.	1 2 3 4 5
Integration of all procedures in the port into a single window system	1 2 3 4 5
Inclusion of the port in the international port community system	1 2 3 4 5
Multimodality, intermodality, value-added services	
Connection and distance to primary railway network	1 2 3 4 5
Connection and distance to primary motor-way network	1 2 3 4 5
Connection and distance to primary airport	1 2 3 4 5
Connection to primary to regional transport and logistics terminals/centers	1 2 3 4 5
Connection to primary international logistics centers, hubs (China, Russia, Asia, Central Asian and European countries)	1 2 3 4 5
Handle different types of cargo	1 2 3 4 5
Additional services for cargo delivery to the final consumer	1 2 3 4 5
Providing a «package of services» (from customs clearance to delivery to the client)	1 2 3 4 5
Labeling, Packing, Order picking up, Bar Coding, Custom setting	1 2 3 4 5
Other services (Please, write bellow):	1 2 3 4 5

In your opinion, what other parameters should be paid attention to in assessing the quality of transport and logistics services of dry ports and terminals?_____
_____
_____

Thank you very much for your participation!

Could you please write your details here if you are willing to take part in an interview with me about the dry-port perspective development (Full name and tel. contact number/email):_____

If you have any further questions regarding the questionnaire or the study, please do not hesitate to contact: kazsocium01@gmail.com

Researcher: Aisulu Moldabekova

Affiliation: al-Farabi Kazakh National University, Almaty

APPENDIX H

Weights of dimensions and subdimensions

Dimensions	Weight	Local weight	Sub-dimensions	Global weight
PI	0,083	0,342	I1	0,028
		0,342	I2	0,028
		0,327	I3	0,027
				0,083
OP	0,228	0,125	OP1	0,029
		0,122	OP2	0,028
		0,124	OP3	0,028
		0,115	OP4	0,026
		0,115	OP5	0,026
		0,133	OP6	0,030
		0,135	OP7	0,031
		0,130	OP8	0,030
				0,228
MS	0,158	0,173	M1	0,027
		0,173	M2	0,027
		0,144	M3	0,023
		0,171	M4	0,027
		0,157	M5	0,025
		0,182	M6	0,029
				0,158
PS	0,079	0,330	P1	0,026
		0,331	P2	0,026
		0,339	P3	0,027
				0,079
ICT	0,215	0,131	ICT1	0,028
		0,125	ICT2	0,027
		0,122	ICT3	0,026
		0,136	ICT4	0,029
		0,130	ICT5	0,028
		0,115	ICT6	0,025
		0,124	ICT7	0,027
		0,117	ICT8	0,025
				0,215
MS	0,236	0,119	MM1	0,028
		0,118	MM2	0,028
		0,095	MM3	0,022
		0,117	MM4	0,028
		0,122	MM5	0,029
		0,113	MM6	0,027
		0,112	S1	0,027
		0,109	S2	0,026
		0,096	S3	0,023

APPENDIX I

Анкета по оценке качества транспортно-логистических услуг

Данное исследование проводится в рамках диссертационной работы по оценке качества транспортно-логистических услуг и перспектив развития «сухих» портов, терминалов в Республике Казахстан. Анкета содержит вопросы по оценке услуг, предоставляемые сухим портами и терминалами. Опрос займет около 10 минут. Ваши ответы останутся конфиденциальными и анонимными. Если вы хотите получить основные результаты опроса,оставьте свой адрес электронной почты в конце анкеты. Мы ценим ваше любезное сотрудничество! Ваш вклад внесет положительный эффект в улучшение качества логистических услуг «сухих» портов в Казахстане!

1. Ваша компания:

1. логистическая
2. промышленная
3. торговая

4. транспортная
5.другое (пожалуйста, укажите) _____

2. Какова ваша текущая должность в организации?

1. генеральный директор / владелец
2. старший исполнительный
3. региональный менеджер
4. руководитель отдела
5. супервайзор
6. специалист
7. Другое (пожалуйста, укажите) _____

3. Количества сотрудников в вашей компании?

1. 1-14
2. 15-49
3. 50-99
4. 100 - 249
5. 250 - 499
6. 500 и более

4. Укажите пожалуйста, направления торговли и транспортировки:

1. экспорт
2. импорт
3. экспорт и импорт
5. транзит в страны Европы
6. транзит в страны Центральной Азии
7. транзит в страны Персдиского залива
8. транзит в другие страны

(пожалуйста, укажите) _____

5. Укажите пожалуйста, в основном услугами какого порта, терминала на границе с Китаем (в станциях «Достык» и «Алтынколь») Ваша компания пользуется (выбрать один основной):

1. АО «Кедентрассервис»
2. «KTZE-Khorgos Gateway»
3. «EuroTranzit»
4. Другое_____

Далее ответить на вопросы по основному партнеру Вашей компании, укажите _____

Инструкция: Если полностью согласны с утверждением, пожалуйста, обведите в кружок 5. Если категорически не согласны с утверждением, обведите в кружок 1. Если Ваша оценка находятся посередине, обведите соответствующее число между 5-1.

Также, оцените уровень важности для Вашей компании, оцениваемых параметров: 5- очень важно 4- важно, 3- умеренно важно, 2- не совсем важно, 1 – неважно

Инфраструктура и технологические оборудования	Уровень согласия	Уровень важности
В целом, порт имеет все необходимые технологические оборудования (козловые краны, ричстакеры, штабелеры, вилочные погрузчики и т.п.)	5 4 3 2 1	5 4 3 2 1
Порт имеет все необходимые виды складов для хранения грузов	5 4 3 2 1	5 4 3 2 1
В целом, в порту оборудования и инфраструктурные объекты современные и правильно функционируют	5 4 3 2 1	5 4 3 2 1
Следующие процедуры просты и не занимают много времени:		
Таможенный контроль	5 4 3 2 1	5 4 3 2 1
Фитосанитарный контроль	5 4 3 2 1	5 4 3 2 1
Ветеринарный контроль	5 4 3 2 1	5 4 3 2 1
Пограничный контроль	5 4 3 2 1	5 4 3 2 1
Карантинный контроль	5 4 3 2 1	5 4 3 2 1
Процессы загрузки / выгрузки	5 4 3 2 1	5 4 3 2 1
Общее время между прибытием и отправкой груза короткое	5 4 3 2 1	5 4 3 2 1
Наши клиенты получают товар в срок	5 4 3 2 1	5 4 3 2 1
Порт всегда делает упор на сохранность и безопасность	5 4 3 2 1	5 4 3 2 1
В порту есть четкая политика по гарантии и безопасности	5 4 3 2 1	5 4 3 2 1
Менеджмент порта		
Операторы порта предоставляют все необходимые информации по нашему запросу	5 4 3 2 1	5 4 3 2 1
Операторы порта аккуратны в документах и информации	5 4 3 2 1	5 4 3 2 1
Порт всегда собирает наши отзывы и применяет их в улучшение сервиса	5 4 3 2 1	5 4 3 2 1
Руководство порта всегда понимает наши конкретные потребности и требования	5 4 3 2 1	5 4 3 2 1
Руководство порта оценивает наши будущие потребности	5 4 3 2 1	5 4 3 2 1
Персонал в порту всегда демонстрирует компетентность при оказании услуг	5 4 3 2 1	5 4 3 2 1
Цены на следующих услуг разумные и соответствуют качеству сервиса		
Погрузочно-разгрузочные операции	5 4 3 2 1	5 4 3 2 1
Сбор, связанный с таможенным осмотром перевозимых грузов	5 4 3 2 1	5 4 3 2 1
Услуги по хранению	5 4 3 2 1	5 4 3 2 1
Обслуживание рефрижераторных контейнеров	5 4 3 2 1	5 4 3 2 1
Комплекс услуг по таможенному досмотру	5 4 3 2 1	5 4 3 2 1

Информационное сопровождение клиента	5 4 3 2 1	5 4 3 2 1
В целом, цены на услуг стабильные	5 4 3 2 1	5 4 3 2 1
Порт всегда предлагает конкурентоспособную цену обслуживания	5 4 3 2 1	5 4 3 2 1
Информационно-коммуникационные технологии		
Процесс оформления заказов по вагонам через http://asudkr.railways.kz удобный	5 4 3 2 1	5 4 3 2 1
Корпоративный сайт порта предоставляет все необходимые информации по услугам	5 4 3 2 1	5 4 3 2 1
Информация в режиме реального времени, включая фотографии груза / контейнеров, доступны на корпоративном веб-сайте или другой платформе	5 4 3 2 1	5 4 3 2 1
Имеется фиксированное онлайн расписание приема и отправления контейнеров	5 4 3 2 1	5 4 3 2 1
Процессы документирования (таможенный, фитосанитарный, ветеринарный, пограничный, карантинный контроль) прозрачны и доступны в режиме реального времени	5 4 3 2 1	5 4 3 2 1
Процессы прибытия и отправки груза прозрачны	5 4 3 2 1	5 4 3 2 1
Уровень применения ИКТ в обслуживании клиентов в порту является комплексным	5 4 3 2 1	5 4 3 2 1
Контроль процессов в порту автоматизирован на достаточном уровне		
В порту все процедуры интегрированы в единую информационную систему		
Порт включен в международное информационное портовое сообщество	5 4 3 2 1	5 4 3 2 1
Мультимодальность, инетрмодальность и другие аспекты		
Порт имеет связь с автомобильной транспортной дорогой	5 4 3 2 1	5 4 3 2 1
Порт имеет связь с воздушными транспортными объектами	5 4 3 2 1	5 4 3 2 1
Порт имеет связь с международными логистическими центрами, хабами (Китай, Россия, Азия, страны Центральной Азии и Европы)	5 4 3 2 1	5 4 3 2 1
Порт имеет связь с внутренними, региональными логистическими центрами и терминалами	5 4 3 2 1	5 4 3 2 1
Порт включен в международное информационное портовое сообщество	5 4 3 2 1	5 4 3 2 1
Порт обрабатывает разные виды грузов	5 4 3 2 1	5 4 3 2 1
Порт имеет дополнительные услуги по доставке груза до конечного потребителя	5 4 3 2 1	5 4 3 2 1
Порт открыт для честной конкуренции	5 4 3 2 1	5 4 3 2 1
Порт предоставляет дополнительные услуги по маркировке, упаковке, штрих-кодированию и т.п.	5 4 3 2 1	5 4 3 2 1
На Ваш взгляд, какие услуги порт еще должен предоставлять (пожалуйста, напишите ниже)	5 4 3 2 1	5 4 3 2 1
	5 4 3 2 1	5 4 3 2 1

В целом, мы удовлетворены возможностями, оборудованием и другой инфраструктурой порта	5 4 3 2 1
В целом, мы довольны руководством и сотрудниками порта	5 4 3 2 1

В целом, мы удовлетворены качеством обслуживания порта	5 4 3 2 1
мы предлагаем услуги порта нашим деловым партнерам	5 4 3 2 1
мы продолжим пользоваться услугами порта	5 4 3 2 1

Благодарим Вас за участие!

Если у вас есть какие-либо дополнительные вопросы относительно данного исследования, пожалуйста, не стесняйтесь обращаться по адресу: kazsocium01@gmail.com

С уважением, исследователь Айсулу Молдабекова

Казахский национальный университет им. Аль-Фараби, г.Алматы

Если вы хотите принять участие в интервью по развитию порта «Khorgos Gateways», просим оставить Ваши контакты: _____

APPENDIX J

Assessment of the level of digitalization and quality of service management within the framework of the case study on the dry port "Khorgos Gateway"

KAZLOGISTICS

Кейс-стади по сухому порту «Khorgos Gateway»
по оценке уровня цифровизации и качества менеджмента сервиса
Анкета

1. Общие показатели

1.1. Грузооборот порта по 2017-2021 гг., ДФЭ

2017	92655
2018	136292
2019	158522
2020	228 677
2021	273 715

Какова (ожидаемая) пропускная способность порта в 2022 году?

Грузооборот 294 806 ДФЭ тонн

1.2. Какие типов грузов порт обрабатывает и какова их пропорция (исходя из общего объема грузоперевозок в 2021 году)?

Виды грузов	%
контейнерные	65
генеральные грузы, сталь, трубы, техника	19
тарно-штучные грузы	17

1.3. Какова загруженность порта в 2021 году?

Загруженность порта = Количество загруженных дней 290 / 365 %

4. Какова загруженность склада в 2021 году?

Загруженность склада = Среднее количество загруженных площадей 16196 / Общая доступная площадь 48588,43 кв.м. %

	класс В	среднее значение
2017	29,0	10,0
2018	47,0	16,0
2019	41,0	14,0
2020	32,0	11,0
2021	35	13,0
2022		

5. Каково среднее время процесса загрузки / выгрузки вагонов?

Среднее общее время процесса загрузки / выгрузки 1час. 20мин часы за вагоны

6. Каково среднее время прохождения (общее время между прибытием и отправкой) груза в порту? 3 суток

1

Среднее общее время груза в порту	Минимум 12 часов Максимум 10 дней

2. Инфраструктура и технологические оборудования, безопасность

Инструкция: Если полностью согласны с утверждением, пожалуйста, обведите в кружок 5. Если категорически не согласны с утверждением, обведите в кружок 1. Если Ваша оценка находятся посередине, обведите соответствующее число между 5-1.

2.1	В целом, порт имеет все необходимые технологические оборудования (козловые краны, ричстакеры, штабелеры, вилочные погрузчики и т.п.)	(5) 4 3 2 1
2.2	Порт имеет все необходимые виды складов для хранения грузов	(5) 4 3 2 1
2.3	В целом, в порту оборудования и инфраструктурные объекты современные и правильно функционируют	(5) 4 3 2 1
2.4	Порт всегда делает упор на сохранность и безопасность	(5) 4 3 2 1
2.5	В порту есть четкая политика по гарантии и безопасности	(5) 4 3 2 1

3. Политика порта по цифровизации

3.1. Каков статус реализации стратегии цифровизации порта (включая управление, стандарты, показатели прогресса и т. д.)?

Отсутствует стратегия цифровизации	Планируется пилотные инициативы	В стадии разработки	Уже разработана	В стадии реализации	Реализована
0	1	(2)	3	4	5

3.2. Какова ваша доля инвестиций на цифровизацию, информационно-коммуникационные технологий по отношению к общим инвестициям в основной капитал?

x ≤ 10%	10 < x ≤20%	20 < x ≤30%	30 < x ≤40%	40 < x ≤50%
(1)	2	3	4	5

4. Применение информационно-коммуникационных технологий в порт процессах и операциях

Инструкция: Если полностью согласны с утверждением, пожалуйста, обведите в кружок 5. Если категорически не согласны с утверждением, обведите в кружок 1. Если Ваша оценка находятся посередине, обведите соответствующее число между 5-1.

4.1	Процесс оформления заказов по вагонам через http://asudkr.railways.kz удобный, нет жалоб со стороны клиентов	5 4 3 2 1
4.2	Корпоративный сайт порта предоставляет все необходимые информации по услугам	(5) 4 3 2 1
4.3	Информация в режиме реального времени, включая фотографии груза / контейнеров, доступны на корпоративном веб-сайте или другой платформе	5 4 3 (2) 1
4.4	Имеется фиксированное онлайн расписание приема и отправления контейнеров	(5) 4 3 2 1
4.5	Процессы документирования (таможенный, фитосанитарный, ветеринарный, пограничный, карантинный контроль) прозрачны и доступны в режиме онлайн	5 4 3 2 1

2

4.6	Процессы прибытия и отправки груза прозрачны	5 4 3 2 1
4.7	Уровень применения ИКТ в обслуживании клиентов в порту является комплексным	5 4 3 2 1
4.8	Контроль процессов в порту автоматизирован на достаточном уровне	5 4 3 2 1
4.9	В порту все процедуры интегрированы в единую информационную систему	5 4 3 2 1
4.10	Порт включен в международное информационное портовое сообщество	5 4 3 2 1

5. Как вы оцениваете уровень и возможности использования следующих цифровых технологий и систем в порт процессах и операциях?
(Инструкция: Если технология не известна -0, вариант использования недоступен - 1, использование не планируется -2, использование планируется-3, в конкретных процессах уже реализованы - 4, всестороннее использование-5)

5.1	Смарт Предприятие-Система планирования ресурса (Smart Enterprise-ResourcePlanning-System)	0 1 2 3 4 5
5.2	Умная система управления складом (Smart Warehouse-Management-System)	0 1 2 3 4 5
5.3	Умный Порт-Сообщество-Система (включая электронную систему управления цепочками поставок) Smart Port-Community-System (incl. Electronic SupplyChain-Management-System)	0 1 2 3 4 5
5.4	Веб-коммуникационные платформы (веб-сайт, социальные сети)	0 1 2 3 4 5
5.5	Мобильный доступ к данным (для сотрудников)	0 1 2 3 4 5
5.6	Мобильный доступ к данным (для клиентов)	0 1 2 3 4 5
5.7	Интернет вещи (Internet-of-Tings)	0 1 2 3 4 5
5.8	Облачные вычисления (Cloud Computing)	0 1 2 3 4 5
5.9	Технологии локализации (GPS, RFID и др.)	0 1 2 3 4 5
5.10	Датчики (влажность, температура и т. д.)	0 1 2 3 4 5
5.11	Большие данные и прогнозные аналитики (в том числе техническое обслуживание и т. д.) (Big Data and Predictive Analytics)	0 1 2 3 4 5
5.12	Блокчейн (включая приложения для смарт-контрактов)	0 1 2 3 4 5
5.13	Искусственный интеллект (Artificial Intelligence)	0 1 2 3 4 5
5.14	Робототехника Дроны (воздушный, земной)	0 1 2 3 4 5
5.15	Автономные решения для терминала, кранов, транспортных средств, кибер-физические системы (CPS)	0 1 2 3 4 5
5.16	Цифровое дублирование, дополненная и виртуальная реальность (включая моделирование) (Digital Twinning, Augmented and Virtual Reality)	0 1 2 3 4 5
5.17	Другие технологии, укажите какие:	0 1 2 3 4 5
5.18		0 1 2 3 4 5
5.19		0 1 2 3 4 5
5.20		0 1 2 3 4 5
5.21		0 1 2 3 4 5
5.22		0 1 2 3 4 5

6. Система менеджмента качества сервиса

6.1. Порт разработал и внедрил Систему менеджмента качества сервиса:

В порту отсутствует Система менеджмента качества сервиса 1

Начата деятельность по разработке и внедрению Системы менеджмента качества 2

3

сервиса	
Да, Система менеджмента качества сервиса разработана и ведутся работы по ее внедрению	3
Да, Система менеджмента качества сервиса разработана и внедрена в полном объеме	4
Да, Система менеджмента качества сервиса разработана, внедрена в полном объеме, и осуществляется деятельность по ее непрерывному усовершенствованию	5

6.2. Формализованное описание организационной структуры Порта

В порту отсутствует формализованное описание организационной структуры	1
Имеется формализованное описание организационной структуры	2
Да. Описание организационной структуры имеет статус внутреннего документа и поддерживается в актуальном состоянии	3
Организационная структура периодически подвергается анализу на адекватность	4
Организационная структура при необходимости на основе оценок (аудитов, экспертиз) изменяется	5

6.3. Процессная модель Порта

Бизнес-процессная модель порта отсутствует	1
Имеются описания основных бизнес-процессов	2
Основные бизнес-процессы идентифицированы. Имеется их перечень	3
Имеются детальные описания взаимосвязи основных бизнес-процессов друг с другом	4
Имеется полноценная процессная модель Порта, включая: ключевые параметры процессов, взаимодействие между ними, показатели эффективности процессов и т.д.	5

6.4. В порту систематически осуществляются мониторинг и измерения процессов, результаты которых используются для анализа эффективности	Да/нет
6.5. Периодически проводится анализ бизнес-процессов для определения их эффективности и возможностей для улучшения	Да/нет

6.6. Сертификация Системы менеджмента качества сервиса

Порт не имеет сертификатов соответствия Системы менеджмента качества каким-либо стандартам или моделям. Подготовка к проверке на соответствие и сертификации никогда не осуществлялась.	1
Порт готовится к проверке Системы менеджмента качества на соответствие определенному стандарту или модели (напр. ISO 9001)	2
Порт имеет сертификат (ы) серии ISO 9000, выпущенный (е) российским (и) сертификационным (и) органом (ами)	3
Порт имеет сертификат (ы) серии ISO 9000, выпущенный (е) международным (и) сертификационны (и) органом (ами)	4
Порт имеет сертификаты или иные признаваемые свидетельства соответствия иным стандартам и моделям менеджмента качества	5

6.7. Порт получала премии, награды и т.п. по качеству. Ее услуги бывали отмечены премиями, наградами и т.п. за качество	Да/ Нет

4

6.8. Если да, укажите:

_____

_____

6.7. Принято ли в Порту определенное понимание качества сервиса?

Нет	1
Да – но эти вопросы рассматриваются только менеджментом Порта.	2
Да – но их несколько, т.е. имеются расхождения в понимании качества между различными категориями сотрудников (между уровнями менеджмента или между техническими специалистами и маркетологами и т.д)	3
Да – единое в рамках всей Порту	4
Дайте определение (ия) качества сервиса принятое (ые) и используемое (ые) в Порту_____	5

_____

_____

_____

6.8. В Порту имеется Политика в области качества сервиса:

Нет	1
Да в устной форме	2
Да, оформлена документально и хранится у руководства Порта	3
Да, оформлена документально и доведена до всех сотрудников Порта	4
Да, оформлена документально, доведена до всех сотрудников компании и регулярно подвергается анализу для подтверждения ее актуальности	5

6.9. Ориентация на потребности потребителей

Порт не ориентируется на потребности потребителей и не использует в своей деятельности данные об этих потребностях	1
Порт ориентируется на выявленные потребности потребителей при разработке новых видов услуг	2
Порт ориентируется на выявленные потребности потребителей при разработке новых видов услуг, при установлении целей в области качества и в процессе совершенствования Системы менеджмента качества	3
Порт ориентируется на потребности потребителей при осуществлении всех процессов и видов деятельности	4
Порт систематически собирает, анализирует информацию о потребностях потребителей и результаты учитываются в принятии управленческих решений	5

6.10.Человеческие ресурсы

Персонал Порта можно считать достаточно компетентным для оказания качественных услуг клиентам	5
Да, весь персонал можно считать достаточно компетентным для качественного выполнения порученных работ	4
Большая часть сотрудников обладают квалификацией и компетентностью, достаточными для качественного выполнения порученных им работ.Остальные будут в ближайшее время дополнительно обучены или заменены для того, чтобы гарантировать качественное выполнение работ	3

Трудно сказать	2
Нет, многим сотрудникам не хватает, квалификации, опыта, уровня компетентности.	1

6.11. Порт прилагает возможные усилия для повышения квалификации и компетентности персонала

Нет	1
Редко и не систематически	2
Да, когда возникает такая возможность (имеется свободное время, имеются финансовые возможности, проводятся нужные учебные мероприятия и т.д.)	3
Да, систематически – на основе выявляемых потребностей в повышении квалификации и компетентности отдельных сотрудников	4
Порт на основе принятого плана осуществляет мероприятия по обучению и повышению квалификации персонала (корпоративные тренинги, отправка сотрудников на обучение и т.д.)	5

7.Мультимодальность и другие аспекты развития порта:

7.1	Порт имеет связь с железнодорожной транспортной сетью	5
7.2	Порт имеет связь с автомобильной транспортной дорогой	5 4 3 2 1
7.3	Порт имеет связь с воздушными транспортными объектами	5 4 3 2 1
7.4	Порт имеет связь с международными логистическими центрами, хабами (Китай, Россия, Азия, страны Центральной Азии и Европы)	5 4 3 2 1
7.5	Порт имеет связь с внутренними, региональными логистическими центрами и терминалами	5 4 3 2 1
7.6	Порт обрабатывает разные виды грузов	5 4 3 2 1
7.7	Порт имеет дополнительные услуги по доставке груза до конечного потребителя	5 4 3 2 1
7.8	Порт открыт для честной конкуренции	5 4 3 2 1
7.9	Порт предоставляет дополнительные услуги по маркировке, упаковке, штрихкодированию и т.п.	5 4 3 2 1
7.10	На Ваш взгляд, на какие дополнительные услуги имеется спрос со стороны клиентов, укажите:	5 4 3 2 1
7.11		5 4 3 2 1
7.12		5 4 3 2 1
7.13		5 4 3 2 1
7.14		5 4 3 2 1

Общие замечание, предложения по анкете