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# A Bibliometric Investigation of the Roles and Obstacles of Women's Leadership in the Corporate Sector

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## ABSTRACT

This article uses a bibliometric approach to identify the roles of women in leadership and the various challenges they face in corporate management. The study's goal is to determine the leading countries, commonly used keywords, research trends and the dynamics of the growth of scientific papers on this subject over the previous fifteen years (2010–2025). To process and analyse data from the Scopus database, programs like VOSviewer and Bibliometrix (R Studio) were used. As a result of the analysis of 1,036 scientific publications, key research trends, the most productive countries and frequently used keywords were identified. It was found that despite the growing representation of women in leadership, structural barriers, gender inequality, and cultural and social constraints remain. The geographical and thematic differentiation of publications indicates the global importance of the topic under consideration and the interdisciplinary nature of the research. The bibliometric approach enabled the identification of the main research clusters: gender stereotypes and discrimination, institutional barriers, and the phenomenon of the “glass ceiling”. The findings highlight a growing interdisciplinary interest linking gender economics, corporate governance, and organizational psychology. Additionally, using the bibliometric technique, the study identifies scientific focus, research gaps, and prospects. Future research should focus on in-depth analysis of under-researched topics such as intersectionality and mentoring, as well as on developing practical tools to overcome structural and cultural barriers in women's leadership.

**KEYWORDS:** Women's Leadership, Corporate Governance, Gender Economy, Gender Inequality, Bibliometric Analysis, Intersectionality, Asia

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EJEBS

## 1. INTRODUCTION

The workforce has seen substantial change over the last 20 years, with a noticeable rise in the proportion of women who are both entering the profession and expressing more intense goals for career advancement. As a result, there has been a noticeable increase in the number of women in leadership positions (Krivkovich et al., 2024). Not only do businesses with diverse leadership teams do better financially, but they also have happier employees and are better at solving problems and coming up with new ideas (Russen et al., 2021).

There are many challenges and barriers to women in leadership. Women are still underrepresented in leadership positions, which restricts their impact and prevents them from achieving diversity and gender equity goals despite decades of intensive work across numerous sectors. Women are underrepresented in leadership roles even though they make up a sizable share of the workforce (Times Higher Education, 2021). There is clear evidence of gender discrimination in executive roles in the US, UK, Europe, Asia, and other regions of the world (Maheshwari, 2021). Despite making up a large portion of the workforce, women are underrepresented in leadership positions (Times Higher Education, 2021). According to a lot of international research, societal stigma and work-life balance seem to have the most significant negative influence on women (Smidt et al., 2017; Tomás et al., 2010). According to a UN report from 2023, it will take 140 years for women to be equally represented in leadership roles in the worldwide workforce.

According to Maheshwari et al. (2021), family support, a desire to change society, a drive to advance professionally, and setting an example for younger girls were the factors that made it possible for women to take on leadership roles. Women are more likely to become leaders in their fields if they have the support of their husbands and close family members, such as fathers, brothers, and parents-in-law. Research in the health sector shows that gender-equal leadership will have several advantages, such as Health: enhancing decision-making, bolstering health systems; Gender: empowering women with more income and agency; and Economic: boosting economic growth through the creation of new jobs and stronger health systems (Borger et al., 2025). A perspective from the higher education sector, developing a more equitable and encouraging institutional environment that gives middle-level female academics the tools and supports they need to move smoothly into senior leadership roles and, eventually, strengthens the institution's leadership pipeline requires an understanding of the dynamics from their point of view (Thien et al., 2025).

Furthermore, there is a strong argument for more research on the ways that important life events and larger life domains affect women's leadership styles and productivity at work. This involves acknowledging the beneficial effects these life experiences have on women's leadership abilities. Cultures that empower women leaders can be created by incorporating these insights into diversity- and inclusion-focused training initiatives and organizational policies (Manfreda et al., 2025). Thus, the study's goal is to determine the leading countries, commonly used keywords, research trends and the dynamics of the growth of scientific papers on this subject over the previous fifteen years (2010–2025).

## 2. LITERATURE REVIEW

*Challenges Women Face in Leadership*

Traditional gender roles and cultural conventions continue to have a significant influence on women's empowerment. There may be resistance to women's involvement in healthcare because of the way society views women's participation in public healthcare, especially in roles that are viewed as difficult or out of the ordinary (Alzaaqi et al., 2025; Mobaraki & Söderfeldt, 2010). Prejudice against female leaders can be a manifestation of stereotypes about women's skills and talents. Women's prospects for job advancement may

be restricted by preconceived ideas about their competence and leadership abilities, especially in specialized or leadership professions (Alsadaan et al., 2021). In the context of the Saudi health care sector, the complete fulfilment of gender equality in healthcare is nevertheless hampered by enduring issues such as prevailing gender conventions, workplace prejudices, and inadequate opportunities for mentoring (Alzaaqi et al., 2025). It is possible that social role expectations unintentionally caused women to adopt gender-conditioned habits that intentionally obstruct their advancement into leadership roles and career prospects. Researchers hypothesize that these stereotypes are influenced by women's views of their appropriateness for jobs in computers and IT (Singh et al., 2018). Similarly, a complex socioeconomic issue that affects the entire community is the pervasiveness of child marriages in rural communities. The upsetting cycle of early marriages is perpetuated by survivors of early marriages who face long-lasting economic, social, and generational consequences. Early marriage puts women at the highest risk since it increases their chances of dropping out of school, losing access to economic empowerment, experiencing domestic abuse, and having problems when a young woman becomes pregnant, which could result in stunting in the unborn child. According to data from Malang Regency's public health centre, almost 2,000 toddlers are stunted as a result of pregnancies by moms under 20 (Anzari & Fitri, 2024).

*Outcomes and Benefits of Women*

In order to achieve gender parity, promote creativity, and advance inclusive decision-making processes, women's leadership development is essential. In order to address complex global concerns, it guarantees various perspectives on leadership and helps women to overcome systematic hurdles. Additionally, cultivating female leaders improves organizational performance since diversity in leadership is associated with better social impact, employee happiness, and financial results. Similarly, a higher percentage of women in management teams improves a gender-diverse workgroup's capacity to cooperate and contribute to overall performance. Implementing gender-inclusive policies, which can eliminate long-standing gender divisions, is made easier when there are more women in management teams (Lee et al., 2025; Sil & Lenka, 2025). According to Hillman (2015) and Triana et al. (2013), companies with female directors typically have higher reputations, make more investments in innovation, gain significant resources, and eventually achieve better company performance. Edacherian et al. (2025) highlighted in their study that a favorable relationship between company success and the representation of women on boards and in executive roles.

*Strategies for Advancing Women in Leadership*

Women leaders must overcome stereotypes and biases in order to be successful in their roles and contribute significantly to their organizations (Smith & Sinkford, 2022). The following are some thorough methods for navigating and overcoming these obstacles: Women leaders frequently have to strike a careful balance between being direct and personable. Although assertiveness is necessary for good leadership, women may be viewed negatively when they exhibit it. Women leaders can overcome this by taking a well-rounded strategy that blends assertiveness and approachability. This entails keeping lines of communication open and showing team members empathy while still being forceful and decisive when needed (Chikwe et al., 2024). Authenticity is necessary for effective leadership, yet women leaders may feel pressured to conform to traditional gender norms in order to be taken seriously. Nonetheless, maintaining one's integrity is crucial for gaining the respect and confidence of teammates. According to Mashele and Alagidede (2022), women leaders can overcome bias by embracing their authentic selves, demonstrating confidence in their abilities, and refusing to compromise their

ideas or values. In order to overcome obstacles and seize opportunities, women leaders must establish networks of support. In the workplace, mentors and allies can offer invaluable advocacy, support, and direction. They can provide insight, counsel, and development opportunities, assisting female leaders in overcoming challenges and realizing their objectives (Chikwe et al., 2024; Akindote et al., 2023). By actively seeking out mentors and sponsors who may offer advice and promote their progress, women leaders can build supportive networks (Akindote et al., 2023). They can also establish connections with coworkers and peers who have gone through similar struggles and experiences. Professional associations, mentorship programs, and networking events can all offer beneficial chances to meet and encourage people (Keating et al., 2022). The engineering and ICT sectors should establish official family-friendly policies, which should be appropriately applied and equally embraced by men, in order to prevent stigmatizing women as being seen as unprofessional and simultaneously promoting men as the ideal dedicated worker. In order to meet the unique career needs of competent women in leadership roles, it is advised that organizations merge work and family life not only by encouraging flexible workplace rules but also by making sure the policies are implemented effectively (Ramseook-Munhurrun et al., 2025).

*Leadership Styles and Approaches*

Leadership philosophies are correlated with gendered attributes: transformational leadership is more in line with community qualities (like empathy and support), which are more commonly associated with women, whereas transactional leadership reflects agentic qualities (like task focus and rewards), which are typically associated with men (Offringa & Groeneveld, 2023). According to empirical research, men are more likely to engage in agentic or directing behaviors. In contrast, women are more likely to engage in transformational behaviors including intellectual stimulation, customized consideration, and even contingent reward (Wolfram & Gratton, 2013). Furthermore, women who possess greater resilience and self-advocacy are better able to overcome obstacles and institutional biases, which enhances their leadership capacity. Authentic leadership is undermined by impression management and impostor syndrome, according to a qualitative study of women leaders in the UK professional business services. Women frequently struggle to balance being authentic with adhering to male-dominated leadership standards (Howard, 2025). Thus, women's skills in self-awareness, emotional intelligence, teamwork, transparency, moral decision-making, and resilience make them natural advocates for authentic leadership. He emphasizes how women frequently succeed in these fields, setting a new standard for genuine leadership.

## 3. RESEARCH METHODS

It is well recognized that a variety of scientific approaches are developing for efficient research. Focusing on the examination of scientific material and the operation of a particular scientific discipline, bibliometric analysis is one of these successful scientific methodologies. Bibliometric analysis is a crucial technique for evaluating the scientific results of research papers, authors, keywords, journals, organizations, and nations in any field of study. Additionally, it aids in comprehending how conceptual, social, and intellectual frameworks have changed over time (Donthu et al., 2021). The primary purpose of this analysis is to locate, evaluate, and comprehend the literature or a portion of it, in a specific field of study (Öztürk, 2021).

Through bibliometric analysis, one can systematically and comprehensively grasp the actual structure of any field, the subtle evolutionary changes within it, the research clusters that define it, the emerging trends, and gain a broad view of the key concepts and their interconnections within the field (Aria & Cuccurullo, 2017; Mukherjee et al., 2022; Kraus et al. 2024). As a result, bibliometry has a broader use and is growing in popularity

among scholars. One of the most essential prerequisites for accurate and successful bibliometric analysis is careful keyword selection. For this reason, we started by compiling phrases associated with the work of women in leadership roles. Moreover, the paper collected keywords related to the difficulties and obstacles that women face in high-ranking positions.

The process of selecting and filtering articles is shown in Figure 1.

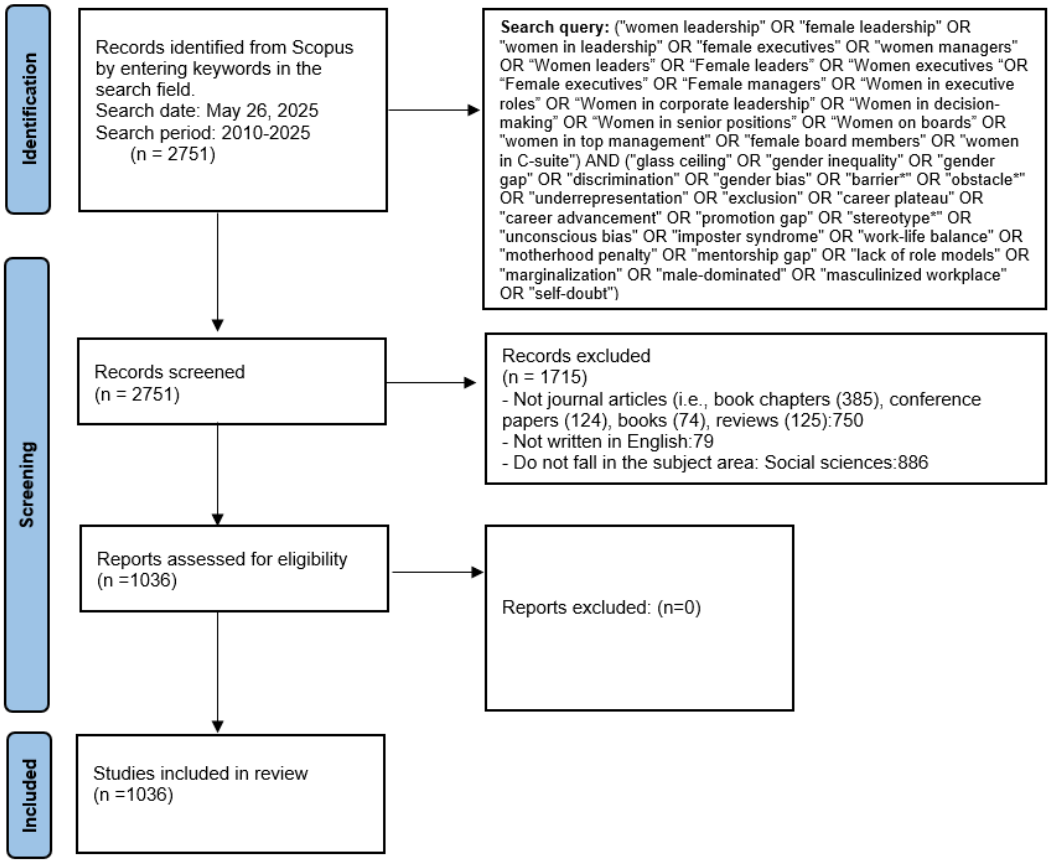


**Figure 1.** Data selection process

After that, using the Boolean operator AND, this research combined the keywords in both directions and performed a search in the Scopus database. On May 26, 2025 the following keywords were used to search in the Article title, Abstract, Keywords field of Scopus database: ("women leadership" OR "female leadership" OR "women in leadership" OR "female executives" OR "women managers" OR “women leaders” OR “female leaders” OR “women executives”OR “female executives” OR “female managers” OR “women in executive roles” OR “women in corporate leadership” OR “women in decision-making” OR “women in senior positions” OR “women on boards” OR "women in top management" OR "female board members" OR "women in C-suite") AND ("glass ceiling" OR "gender inequality" OR "gender gap" OR "discrimination" OR "gender bias" OR "barrier*" OR "obstacle*" OR "underrepresentation" OR "exclusion" OR "career plateau" OR "career advancement" OR "promotion gap" OR "stereotype*" OR "unconscious bias" OR "imposter syndrome" OR "work-life balance" OR "motherhood penalty" OR "mentorship gap" OR "lack of role models" OR "marginalization" OR "male-

dominated" OR "masculinized workplace" OR "self-doubt"). In total, there were 2,751 articles related to a research topic in the database. The maximum search period is set for 2010-2025. The field of Social Sciences was chosen as the main scientific direction. In addition, only journal articles were taken into account in the search method. In addition, only documents written in English were accepted for the study. Ultimately, 1,036 works were selected for further study, meeting the requirements for inclusion in the study.

Although there are numerous visualization programs available for bibliometric analysis, we chose VOSviewer and Biblioshiny to perform descriptive analysis in this study (Aria & Cuccurullo, 2017). VOSviewer was used to analyze keywords and study their co-occurrence (Eck & Waltman, 2009). To sum up, this article's methodology uses bibliometric tools to conduct a comprehensive analysis of the literature on the challenges faced by women in higher positions. This study intends to determine the most contributing nations, commonly used phrases, trend topics, and co-occurrence of keywords that have been encountered in works on the research issue using the aforementioned functional research components.

## 4. RESULTS

*Annual academic research*

In the past few years, the number of yearly scientific studies on the challenges faced by women in leadership positions has significantly increased. Only the last fifteen years' worth of articles that addressed the research issue were selected for examination. From Figure 2 below, you can see the general trend of the annual level of scientific productivity.

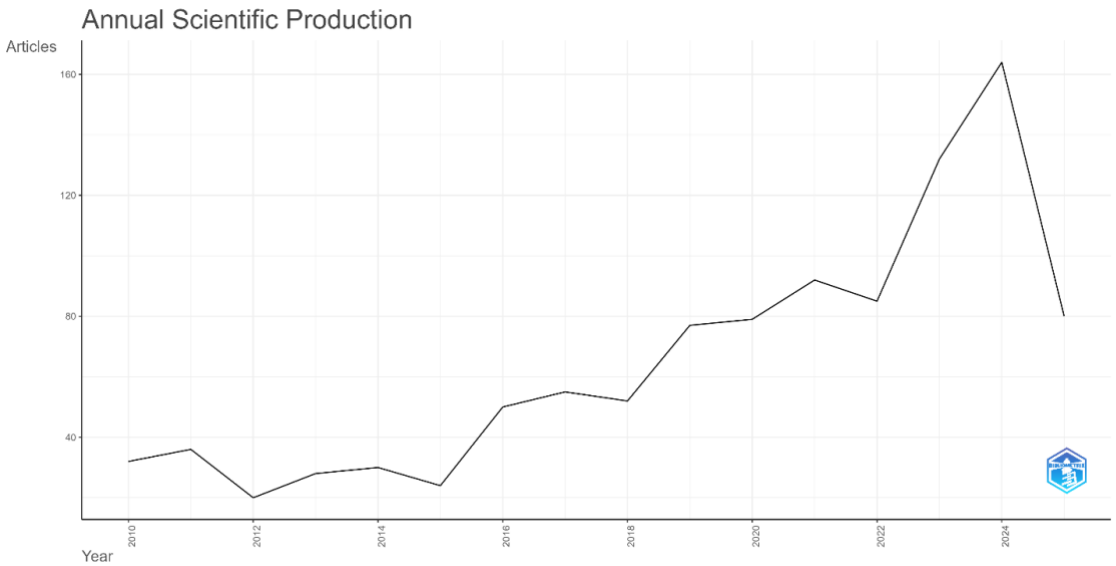


**Figure 2.** Annual scientific production

Graph 2 shows the annual scientific production on the challenges of leading women from 2010 to 2025. Interestingly, in the early years, there was little activity. An upsurge in publications has been observed since 2016.

From 2010 to 2015, interest in this topic was limited, as can be seen from the small indicator of the number of published articles. The number of publications has gradually increased since 2018, with 2021 and 2023 showing relatively high indicators (92 and 132 articles, respectively). This growth continued, albeit with slight fluctuations, and in the first half of 2025, 83 articles were published.

The most remarkable increase was observed in 2024, when the number of articles increased sharply, with 164 publications published in the same year alone. Such growth may indicate a growing global focus on gender equality, socio-economic issues, and broader recognition of the role of women in leadership positions. Overall, the findings indicate that in recent years, the issue of obstacles facing women in higher positions has gained significant attention from academics.

The proportion of countries that produced articles in the field of challenges faced by women leaders shows significant geographical differences, with different countries in different corners of the world being leaders in productivity. The United States leads the list of nations with the most contributions (716 articles), followed by the nations with the most publications, like Australia and the United Kingdom, each of which has a notably greater quantity of research papers (see Table 1).

**Table 1.** Number of articles per country

| Country | Number of articles |
|---|---|
| USA | 716 |
| UK | 192 |
| AUSTRALIA | 161 |
| CANADA | 133 |
| SPAIN | 126 |
| SOUTH AFRICA | 101 |
| INDIA | 85 |
| INDONESIA | 71 |
| GERMANY | 63 |
| MALAYSIA | 55 |
| CHINA | 51 |
| TURKEY | 35 |
| BRAZIL | 34 |
| NETHERLANDS | 34 |
| GHANA | 33 |
| PAKISTAN | 32 |
| SWEDEN | 30 |
| UNITED ARAB EMIRATES | 28 |

Note: compiled by the author

The data in the table indicates that South Africa, Canada, and Spain are among the nations with the highest levels of productivity. The fact that so many research papers from many nations around the world have been published demonstrates the significance of the research topic.

The aforementioned map displays the regional distribution of study findings on female leaders, identifying the countries that have published the most publications (refer to Figure 3).

The US, UK, and Australia are the top states, as indicated by the dark colours, which also show a significant number of publications. Almost all the world's major areas are represented in this picture, with a significant concentration of research being conducted in North and South America, Oceania, Europe, and Asia. In other regions of the world, including the African continent, where comparatively few publications were released, the map likewise demonstrates a dearth of publications. Nonetheless, certain nations on this continent, including Ghana and South Africa, have produced a specific quantity of articles. This illustrates how much academic performance varies by region.

The three fields' diagram shows how authors, nations, and keywords are interconnected, with grey lines signifying their relationships.

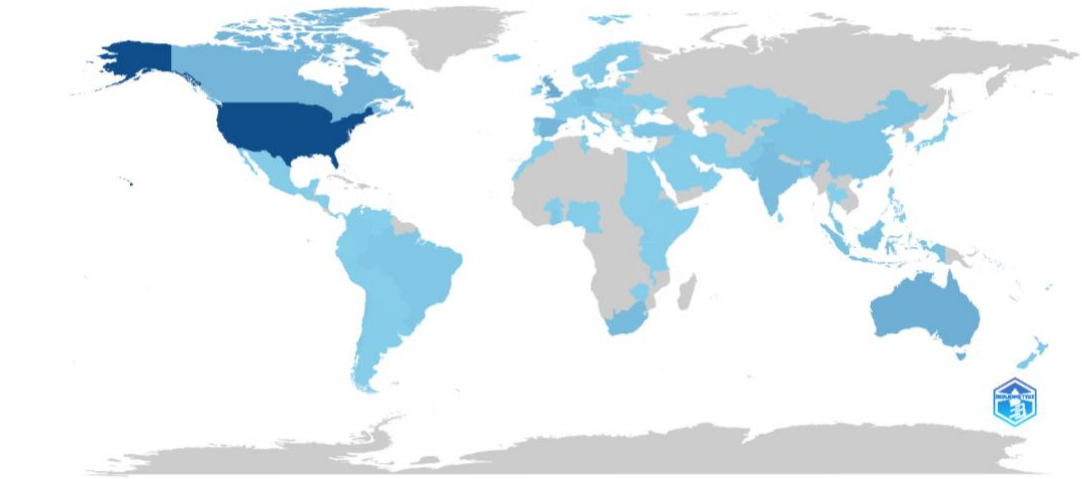

**FIGURE 3.** Most contributing countries

Note: compiled by the author based Bibliometrix (R Studio)

The author's country of origin is the first link in this connection, which then links to the author and concludes with research-related keywords. The size of each rectangle indicates the number of papers associated with each component. The author's country is displayed on the left side of the diagram, while commonly appearing keywords such as “leadership,” “gender,” “gender stereotypes,” “women leaders,” “intersectionality,” “gender equality,” “glass ceiling,” “higher education,” “barriers,” “gender inequality,” and “discrimination” emphasize the main themes in the field (see Figure 4).

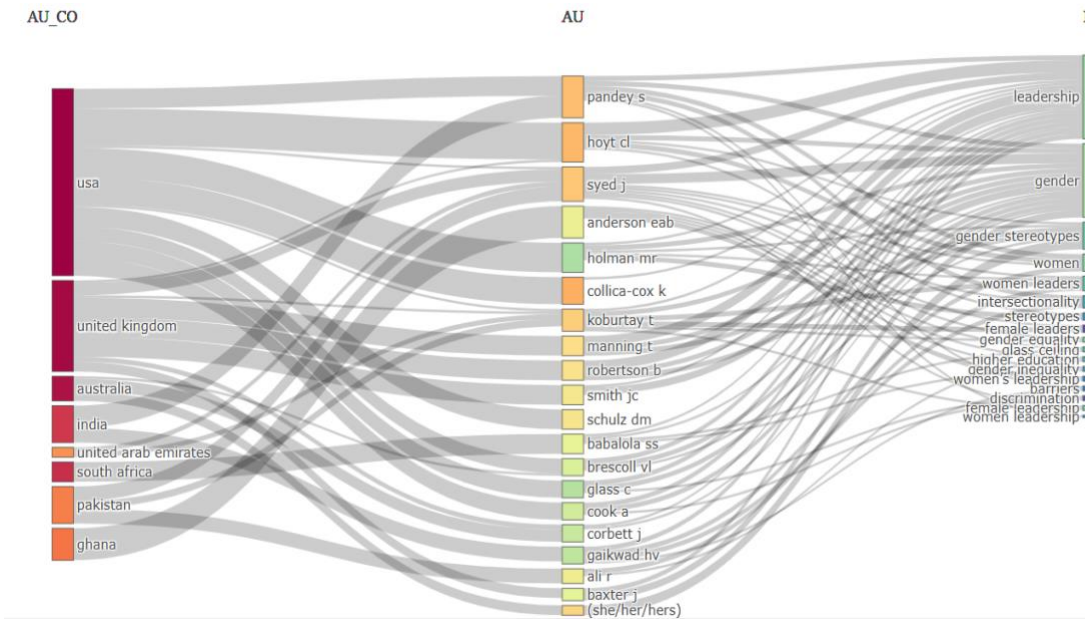


**Figure 4**. Three-field plot analysis

Note: compiled by the author based Bibliometrix (R Studio)

The three-field diagram illustrates the links between authors' countries (left), individual authors (centre), and frequently used keywords (right) in research concerning obstacles in women's leadership. Notable keywords like “leadership,” “gender,” “gender stereotypes,” and “women leaders” underscore key focus areas. On the other hand, nations like the USA, UK, and Australia are notable for their significant contributions, as they are associated with prominent writers and important subjects in this field.

TreeMap is a technique for displaying the most prevalent terms in the data that has been collected (Nailah & Rusydiana, 2020). The TreeMap visualisation shown in Figure 5 illustrates the words that frequently appear in the dataset of articles analysed in the area of women's leadership.

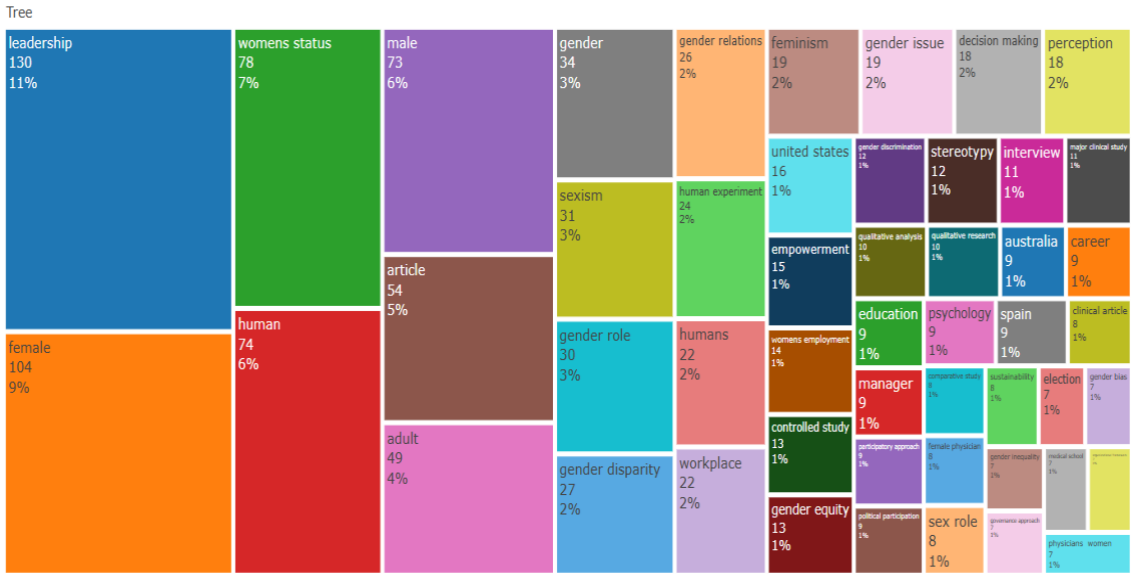


**Figure 5.** TreeMap analysis

The words like “leadership”, “female”, “women's status” and “human” are the most repetitive words with 130 times (11%), 104 times (9%), 78 times (7%) and 74 times (6%), respectively, which identify the interest sphere of authors. Furthermore, keywords like “gender role” 30 times (3%) and “gender disparity” 27 times (2%) were repeated in the field of research subject. The frequent occurrence of words like these suggests that gender equality issues are among the main obstacles in women's leadership.

Finding trend topics in bibliometric analysis aids in understanding the reasoning behind the evolution of the field and in making informed decisions about the course of scientific investigation. It can be used to evaluate the scientific significance of a specific topic and to take into account new developments. Examining more recently researched subjects allows us to see how scientific study is evolving.

Figure 6 illustrates the dynamics of trend subjects in research articles about the issues facing women in leadership roles.

Based on the information in the graph, the main topics and issues related to the topic of women's leadership have become more relevant in recent years. For example, since 2021, topics such as leadership, women’s status, and gender roles have been widely discussed and have gained a large frequency. In those periods, these topics were often mentioned among scientists.

Moreover, since 2023, researchers have focused more on the issues of gender and feminism.Thus, the gender inequality and

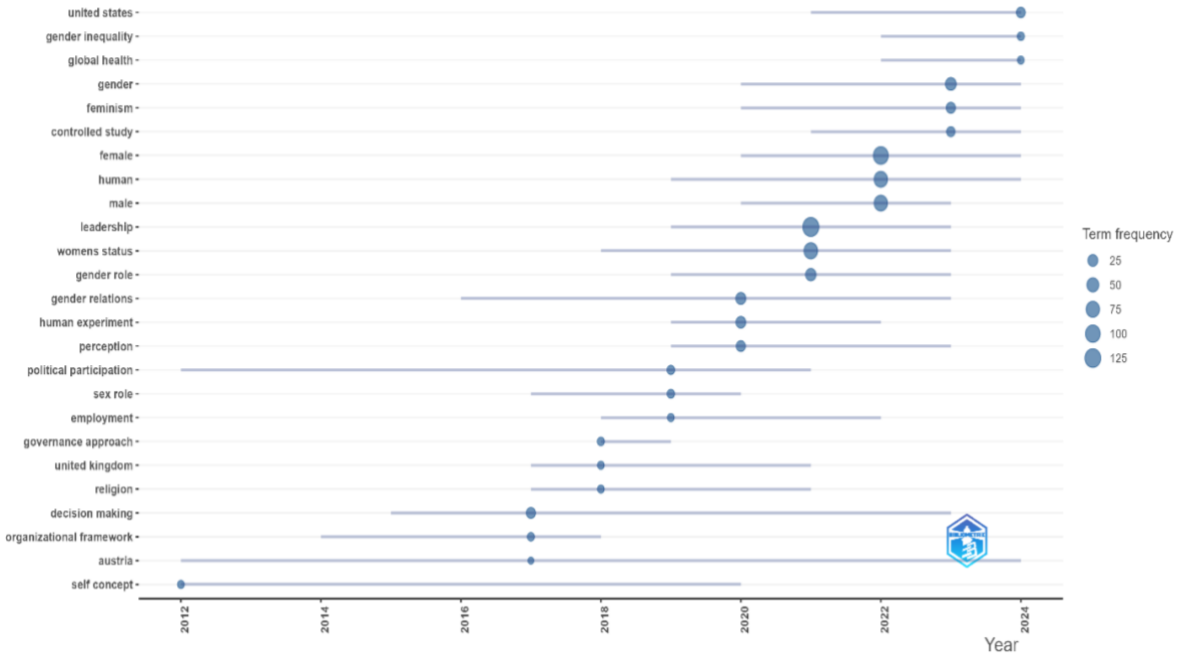


**Figure 6.** Trend topics

health care are the primary topics at the forefront of current study. As a result, it is well known that scholars frequently emphasize the fact that women leaders encounter gender-related challenges when carrying out their duties.

The keyword co-occurrence analysis revealed that 51 out of 2617 keywords satisfied the requirements by establishing a threshold of 9 occurrences. The main concepts and topics found in research on women in leadership positions are summarized by these 51 keywords. Five different clusters were formed from these keywords, which may indicate different research directions or thematic areas within this field (Figure 7).

This network visualization shows the co-occurrence of keywords in research on the difficulties faced by women in leadership roles. Each hue indicates a theme grouping, and the keywords are arranged into clusters. The frequency of the keyword is reflected in the size of each node; larger nodes denote important research areas. This kind of study revealed five major clusters. Cluster 1 (red) contains keywords related to gender stereotypes and discrimination. The keywords found in this cluster are “female leadership”, “gender bias”, “gender stereotypes”, “women executives”, “management”, “mentoring” and “patriarchy”. This cluster reflects the following social barriers that women face in a professional environment: stereotypes, discrimination, and patriarchal culture. Furthermore, Cluster 2 (green) covers the institutional and cultural context. The frequent occurrence of keywords such as “gender gap”, “sexism”, “gender roles”, “empowerment”, “organizational culture” in this cluster means that the topic of gender culture and institutional barriers within the organization or society has gained significant interest of researchers.

The following cluster 3 in blue addresses the issues of education and the glass ceiling. The following words are often reflected in this direction: “higher education”, “glass ceiling”, “women's leadership”, “gender equity”. Through this cluster we can find out that education, academic leadership and the phenomenon of the “glass ceiling” have been widely discussed among scientists. This cluster allows us to describe some of the barriers to women reaching higher-level positions. Moreover, cluster four (yellow) includes

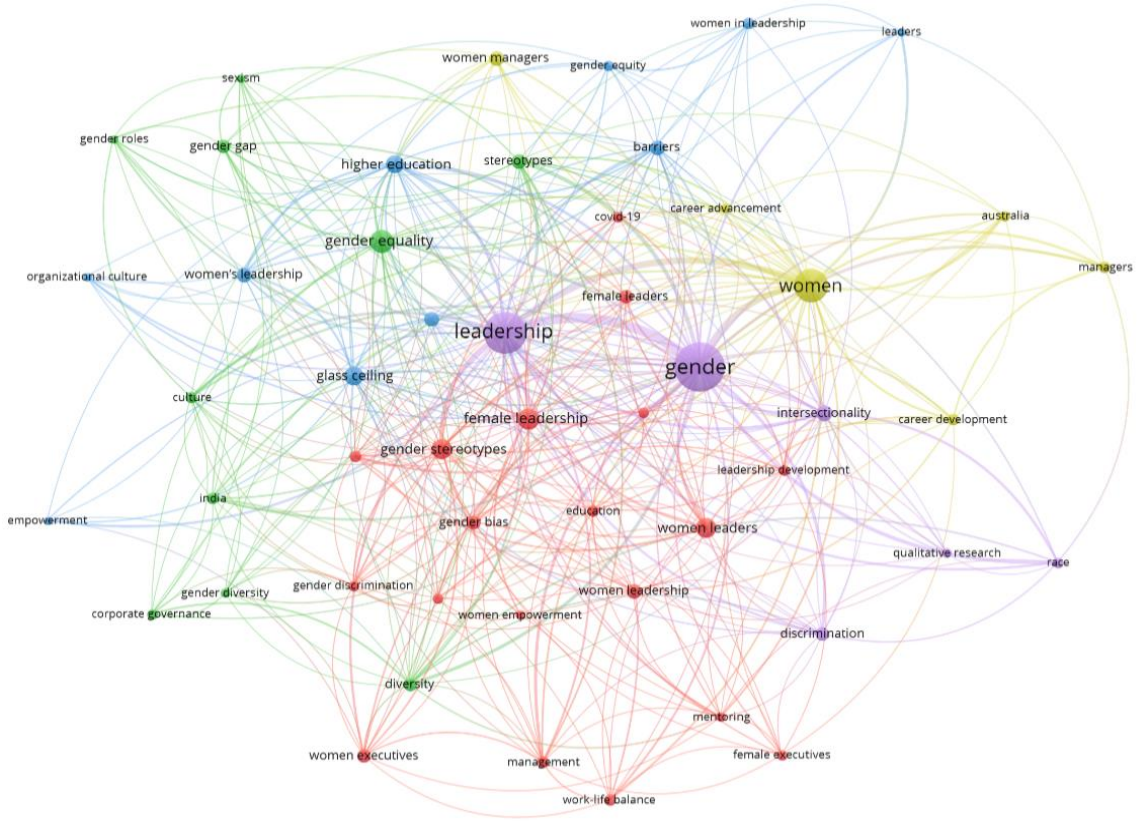


**Figure 7**. Keyword co-occurrence network

Note: compiled by the author based VosViewer

difficulties in personal development and career growth. In this direction, such words as "women", "career development", "women in leadership", "managers" were often used among researchers. This cluster describes factors such as career development, professional advancement, and issues of women in managerial roles. In the last 5th cluster (purple), questions of inclusivity and intersectionality are often addressed. "Intersectionality", "race", "discrimination" are found among the main keywords in this cluster. In this bunch, gender issues are considered not only in terms of gender, but also in relation to race, ethnic origin and intersectional experience. In general, through this analysis, we know that scientists in different directions have studied the difficulties and problems faced by women leaders in their workplace. This paper notes that women leaders face gender issues and various socio-economic problems in the course of their activities. In addition, the fact that the words "mentoring" and "intersectionality" contain a small circle means that these topics have not been studied in depth and indicates that they can be considered as one of the areas of study in the future.

## 5. CONCLUSIONS

With a bibliometric method, this paper distinguished the scientific literature on the obstacles experienced by female leaders in their professional endeavours, demonstrating that the research topic is now being examined from several perspectives. The study examined

the degree of scientific productivity in recent years and determined which nations published the most on this subject. It was also feasible to distinguish under-covered themes and potential research fields by identifying the most commonly used terms and trend topics in the research articles that were selected for examination. This could be the foundation of upcoming studies. In addition, the study found that such concepts as "gender inequality", "social stereotypes", "glass ceiling", "patriarchy", "women managers", "career development", and "intersectionality" are common. Collected data shows the multiplicity of factors that prevent women from reaching higher positions. In particular, it has been noticed that gender stereotypes and structural inequalities are still an urgent problem in the work environment. It is also important to pay attention to how intersectionality – that is, women's gender, as well as other factors such as race, social status, and cultural background- affects their career path. In this context, qualitative studies are becoming increasingly important, as they help to describe the real experience of women deeply. Generally speaking, even if current scientific research indicates advancements in the understanding of the formal obstacles faced by female leaders, several facets still need further investigation. As a result, it is becoming more pertinent to expand this topic in future research by analyzing specific examples and practical advice. Bibliometric analysis provides a comprehensive picture of the state of research today, emphasizing important clusters and emerging patterns. These observations can help guide future theoretical and empirical research projects that try to remove the societal and systemic barriers that prevent women from achieving their full leadership potential.

## AUTHOR CONTRIBUTION

Writing – original draft: Rab Nawaz Lodhi, Zahida Parveen.
Conceptualization: Rab Nawaz Lodhi, Zahida Parveen.
Formal analysis and investigation: Rab Nawaz Lodhi, Zahida Parveen.
Development of research methodology: Rab Nawaz Lodhi.
Resources: Rab Nawaz Lodhi.
Software and supervisions: Rab Nawaz Lodhi, Zahida Parveen.
Data collection, analysis and interpretation: Rab Nawaz Lodhi.
Visualization: Rab Nawaz Lodhi, Zahida Parveen.
Writing review and editing research: Rab Nawaz Lodhi.

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# Determinants of Teachers' Adoption of Artificial Intelligence: Evidence from Kazakhstan

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**ABSTRACT**

In the context of accelerated digitalization of education and national initiatives for the introduction of artificial intelligence (hereinafter – AI) in Kazakhstan, the study aims to identify the factors determining the adoption of AI by teachers. This study examines the determinants of teachers' adoption of AI in Kazakhstan, a context where empirical evidence remains limited despite growing national emphasis on AI integration in education. Drawing on survey data from 662 teachers across diverse regions, the study investigated how demographic factors, professional qualifications, ICT training, self-efficacy, and resource availability influence AI use in classrooms. Results indicate that younger teachers are significantly more likely to use AI, whereas qualification level did not affect use. Formal ICT training during university education emerged as a strong positive predictor of adoption, and initial confidence with ICT was modestly associated with AI use. Age was a statistically significant predictor ($F = 3.72$, $p = 0.0054$): teachers aged 20-39 are more likely to use AI ($M = 2.18$) than teachers in older age groups ($M = 1.82$). On the contrary, the presence of ICT education in higher education significantly increased AI use ($U = 48{,}209.5$, $p = 0.0015$). By contrast, gender, subject specialisation, school location, and language of instruction did not yield meaningful differences. The findings highlight that while AI adoption among Kazakhstani teachers is growing, its use remains selective rather than routine. The study concludes that embedding structured ICT preparation in teacher education and providing sustained professional.

**KEYWORDS:** Digital Economy, Human Capital, Artificial Intelligence, Education, Training, New Technology, Technology Adoption, Technology Self-Efficacy

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## 1. INTRODUCTION

Artificial intelligence (hereinafter – AI) is increasingly viewed as a transformative driver of economic and social development. At the macro level, studies demonstrate that integrating AI with human capital fosters economic growth by enhancing productivity and innovation capacity (Gomes, 2025). Similarly, AI is reported to reshape economic development trajectories by altering business models, labour dynamics, and knowledge dissemination (Trabelsi, 2024). These insights highlight that AI is not solely a technological development but a structural force with implications for multiple domains, including education. Given that education systems prepare future workers and citizens to participate in digitally mediated societies, the integration of AI into teaching and learning environments assumes significant practical and policy relevance. The importance of adopting AI has repeatedly been emphasised at the national level. For example, in his speech at the August 2025 conference for educators, the President of the Republic of Kazakhstan stressed that preparing teachers to use AI should be a priority of the country's education policy (Tokayev, 2025).

In education, teachers' roles remain pivotal in mediating the adoption of technological innovations. A growing body of literature explores how teachers perceive and use AI, often applying technology acceptance frameworks to analyse determinants of adoption (Ali et al., 2025; Du et al., 2025; Granström & Oppi, 2025). Central predictors such as performance expectancy and perceived usefulness are consistently associated with positive behavioural intentions to adopt AI, while effort expectancy, confidence, and institutional support further shape actual use (Adigun et al., 2025; Liu, 2025; Molefi et al., 2024).

Despite the rapid expansion of empirical studies across contexts such as China, Estonia, Nigeria, and South Africa, research in Kazakhstan remains limited. The few available studies suggest that Kazakhstani teachers express positive attitudes toward AI's potential but also raise concerns about personalisation, automation bias, and the adequacy of pedagogical preparation (Fazilova & Kayip, 2025; Sulaiman et al., 2025). Given the country's strategic investments in education and innovation, examining how Kazakhstani teachers adopt and use AI is both timely and necessary. Existing evidence on Kazakhstan does not provide a comprehensive analysis of how demographic characteristics, professional qualifications, training experiences, or self-efficacy influence AI adoption in this national context.

The purpose of this study is to explore the determinants of teachers' adoption and use of AI in Kazakhstan, focusing on demographic, professional, and organisational factors. The analysis emphasises both individual characteristics (such as age, qualification level, and confidence in ICT use) and structural supports (such as ICT training and resource availability). In doing so, the study aims to provide evidence-based insights for teacher education and policy initiatives aimed at promoting effective AI integration in schools.

Guided by this purpose, the research addresses the following questions:

(1) Do age and teacher qualification levels determine teachers' adoption and use of AI in classrooms?

(2) Do ICT training in teacher education and technology self-efficacy increase teachers' adoption and use of AI in classrooms?

(3) What other factors affect the adoption and use of AI in classrooms?

## 2. LITERATURE REVIEW

In this section, the paper provides a review of recent literature on factors that affect teachers' adoption of AI. A significant stream of research applies established technology acceptance frameworks, such as the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (hereinafter – UTAUT), to AI in education. A prevailing finding from this work is that Performance Expectancy (hereinafter –

PE) and Perceived Usefulness (hereinafter – PU), an educator's belief that using AI will improve their job performance and pedagogical effectiveness, are among the most consistent predictors of the behavioural intention to adopt these tools (Ali et al., 2025). A meta-analysis by Ali et al. (2025) confirmed that PE demonstrated the strongest association with behavioural intention across UTAUT variables. This is empirically supported in specific contexts; for example, perceived usefulness was a salient predictor of readiness among Estonian teachers (Granström & Oppi, 2025), and performance expectancy was the strongest correlate of intention for K–12 mathematics teachers in China (Du et al., 2025) and a key driver of preparedness for teachers in South Africa (Ayanwale et al., 2024).

Alongside utility, Effort Expectancy (hereinafter – EE), or the perceived ease of using the technology, also plays a critical role. While some studies find its effect secondary to performance expectancy, others highlight its situational importance (Ali et al., 2025). Research in resource-constrained contexts, such as a study of Nigerian pre-service teachers, found that EE was the only strong, direct positive predictor of intention, suggesting that when infrastructural barriers are high, usability becomes the paramount concern (Adigun et al., 2025). This highlights a recognised intention-behaviour gap: while beliefs about benefits (PE) may drive willingness to use AI, practical factors like usability (EE) and support often determine actual usage (Du et al., 2025). Educators may see AI's potential but refrain from adoption if the tools are perceived as too complex, time-consuming, or poorly integrated into their workflow (Ofem et al., 2025).

While perceived utility and ease are foundational, the literature demonstrates that teachers' individual competencies and confidence mediate these beliefs. This is where the concepts of technology self-efficacy (an educator's confidence in their own ability to use technology effectively) and AI readiness converge as critical determinants of adoption (Ofem et al., 2025). Recent studies confirm that general knowledge or positive attitudes alone are insufficient. Instead, as Liu (2025) demonstrated, adoption intention is built through a chain in which external support fosters confidence, which in turn builds specific AI readiness, ultimately strengthening the intention to adopt. Confidence facilitates the willingness to engage with new tools, whereas a lack of it is a significant barrier (Granström & Oppi, 2025). Qualitative studies from Nepal and Ethiopia, for instance, found that teachers' primary constraints were not a lack of interest but rather significant knowledge gaps and “limited preparation and confidence” to integrate AI pedagogically or ethically (Bohara & Rana, 2024; Deriba & Sanusi, 2025).

Professional development (hereinafter – PD) and foundational training are essential for successful AI integration. Training is the mechanism that translates abstract support into tangible competence. In a large-scale, two-wave study, Collie et al. (2024) identified professional learning programs as a primary job resource (enAI support type) positively associated with teachers’ generative AI self-efficacy, their valuing of the technology, and their actual integration of it into their work practices. This is because targeted training moves educators beyond mixed awareness, where AI is often conflated with general ICT use, toward pedagogical clarity (Bohara & Rana, 2024). Modelling this pathway, Ayanwale et al. (2024) found that AI-focused PD serves as a crucial mediator, translating factors such as social influence and broader technological, pedagogical, and content knowledge into practical preparedness for AI integration.

Teacher adoption of AI does not occur in a vacuum; it is deeply embedded within an institutional ecosystem of social influences and material resources. The literature is unequivocal that organisational context strongly moderates individual willingness to adopt new technologies. Liu (2025) found that a supportive climate exerts a strong, direct positive effect on willingness to adopt AI. This social factor appears especially critical for

educators in training. Studies of pre-service biology teachers in Nigeria found that attitude and subjective norms were significant predictors of behavioural intention, more so than even perceived control, suggesting that social endorsement and encouragement from leaders are central drivers of uptake among novices (Adelana et al., 2024).

Beyond social encouragement, educators require tangible Facilitating Conditions (FC), defined by Molefi et al. (2024) as school support and resources (SSR), including adequate infrastructure, time, managerial encouragement, and access to training. This support structure acts as a pivotal lever (Molefi et al., 2024). Their research demonstrated that SSR functions as a key mediator: positive attitudes and perceptions of usefulness are far more likely to translate into intention when the school actively provides the necessary time, resources, and collegial support (Molefi et al., 2024). Conversely, a lack of FC can neutralise the positive effects of other predictors; infrastructural constraints may lead to a counterintuitive negative relationship between high performance expectations and intention, as teachers grow frustrated by the gap between AI's potential and their school's reality (Adigun et al., 2025).

Educators simultaneously recognise AI's potential for efficiency such as automating routine tasks or providing 24/7 learner support, while harbouring substantial concerns (Brandhofer & Tengler, 2025). Persistent risks cited across studies include data protection, algorithmic bias, the transparency of AI systems, plagiarism, and the reliability of AI-generated content (Brandhofer & Tengler, 2025; Erümit & Özdemir Sarıalioğlu, 2025).

Although research on the adoption and use of artificial intelligence (AI) in education has expanded rapidly, there are limited empirical studies on the case of Kazakhstan. The survey by Fazilova and Kayip (2025) examined Kazakhstani EFL teachers' attitudes toward AI-generated lesson plans, finding overall positive perceptions due to efficiency, customisation, and creative ideas, but with concerns about automation bias, lack of personalisation, and the need for teacher modification. Similarly, Sulaiman et al. (2025) highlighted how Malaysia and Kazakhstan view AI as a transformative tool for enhancing STEM education, bridging disparities, and fostering collaborative initiatives like Malaysia's AI TEACH program and Kazakhstan's NURIS Innovation Cluster. This paper contributes to the growing literature on educators' use of AI by drawing on survey data.

*Hypothesis development*

Prior research indicates that age is linked to AI competency, with competency reflecting an individual's ability and confidence to use AI effectively, which in turn supports adoption. Empirical evidence confirms this association, showing a significant negative correlation between age and AI competency in both UK and Arab samples, indicating that older individuals tend to report lower levels of AI competency (Naiseh et al., 2025). Accordingly, the following hypothesis 1 was formulated:

*H1:* Younger teachers are expected to report higher levels of AI use than older teachers.

The literature on the use of ICT suggests that teachers' qualifications and related professional characteristics influence how effectively they integrate technology into their teaching (Gil-Flores et al., 2017). In Kazakhstan, teachers are assigned qualification levels that reflect their professional growth and expertise: trainee-teacher, teacher, teacher-moderator, teacher-expert, and teacher-researcher. These levels indicate a progressive system of competencies, where advancement is linked to demonstrated pedagogical skills, professional development, and contributions to educational practice and research. Hypothesis 2 was formulated:

*H2:* That Teachers' professional qualifications will be associated with differences in AI use.

Teacher training and preparation are central to technology integration, as they shape both confidence and competence in using digital tools. Teachers with lower professional development needs in ICT are significantly

more likely to frequently use technology in classrooms, while those reporting higher training needs are less likely to do so (Gil-Flores et al., 2017). Thus, the following hypothesis 3 was formulated:

*H3:* Teachers who received formal ICT preparation during initial teacher education will report higher AI use than those without such preparation.

Previous research consistently links self-efficacy, defined as confidence in one's ability to use technology, to adoption and sustained use of emerging digital tools. Individuals with greater self-efficacy approach AI with less anxiety and more openness to learning, which fosters both skill acquisition and positive attitudes toward integration (Naiseh et al., 2025). Based on this, hypothesis 4 was proposed:

*H4:* Higher initial confidence in using ICT will predict greater AI use.

Literature on technology adoption highlights that access to appropriate digital resources, especially educational software, plays a significant role in determining the extent to which teachers integrate technology into their practice. While the availability of hardware and internet access did not show strong effects, the presence of suitable instructional software was positively linked to more frequent classroom use of ICT (Gil-Flores et al., 2017). The following hypothesis 5 was formulated:

*H5:* Greater perceived availability of instructional materials will be positively associated with teachers' AI use.

Evidence from ICT and AI adoption studies shows gender-related differences, though often nuanced. In AI specifically, males reported higher favourable attitudes toward AI compared to females in the UK sample, though not in Arab contexts (Naiseh et al., 2025). A recent meta-analysis of active teachers' ICT attitudes found that overall gender differences were slight and inconsistent. However, it revealed domain-specific patterns: female teachers scored higher in affective-emotional attitudes, while males showed stronger self-efficacy beliefs (Guillén-Gámez & Rodríguez-Fernández, 2022). To test the association between gender and AI use, the following hypothesis 6 was proposed:

H6: Male and female teachers will differ in their levels of AI use.

## 3. RESEARCH METHODS

The study employed an online survey to investigate teachers' working conditions, practices, and opinions in Kazakhstan, with particular emphasis on professional development, AI use, career aspirations, and school environments. The questionnaire was first tested on a pilot group to identify ambiguities and refine its structure. Following revisions, the instrument was submitted to the Ethics Committee of JSC "Taldau" and received approval. The survey was administered via the SurveyMonkey platform. Participation was voluntary and preceded by the presentation of an informed consent form. Respondents who agreed proceeded to the questionnaire, which was fully anonymous.

To ensure representativeness, a stratified cluster sampling approach was applied. In the first stage, settlements from five regions of Kazakhstan (central, southern, northern, western, and eastern) were selected, each stratified by urban location (regional centres or cities of national significance) and surrounding rural districts. From these strata, 50 schools were randomly chosen. Invitations to participate were shared with regional education departments and school administrations to broaden outreach and encourage participation.

In total, 662 valid responses were collected. Data preparation and statistical analysis were conducted using. The primary data processing and statistical analysis were carried out using Microsoft Excel and Python programs. During data preparation, the questionnaires were checked for completeness, value correctness, and the exclusion of duplicate entries. Descriptive statistics confirmed that the sample was broadly representative of the teaching workforce in Kazakhstan, with demographic indicators, such as gender distribution, qualification level, and teaching experience,

closely aligned with the national population. The demographic indicators are presented in the next section.

To assess the extent of AI adoption among educators, respondents were asked: "How often do you use AI tools in your professional activities?". The answers were recorded on a five-point scale, where the value of 1 corresponded to the option 'never', 2 – 'rarely', 3 – 'sometimes', 4 – 'often' and 5 – 'always'. This gradation enabled quantifying the level of teachers' involvement in the use of artificial intelligence technologies and conducting a comparative analysis of various socio-professional characteristics, including age, qualification level, availability of training in information and communication technologies, and other demographic and organisational factors. Additionally, the questionnaire included questions aimed at identifying teachers' levels of digital competence, their confidence in working with ICT, and a subjective assessment of the school's provision of the necessary educational, methodological, and technical resources. The combination of these indicators enabled a comprehensive evaluation of the factors influencing the adoption and use of artificial intelligence in Kazakhstan's educational environment.

The study's stages are shown in Figure 1, which outlines the sequence of actions.

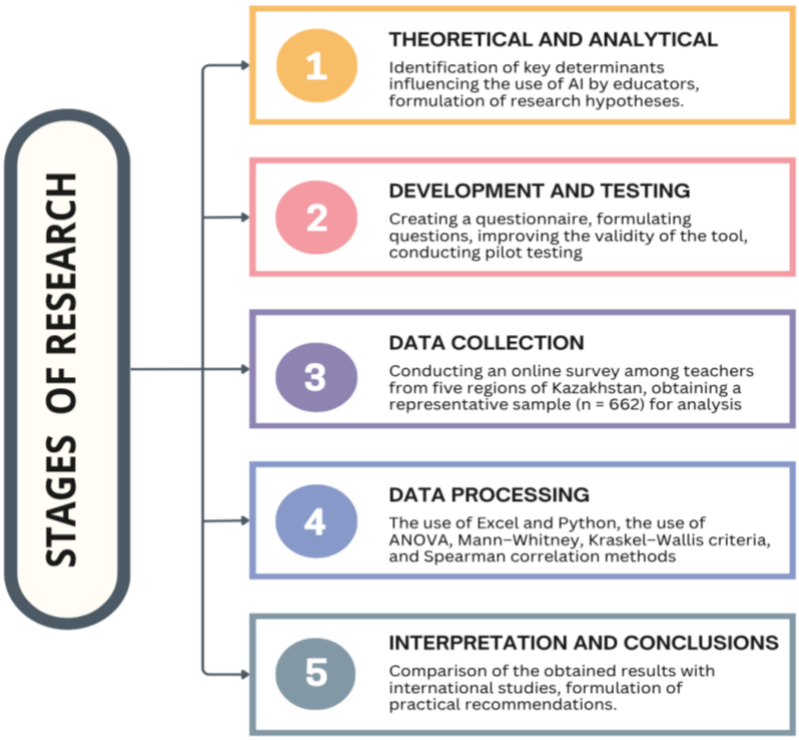


**Figure 1.** The steps of conducting scientific research

Statistical data processing was carried out in Python using methods of univariate analysis of variance (ANOVA), the Mann-Whitney criterion, the Kruskal–Wallis criterion and Spearman's rank correlation. These methods allowed us to determine the significance of differences and relationships between teachers' demographic, professional, and organisational characteristics and the level of AI use.

## 4. RESULTS

According to the survey results, the majority of participants were middle-aged

teachers. The largest groups were those aged 30–39 years (212 participants, 32.02%) and 40–49 years (207 participants, 31.27%). Teachers aged 50–59 years accounted for 19.03% (126 participants).

Younger teachers aged 20–29 years were less represented, comprising 102 participants (15.41%), while only 15 respondents (2.27%) reported being 60 years or older (see Figure 2).

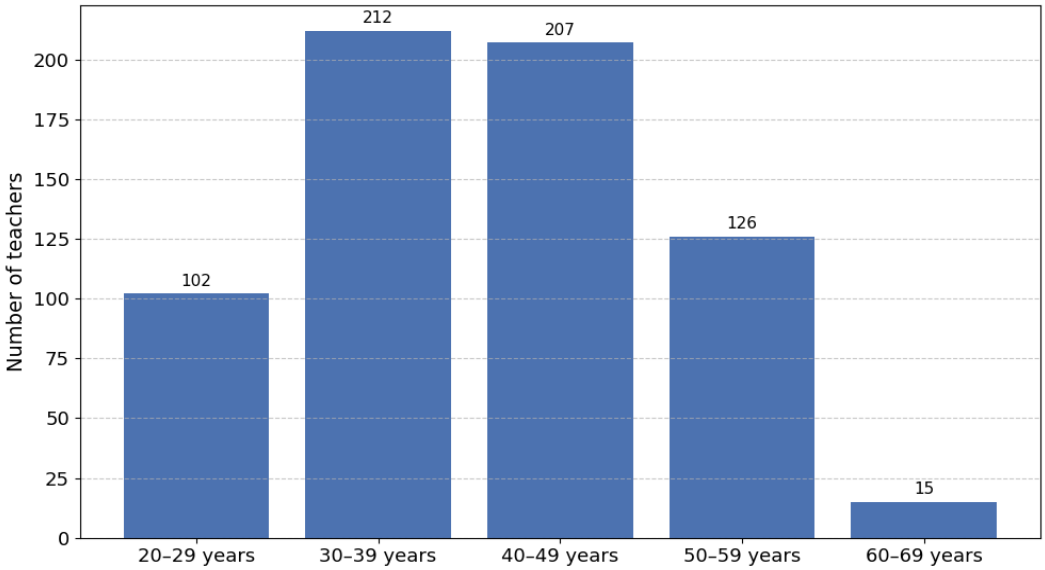


**Figure 2.** Distribution of teachers by age group

The distribution of participants by age closely reflects the national teacher population structure, with an average age of 41 years according to the National Open Database of Education (NOBD, June 2025). Since the survey captured age ranges rather than exact values, an estimated mean age of 40.57 years was calculated using midpoints of the ranges. The survey sample was predominantly female, with 548 women (82.78%) compared to 114 men (17.22%) (see Figure 3).

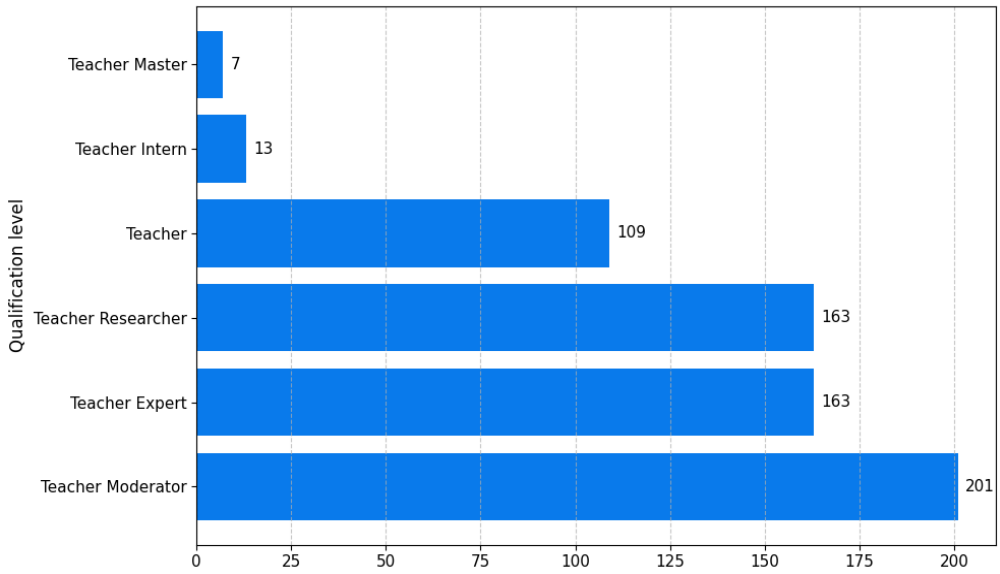


**Figure 3.** Distribution of teachers by qualification level

This gender distribution is consistent with national statistics, which show that women represent 82.1% of the teaching workforce in Kazakhstan as of 2025. Respondents also provided information on their professional qualification levels. The largest group was teachers with the "Teacher Moderator" qualification (201 participants, 30.64%). Nearly equal proportions of participants reported qualifications as "Teacher Expert" (163 participants, 24.85%) and "Teacher Researcher" (163 participants, 24.85%). A total of 109 respondents (16.61%) identified as holding the base level "Teacher" qualification. Less common were the categories of "Teacher Intern" (13 participants, 1.98%) and "Teacher Master" (7 participants, 1.07%). These proportions generally align with national statistics from the NOBD (June 2025), where the largest group is also Teacher Moderators (29%), while Teacher Interns (0.6%) and Teacher Masters (0.8%) are the smallest groups.

The results on teachers' use of AI are presented in Table 1.

**Table 1.** Frequency of teachers' use of AI

| Frequency of AI use | Number of respondents | Percentage (%) |
|---|---|---|
| Sometimes | 254 | 40.8 |
| Often | 145 | 23.3 |
| Rarely | 121 | 19.5 |
| Never | 56 | 9.0 |
| Always | 46 | 7.4 |

Note: compiled by authors

The most common response was 'sometimes' (40.8%), followed by 'often' (23.3%) and 'rarely' (19.5%). Only 9.0% of teachers reported never using AI, while 7.4% reported consistently using such tools. In other words, approximately one-third of the surveyed teachers reported using AI frequently (often or always) in their professional practice. These results suggest that while complete non-use of AI remains relatively uncommon, the technology has not yet become an integral or routine part of most teachers' professional activities. Instead, AI tools appear to be used selectively and situationally, with only a minority of teachers reporting consistent integration into their work.

*Hypothesis testing results*

For Hypothesis 1, which posited that younger teachers would report higher levels of AI use than older teachers, a one-way ANOVA was conducted to compare the extent of AI use across five independent age groups. This test is appropriate when assessing whether the means of more than two groups differ. The analysis revealed a statistically significant effect of age on AI use ($F = 3.72$, $p = 0.0054$), indicating that the extent of AI adoption varies by age category. The mean levels of AI use by age category are presented in Table 2, which shows that younger teachers reported higher adoption than older cohorts.

**Table 2**. Mean AI use by age group

| Age group | Mean | Standard deviation | Sample size |
|---|---|---|---|
| 20–29 | 2.16 | 1.09 | 96 |
| 30–39 | 2.20 | 1.00 | 193 |
| 40–49 | 1.89 | 1.03 | 183 |
| 50–59 | 1.81 | 1.11 | 98 |
| 60–69 | 1.83 | 0.72 | 12 |

Note: compiled by authors

Comparison of group means showed that AI use was highest among teachers aged 20–29 (M = 2.16) and 30–39 (M = 2.20). In contrast, teachers aged 40–49 (M = 1.89) and 50–59 (M = 1.81) reported lower levels of use, while the oldest group, aged 60–69, reported a comparable level (M = 1.83). These findings suggest that younger teachers are more active in adopting AI and digital technologies, whereas older age groups demonstrate relatively lower levels of engagement.

For hypothesis 2, which posited that teachers' professional qualification level would be associated with differences in AI use. A Kruskal–Wallis test was conducted to examine the relationship between teachers' qualification level and AI use. This nonparametric test was chosen because more than two independent groups were compared, and the data were ordinal and not normally distributed. The analysis revealed no significant differences in AI use across qualification levels (H = 2.38, p = 0.795), indicating that AI use was similar across levels.

Across all qualification categories, the average level of AI use was approximately 2.0, with consistent medians of 2.0. The only exception was the master teacher group, which reported a higher mean (M = 2.67, median = 3.0). However, this subgroup was very small (n = 3), and no reliable conclusions can be drawn from this finding. Overall, these results suggest that teachers' qualification level does not influence their engagement with AI technologies, as use remains comparable across groups.

For hypothesis 3, which posited that teachers who received formal ICT preparation during initial teacher education will report higher AI use than those without such preparation, a Mann–Whitney test was conducted to assess differences in AI use between teachers who reported having ICT training in their university program and those who did not. This nonparametric test was selected because it compares two independent groups using ordinal data without assuming normality. The analysis revealed a statistically significant difference in AI use between the two groups (U = 48,209.5, p = 0.0015).

Teachers who received ICT training during their university studies reported higher levels of AI use (M = 2.17) compared to those without such training (M = 1.89). Although the median was identical in both groups (2.0), the difference in means and the overall distributions indicate greater engagement with AI among teachers with ICT in their academic preparation (see Table 3).

**Table 3**. Mean and median "AI use" by inclusion of ICT in university training

| Group | Mean [Median] | Standard deviation | Sample size |
|---|---|---|---|
| Not included in university program (0) | 1.89 [2.0] | 1.03 | 314 |
| Included in university program (1) | 2.17 [2.0] | 1.06 | 268 |

Note: compiled by authors

These results suggest that the inclusion of ICT training in university programs is positively associated with the adoption of AI in professional practice.

For hypothesis 4, which argued that higher initial confidence in using ICT will predict higher levels of AI use, Spearman's rank-order correlation was conducted, revealing a weak but statistically significant positive relationship between initial ICT confidence and current AI use ($\rho = 0.172$, $p < 0.001$). This suggests that teachers who entered the profession with higher ICT confidence are somewhat more likely to engage with AI in their practice. However, the small effect size indicates that ICT confidence is only one contributing factor, not a decisive predictor of AI adoption. Teachers reported relatively high confidence in using ICT when they began working at their current school (M = 4.10, median = 4.0). In contrast, their current level of AI use was considerably lower (M = 2.01, median = 2.0), reflecting only moderate integration of AI into teaching practice.

For hypothesis 5, which argued that greater perceived availability of instructional materials will be positively associated with teachers' AI use, Spearman's correlation analysis revealed a weak but statistically significant positive association between perceived availability of materials and AI use ($\rho = 0.102$, $p = 0.014$). This finding suggests that teachers in better-resourced schools tend to report slightly higher levels of AI use.

Teachers rated the statement "Necessary materials, such as textbooks, supplies, and photocopiers, are available to staff as needed" at an average of 3.06 (median = 3.0). This suggests that while resources are generally available, they are not consistently provided at an optimal level. The variability in responses (range 1–4) indicates differences across schools, with some teachers perceiving access as sufficient and others as limited. In comparison, AI use was rated lower, with a mean of 2.02 (median = 2.0), reflecting only moderate integration of such technologies into teaching practice.

Finally, for hypothesis 6, which posited that male and female teachers will differ in levels of AI use, a t-test comparison showed no significant difference in AI use between female ($M = 2.03$) and male ($M = 1.97$) teachers ($t = 0.493$, $p = 0.623$). These results align with previous findings, suggesting that gender is not a determining factor in the adoption of AI technologies.

## 5. DISCUSSION

This study investigated the determinants of teachers' adoption of AI in Kazakhstan, with a particular focus on demographic factors, professional qualifications, ICT training, and self-efficacy. Age emerged as a significant factor, with younger teachers more likely to use AI. This supports earlier evidence from cross-national samples that identified a negative relationship between age and AI competency (Naiseh et al., 2025). By contrast, qualification level did not significantly influence AI adoption. ICT training during initial teacher education was found to be a positive predictor of AI adoption. This finding resonates with studies emphasising professional development and training as pivotal in bridging the gap between readiness and actual classroom practice (Collie et al., 2024; Ayanwale et al., 2024; Molefi et al., 2024). Similarly, higher self-reported ICT confidence modestly predicted AI use, aligning with evidence that self-efficacy underpins willingness to engage with emerging technologies (Liu, 2025; Granström & Oppi, 2025).

Resource availability also showed a weak but significant association with AI use, consistent with prior findings that facilitating conditions, such as infrastructure and access to materials, mediate the translation of positive attitudes into practice (Molefi et al., 2024; Adigun et al., 2025). However, gender, subject specialisation, school location, and language of instruction did not yield significant differences, suggesting that these factors may be less influential in the Kazakhstani context than in other regions.

The results reinforce previous findings that technological readiness plays a strong role, impacting perceived usefulness and preparedness to adopt AI (Ofem et al., 2025). Practically, the evidence underscores the value of embedding ICT training into teacher education curricula and induction programs as a foundation for future AI adoption. Future research in the Kazakhstan context should also examine the role of AI-related professional development in AI use. The study is limited by its cross-sectional design and reliance on self-reported measures, which constrain causal inference.

*Practical implications*

The results of this study carry several important implications for teacher education policy, school-level implementation, and national digital transformation strategies. Because younger teachers demonstrated higher levels of AI use, policymakers should prioritise scalable professional learning pathways that specifically support mid- and late-career teachers. Targeted capacity-building, such as modular short courses, mentorship from

digitally fluent peers, and school-embedded coaching, may help reduce generational gaps in adoption and prevent fragmentation in pedagogical innovation.

The positive association between prior ICT training and subsequent AI use indicates that foundational digital competencies act as an enabling condition for more advanced technologies. Teacher preparation institutions should therefore integrate AI-related competencies into existing ICT courses, focusing on pedagogical applications rather than general digital literacy. Accreditation bodies may consider requiring demonstrated capability in AI-assisted planning, feedback, and assessment practices. Continuous professional development should extend these competencies throughout the career lifecycle to sustain adoption.

Although qualification levels were not linked to AI use, resource availability showed a small but significant effect, suggesting that infrastructure remains a prerequisite for consistent integration. Policymakers should ensure equitable access to devices, connectivity, and school-approved AI platforms across regions. Investments should emphasise not only hardware but also technical support and time allowances for experimentation, as teachers rarely adopt tools that increase workload.

Schools should also develop clear guidelines addressing ethical use, student data protection, academic integrity, and transparency in AI-supported teaching. Such policies can reduce uncertainty and facilitate responsible engagement. Highlighting subject-specific exemplars and facilitating collaborative planning communities can further translate interest into routine practice.

## 6. CONCLUSION

This study contributes to the growing body of research on AI adoption in education by providing large-scale empirical evidence from Kazakhstan. The findings demonstrate that while AI is increasingly present in teachers' professional practice, its integration remains selective rather than routine. Younger teachers were more likely to adopt AI, whereas qualification level did not. More importantly, formal ICT training during initial teacher education and higher levels of technology self-efficacy emerged as positive predictors of AI use, underscoring the importance of foundational preparation that equips educators with the skills and confidence to integrate emerging technologies into their classrooms. The results also indicate that resource availability has a modest influence on AI uptake. However, other demographic and contextual factors, such as gender, subject specialisation, school location, and language of instruction, did not show significant effects.

These outcomes reinforce the centrality of ICT preparation and induction/professional development as critical levers for effective AI integration. Embedding structured ICT training in teacher education curricula, alongside sustained opportunities for AI-focused professional development, may help bridge the gap between willingness to adopt and actual classroom practice. The findings also suggest that strengthening institutional support systems and ensuring adequate resources can further facilitate adoption. Additionally, the development of digital competencies among teachers helps increase the productivity of the educational system, create prerequisites for the introduction of adaptive and personalised learning technologies, and train specialists capable of working in the knowledge economy.

From a theoretical perspective, the study confirms the relevance of the TAM and UTAUT models in the context of emerging market countries, demonstrating that individual and institutional factors mutually enhance the process of technological adoption. The practical significance lies in the fact that the data obtained can be used to develop national education digitalisation programs, improve teachers' digital literacy, and create targeted courses on the use of AI in the educational process.

In the future, it is promising to expand the research methodology by including longitudinal data, assessing the impact of AI on

learning outcomes, and comparing these findings with those from other Central Asian countries. This will enable the identification of institutional differences, the assessment of the dynamics of digital inequality, and the establishment of an empirical basis for integrating AI into the education system at the level of public policy.

## AUTHOR CONTRIBUTION

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# Ecotourism Business and Marketing Strategies: Insights from Kazakhstan and Global Leaders

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**ABSTRACT**

Kazakhstan's ecotourism marketing is currently fragmented and weakly aligned with sustainability governance (e.g., no national eco certification), unlike leading destinations that integrate environmental values into their branding and communications. This study benchmarks Kazakhstan against four international ecotourism leaders to identify strategic gaps and adaptation opportunities. The methodology is based on comparative and systematic approaches, including the development of a composite index of marketing-resistant architecture (CMSI), analysis of the PESO model (Paid, Earned, Shared, Owned), and panel regression based on 2019-2024 data. International best-practice destinations embed sustainability certification into national brands and maintain an Owned/Shared-media–heavy outreach, whereas Kazakhstan relies mainly on advertising, with limited data transparency or visitorflow management. As a result, Kazakhstan's composite marketing sustainability score is barely 0.32 (on a 0-1 scale), about half that of peers, correlating with weaker visitation outcomes. Regression analysis showed that an increase in CMSI by 1 point is associated with an increase in attendance by +12.4 p.p. and the introduction of internationally recognized certification by +3.2 p.p. The results confirm the importance of integrating a certification system, a balanced PESO media mix, and open data to enhance ecotourism's competitiveness. Future research is advisable to model stress indices for parks through 2030 and assess the impact of the transition to owned or shared dominant communication channels on demand sustainability and ecosystem conservation.

**KEYWORDS:** Ecotourism, Tourism Economics, Green Economy, Marketing, Business Model, Sustainable Development, Branding, PESO Model, Kazakhstan

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## 1. INTRODUCTION

Modern global tourism is characterised by the active development of sustainable and environmentally oriented types of travel. In the tourism industry, the trend toward sustainability has become a key global growth driver, as intensifying environmental problems, climate change, and the depletion of natural resources directly affect the nature of the tourism product. According to UNWTO, international tourist trips reached 1.4 billion in 2024, about 99% of the pre-COVID level (UNWTO, 2024). These figures demonstrate a substantial recovery in demand but also clearly illustrate growing competition in the ecotourism segment, where tourists are sensitive to product quality and sustainability attributes. Consequently, in the international market, ecotourism is considered not just a niche field of activity, but a socio-economic phenomenon of strategic importance.

Kazakhstan, with its unique natural heritage, regards ecotourism as a significant development area. In 2024, more than 2.8 million people visited the country's protected natural areas, which is 18% more than in 2023 (Bureau of National Statistics, 2024). These data confirm the increased interest of the population in environmentally friendly, nature-based recreation. The growth of domestic demand demonstrates the potential for ecotourism to develop as an economically promising and environmentally significant industry. However, at present, the marketing promotion of ecotourism in Kazakhstan is fragmentary: although the national tourism brand (Kazakhstan.travel) is being actively deployed internationally, a unified national «green» certification system has not yet been formed, and use of the full PESO communications mix remains limited. This situation risks reducing the competitiveness of the tourism industry and could lead to a widening gap in experience compared to foreign markets.

International experience shows that marketing plays a key role in increasing the competitiveness of ecotourism destinations. For example, Slovenia's «Slovenia Green» program became a core component of the national brand, allowing the country to promote regions certified for sustainable tourism. New Zealand's "100% Pure" strategy combined pristine nature with national identity, embedding the Qualmark sustainability certification into the country's tourist image. Costa Rica supports ecotourism through public policy, directing a significant share of tourism income to environmental protection and running the long-standing CST certification program. Norway, for its part, treats preservation of natural landscapes as a top priority through balanced communication strategies under its Sustainable Destinations program. These examples prove that integrating environmental values into national brands and using comprehensive marketing mechanisms can not only increase tourist flows but also reduce negative impacts on ecosystems.

It is clearly important for Kazakhstan to learn from such experiences. First, for the sustainable development of ecotourism at the national level, a single communication platform is needed that aligns promotion with stewardship. Second, within the PESO model, the challenge is to achieve a balanced use of diverse media tools (Paid, Earned, Shared, and Owned) rather than over-reliance on advertising. Third, to ensure the competitiveness of the ecotourism product, it is necessary to introduce a national "green certification" system that meets international standards. These steps would make ecotourism a truly sustainable segment in the global market.

Thus, the relevance of the study lies in the need for a critical analysis and comparison of international and Kazakhstani experience in ecotourism marketing. Evaluating the effectiveness of marketing strategies in ecotourism contributes to diversifying the country's tourism industry, promoting the socio-economic development of regions, and conserving nature. Defining strategic priorities for Kazakhstan is relevant not only economically but also in terms of environmental security and national image.

The purpose of the study is to conduct a comparative analysis of ecotourism marketing strategies in Kazakhstan and selected foreign countries, identify effective practices, and justify ways to adapt them to national conditions. To achieve this goal, the following research objectives were defined:

(1) Examine international models of ecotourism marketing promotion, with emphasis on how sustainability certification and branding are integrated;

(2) Compare the PESO model tools (paid, earned, shared, owned media) used in different countries for ecotourism promotion;

(3) Analyse the current state and prospects of ecotourism marketing in Kazakhstan, diagnosing key gaps;

(4) Develop proposals for creating a national system for promoting ecotourism, taking into account international experience and the identified gaps.

## 2. LITERATURE REVIEW

*Sustainable Tourism and Certification Standards*

Modern research on sustainable tourism and ecotourism demonstrates a transition from purely descriptive approaches to a systematic analysis of the interactions among marketing, visitor flow management, and ecosystem protection (Stein et al., 2021; Kilipiri et al., 2023; Veiga et al., 2024). Recent global data underline this trend: international tourist arrivals in 2024 reached 99% of the 2019 level, indicating an almost complete recovery of global mobility (UNWTO, 2024). The ecotourism segment remains among the fastest-growing; WTTC estimates an annual compound growth of 7–8% in nature-based tourism demand (WTTC, 2024). Demand-side surveys also show a structural shift in traveller preferences: more than 70% of travellers report a preference for destinations that demonstrate clear environmental responsibility (Booking.com, 2024).

The classic works of Butler, Weaver, and Hall-Gossling-Scott emphasised that sustainability in tourism can scale only when underpinned by institutional standards and transparent data regimes (Butler, 2019; Weaver, 2020; Hall et al., 2021). Since the 2010s, the Global Sustainable Tourism Council (hereinafter – GSTC) has provided universal criteria for destinations and businesses across four domains –management, socio-economic benefits, cultural heritage, and environmental performance – creating a common measurement language (GSTC, 2023). In recent years, more than 40 national certification programs have been recognised by GSTC, including Slovenia Green, Qualmark Sustainable Tourism (New Zealand), CST (Costa Rica), and Sustainable Destinations (Norway). These programs illustrate how global standards can be localised into national schemes. OECD evidence indicates that countries integrating sustainability standards into their national branding realise 25-30% higher trust among visitors and investors (OECD, 2020). In practice, data openness (e.g. public dashboards, registries) and certification "badge" help convert sustainability performance into a recognisable market signal, aligning governance with promotion (Trunina et al., 2020; Can et al., 2023).

In parallel with certification, destinations are increasingly structuring promotion via the PESO media architecture (Paid-Earned-Shared-Owned). The PESO framework, coined by Dietrich (2014), emphasises that balanced coverage across these channels supports both brand equity and visitor load management. Empirical findings suggest that when owned and shared media contribute over 50% of the content mix, trust and repeat visitation outcomes surpass those of paid-heavy strategies (WTTC, 2024). In other words, authenticity and engagement – often driven by owned (official content, data sharing) and shared (social/community content) media – tend to anchor sustainable demand. In contrast, excessively paid advertising can yield only short-term gains.

*International Integration of Branding and Sustainability*

Several leading ecotourism destinations illustrate the integration of certification,

branding, and PESO-based marketing. Slovenia pioneered country-level green branding through the Slovenia Green system. Certified regions and businesses in Slovenia display a "green" badge and publish sustainability data on interactive maps – essentially turning branding into a governance instrument for spatially redistributing demand (OECD, 2020). In New Zealand, the Qualmark sustainable tourism certification is embedded within the national 100% Pure New Zealand brand, serving simultaneously as a mark of quality, an environmental compliance mechanism, and a marketing vehicle. Over 2,400 New Zealand businesses have attained Qualmark sustainable status, with reported visitor satisfaction around 93%, and digital tools are used to ease pressure on iconic routes (Tourism New Zealand, 2022). Costa Rica's CST program (operating since 1997 and GSTC-recognised) demonstrates long-run market returns: a large majority of certified tourism businesses report customer growth following certification (Instituto Costarricense de Turismo, 2023). Norway's sustainable destinations program combines certification with capacity management and dynamic promotion: for example, when a site becomes overloaded, tourism boards temporarily pause advertising and instead steer demand toward alternative destinations (Innovation Norway, 2023).

*Ecotourism Marketing in Kazakhstan: Current Gaps*

Interest in ecotourism is also growing rapidly in Kazakhstan. Attendance at the nation's specially protected natural areas exceeded 2.8 million in 2024 (+18% year-on-year), with peak flows in popular parks like Ile-Alatau, Kolsai Kol, Burabai, and Altyn-Emel (Bureau of National Statistics, 2024). However, sectoral analyses reveal that the marketing layer in Kazakhstan remains weakly connected to protected-area governance. A unified national sustainability certification scheme (a recognisable "green trust mark") is still absent, and public registries of certified eco-facilities or route-level load dashboards are only nascent (Bureau of National Statistics, 2023). An audit of Kazakhstan travel communications indicates a dominance of Paid placements and limited data-driven owned content, with under-leveraged Shared channels, this despite rapidly growing organic community activity on social media, e.g., hashtags like #ilealatau or #ecotourismkz suggesting public interest (Kazakhstan.travel, 2024). Kazakhstani academic assessments echo this diagnosis: without institutionalised sustainability mechanisms (norms, certification, data transparency), marketing effects tend to remain short-lived and superficial). Empirical studies on visitor management confirm that transparent regulation of visitor flows, such as timed-entry or quota-based systems, increases both visitor satisfaction and support for conservation measures (Miller et al., 2023).

International evidence consistently shows that effective ecotourism promotion arises from a triad: (1) a recognised certification ensuring measurable sustainability, (2) integration of that certification into the destination's branding, and (3) a balanced PESO communication system that privileges Owned/Shared credibility while coordinating tactical Paid bursts.

Against this benchmark, Kazakhstan exhibits a structural decoupling of marketing from governance – characterised by fragmented certification, low data transparency, and pay-centric messaging. Accordingly, the research gap addressed by this article is the lack of an integrated, comparative assessment that explicitly connects branding and PESO-based communication architectures with the adoption of sustainability certification and operational visitor-flow management in Kazakhstan vis-à-vis advanced international reference cases.

## 3. RESEARCH METHODS

The study adopts an integrated methodological approach combining comparative, systemic, and analytical procedures. A comparative research design was

used to identify similarities and differences between the international reference cases (Slovenia, New Zealand, Costa Rica, Norway) and Kazakhstan, examining both individual promotion tools and unified models of ecotourism brand formation. The systemic approach rests on analysing the interaction of economic, environmental, and social factors: ecotourism evolves at the intersection of state regulation, business incentives, local community participation, and visitor behaviour. Therefore, institutional settings, natural-geographical specificities, infrastructure development, and community engagement were considered in tandem. Triangulation was applied by drawing on multiple data sources – statistical series, policy documents, and peer-reviewed scholarship – to enhance robustness and replicability over the 2019–2024 period (which captures the post-pandemic recovery phase and the shift toward sustainability-oriented policies). To move beyond simple descriptive contrasts, key constructs were operationalised into measurable indicators and a composite index, enabling analytical cross-country comparisons.

Four countries were selected for international comparison: Slovenia, New Zealand, Costa Rica and Norway - based on a set of objective criteria:

(1) availability of a national sustainable tourism certification system;

(2) integration of sustainability principles and certification standards into the state system of tourism branding and marketing;

(3) availability of managed natural areas (national parks, nature reserves) comparable to Kazakhstan in terms of tourist flow (1-4 million visits per year);

(4) availability of official statistical series and open data to ensure reproducibility of the analysis.

These countries represent different geographical regions, but they are united by the fact that ecotourism is part of a national economic strategy and is based on certified sustainability standards.

Table 1 summarises the comparative scoring rubric (0–3 scale) and the observable evidence used to ensure reproducible assessments across countries.

**Table 1.** Comparative rubric (0–3) and evidence mapping for marketing–sustainability architectures

| Dimension | Score 0 (Absent) | Score 1 (Partial/Pilot) | Score 2 (Developed) | Score 3 (Integrated Nationally) | Evidence Anchors / Examples |
|---|---|---|---|---|---|
| Brand-Certification Integration (BCI) | No national sustainability scheme; branding unrelated to certification | Pilot or fragmented certification; ad-hoc brand mentions | Recognised scheme present; partial brand co-use guidelines | GSTC-recognised scheme with formal co-branding rules across NTO/DMOs | GSTC recognition page; national co-branding manual; consistent badge usage on official assets |
| PESO Balance (PESO_B) | Paid-dominant; minimal Owned/Shared presence | Owned or Shared initiatives sporadic; limited link to data | Owned+Shared frequent; partial alignment with brand strategy | Owned+Shared majority; analytics and editorial calendars in place | Content share audits; social/dashboard archives; NTO media kits |
| Visitor-Flow & Capacity Management (VFCM) | No link between promotion and capacity; no | Occasional advisories; limited seasonal coordination | Defined thresholds and route management for select sites | Systematic quotas/reservations; dynamic diversion; promo pauses at overload | Policy docs; reservation portals; logs of paused |

| | | | | | |
|---|---|---|---|---|---|
| | quotas/diversion | | | | campaigns/diversions |
| Data Transparency & Reporting (DTR) | No public registry; no periodic reporting; no open data | Basic lists; irregular reporting; PDFs only | Public registry with indicators; periodic reports | Open registry with API/CSV; audited indicators and dashboards | Open-data portal; sustainability dashboard; audit notes/metadata |
| *The rubric was compiled by the authors based on best-practice criteria and publicly verifiable evidence. Two independent coders rated each country on the above dimensions using data from 2019 to 2024. Inter-rater agreement was substantial (Cohen's $\kappa \approx 0.76$); disagreements were resolved by a third reviewer. | | | | | |

Note: compiled by the authors

Each of the four dimensions was evaluated annually from 2019–2024 and normalised to the [0, 1] interval using the min-max transformation with 5-95% winsorization to limit the influence of outliers. In parallel with the qualitative 0-3 scoring, a composite Comparative Marketing–Sustainability Index (hereinafter – CMSI) was computed as the equally weighted mean of the four normalised dimension scores. Sensitivity tests using alternative weighting schemes (e.g., 0.4/0.2/0.2/0.2 and 0.2/0.4/0.2/0.2) confirmed that the relative country rankings remained qualitatively stable.

The PESO balance metric (PESO_B) was defined as the share of Owned + Shared content within the total communication mix (Owned + Shared + Paid + Earned), measured through a structured content analysis of official portals, verified social media feeds, and media databases, using consistent weekly sampling windows.

The Visitor-Flow and Capacity Management (hereinafter – VFCM) m captures the existence of formal mechanisms linking promotional activity to ecological carrying capacity such as reservation systems, temporal visitor caps, or demand-diversion protocols, whereas DTR (Data Transparency and Reporting) measures the availability of public registries of certified operators and sites, open data sets, and regular sustainability-performance reporting (Zou et al. 2024). To examine whether marketing architecture is associated with tourism-demand outcomes (rather than being merely correlated with overall promotional intensity), a panel OLS regression was estimated for the annual growth rate of visits to protected areas, controlling for country- and year-specific effects using fixed effects.

The model (covering 5 countries × 6 years = 30 observations) is specified by formula (1):

$$g_{it} = \beta_1 \mathrm{CMSI}_{it} + \beta_2 \mathrm{PESO\_B}_{it} + \beta_3 \mathrm{Certification}_{it} + \mathrm{X}_{it} + \alpha_i + \tau_t + \varepsilon_{it} \qquad (1)$$

where:

$g$ – the annual growth rate (%) of visits to protected areas in country $i$ and year $t$;

$X_{it}$ – control variables (GDP per capita in PPP, total population, and a post-COVID dummy for years;

$\alpha_i$ and $\tau_t$ – country and year fixed effects;

$\varepsilon_{it}$ – random remainder reflecting the influence of unaccounted-for factors.

Given the limited sample and potential endogeneity, we interpret coefficients as associations rather than causal effects. Robustness was assessed using alternative CMSI weightings and leave-one-out tests (re-estimating the model while dropping each country in turn). For objectivity and reproducibility, our data sources are as follows.

The empirical base includes datasets from the UNWTO (World Tourism Barometer and related databases), WTTC (Travel & Tourism Economic Impact reports), the Bureau of National Statistics (visitor numbers to protected natural areas), and official documents such as the Concept for the Development of the tourism industry of the Republic of Kazakhstan 2023-2029, together with strategic materials from the Ministry of Tourism and Sports. Aggregated UNWTO and WTTC data were cross-verified against national statistics, and discrepancies exceeding three percentage points were reconciled through a documented averaging procedure.

The empirical base includes UNWTO (World Tourism Barometer and related datasets), WTTC (Travel & Tourism Economic Impact reports), Kazakhstan's Bureau of National Statistics (visitor numbers to protected areas), and official documents such as the Concept for the development of the tourism industry of the Republic of Kazakhstan 2023–2029 alongside strategic materials from the Ministry of Tourism and Sports. UNWTO/WTTC aggregates were cross-verified against national statistics; discrepancies of more than three percentage points were reconciled using documented averaging rules.

The scenario-based components of the analysis were applied at the park level using a stress-index approach. A simple stress index was defined by formula (2):

$$S = \frac{V}{C} \qquad (2)$$

where:

$V$ – the number of visitors;

$C$ – the estimated ecological carrying capacity of a given park.

Two trajectories were simulated through 2030: a business-as-usual scenario, assuming that domestic ecotourism visitation continues to grow at approximately 10% annually with no new control measures; an improved-architecture scenario, under which C is effectively increased through the introduction of quotas and diversion mechanisms, and the communication mix shifts toward Owned and Shared channels supported by open-data alerts.

The years in which the stress S index exceeded critical thresholds (e.g., $S > 1$, indicating visitation beyond sustainable capacity) were recorded and compared across parks. Baseline capacity values (C) for major national parks were obtained from the Ministry of Ecology (2024).

## 4. RESULTS

This section presents analytical evidence rather than descriptive case summaries. It reports the normalised indicator values, the composite CMSI results, the econometric associations with visitor demand, and the park-level scenario outcomes. The analysis follows the operational definitions established in the Methods section and covers 2019-2024 period for all benchmark countries.

National Park Visitation Dynamics in Kazakhstan: Kazakhstan's national park visitation rose from 1,250 thousand visits in 2019 to 2,800 thousand in 2024, confirming a strong domestic appetite for nature-based travel. Year-over-year growth rates were –32.0% (2020), +64.7% (2021), +39.3% (2022), +20.5% (2023), and +19.1% (2024), implying a compound annual growth rate (CAGR) of roughly 17.5% over the post-pandemic recovery period. While this baseline indicates robust demand, it also highlights the need for governance instruments that keep pace with growth. Notably, growth has been uneven across national parks. Some destinations, such as Ile-Alatau and Altyn-Emel, have shown particularly strong increases in visitation, while others (Sharyn Canyon and Kolsai Lakes) have seen more moderate growth.

This disparity suggests that certain parks are experiencing higher visitor pressure and are therefore approaching or exceeding their ecological carrying capacities, emphasising the need for differentiated capacity management strategies. This heterogeneity suggests that some parks are under much greater pressure

than others, underscoring emerging capacity management needs.

The quantitative trends in Figure 1 validate the study's premise.

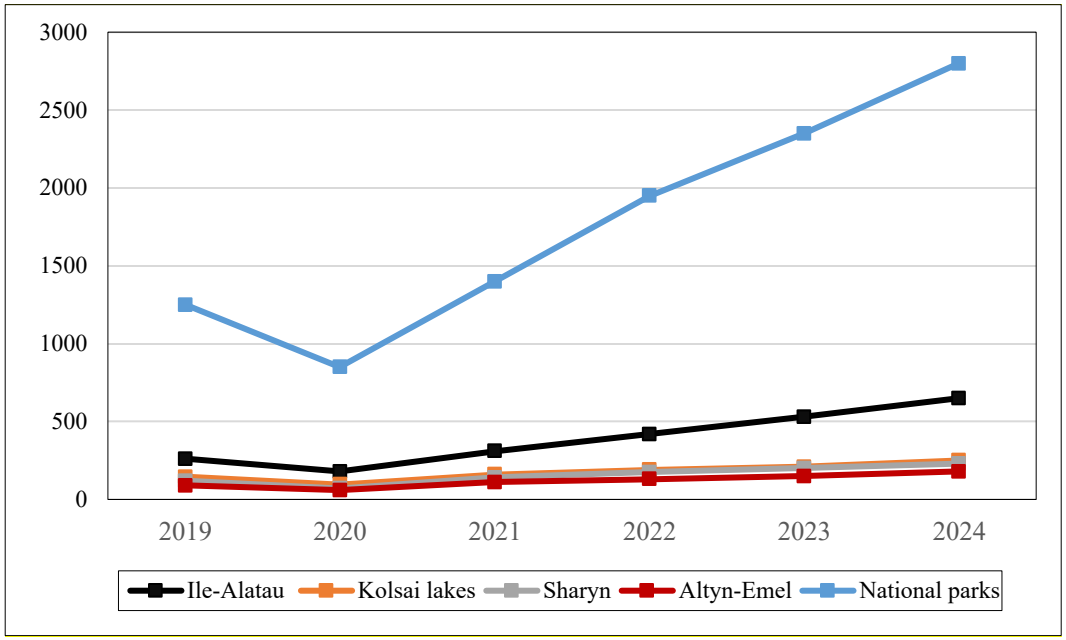


**Figure 1.** Dynamics of visits to selected national parks of Kazakhstan for 2019-2024, thousand people

Between 2019 and 2024, total visits to national parks almost doubled (+124%), whereas the number of officially promoted eco-routes or major attractions increased by only about 15% (Bureau of National Statistics, 2024). This imbalance confirms that demand is growing much faster than institutional capacity (in terms of infrastructure and management tools) can currently accommodate. The pattern also mirrors global post-pandemic trends: nature-based tourism segments have expanded at rates about 1.7 times higher than traditional mass leisure tourism (UNWTO, 2024). In other words, Kazakhstan's demand momentum is strong but «management-light»: visitation is rising faster than the build-out of sustainability measures such as certification programs, open data registries, and dynamic visitor flow controls.

Using four analytical dimensions Brand–Certification Integration (BCI), PESO Balance (PESO_B), Visitor-Flow and Capacity Management (VFCM), and Data Transparency and Reporting (DTR) combined into an equally weighted composite index (CMSI), Kazakhstan was evaluated against the benchmark destinations. The results show that Slovenia and New Zealand perform best, followed by Norway and Costa Rica, while Kazakhstan demonstrates the lowest level of marketing–sustainability integration.

Table 2 presents the normalised values for each dimension and the composite CMSI, averaged over the 2019–2024 period and reported separately for 2024 by country.

The CMSI patterns suggest that verifiable sustainability and open data are key conditions for effective communications, rather than being separate tracks. The results indicate that Slovenia and New Zealand achieve the highest levels of marketing–sustainability integration. In contrast, Kazakhstan has the lowest composite score (CMSI ≈ 0.3), primarily due to weak brand–certification integration and limited public disclosure of data. Closing even half of that gap (≈0.25 increase in CMSI) would, *ceteris paribus*, yield meaningful gains in tourism outcomes, as explored below. These results confirm that higher CMSI values are associated with greater institutional maturity

**Table 2.** Normalized indicators and CMSI by country (2019–2024 mean and 2024 value)

| Country | BCI (Mean) | PESO_B (Mean) | VFCM (Mean) | DTR (Mean) | CMSI (Mean) | BCI (2024) | PESO_B (2024) | VFCM (2024) | DTR (2024) | CMSI (2024) |
|---|---|---|---|---|---|---|---|---|---|---|
| Slovenia | 0.95 | 0.68 | 0.75 | 0.85 | 0.81 | 0.98 | 0.70 | 0.80 | 0.90 | 0.84 |
| New Zealand | 0.93 | 0.66 | 0.78 | 0.82 | 0.80 | 0.96 | 0.68 | 0.80 | 0.85 | 0.82 |
| Costa Rica | 0.85 | 0.56 | 0.60 | 0.62 | 0.66 | 0.88 | 0.58 | 0.62 | 0.65 | 0.68 |
| Norway | 0.88 | 0.58 | 0.80 | 0.75 | 0.75 | 0.90 | 0.60 | 0.82 | 0.78 | 0.77 |
| Kazakhstan | 0.25 | 0.35 | 0.22 | 0.30 | 0.28 | 0.30 | 0.38 | 0.25 | 0.33 | 0.32 |

*Indicators normalized to [0,1] (higher = better performance). CMSI = equally weighted mean of BCI, PESO_B, VFCM, DTR.

Note: compiled by the authors

and better alignment between sustainability governance and marketing practices. The significant performance gap between Kazakhstan and the top performers underscores the need for a formal green certification scheme and enhanced data transparency mechanisms

High-scoring cases maintain an Owned/Shared-majority communication mix, which anchors authenticity through transparent initiatives (e.g., public sustainability dashboards, interactive maps, community engagement) and supports broad earned media visibility. Paid media in these cases is used tactically and seasonally, not as the main driver. By contrast, Kazakhstan's current PESO composition is skewed toward paid (PESO_B ≈ 0.35). Owned channels (e.g., data-driven storytelling on official websites or apps) and shared channels (structured community or influencer programs) are under-leveraged. At the same time, earned media coverage is sporadic rather than sustained. This composition likely contributes to the weaker translation of domestic interest into sustained trust and repeat visitation for Kazakhstan.

The panel OLS analysis with country- and year-fixed effects provides further insight. Table 3 summarises the estimated associations between marketing–sustainability variables and annual growth in protected-area visits.

**Table 3.** OLS estimates of annual growth in protected-area visits

| Variable | Coefficient | Std. Error | t-stat | p-value | 95% CI (low) | 95% CI (high) |
|---|---|---|---|---|---|---|
| CMSI | 12.4 | 4.8 | 2.58 | 0.017 | 2.3 | 22.5 |
| PESO_B | 6.1 | 3.2 | 1.90 | 0.069 | −0.5 | 12.7 |
| Certification (GSTC-recognised) | 3.2 | 1.6 | 2.00 | 0.056 | −0.08 | 6.48 |
| GDP per capita (PPP) | 0.001 | 0.0006 | 1.67 | 0.104 | −0.0002 | 0.0022 |
| Population | 0.00002 | 0.00003 | 0.67 | 0.508 | −0.00004 | 0.00008 |
| Post-COVID dummy | 20.3 | 5.9 | 3.44 | 0.002 | 8.0 | 32.7 |
| Constant | −5.7 | 6.8 | −0.84 | 0.408 | −19.9 | 8.5 |

*Model statistics: N = 30 (5 countries × 6 years)
**Fixed effects: country & year; SE clustered by country; R-squared ≈ 0.52.

Note: compiled by the authors

Despite the small sample, the associations are intuitive and significant at the 5-10% level for the key variables. CMSI and the presence of a GSTC-recognised certification show positive relationships with visitation growth ($p \sim 0.02$ and 0.06, respectively). The PESO_B coefficient is positive as well, and although its p-value (~0.07) is slightly above 0.05, it suggests a meaningful trend: destinations with more balanced (Owned/Shared-heavy) media mixes tend to experience higher growth. These relationships are consistent with marketing theory (e.g., signalling theory and the PESO model logic): credible sustainability signals and data-anchored Owned/Shared content appear to strengthen marketing effectiveness in terms of converting interest into visits.

It bears emphasising that these coefficients are treated as associative. We performed robustness checks: using alternative weights for the CMSI and dropping each country one at a time, the signs and relative magnitudes of CMSI, PESO_B, and Certification remained stable (qualitative significance was preserved). The paper explored adding a one-year lag of CMSI (to see if prior marketing architecture predicts current growth), the lagged terms remained positive but were noisier, which is not surprising given the short panel. As a placebo test, we ran a similar regression using overall international tourist arrivals (where data available) instead of nature-based visits – the associations weakened or vanished, suggesting that the effects the paper observes are more potent for the ecotourism segment than for undifferentiated tourism demand.

Finally, park-level scenario analysis underscores the importance of proactive governance. Using stress index $S = V/C$, we find that under the BAU scenario (10% annual growth without new controls), popular parks like Kolsai Lakes and Sharyn would likely exceed sustainable capacity thresholds by 2030 ($S > 1$). In contrast, under an improved-architecture scenario (where marketing–sustainability architecture is enhanced – effectively a higher CMSI via introducing reservations/quotas, diversion rules, open-data nudges, and a shift to Owned/Shared content), the simulated visitor peaks stay below capacity and seasonal load curves flatten. Specifically, the CMSI-improving scenario reduced peak stress indices by ~15–25% relative to BAU in the high-pressure parks, by shifting a portion of demand temporally (off-peak) and spatially (to alternative sites), and by dampening excessive paid media pushes during periods of potential overload.

Across comparative benchmarks, regression results, and scenario outcomes, the evidence supports a single implication: the conjunction of brand–certification integration, a balanced PESO media mix, capacity-sensitive promotion, and open data transparency is associated with stronger, more sustainable tourism demand dynamics. Kazakhstan's expanding domestic interest in ecotourism is therefore a valuable asset, but it can be fully realised as a competitive advantage only if the institutional elements (a GSTC-aligned national certification scheme, co-branding rules, a public sustainability registry/API, and dynamic promotion controls) are formalised and consistently implemented via Owned/Shared channels. This directly addresses the research problem identified in the Introduction: the question is not merely whether marketing works, but under what institutional architecture it translates into durable, capacity-consistent growth.

## 5. CONCLUSIONS

Marketing in ecotourism is not only a means of attracting tourists, but also a mechanism for institutionalizing sustainable development principles. International experience shows that the most successful destinations build a unified promotion architecture in which branding, certification systems, and PESO-based communications work together as one coherent mechanism. This integrated bundle ensures the long-term reliability of the tourism product and allows management of tourist flows in line with environmental limits. Our results substantiate this proposition quantitatively: destinations that combine brand–certification integration, capacity-sensitive promotion, and open

data score higher on the composite CMSI and exhibit stronger, more stable growth in protected-area visitation.

These conclusions are derived from the integrated methodological framework applied in the study – namely, a comparative, systemic, and dialectical analysis supported by empirical data from UNWTO, WTTC, and the Bureau of National Statistics of Kazakhstan. The triangulation of quantitative and qualitative sources helps to verify hypotheses regarding the interdependence between institutional maturity and marketing effectiveness. In this regard, ecotourism marketing should be understood not as a purely creative or communicative activity, but as a systemic governance instrument embedded in sustainability policy. Moving beyond description, our panel analysis indicates that a one-point increase in CMSI (on the 0–1 scale) is associated with approximately +12.4 percentage points in annual growth of protected-area visits; implementing a GSTC-recognised national certification is associated with +3.2 p.p.; and increasing the PESO balance toward an Owned/Shared majority co-moves positively with demand (+6.1 p.p per 0.5 change, approximately). Although these are correlations, the robustness checks (alternative weights, jackknifing) give confidence that the directions of association are meaningful.

For Kazakhstan, the study reveals a dual reality. On one hand, domestic demand for nature tourism shows steady growth: national parks have recorded increasing visitor numbers each year, indicating the public's willingness to engage in ecotourism products. On the other hand, the lack of a national «Green» certification system, and the fragmentary use of Kazakhstan. Travel brand for sustainability, and the weak integration of PESO media models significantly reduces the effectiveness of marketing efforts, failing to balance economic benefits with conservation needs. The normalized comparison with peers explains Kazakhstan's lag through specific deficits: (i) low Brand – Certification Integration (no GSTC-aligned national scheme or co-branding rules), (ii) limited Data Transparency & Reporting (no public registry/API for eco-sites and sustainability indicators), (iii) a Paid-heavy communication mix (low PESO_B, indicating underuse of Owned/Shared channels), and (iv) incomplete Visitor-Flow & Capacity Management (few reservation or quota systems and minimal diversion protocols). Together, these gaps weaken the credibility of Kazakhstan's sustainability signalling, constrain organic visibility (earned media and word of mouth), and impede the redistribution of visitor loads during peak seasons.

The analysis also suggests that Kazakhstan's current institutional fragmentation – with separate agencies handling marketing, certification, and environmental management – hinders progress. Unlike Slovenia or New Zealand, where the state (through tourism boards or ministries) acts as a moderator integrating sustainability standards into marketing, Kazakhstan's system remains divided among multiple bodies. Bridging this institutional fragmentation should become a key governmental objective under the 2025–2029 national tourism development framework. Furthermore, the absence of standardized environmental data and unified communication metrics limits Kazakhstan's participation in global sustainable tourism rankings and programs (e.g., GSTC certification, Travelife, EarthCheck). The scenario evidence reinforces this governance imperative: under business-as-usual growth, stress on ecosystems will exceed sustainable thresholds in certain parks by 2030, whereas an improved marketing-governance architecture can keep usage within capacity and significantly reduce peak stresses.

Thus, the main priority for Kazakhstan is transitioning from piecemeal advertising initiatives to a comprehensive ecotourism marketing strategy. Practical steps include:

(1) Launch a national «Green Kazakhstan» certification scheme by 2026, aligned with GSTC criteria and accompanied by codified co-branding guidelines so that certified destinations and businesses can use a standard label alongside the national brand;

(2) Establish a public sustainability registry and open data portal (by 2027) for certified ecotourism operators and park indicators, with an API for developers – increasing transparency and enabling third-party apps or analyses of visitor impact;

(3) Rebalance the PESO communication mix toward ≥ 60% Owned + Shared content by 2028, by investing in content creation (e.g. storytelling, virtual park tours, community challenges) and strategic social media campaigns, with editorial calendars tied to seasonal capacity considerations;

(4) Institutionalize capacity-sensitive promotion mechanisms by 2026, including an online reservation system for popular parks, visitor quotas or timed-entry permits during peak periods, real-time monitoring of visitation vs. capacity, and protocols to temporarily pause paid promotions or redirect visitors when thresholds are reached.

Implementing these measures could lead to measurable socio-economic and environmental benefits. Modelling based on Kazakhstan's visitation dynamics suggests that introducing a national «Green Kazakhstan» certification (along with the associated branding and standards) could increase inbound and domestic eco-tourism visits by an estimated 20–25% within five years, while simultaneously reducing environmental pressure in overloaded areas by up to 15% through controlled distribution of tourist flows. Moreover, aligning the Kazakhstan.travel brand with internationally recognized sustainability standards will strengthen the country's visibility on the global stage, enabling participation in green destination networks and co-branding campaigns with partners abroad (Kazakhstan.travel, 2024). Back-of-the-envelope calculations from our regression imply that a realistic CMSI gain of +0.25 (achievable through the combination of a certification program, open data registry, and capacity rules) corresponds to roughly +3.1 percentage points in annual visitation growth. Similarly, a PESO_B improvement of +0.30 (shifting toward an Owned/Shared-majority content strategy) might add about +1.8 pp to annual growth. These effects would sustainably increase demand while mitigating negative impacts through built-in governance triggers.

Adopting a data-driven PESO model will also provide analytical transparency – enabling real-time monitoring of how marketing activities impact ecosystem load and visitor satisfaction. This would facilitate a shift from intuitive or reactive promotion to evidence-based destination management, ensuring that economic growth and ecological protection progress in parallel rather than in conflict. Operationally, such an approach requires unified dashboards that link marketing campaigns to park capacity status, standardized tagging (UTM codes) for campaign traceability, and regular public reporting of brand trust and repeat visit metrics alongside conservation indicators.

In summary, these measures will allow Kazakhstan to convert its growing domestic interest in ecotourism into a stable competitive advantage in the international ecotourism market. The implementation of the proposed model will contribute not only to economic development but also to the preservation of unique ecosystems, aligning with the country's strategic goals for sustainable tourism.

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# The Human Dimension of Urbanization and Economic Development in Kazakhstan: Demographic Trends

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## ABSTRACT

Cities are the main centres of economic growth and spatial development in Kazakhstan; therefore, studying their formation and dynamics is of particular relevance. The purpose of the study is to identify regional differences and patterns in urbanisation processes by analysing social, economic, and geographical factors that determine the dynamics of urban growth. The methodological framework includes comparative, statistical, and GIS analysis, as well as correlation and regression methods, aimed at studying the interrelationships among urbanisation levels, demographic changes, infrastructure development, and the quality of education. The empirical database is based on official data from the Bureau of National Statistics, the UNFPA, and the World Bank for 2014-2024. The results showed that the share of the urban population in Kazakhstan increased from 54% in 2014 to 60% in 2024, with the most significant increases observed in Almaty (+200 thousand) and Astana (+150 thousand). Large agglomerations concentrate economic activity and human capital, while small, single-industry cities face depopulation and a lack of infrastructure. A stable relationship has been established between the level of socio-economic development of the region and the quality of education: the integral indicators of educational achievement are 76-78% in Astana, 73-75% in Almaty and 68-70% in Shymkent. The practical significance of the results is determined by their applicability in shaping regional policies, spatial planning strategies, and sustainable urban development programs.

**KEYWORDS:** Urbanisation, Urban Economy, Human Capital, Demography, Economic Geography, Business Environment, Economic Growth

**SCSTI:** 06.61.53

**JEL Code:** I31, R11, R23

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## 1. INTRODUCTION

In the context of contemporary global development, cities have become the main pillars of economic and social progress. According to the United Nations (2023), more than 56% of the world's population currently resides in urban areas, and this figure is projected to reach nearly 70% by 2050. Urbanisation not only transforms settlement patterns but also drives innovation and technological advancement. Cities function as key catalysts of economic activity, investment flows, and scientific and technological development. They represent spatial concentrations of high-tech industries, education and culture, as well as financial and transportation networks (OECD, 2014). The study of urbanisation processes in emerging markets is of particular importance for the global discussion on balanced and sustainable urban development. Thus, Kazakhstan is an illustrative example of a country where rapid urbanisation coexists with spatial and social contrasts, making it a valuable model for comparative research.

At the same time, rapid urbanisation has generated complex challenges, including housing shortages, environmental degradation, and widening social inequality (World Bank, 2024). Therefore, contemporary urban development policies must be guided not only by the principles of economic growth but also by those of sustainable development, environmental security, and social inclusiveness.

For Kazakhstan, urbanisation is not merely a demographic phenomenon but a key factor shaping regional development, the concentration of human capital, and spatial organisation. Cities play a decisive role in accelerating national economic growth, disseminating innovation, and improving social infrastructure (Bureau of National Statistics, 2024). However, internal migration, particularly the steady movement from rural to urban areas, has led to demographic imbalances across regions, contributing to depopulation of rural territories and increased pressure on the housing market and urban social infrastructure. Despite the active development of cities and the implementation of government programs, spatial and socio-economic differences between large agglomerations and peripheral territories remain significant. The existing approaches to urban policy are mainly focused on infrastructure and investment, while the human dimension remains underdeveloped. This reinforces the need for a comprehensive analysis combining the economic, demographic and spatial factors of urban development.

These dynamics underscore the need for a deeper understanding of the spatial and demographic dimensions of urbanization. Such an approach is essential for formulating sustainable development strategies, optimising regional policy, and regulating migration. Moreover, evaluating urbanisation only through industrial and investment indicators is insufficient; modern urban research must also integrate human-centred factors such as quality of life, social mobility, cultural diversity, and demographic stability (Thisse, 2018; UN-Habitat, 2022).

Despite the growing body of research on urban growth, there remains a significant gap in the literature on the human dimension of urbanisation in Kazakhstan, particularly regarding spatial differentiation, migration dynamics, and quality-of-life disparities across cities. To address this gap, the present study analyses the spatial and demographic trends of urbanisation in Kazakhstan using quantitative, statistical, and Geographic Information System (hereinafter – GIS)- based approaches. The purpose of the study is to identify regional differences and patterns in urbanisation processes by analysing social, economic, and geographical factors that determine the dynamics of urban growth. Unlike most previous studies, this work uses a multidimensional approach that includes statistical, demographic, and spatial indicators, helping identify the typology and patterns of urbanisation differences across cities in Kazakhstan.

The remainder of this paper is structured as follows: Section 2 provides a review of the relevant literature; Section 3 presents the data sources and research methodology; Section 4 discusses the main results and findings; and Section 5 concludes with key implications and recommendations for policy and practice.

## 2. LITERATURE REVIEW

Urbanisation has evolved from a demographic trend into a complex and multidimensional process that fundamentally reshapes spatial structures, social systems, and economic models. According to UN-Habitat (2022), more than half of the global population now resides in urban areas, a proportion expected to reach 70% by 2050. Cities are increasingly seen not just as population centres but as engines of innovation and human capital development (Goodman, 2011; Thisse, 2018; Florida, 2019). The global literature interprets urbanisation as a catalyst of technological, institutional, and social transformation, underscoring that modern cities operate as knowledge networks where human creativity and innovation intersect (Adnan, 2016; Batty, 2018).

The theoretical basis for understanding these dynamics stems from classical models of economic geography and growth theory. Krugman (1991) and Fujita et al. (1999) explained how spatial concentration generates cumulative advantages, while Lucas (1988) and Romer (1990) demonstrated that knowledge and human capital accumulation drive endogenous growth. These concepts provided a foundation for subsequent work by Florida (2019), who introduced the creative class as a key component of competitive cities, and by Sassen (2001), who conceptualised global cities as strategic nodes of finance and information exchange. Together, these frameworks highlight that innovation, talent, and governance collectively determine the sustainability and competitiveness of urban systems.

In the twenty-first century, digitalisation and technological innovation have become defining features of urban development. Caragliu et al. (2011) identified smart cities as ecosystems where information and communication technologies enhance efficiency, participation, and environmental performance. Empirical studies demonstrated that digital infrastructure not only supports economic diversification but also promotes new governance models (Acemoglu & Restrepo, 2018; Batty, 2018). OECD (2014) findings confirm that cities investing in digital transformation experience higher productivity, while the World Bank (2020) reports that integrating digital strategies into spatial planning reduces inequality and strengthens resilience. However, technological progress also brings challenges: automation alters labour markets, and unequal access to digital tools reinforces existing disparities (Gao, 2023).

Environmental and social sustainability have simultaneously emerged as critical dimensions of urbanisation (Henderson, 2002; Gao, 2023; Bekturganova et al., 2025). The rapid urbanisation in many developing countries over the past half-century appears to have been accompanied by excessively high levels of urban population concentration in large cities (Henderson, 2002). Gao (2023) emphasised that sustainable cities balance economic, ecological, and social objectives, while Yan and Liu (2023) linked urban growth to transformations in social equity and structure. Bekturganova et al. (2025) provided empirical evidence that environmental governance, when combined with digital technologies, contributes to lower $CO_2$ emissions and improved quality of life. Global policy frameworks, including those of UN-Habitat (2022), stress that urban resilience requires an integrated approach in which technology, governance, and public participation are interdependent.

In developing and transition economies, including Kazakhstan, urbanisation takes on a dual character: it accelerates modernisation but often amplifies regional disparities. According to the Bureau of National Statistics (2024), nearly 60% of Kazakhstan's population lives in

cities, yet urbanisation remains concentrated in Almaty, Astana, and Shymkent. Scholars (Kabdesov, 2020; Bekbossinova & Niyazbekov, 2024) argue that this imbalance creates uneven infrastructure quality and migration pressure, contributing to socio-spatial inequality. Similar to patterns described by Turok and McGranahan (2019) in Africa and Asia, Kazakhstan's regional centres outside major agglomerations are developing more slowly due to limited innovation capacity and weak institutional frameworks.

Human capital and education emerge as decisive factors in overcoming these constraints. Endogenous growth theory (Lucas, 1988; Romer, 1990) and empirical research highlight that knowledge diffusion and innovation capacity underpin sustainable urban development (Kireyeva, 2025). In Kazakhstan, regions with advanced universities and research institutions, primarily Almaty and Astana, demonstrated higher productivity and diversification. However, as Muratova et al. (2023) and Kenzhegulova et al. (2023) noted, smaller cities often lack digital access and institutional support, limiting their ability to attract and retain talent.

Institutional quality plays a pivotal role in determining how effectively cities translate urbanisation into inclusive growth. Acemoglu and Robinson (2019) argued that inclusive institutions foster innovation and equitable resource distribution, whereas extractive systems reinforce the concentration of wealth and power. In Kazakhstan, local governance remains highly centralised, constraining municipal autonomy and innovation potential (Bolysbek et al., 2024). OECD (2022) recommendations emphasise the need for decentralisation and multi-level coordination to enhance efficiency and citizen participation. Such reforms are essential to shift urban management from administrative control toward evidence-based governance, transparency, and accountability.

The environmental dimension of Kazakhstan's urbanisation reflects both global and domestic challenges. Research by Bekbossinova and Niyazbekov (2024) and Unerbayeva et al. (2025) showed that industrial cities such as Karaganda, Pavlodar, and Temirtau continue to generate high emissions and environmental risks. While technological innovations can reduce ecological footprints, their success depends on institutional integrity and public awareness. Integrating environmental objectives with digital solutions offers a path toward sustainable urban transition, yet requires policy coherence and long-term investment in green technologies.

Migration dynamics and spatial inequality further complicate Kazakhstan's urban trajectory. The concentration of human and financial capital in a few megacities generates regional imbalances, echoing findings by Turok and McGranahan (2019). Peripheral areas and mono-industrial towns experience depopulation and stagnation, which reinforces the uneven development cycle. Addressing these disparities demands a shift toward polycentric urban development and regional innovation clusters. Thus, Kenzhegulova et al. (2023) suggested expanding digital infrastructure and smart governance beyond major centres could foster broader participation and reduce territorial inequality.

Overall, urbanisation in Kazakhstan reflects both opportunities and systemic constraints. Rapid growth in leading cities demonstrates the country's potential to build knowledge-based urban economies, while persistent inequality exposes institutional and infrastructural gaps. Global experience showed that sustainable urbanisation is achieved through the synergy of three pillars: substantial human capital, effective institutions, and technological inclusiveness (Henderson, 2002; Acemoglu & Restrepo, 2018; Florida, 2019). For Kazakhstan, aligning these dimensions requires coherent policy efforts aimed at decentralisation, education reform, and environmental innovation. The integration of digitalisation with social equity and ecological governance will determine whether Kazakhstan's urban transition evolves into a model of inclusive and sustainable development.

Overall, the literature demonstrates that urbanisation represents a multidimensional system of interrelations among human, spatial, and economic factors. While serving as a foundation for innovation and social progress, it also intensifies regional imbalances and social stratification. Therefore, this study aims to develop a balanced model of urban development in Kazakhstan by conducting a comprehensive analysis of spatial-demographic trends and the human dimension of urbanisation.

## 3. RESEARCH METHODS

The study of the spatial and demographic development of cities constitutes a key research area in contemporary geography and social sciences. This research aims to conduct a comprehensive analysis of the social, economic, and spatial factors shaping urbanisation in Kazakhstan's cities. Urbanisation is examined not only as a driver of national economic growth but also as a key indicator of social infrastructure development, migration dynamics, and quality of life. The main research problem is to identify the causes and consequences of spatial and demographic inequalities in urban development in Kazakhstan, and to propose effective mechanisms to reduce these disparities. The purpose of the study is to determine the patterns of urban development imbalances through a systematic and integrated analysis of the socio-economic and demographic aspects of urbanisation, and to provide a scientific justification for the spatial organisation of cities.

Accordingly, Kazakhstan's strategic documents, including the President's annual addresses, the "Kazakhstan-2050" Strategy, and the National Development Plan until 2029, clearly define the national priorities for reducing regional disparities and promoting sustainable urban development (Government of the Republic of Kazakhstan, 2023).

Figure 1 illustrates the key objectives outlined in the "Kazakhstan-2050" Strategy and the National Development Plan aimed at reducing regional disparities and promoting sustainable urban development across the country.

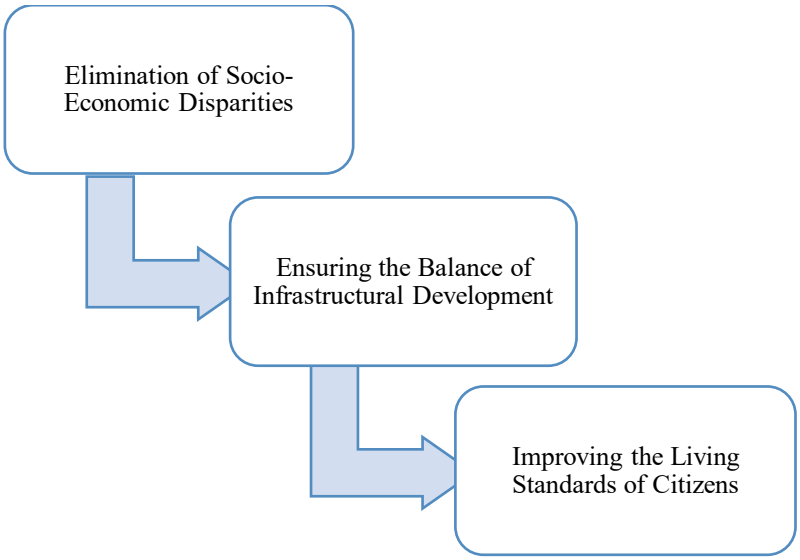


**Figure 1.** National priorities for regional and urban development

The diagram shows the strategic priorities of sustainable urban and regional development, reflected in the Strategy "Kazakhstan-2050" and the National Development Plan until 2029. They include balanced territorial growth, improving the quality of life of the population

in all regions, infrastructure development and strengthening the role of cities as drivers of economic and social progress. Kazakhstan has identified the transition from a raw-materials-based economy to an industrial and innovative one as a priority area of state policy. This transition aims to diversify regional economies, stimulate innovative industries, and improve transport and engineering infrastructure. Such measures not only promote economic growth but also reduce inter-regional differences, strengthening social equality.

In this context, the purpose of the study is to analyse the spatial and demographic trends in the development of Kazakhstani cities from a human dimension perspective and to identify their impact on regional inequalities and the overall trajectory of the country's development. The theoretical significance of the work lies in the scientific substantiation of the role of human capital in the spatial development of cities and in clarifying the concept of the "human dimension" in the context of urban geography. The practical significance lies in the possibility of applying the results to the development of regional policy, urban planning, and the management of migration and demographic processes. Thus, the study comprehensively examines the spatial and demographic evolution of cities in Kazakhstan, focusing on the human factor of their transformation. Scientific work helps identify ways to achieve balanced regional development and to improve national urbanisation policy.

The central research question of the study is as follows:

*RQ:* How does urbanisation in Kazakhstan influence social and spatial inequality, and which factors and mechanisms can effectively mitigate these disparities?

To address this question, the following hypothesis is proposed:

*Hypothesis:* Socio-economic disparities among Kazakhstan's cities are determined by variations in natural resource potential, industrial and infrastructural capacity, and the effectiveness of regional policy implementation. It is further hypothesized that if innovative, digital, and ecological principles become the dominant framework for urban spatial management, regional inequalities will gradually decline, thereby fostering sustainable urban and economic development.

The study was conducted in three interrelated stages, including theoretical and analytical, empirical and generalising phases. At the first stage, the analysis of the scientific literature and the collection of socio-economic and demographic data on the cities of Kazakhstan were conducted. At the second stage, statistical and spatial methods (correlation and regression analyses, GIS visualisation) were used to identify patterns of urbanisation and regional differences. At the final stage, the results were summarised, and practical recommendations were formulated for regional policy and planning of sustainable urban development.

The study's methodological framework integrates theoretical, statistical, and spatial approaches to provide a comprehensive understanding of urbanisation processes. The research was conducted through three interrelated stages that combined literature synthesis, empirical analysis, and policy interpretation. At the initial stage, a systematic review of domestic and international sources on urbanisation and spatial development was conducted, followed by the collection and structuring of socio-economic and demographic data for Kazakhstan's cities. The main stage involved applying quantitative and qualitative methods, including correlation and regression analyses, to examine the dynamics of regional urbanisation rates, migration flows, infrastructure development, and the spatial concentration of economic and social activities. GIS tools were used to visualise spatial patterns, identify growth centres, and assess the extent of regional inequality.

At the final stage, the results were synthesized to formulate evidence-based recommendations for regional policy and urban planning. The integration of statistical analysis, GIS visualisation, and comparative assessment enabled the identification of key spatial-demographic trends in Kazakhstan's urban

development and the proposal of mechanisms to reduce socio-economic disparities. This mixed-methods design ensured the validity and reliability of findings while maintaining both scientific rigor and practical relevance.

To ensure the reliability of the results, a set of complementary methods was used in the study. The theoretical analysis was used to systematise and compare patterns of urbanisation and spatial development factors. The comparative geographical method was used to identify socio-economic and infrastructural differences between cities and regions. Statistical analysis enabled quantification of population dynamics, migration flows, urbanisation levels, and infrastructure conditions.

GIS methods were used to visualise spatial data, map urban centres, and identify areas of socio-economic activity concentration and spatial inequality. The use of GIS technologies, statistical modelling, and multifactor analysis has allowed us to develop a detailed typology and cartographic model of spatial inequalities, providing a new scientific perspective on the patterns of the urbanisation process. The inductive and deductive approaches provided a transition from particular empirical observations to generalising conclusions and testing the research hypothesis. In addition, a multifactorial analysis (regression and correlation) was used, enabling quato reducentification of the relationships among urbanisation levels, socio-economic indicators, and regional disparities.

As an empirical basis, demographic, social and economic indicators were analysed for all 16 urban regions of Kazakhstan, including the three largest agglomerations — Astana, Almaty and Shymkent — for the period up to 2025. The primary data sources included the Bureau of National Statistics of the Republic of Kazakhstan (2020-2024), materials from the United Nations Population Fund (UNFPA, 2022), World Bank reports (2021-2024), as well as publications and analytical reports from international research institutes on regional development and urbanisation.

The results obtained can serve as a basis for improving regional and urban policy, managing urbanisation processes in line with sustainability and balance principles, developing strategies for social infrastructure, housing, and human capital development, and planning migration and demographic policies to reduce socio-spatial disparities. Thus, the comprehensive integration of theoretical analysis, statistical methods, GIS visualisation, and comparative evaluation provided a holistic methodological framework for the study, enabling the formulation of scientifically grounded recommendations and enhancing the practical significance of the results.

## 4. RESULTS

This study aims to identify and analyse regional disparities in the socio-economic development of Kazakhstan's cities, with a primary focus on the factors driving spatial inequality and the dynamics of urbanisation. The analysis was based on statistical data by region and city, official reports, and results of spatial and GIS-based analyses. The findings reveal that regional disparities among Kazakhstan's cities remain significant despite a gradual trend toward convergence.

These disparities are determined mainly by differences in socio-economic development, infrastructure quality and entrepreneurial opportunities. One key trend is the growth of the urban population and intensified migration from rural to urban areas, particularly toward major metropolitan centres such as Almaty, Astana, and Shymkent. While this urban migration stimulates economic growth, it also leads to housing shortages, overburdened social and communal infrastructure, and increased social tensions.

Over the past decade, the level of urbanisation in Kazakhstan has steadily increased: as of 2024, more than 60% of the country's population resides in cities (Bureau of National Statistics, 2024). Based on these data, a diagram illustrating the dynamics of urbanisation in Kazakhstan between 2014 and 2024 was developed (Figure 2).

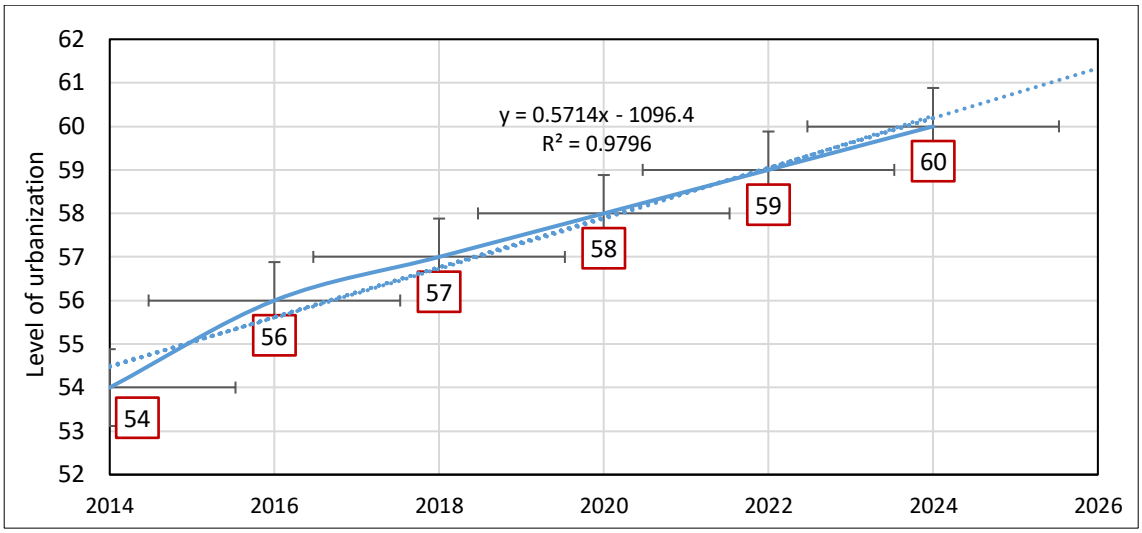


**Figure 2.** The trend of changes in the level of urbanisation in Kazakhstan for 2014-2024

As shown in Figure 2, over the past decade, the level of urbanisation in Kazakhstan has gradually increased, with the urban population share rising from 54% in 2014 to 60% by 2024. This trend demonstrates the steady pace of urbanisation and reflects the growing socio-economic attractiveness of cities. Urbanisation has become a key driver of socio-economic development in Kazakhstan. However, the process is uneven across regions. Southern and central areas exhibit higher urbanisation rates, whereas northern and western regions experience slower growth. Major cities such as Almaty, Astana, and Shymkent have developed into primary agglomeration centres, concentrating most internal migration flows.

Over the last five years, the population of Almaty increased by approximately 200,000 people, and Astana by around 150,000. In contrast, several smaller or mono-functional towns have experienced population decline. Such migration disparities contribute to changes in demographic structures, regional imbalances in labour resources, and increased pressure on social and infrastructural systems. These findings confirm that urbanisation in Kazakhstan is a multi-dimensional process, with both economic benefits and social challenges. They highlight the importance of balanced regional planning to mitigate inequality, optimise infrastructure, and ensure sustainable urban growth across all regions.

The data clearly demonstrate a steady flow of migration and high rates of urbanisation in Kazakhstan's largest megacities. The population growth dynamics of Almaty and Astana between 2014 and 2024 clearly illustrate the pace of urbanisation, the sustained pattern of migration, and the progressive trend of demographic concentration. Both megacities have experienced consistent population growth over the past decade, reflecting their growing economic attractiveness, expanded social infrastructure, and increasing labour market opportunities (Bureau of National Statistics, 2024). However, Kazakhstan's regions differ significantly in terms of natural and economic resources, which directly affects the rate of socio-economic development, investment potential, and residents' quality of life. These spatial disparities are determined mainly by the historical features of territorial development, differences in initial conditions of urban and regional growth, and the diversity of economic specialisation across territories.

This trend is further illustrated in Figure 4, which presents the population dynamics of Almaty and Astana from 2014 to 2024.

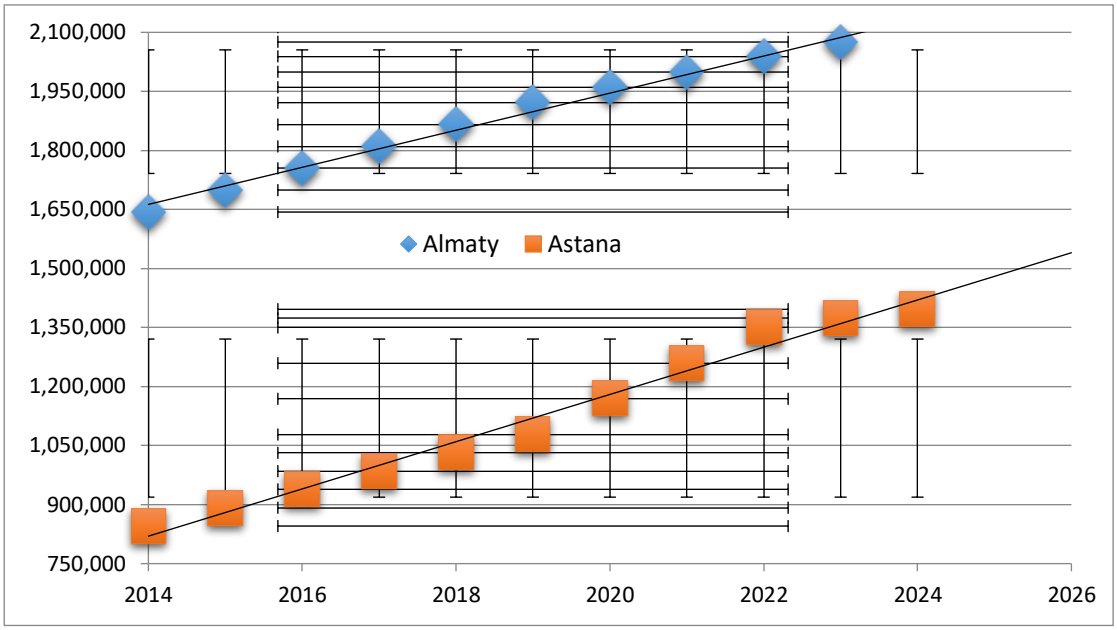


**FIGURE 1.** Population dynamics of Almaty and Astana cities between 2014-2024

The data clearly demonstrate a steady flow of migration and high rates of urbanisation in Kazakhstan's largest megacities. The population growth dynamics of Almaty and Astana between 2014 and 2024 clearly illustrate the pace of urbanisation, the sustained pattern of migration, and the progressive trend of demographic concentration. Both megacities have experienced consistent population growth over the past decade, reflecting their growing economic attractiveness, expanded social infrastructure, and increasing labour market opportunities (Bureau of National Statistics, 2024). However, Kazakhstan's regions differ significantly in terms of natural and economic resources, which directly affects the rate of socio-economic development, investment potential, and residents' quality of life. These spatial disparities are determined mainly by the historical features of territorial development, differences in initial conditions of urban and regional growth, and the diversity of economic specialisation across territories.

Such disparities are also evident in the education sector. The quality of education in Kazakhstan closely correlates with the overall socio-economic development of each region. In highly urbanised and economically developed cities, particularly Astana, Almaty, and Shymkent, educational infrastructure and human capital are significantly stronger, and modern technologies and innovative teaching methods are more widely implemented. Conversely, in less developed regions, schools tend to have fewer material and technical resources, and the quality of teaching remains lower.

At the city level, the relationship between educational quality and socio-economic development is increasingly evident. Economically strong regions concentrate educational infrastructure and skilled pedagogical staff, while resource-constrained regions face limited access to quality education (World Bank, 2022). For example, during the 2023–2024 academic year, the average academic performance indicator across Astana schools reached 62.03%, a +2.30% increase from 59.73% in 2022–2023 (Bureau of National Statistics, 2024).

Although overall education quality has improved, intra-urban disparities persist:

megacities continue to outperform smaller towns and rural areas, highlighting the unequal distribution of educational resources and opportunities. Spatial inequality in Kazakhstan's education system is directly tied to socio-economic disparities, the availability of infrastructure, and pedagogical capacity across cities. This demonstrates the mutually dependent relationship between a city's socio-economic development and educational outcomes: higher economic potential contributes to better education outcomes; improved education strengthens human capital and supports sustainable regional development (Kabdesov, 2020; Muratova & Baigojaeva, 2023; Kireyeva et al., 2025).

However, economic crises and uneven implementation of reforms during the transition to a market economy have disrupted this balance, deepening socio-economic inequality across regions. As a result, disparities have emerged in access to social infrastructure, income levels, migration flows, and economic activity. Nevertheless, with effective regional policies and favourable investment conditions, urban population growth can serve as a key driver of development. Population growth stimulates small- and medium-sized business growth, creates new jobs, enhances business activity, and ultimately improves the overall quality of life for citizens.

*Analysis of population dynamics across Kazakhstan's cities*

During the research, the population dynamics of 16 cities in Kazakhstan were analysed from their establishment to 2025. This longitudinal analysis allowed for tracking each city's demographic development trajectory, assessing the pace of urbanisation, and clarifying the nature of regional disparities.

The results indicate that major cities (Almaty, Astana, and Shymkent) have experienced consistent population growth, whereas several small and medium-sized cities have shown declining or slower population growth. These patterns confirm that the urbanization process in Kazakhstan possesses not only a quantitative dimension but also a qualitative aspect, as population concentration is closely linked to economic activity levels and the development of regional infrastructure (Table 1).

**Table 1.** Periods of establishment and population dynamics of Kazakhstan's cities

| City | 1939 | 1989 | 2009 | 2025 |
|---|---|---|---|---|
| Oral | 47 200 | 198 600 | 276 300 | 348 000 |
| Atyrau | 27 800 | 180 000 | 180 000 | 372 000 |
| Aktobe | 33 400 | 253 000 | 280 000 | 540 000 |
| Aktau | 26000 | 143 000 | 165 000 | 190 000 |
| Kostanay | 61 000 | 145 000 | 214 000 | 250 000 |
| Kokshetau | 37 000 | 123 000 | 147 000 | 158 000 |
| Karaganda | 166 000 | 436 000 | 459 000 | 520 000 |
| Pavlodar | 52 000 | 300 000 | 334 000 | 360 000 |
| Petropavl | 19 688 | 206 559 | 203 523 | 222 500 |
| Taldykorgan | 10 200 | 98 700 | 112 900 | 150 000 |
| Semey | 170 700 | 335 400 | 299 300 | 360 000 |
| Turkistan | 28 400 | 102 900 | 142 900 | 210 000 |
| Oskemen | 49 800 | 311 000 | 308 736 | 347 000 |
| Almaty | 311 000 | 1 136 000 | 1 365 600 | 2 150 000 |
| Astana | 33 000 | 281 000 | 613 000 | 1 420 000 |
| Shymkent | 101 700 | 401 200 | 603 500 | 1 300 000 |

Note: compiled by the authors

This table systematizes demographic data for Kazakhstan's 16 cities, presenting establishment dates and population trends over nearly a century. Such chronological data allow

for a comprehensive analysis of urbanization processes, regional development disparities, and changes in cities' economic potential. Based on these demographic indicators, a cartographic visualization was created to illustrate the spatial distribution of the population and the dynamics of urbanization across Kazakhstan's cities. This map provides a clear depiction of urban development levels, regional concentration patterns, and territorial differences in urbanization processes (Figure 4).

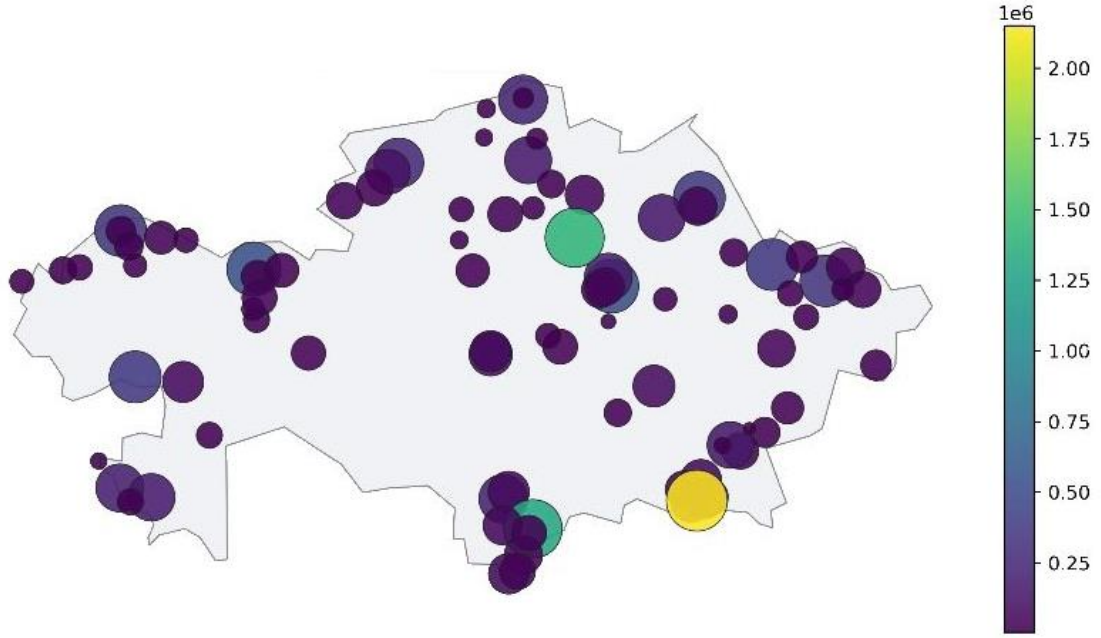


**FIGURE 4**. Map of the dynamics of population change in the cities of Kazakhstan

Based on the analysis of the map, several distinct trends in the development of Kazakhstan's cities were identified:

(1) Major metropolitan areas such as Almaty, Astana (Nur-Sultan), Shymkent, Atyrau, and Karaganda have experienced significant population increases over the past eighty years. These cities have become key economic, migration, and innovation centres, serving as hubs for investment and labour resources.

(2) Industrial cities, including Zhanaozen, Ekibastuz, Temirtau, and Rudny, largely depend on their industrial sectors. Economic crises in mining or energy industries have slowed demographic growth and caused instability in these areas.

(3) This trend is particularly evident in agrarian regions and single-industry cities (e.g., Derzhavinsk, Lisakovsk, Saran, Ridder, and Serebryansk), reflecting population concentration in major centres and internal rural-to-urban migration.

(4) Development in oil, gas, mining, and energy sectors led to the emergence of cities such as Aktau, Zhanaozen, Kulsary, Khromtau, and Kentau, which later evolved into regional economic centres.

(5) In recent decades, urbanisation has focused not only on population growth but also on improving the quality of life through social infrastructure, transportation networks, education, and services.

The data demonstrate that the demographic development of cities is closely linked to historical, economic, and political factors, including industrialisation policy, migration, and regional development programs. Long-term population analysis allows for an assessment of socio-economic potential and

provides a scientific basis for regional development strategies.

Comparative analysis indicates that Almaty and Astana are the leading financial and innovation centres, characterised by substantial budgetary resources, well-developed infrastructure, strong investment potential, and highly concentrated human capital. Regions such as Atyrau, Aktobe, and Karaganda are economically important due to their natural resources and industrial capacity, particularly in oil, gas, and metallurgy. Conversely, Zhambyl, Kostanay, and Kyzylorda are marked by lower budget levels and limited industrialisation, reflecting low investment, poor economic diversification, and high dependence on agriculture. For the cities in the Almaty region (Taldykorgan, Konaev, and Shymkent), an economic environment quality index of 1.69 was identified, with recommendations to enhance economic activity through infrastructure investments. Measures include modernisation of transport and utility networks, industrial capacities, and support for small and medium-sized businesses, aimed at reducing socio-economic inequalities.

For sustainable cities such as Pavlodar, Oskemen, Zhambyl, Astana, Semey, and Turkistan, optimising existing programs is recommended, including reassessing effectiveness, reallocating resources, and strengthening cooperation between the government and the private sector to improve regional competitiveness. Environmental sustainability is critical for leading cities. Priority measures include reducing emissions, implementing eco-friendly technologies, modernising industrial processes, waste management, recycling, and ecosystem restoration. These initiatives improve living conditions, attract investors and tourists, and enhance regional development.

Despite positive trends, territorial inequality persists. “Leading cities” continue to outperform “peripheral cities,” creating fiscal disparities in which some regions serve as budget donors and others as recipients. To reduce these inequalities, enhancing regional policy effectiveness, supporting local entrepreneurship, developing transport and social infrastructure, and implementing smart city technologies are essential. A comprehensive spatial development policy will stimulate economic activity in remote areas and promote balanced territorial growth. Overall, the research findings confirm that regional disparities in Kazakhstan’s cities remain significant, requiring systematic, evidence-based strategies to ensure sustainable urban development, reduce socio-economic inequalities, and improve quality of life for the population.

## 5. CONCLUSION

The primary objective of this study was to conduct a comprehensive analysis of the socio-economic development dynamics and spatial-demographic trends of Kazakhstan’s cities, examining their impact on urbanisation and education quality. The research relied on official data from the Bureau of National Statistics of the Republic of Kazakhstan, the Ministry of Education and Science, and municipal education departments’ reports for 2024. Methodologically, the study employed comparative-analytical, statistical, and graphical methods, as well as data visualisation techniques. Dynamic comparison, diagrammatic analysis, and cartographic visualisation were applied to examine the interrelations between geographic and socio-economic factors.

Key findings:

1. Urbanisation trends. Over the past decade, Kazakhstan has experienced steady urbanisation: as of 2024, approximately 60% of the population resides in urban areas. This process is most pronounced in major cities such as Almaty, Astana, and Shymkent, which have become central drivers of economic and social development. For example, over the last five years, Almaty’s population increased by about 200,000, while Astana grew by 150,000, reflecting the concentration of population in megacities and the pivotal role of urbanisation in national spatial development.

2. Demographic and regional disparities. Analysis of population data from 90 cities, including historical formation periods and population dynamics, revealed apparent regional inequalities. Large cities show continuous growth, while smaller settlements and monotowns often face population decline. Natural resource availability, industrial potential, historical development patterns, and uneven infrastructure and market reforms influence regional disparities.

3. Education and socio-economic interdependence. The study demonstrates a strong correlation between education quality and socio-economic development. In Almaty, Astana, and Shymkent, educational facilities are modern, teaching staff are highly qualified, and digital technologies are widely implemented. In contrast, smaller and mono-industrial towns face teacher shortages, limited resources, and weaker educational outcomes. Improved economic potential enhances education quality, while high-quality education strengthens human capital, supporting sustainable regional development.

4. Policy implications. To reduce spatial inequalities and promote balanced urban development, it is essential to: ensure equitable progress in infrastructure and educational capacity across all regions; provide targeted teacher training programs and integrate innovative educational technologies; foster economic diversification and investment in medium-sized and small cities to mitigate population decline; promote sustainable urbanisation policies that align economic growth with social and environmental priorities.

The findings can inform regional development strategies, urban infrastructure planning, educational quality assessment systems, and efforts to promote social balance. Future studies could expand to include spatial correlation modelling of educational quality and economic indicators using GIS, as well as quantitative analysis of urbanisation's impact on human capital and labour markets. This study highlights the critical role of urbanisation and human capital in Kazakhstan's socio-economic development. Systematic and evidence-based assessment of regional disparities and education quality is essential for fostering sustainable development, improving quality of life, and enhancing the country's global competitiveness.

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# Factors Influencing Women's Participation in the ICT Sector of Kazakhstan: Barriers and Drivers

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## ABSTRACT

The participation of women in the information and communication technology (hereinafter – ICT) sector remains one of the key challenges for the digital transformation and inclusive economic development of Kazakhstan. The purpose of this study is to identify the structural, institutional and innovative factors influencing the involvement of women in entrepreneurship and management in the field of ICT. The methodological framework is based on quantitative analysis and binary logistic regression. Empirical data from the World Bank's Enterprise Survey (2024) were used, which included 1,013 companies, of which 26.9% were female-owned (≥50% female ownership or presence of a female top manager). Descriptive statistics show that most women are involved in small- and medium-sized businesses: the average company size with a female manager is 53 people versus 100 or more male employees. The econometric assessment revealed that the size of the firm is the most significant factor: an increase in the number of employees per person reduces the likelihood of female participation by 0.05 percentage points ($\beta = -0.0026$; $p < 0.01$). The remaining variables demonstrated statistically insignificant but significant negative effects. connections, which indicates the presence of hidden structural obstacles. The results confirm that the key barriers remain limited access to financial resources, weak scaling opportunities for women's businesses, and the structural concentration of women in smaller and younger ICT companies. Strengthening women's participation requires targeted support measures, including loan guarantees, scaling programs, and institutional mechanisms for the development of a gender-sensitive digital ecosystem.

**KEYWORDS**: Economy, Gender Economics, Women, Technological Entrepreneurship, Women's Entrepreneurship, Business Leadership, Labor Market

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## 1. INTRODUCTION

The information and communication technology (hereinafter – ICT) sector has become one of the most dynamic engines of economic growth and social transformation in the 21st century. However, despite its expanding role in shaping global competitiveness and innovation, gender disparities persist within ICT employment, leadership, and entrepreneurship. Women continue to represent a significantly smaller proportion of the ICT workforce, occupying fewer technical, managerial, and decision-making positions than men. This underrepresentation undermines not only principles of equity and social inclusion but also the innovative and productive potential of the digital economy. Research consistently indicates that diversity within ICT teams enhances creativity, problem-solving capacity, and organisational resilience, making women's participation both an ethical and economic imperative (Ahuja, 2002; Trauth et al., 2008; Kovaleva et al., 2023).

Gender gaps in ICT stem from a combination of social, cultural, institutional, and economic barriers. In many societies, technology-related fields are still perceived as male domains, reinforcing gender stereotypes that discourage women from pursuing ICT education or careers. These perceptions are often compounded by social expectations surrounding family responsibilities and work-life balance, which disproportionately affect women's career trajectories (Trauth et al., 2008; Ramseook-Munhurrun et al., 2023). At the organisational level, male-dominated cultures, limited mentorship opportunities, and opaque promotion practices reduce women's access to leadership roles, while at the structural level, unequal access to finance and digital infrastructure continues to constrain female entrepreneurship in the ICT sector (Sekoaila & Adebesin, 2016; Naseviciute & Jucevičienė, 2023).

The challenge is particularly relevant for developing and transition economies such as Kazakhstan, where rapid digitalisation is reshaping labour markets, innovation systems, and business models. National strategies emphasise inclusive digital transformation and the creation of high-value ICT employment. However, empirical data reveal that women remain underrepresented in technological professions, research, and entrepreneurship. Understanding the determinants of women's participation in Kazakhstan's ICT sector is therefore critical for formulating effective gender-responsive policies that align with sustainable development and human-capital goals.

Drawing on international and regional evidence, this study investigates the factors influencing women's participation in Kazakhstan's ICT sector, with a specific focus on organisational, social, and individual determinants. The research combines descriptive statistics and econometric modelling using firm-level data from the World Bank Enterprise Survey (2024) to analyse how firm size, age, financial accessibility, innovation activity, and institutional obstacles affect women's ownership and leadership in ICT enterprises. By situating the empirical findings within the broader literature on gender and technology, the paper aims to contribute to both academic debate and policy formulation concerning gender equality, digital transformation, and inclusive growth.

In doing so, this research addresses three key objectives:

(1) to assess the current level of women's ownership and leadership participation in ICT enterprises in Kazakhstan;
(2) to identify the primary structural, cultural, and institutional barriers affecting female representation in the sector; and
(3) to propose evidence-based recommendations for promoting gender inclusiveness in the digital economy through education, innovation, and policy reform.

Ultimately, the study seeks to demonstrate that enhancing women's participation in ICT is not solely a matter of social justice but a strategic prerequisite for fostering innovation, competitiveness, and sustainable digital development in Kazakhstan and beyond.

## 2. LITERATURE REVIEW

The involvement of women in the information and communication technology (ICT) industry has been a research area for more than two decades. During this time, a transformation in research — from structural issues to recent studies employing concepts of intersectionality, psychological perspectives, global ICT transformation, and constraints of entrepreneurial environments, to name a few has taken place. This study proposes to highlight the transformation of research from/to more informed scholarship on gender inequality in ICT, as reflected in studies published between 2002 and 2025.

The first foundational study in this timeline is Ahuja's (2002) seminal review, which laid the groundwork for future research by highlighting the intrinsic nature of gender inequality in ICT as a profession for women. According to Ahuja, women's low representation in ICT is neither a result of individual choice nor an issue of employees' needs, but a result of structured, social, and work-related impediments to opportunities; workplace masculinity, lack of access to networks, impediments to opportunities in which careers flourish, as well as work-family conflicts.

The mid-2000s also brought greater emphasis on the multicultural, relational aspects of ICT careers, though these perspectives are subject to change over time. For instance, Trauth et al. (2008) studied ICT career choice for women in relation to a multicultural framework, which showed that people's cultures, as well as social expectations, shape women's ICT-related choices in different ways, as gender inequalities cannot be recognised from a social systems perspective because inequalities pertain to more than gender in itself.

Subsequent research by Trauth et al. (2009) further examined an organisation's analysis to examine the relationship between gendered work environments and women's retention in ICT. A set of determinants, such as mentoring programs, attitudes toward discrimination, and work-home demands, influences women's continued involvement in ICT work, as this body of research further supports the idea that ICT work is neither gender-neutral nor free from inequalities ingrained in an organisation's culture.

Between 2010 and 2015, there was an increasing trend of interest in internal processes of organisations, pathways to leadership, as well as internal cultural influences affecting women's careers in ICT. Berghi and Scorrano (2015) investigated barriers to, as well as facilitators of, women's professional ambitions in ICT, underlining that views of ICT as a man's sector impede women's confidence in, as well as interest in, a career in ICT. The results indicated a twofold barrier: general cultural stereotypes and a lack of adequate organisation-level measures to address them.

Likewise, in exploring what hampers women's movement in the ICT industry in Nova Scotia, Fauteux (2015) has established that gender-insensitive criteria for promotion, a shortage of people for women to be mentored by, as well as an undervaluing of women's input in an organisation, limit professional advancement for women in this industry. Sekoaila and Adebesin (2016) continued to augment this body of literature examining gender-related dynamics in South Africa's ICT industry. The results of this work indicated that gender discrimination is both implicit and explicit, that women lack social power in the industry, and that they are excluded from influential decision-making networks, despite formal equality in specific sectors of ICT policy advancements in the mid-2010s.

During the late 2010s, scholarship increasingly acknowledged that gender cannot be studied in a vacuum but must be understood alongside other factors. A significant body of work during this period focused on issues of intersectional inequality, in which multiple factors such as gender, race, ethnicity, class, and Internet access interact in complex ways. Yeganehfar et al. (2018) systematic review of gender gaps in technological policy and Internet access, for example, documented how

women's inequality is maintained by disparities in educational opportunities, a lack of support for digital literacy, and blind spots in technological policymaking. Contemporaneous scholarship by Kimberly (2018) and McGee (2018) explored issues of race, ethnicity, and ICT development, finding that women from minority ethnic groups experience further disadvantage due to multiple, intersecting stereotypes, as well as a lack of opportunities for mentoring and for senior positions in ICT development.

Extending this line of investigation to cover an even wider range of countries, Efobi, Asongu, and Tchamyou further analysed in 2018 the influence of ICT development on women's economic empowerment in Sub-Saharan Africa. In this study, results indicated that ICT development is an important driver of increased women's economic involvement, but structural issues, including infrastructure, human capital, and an inadequate framework, impede this. This study broke ground by exploring in detail an even more vital structural component of ICT development for women's involvement.

Huyer et al. (2019) studied the political and cultural factors influencing women's employment in ICT-related jobs worldwide and concluded that the ICT gender gap results from the interplay among structural factors in education systems, politics, and cultural discrimination. The authors state that ICT offers opportunities for women's empowerment, but only when accompanied by political support and societal acceptance. Krchová and Höesová (2021) targeted ICT transformation indicators in CEE countries, examining the influence of national GDP rates in ICT, competitiveness in ICT, as well as science, technology, engineering, and mathematics (STEM) initiatives, affecting women's representation in ICT occupations. The authors showed a significant association between macroeconomic/institutional factors and women's involvement in the profession, suggesting a strong influence of national ICT transformation agendas on gender equality outcomes.

The authors present a cultural-historical psychological approach to this issue in Adams and Mavers (2021). The authors explored how relational tensions, learning processes, and emotional issues relate to women pursuing degrees in computer science and information technology, and explained the importance of emotional conditions, identity, and culture in influencing women's retention in ICT studies.

In this phase, the literature recognised that gender inequality in ICT is no longer merely an organisational-level or individual matter, but is situated within wider social, cultural, and economic systems. From 2022 to 2024, the literature grew in coverage, encompassing concepts of entrepreneurship, institutional hurdles, inter-industry comparisons, and psychological processes in careers.

A study by Kovaleva et al. (2023) explored women's issues in the tech entrepreneurial domain, finding that women also encounter distinct challenges, such as investor bias, financial instability, cultural intolerance, and institutional constraints. Simultaneously, another study by Ramseook-Munhurrun et al. (2023) examined issues affecting women in ICT and engineering at higher levels of organisations. The study revealed that second-generation bias, which is more of an unconscious bias within an organisation, is a hindrance to women's progress even when organisations have recognised diversity initiatives in place.

Later, Naseviciute and Juceviciene (2023) further emphasised empowerment, as well as the issue of perceived fairness in an organisation. In this study, women's motivation to run for ICT positions is greatly affected by a sense of inclusion in an organisation, confidence, and opportunities for advancement in an organisation. However, Akar et al. (2024) refocused attention by proposing a psychological model that clarifies how irrational beliefs about employment influence women's lack of decisiveness in pursuing an ICT-related vocation, as mediated by job-related positivity and perceived employability within an organisation.

Ranasinghe et al. (2024) examined international influences shaping women's employment in the ICT sector and found that industry-based gender stereotypes, underrepresentation, and a lack of professional opportunities remain widespread worldwide. The study indicated that even global digitisation does not automatically lead to the end of gender inequality in the sector, as measures must be taken to achieve equality. Raufi et al.'s (2024) study, which focused on empowerment through mentorship, found that women's involvement in technological development is strongly promoted by strong support systems within institutions, including inclusive gender-inclusive mentorship. This study indicated that gender inequalities, which have been deep-rooted in society, could be significantly diminished by support systems in organisations.

The most recent developments in this timeline of gender inequality in ICT show that inequality in ICT persists worldwide, even amid ICT transformation, equal opportunities in ICT-related education, and increased awareness of gender issues in ICT development. According to Mannan et al. (2025), research exploring women's involvement in ICT in the Philippines found that institutional, cultural, and community-level factors limit women's participation in the sector. The study explained that women's lack of confidence, opportunities, and structural inequality in ICT development result from inequalities in educational opportunities, community views, and institutional perspectives.

## 3. METHODOLOGY

The research employs a quantitative empirical methodology to examine the drivers of female engagement in the ICT sector in Kazakhstan, including organisational features, innovation, and institutional constraints. The research is based on the assumption that the gender gap in the ICT sector is shaped by both individual and organisational and institutional factors. The analysis relies on a dataset from the World Bank Enterprise Survey 2024, which provides a representative sample of Kazakhstani firms and covers their management structures, innovation activities, and operating conditions, among other parameters.

The empirical data set consists of 1,013 ICT-relevant firms with valid observations on all owner, management, and innovation parameters included in the WBES dataset. Missing or discordant values marked as −9 or −8 are removed from consideration. The dependent variable, female participation, was defined as a dummy variable equal to 1 if the enterprise is at least 50% female-owned (b4a >= 50) or has a female top manager (b7a = 1), and zero otherwise. Based on this definition, around 26.9% of firms fulfil the female participation condition, which highlights the gender asymmetry characteristic of technologically intensive industries.

The independent variables are categorised into structural, innovation, and institutional, all of which are obtained from tested theory and empirical studies present in the literature. The number of full-time workers was measured by size (a6c), while age (b5) was calculated as the difference between 2024 and the company's established year. The availability of finance (k30) and the corruption obstacle (j30f) are measured on a 0-4 scale, respectively, indicating the extent to which they can obstruct a company's operations.

The innovation capacity is measured through product innovation (h1) and process innovation (h5). They show whether a company has developed a new or improved product or process in the last three years. ICT web presence (c22b), a proxy for digitisation, was measured by whether the company has an official website or web-based platform: one if yes, zero if no.

Variable standardisation was performed as per the WBES guidelines, and the results included descriptive statistics to examine patterns and identify potential outliers. The results included correlation diagnostics tests to ensure acceptable levels of multicollinearity among the independent variables.

The research estimated a binary logistic regression model to examine the likelihood that a given company is female-owned or female-managed, based on its structural and institutional features. The functional form of the model is specified as formula (1):

$$Logit(P_i) = \beta_0 + \beta_1 \text{FirmSize}_i + \beta_2 \text{FirmAge}_i + \beta_3 \text{AccessFinance}_i + \beta_4 \text{Corruption}_i + \beta_5 \text{ProductInnovation}_i + \beta_6 \text{ProcessInnovation}_i + \beta_7 \text{ICTWeb}_i + \varepsilon_i \quad (1)$$

where:

$P_i$ – the probability of female participation in firm $i$;

$\varepsilon_i$ – the error term;

Coefficients $\beta$ – the log-odds of women's participation associated with a one-unit change in each explanatory variable.

The model estimation was conducted in Stata 18. The robust standard error was employed to account for heteroscedasticity. The significance of the estimated parameters was tested via the z-statistic at 1%, 5%, and 10% significance levels. Finally, marginal effects (dy/dx) are calculated to show the change in the probability of female participation for a unit change in each independent variable, thereby facilitating a more straightforward interpretation of the findings. The fit and adequacy of the model are validated by the likelihood-ratio chi-squared statistic, pseudo-R-squared, or the log-likelihood.

The choice of the logistic regression model is due to its appropriateness as a model type when the response variable is dichotomous. It enables the measurement of the strength of influence of company size, age, financial constraints, and innovation activities as determining factors influencing women's involvement in leading and owning ICTs. The model is ideal to apply when the data are cross-sectional and the desired outcome, female involvement, is categorical. Figure 1 illustrates the average firm size (measured by the number of full-time employees) comparing establishments led by female top managers and those led by male managers.

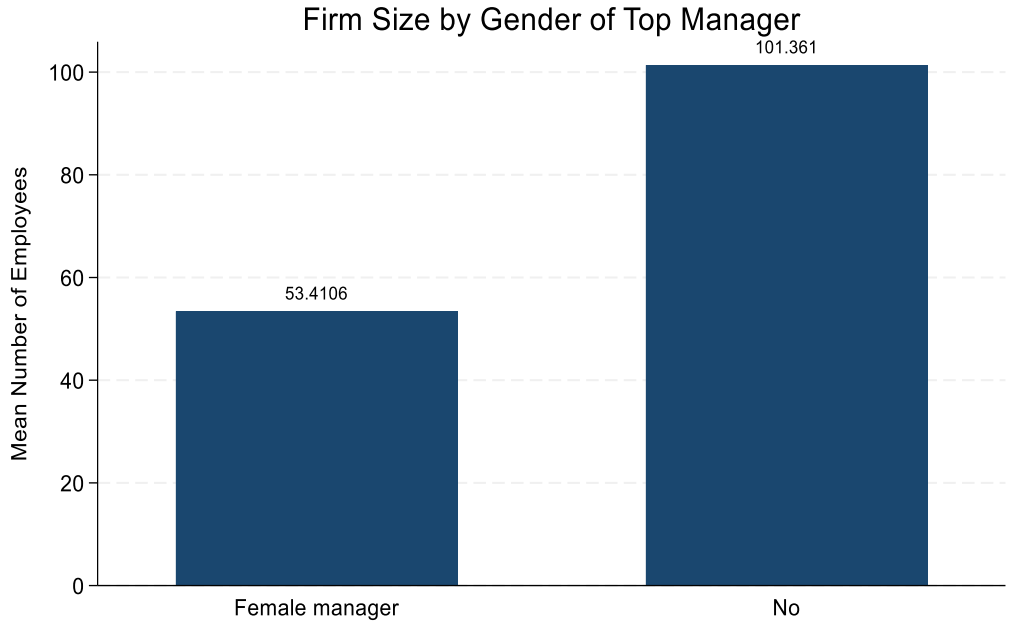


**Figure 1.** Firm size by gender of top manager

Firms with female managers employ, on average, approximately 53 employees, whereas firms led by male managers employ over 100 employees. The descriptive pattern indicates a substantial size differential between male-managed and female-managed establishments in Kazakhstan's business sector.

The analytical process encompassed six steps: (1) data preparation and cleaning, (2) creation of new analytic variables, (3) description and correlation analysis, (4) estimation of the logistic model, (5) calculation of marginal effects, and finally, (6) validation of results. Model building was guided by the philosophy of parsimony, which selects theoretically valid and relevant variables for inclusion in a model.

The integration of structural indicators at the company level, innovation, and institutions offers an evidence-based perspective on gender participation dynamics within the ICT sector in Kazakhstan.

The methodology developed creates a robust basis for the interpretation, as the results are explored and explained in light of gender equity, transformation, and economic development.

## 4. RESULTS

The descriptive analysis offers a first glimpse into gender participation and the features of firms in the ICT industry in Kazakhstan, aggregated from a dataset of 1,013 surveyed firms. The findings show that 26.9 per cent of firms are female-led or female-owned, while 73.1 per cent are male-owned or male-managed. The findings are emblematic of an existing gender disparity among ICT entrepreneurs, as seen in emerging markets, where the technology industry remains predominantly male. Nevertheless, the presence of firms with more than a quarter of their leadership being female or co-owned represents a step toward a more balanced market.

The average company hires 84 employees, suggesting that most companies are medium-sized, even though the standard deviation (203.6) is very high, ranging from 2 workers to 4,000. The average age of a company is 14.5 years, indicating that the vast majority of ICT companies are still young and growing, especially with regard to technological innovation and governance development.

The indicators of innovation activity register a moderate pace of technological innovation. The average innovation indicator values, 1.82 and 1.86, respectively representing product and process innovation, are measured on a three-point scale, indicating that almost half of all organisations achieved new or upgraded products and processes over the last three years. It should, however, be noted that innovation activities are lower than those among advanced digital economies, meaning that ICT transformation in Kazakhstan is in its nascent stage.

As regards external hindrances, a moderate level of financial and institutional barriers was apparent. The average scores of 1.50 for access to finance and 0.95 for corruption barriers, out of a scale of 0 to 4, indicate that, even if present, these are not the most serious barriers to the ICT sector. It should be noted that firms with female participation are predominantly small and face greater credit barriers, which may affect their future development and investment potential. The ICT web indicator, which indicates whether a firm has an official website or a social media account, received an average score of 1.52, indicating that cyberspace presence is a ubiquitous characteristic among firms in the ICT sector.

The descriptive statistics accurately reflect the two-tier structure of the ICT sector as a whole in Kazakhstan, comprising a small but growing number of innovative, female-headed firms and a larger body of established, male-headed firms. The following is a summary of the model variables presented in Table 1.

The involvement of females may be a characteristic predominantly found in small and medium-sized organisations, perhaps as a consequence of lower entry requirements, flexible organisational structures, and

**Table 1.** Descriptive statistics of key variables

| Variable | Obs | Mean | Std. Dev. | Min | Max | Description |
|---|---|---|---|---|---|---|
| Women's participation (1=Yes) | 1,013 | 0.27 | 0.44 | 0 | 1 | Female ownership ≥50% or female top manager |
| Firm size | 1,013 | 84.22 | 203.63 | 2 | 4,500 | Number of full-time employees |
| Firm age | 1,013 | 14.48 | 10.20 | 1 | 89 | Years since establishment |
| Access to finance | 1,013 | 1.50 | 1.44 | –9 | 4 | Perceived financial obstacles (0–4 scale) |
| Corruption obstacle | 1,013 | 0.95 | 2.17 | –9 | 4 | Perceived corruption barrier (0–4 scale) |
| Product innovation | 1,013 | 1.82 | 0.50 | –9 | 2 | Introduction of new or improved products |
| Process innovation | 1,013 | 1.86 | 0.48 | –9 | 2 | Introduction of new processes |
| ICT web presence | 1,013 | 1.52 | 0.50 | 1 | 2 | Existence of a website or social media |

Note: compiled by the authors according to calculations

emerging sectors such as internet-based services, e-commerce, and IT consulting. However, the lower innovation and greater concern expressed regarding financial constraints imply unequal gender performance in innovation potential and integration capacity.

Taking a closer look, the descriptions indicate that women's involvement in the ICT industry in Kazakhstan remains substantial but confined mainly to small, young, and less capital-intensive organisations. It is this scenario that provides a basis for moving to the next stage, an econometric analysis presented in Section 3.2.

The logistic regression model, a type of binary logistic regression, was specified to examine the influence of various company-level drivers on the involvement of women in the ICT sector in Kazakhstan, with the dependent variable measured as whether or not the company is female-owned (more than 50% female-owned or whether a female top manager heads the company). The results are represented in Table 2.

**Table 2.** Logistic regression results for determinants of women's participation in ICT firms.

| Variable | Coefficient (β) | Std. Error | z | p > \|z\| | Marginal Effect (dy/dx) | Significance |
|---|---|---|---|---|---|---|
| Firm size | −0.0026 | 0.0008 | −3.29 | 0.001 | −0.00050 | Significant |
| Firm age | −0.0069 | 0.0081 | −0.85 | 0.394 | −0.00133 | n.s. |
| Access to finance | −0.0863 | 0.0542 | −1.59 | 0.111 | −0.01670 | n.s. (marginally) |
| Corruption obstacle | 0.0318 | 0.0372 | 0.85 | 0.394 | 0.00614 | n.s. |
| Product innovation | −0.1237 | 0.1654 | −0.75 | 0.455 | −0.02392 | n.s. |
| Process innovation | −0.0041 | 0.1731 | −0.02 | 0.981 | −0.00079 | n.s. |
| ICT web presence | −0.0586 | 0.1515 | −0.39 | 0.699 | −0.01133 | n.s. |
| Constant | −0.3030 | 0.4051 | −0.75 | 0.454 | — | — |
| *Model statistics: LR $\chi^2(7) = 20.49$, Prob > $\chi^2 = 0.0046$, Log Likelihood = −580.09. Pseudo $R^2 = 0.0174$, N = 1,013. | | | | | | |

Note: compiled by the authors according to calculations

The model shows a statistically significant joint influence of the explanatory variables on the probability of female participation, proving that individual company characteristics are a collective factor influencing gender differentiation in the ICT industry ($p < 0.01$). The low value of the explained fit, or pseudo $R^2$, of 0.0174, nonetheless, is a characteristic indication, given that the data represent a cross-sectional observation of a rather complex socioeconomic phenomenon.

Among the various predictors, the size of the company proves to be the strongest determinant. The negative and significant result (beta = -0.0026, p-value = 0.001) reveals that large companies are less likely to be headed or owned by females. The marginal effect (dy/dx = -0.0005) reveals that an additional person reduces the female involvement rate by 0.05 percentage points. The results are consistent with the literature, which asserts that female entrepreneurship and management are predominantly seen in small and medium-scale companies, as the barriers to entry remain low, and their organisational setups remain flexible.

Other covariates are not substantial enough to achieve the significance threshold but show interesting signs. The negative sign of the access to finance covariate ($\beta = -0.086$, $p = 0.111$) indicates that financial constraints are greater among female-led firms, as hypothesised, suggesting that a lack of access to orthodox funding affects female entrepreneurship in technology sectors. The negative sign of the 'firm age' covariate ($\beta = -0.0069$, $p = 0.394$) indicates that young firms are dominated by females as managers or partners, suggesting changes in the labour market and in technology expertise among the young generation.

Interestingly, both coefficients for product and process innovation are negative but statistically insignificant, suggesting that innovation intensity is not a discriminant factor between female- and male-headed ICT firms. It could be that innovation by female ICT firms, which are often service-oriented, is embedded in their business model or customer engagement rather than in R&D expenses. The coefficient for the ICT web variable is small and statistically insignificant, suggesting that the mere adoption of internet technology does not necessarily ensure gender inclusion.

Overall, regression analysis results show that structural features of firms, namely, size and access to funding, matter much more for gender participation than operational or technological features. The following section will discuss this set of results within an institutional and policy framework, focusing on gender equity and digital economy strategies in Kazakhstan.

The regression results offer important insights into both structural and institutional drivers of women's participation in Kazakhstan's ICT sector. The influence of the significance of the model parameters, although small, shows that gender participation rates are shaped by company-specific features overall. The evidence shows that gender participation is highest in small- and medium-sized ICT firms. In contrast, large firms are still lagging far behind concerning gender inclusion rates, proving that a structural divide exists, which, among other things, is rooted in traditional gender roles exercised by women as managers, as well as their prevalence in new, less capital-intensive ICT sectors like marketing, design, or software development. The results are presented in Table 3.

**Table 3.** Summary of determinants and qualitative interpretation.

| Determinant | Direction of Effect | Statistical Significance | Interpretation | Classification |
|---|---|---|---|---|
| Firm size | Negative | *p < 0.01* | Larger firms are less likely to be female-owned or led; women are concentrated in SMEs | Barrier |

| | | | | |
|---|---|---|---|---|
| Firm age | Negative | n.s. | Younger firms show slightly higher female participation, possibly reflecting generational shifts. | Mild driver |
| Access to finance | Negative | p ≈ 0.10 | Financial constraints reduce women's capacity to expand ICT enterprises | Barrier |
| Corruption obstacle | Positive | n.s. | Minimal impact; women-led firms may have neutral perceptions of institutional barriers | Neutral |
| Product innovation | Negative | n.s. | Innovation activities do not significantly differentiate female-led firms | Neutral/Barrier |
| Process innovation | Negative | n.s. | Technological process improvements show no gender-based differentiation | Neutral |
| ICT web presence | Negative | n.s. | Online visibility is widespread | Neutral |

Note: compiled by the authors according to calculations

The strongest and most robust finding concerns firm size, supporting the view that structural barriers to scale are the primary hindrance faced by females in ICT entrepreneurship. The small size of female-controlled firms is attributed to their limited access to credit, venture capital, and networking, which hinder their entry into a broader, more competitive sector of the technology market. It could therefore be interpreted that gender gaps in the ICT sector are not founded solely on their innovation and skill potential. Figure 2 displays the average marginal effects derived from the logistic regression estimating the probability that a firm is female-led.

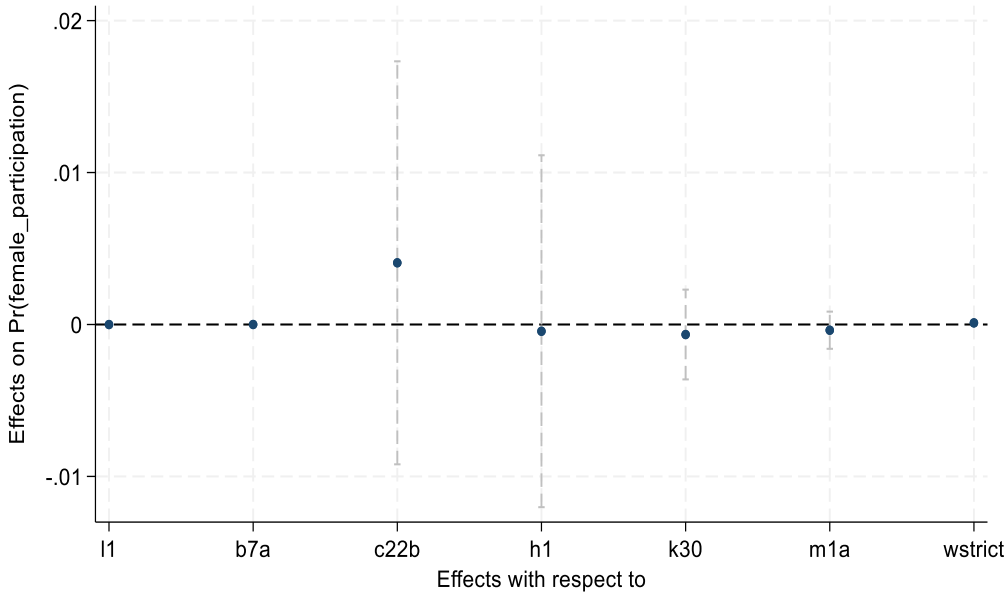


**FIGURE 2.** Marginal effects of regression variables on female participation

Each point represents the change in the predicted probability of female participation associated with a one-unit change in the corresponding explanatory variable, holding all other factors constant. The confidence intervals illustrate the degree of statistical precision, indicating that the included predictors exhibit relatively small and statistically insignificant marginal effects on female participation in Kazakhstan's firms.

Even if the lack of statistical significance existed for innovation and technology participation, a negative or non-positive sign indicated that female participation is not necessarily positively related to innovation and technology sophistication. It is consistent with global findings, as female participation in ICT initiatives is found to be highly vulnerable to the quality of an innovation ecosystem, including the availability of innovation inclusion programs, mentors, and technology infrastructure.

At the policy level, the conclusions point in several directions toward gender equity through the development of the Kazakhstan digital economy. Create credit lines, guarantees, and micro-financing facilities specifically targeting women-led ICT startups as a measure to reduce structural credit barriers. Include programs that mentor or train women to participate in technology-based sectors, with a focus on innovation management and scalability. Make gender-relevant criteria part of national innovation and digitisation strategies that align with ESG principles, emphasising equality, transparency, and inclusion. Enhance initiatives aimed at involving women in leadership, strengthen policies promoting gender diversity, gender inclusion and gender equality, and enhance leadership development programs designed specifically for women or targeted toward the female gender group.

The research results show that, although emerging gender diversity trends are apparent in the ICT industry in Kazakhstan, women's engagement is currently affected by company size and financial access. The development of this sector, leading to a diverse and innovative ecosystem, will depend both on technological development and institutional initiatives aimed at reducing gender-rooted barriers.

## 5. CONCLUSION

This study examined the determinants of women's participation in the information and communication technology (ICT) sector of Kazakhstan using firm-level data from the World Bank Enterprise Survey (2024) and insights from global empirical research. The analysis revealed that despite growing awareness and national digitalisation efforts, women's representation in ICT ownership and leadership remains limited, with only about one-quarter of firms led or co-owned by women. This underrepresentation is not an isolated phenomenon but reflects structural, institutional, and socio-cultural constraints that continue to shape gender dynamics in the labour market.

The empirical results indicate that firm size is the most significant determinant of women's participation: female-led enterprises are predominantly small and medium-sized, suggesting that scaling barriers—such as access to finance, managerial networks, and market power—restrict women's advancement into larger, more competitive segments of the ICT sector. Although other factors, including firm age, access to finance, innovation activity, and corruption obstacles, were not statistically significant, their directional effects confirm the multidimensional nature of gender disparities. Women's participation tends to be higher in younger, more innovative, and more digitally adaptive firms, suggesting that modernisation and generational change may gradually reduce gender imbalances over time.

The literature review reinforces these findings by highlighting the interplay between social expectations, cultural attitudes, organisational climates, and individual confidence in determining women's ICT careers. Gender stereotypes, lack of mentorship, and limited visibility of female role models remain significant barriers across contexts, while inclusive policies, educational empowerment, and community support emerge as enabling conditions. Comparative evidence from Africa, Europe, and Asia further demonstrates that women's participation in ICT improves when supported by digital infrastructure, gender-sensitive policies, and targeted financing mechanisms.

For Kazakhstan, these results carry important implications. Promoting gender inclusiveness in the ICT sector requires a

coordinated policy response that integrates economic incentives, educational reform, and institutional modernisation. Specifically, three strategic directions are recommended: enhancing financial inclusion and access to capital for women-led ICT startups through dedicated grant programs, credit guarantees, and venture support; embedding gender-sensitive approaches in national innovation and digitalisation strategies, including mentorship networks, flexible work arrangements, and transparent promotion systems; and strengthening ICT education and training for women and girls, particularly in rural and underserved regions, to build a sustainable talent pipeline for the digital economy.

Ultimately, the findings underscore that gender equity in ICT is not merely a social objective but a strategic driver of innovation, productivity, and sustainable growth. As Kazakhstan advances its digital transformation under initiatives, ensuring the full inclusion of women in ICT-related education, employment, and entrepreneurship will be critical for unlocking the country's human capital potential and achieving equitable participation in the global digital economy

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Resources: Peter Karascony.
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Data collection, analysis and interpretation: Peter Karascony.
Visualization: Peter Karascony.
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# Issues of Ensuring Food Security Among the Elderly Population: A Scientometric Review of Publications

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## ABSTRACT

Food security among the elderly population is a pressing issue with multifaceted implications for health and well-being. The study aims to systematically map the global research landscape on food security among the elderly population and identify dominant thematic clusters, influential publications, and structural research gaps. A scientometric methodology was applied, combining descriptive statistics and network analysis using Scopus data for 1996-2024. Descriptive statistics and network analysis methods were employed using VOS viewer software for data processing and visualization. Descriptive statistics revealed a sharp acceleration in research output after 2011, with publication dynamics well captured by a 4th-degree polynomial model ($R^2$ = 0.9288). The research is highly interdisciplinary, spanning agricultural and biological sciences, medicine, and social Sciences. The United States, China, and the United Kingdom lead in publication output, while the Chinese Academy of Sciences (55 publications) and the National Natural Science Foundation of China (92 funded studies) are the key institutional and financial contributors. The analysis confirms the field's complexity and interdisciplinary nature and reveals critical gaps, particularly the lack of longitudinal and qualitative studies. A critical structural gap was identified between biological research and socio-policy studies, indicating limited integration across disciplinary boundaries. The systematized knowledge and identified research structure serve as a robust basis for policymakers and researchers to develop targeted interventions and define new, high-priority research directions.

**KEYWORDS**: Food Security, Elderly Population, Ageing Economics, Economic Vulnerability, Scientometric Analysis, Social Inequality, Evidence Mapping

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## 1. INTRODUCTION

Food security among the elderly population is a pressing issue with multifaceted implications for health, well-being, and societal dynamics. Conducting a scientometric analysis of research in this area is crucial for understanding the nuanced challenges and devising effective interventions.

Nutrition problems represent a fundamental aspect of food security among older adults. Factors such as decreased appetite, limited mobility, and health problems often hinder their ability to maintain a balanced diet. Poor nutrition not only exacerbates existing health conditions but also increases susceptibility to diseases, thereby compromising overall well-being. Economic factors further compound the issue, as limited financial resources may lead to food insecurity. Fixed incomes, rising food prices, and high healthcare costs force older individuals to make difficult choices, often compromising the quality and quantity of food they can afford. This economic strain exacerbates nutritional deficiencies and undermines health outcomes. Social isolation adds another layer of complexity to the issue. Many elderly individuals live alone or lack a robust support system, which can impede their access to nutritious food. Feelings of loneliness and isolation may also diminish their motivation or ability to shop for groceries and prepare meals, exacerbating nutritional challenges. Health status significantly influences food security among older people. Chronic illnesses, disabilities, and cognitive decline can diminish their capacity to shop, cook, and eat independently. These health-related limitations further exacerbate nutritional deficiencies and contribute to the cycle of food insecurity.

The purpose of this review is to provide a comprehensive overview of research related to food insecurity among older adults. Conducting a scientometric analysis of research on this topic is crucial for several reasons. Firstly, such an analysis provides a comprehensive overview of existing knowledge and research trends in the field of food security among older adults. By examining a wide range of scholarly publications, including academic articles, reports, and studies, researchers can identify gaps in the literature, emerging research themes, and areas that require further investigation. This insight is invaluable for informing future research directions and policy interventions to address food insecurity among older adults. Moreover, a scientometric analysis allows researchers to assess the impact and dissemination of existing research on food security among the elderly. By analyzing citation patterns, publication trends, and collaboration networks, researchers can gain insights into which studies have had the most significant influence and which areas of research are receiving the most attention. This information can help identify key stakeholders, potential collaborators, and opportunities for knowledge translation and exchange.

Additionally, conducting a scientometric analysis enables researchers to evaluate the effectiveness of interventions and policies aimed at improving food security among older adults. By examining changes in research output and citation rates over time, researchers can assess whether efforts to address food insecurity among older adults are yielding positive results and identify areas where further action is needed.

Conducting a scientometric analysis of research on food security among the elderly is essential for understanding the current state of knowledge, identifying research gaps, assessing the impact of existing interventions, and informing future research and policy efforts in this critical area.

## 2. LITERATURE REVIEW

Food security (hereinafter – FS) among the elderly population is fundamentally a nutritional issue, intrinsically linked to their health status and the physiological changes inherent to ageing. Food insecurity (hereinafter – FI), defined as the lack of consistent access to sufficient quantities of safe and nutritious food,

is a primary predictor of negative health outcomes among this demographic group.

When older adults are forced to ration or compromise on food quality, they may also fail to comply with vital medication regimens or use low-quality products, which consequently exacerbates their overall health status (Wolfe et al., 1996). Food insecurity is directly correlated with an increased risk of developing or exacerbating chronic conditions, such as type 2 diabetes, hypertension, and cardiovascular diseases (Cook & Jeng, 2009).

Furthermore, studies have established a clear association between FI and worsened mental health, including higher rates of depression, anxiety, and stress (Leroux et al., 2020). Age-related physiological changes, such as reduced appetite (anorexia of ageing), limited physical mobility, and dental issues, are significant barriers to maintaining a balanced and adequate diet. The systematic review by Zarei et al. (2021) confirmed that food insecurity in the elderly is significantly associated with low levels of vitamins and minerals and with overall insufficient intake of both micro- and macronutrients. Therefore, the issue extends beyond merely having a sufficient quantity of food; it crucially concerns the quality and nutritional density of the food.

In practice, older adults frequently face complex barriers to achieving adequate nutrition. Jones et al. (2009), in their review, highlighted obstacles such as a lack of nutritional education, low income, and transportation difficulties in accessing grocery stores. They emphasise the need to develop targeted interventions, such as food subsidy programs, meal delivery services, and educational initiatives, to improve dietary behaviours.

The issue of food insecurity is not confined to the home environment. An integrative review by Wang et al. (2017) focusing on access to food choices in residential aged care facilities revealed that, despite centralised food provision, residents often face limited choice and insufficient access to palatable alternatives. This factor compounds the risks of malnutrition and nutritional deprivation even within institutional settings, underscoring the importance of individualized care.

Food insecurity among older adults is inextricably linked to their socio-economic status and specific behavioral patterns. The primary economic determinant is limited fixed income (pensions) combined with rising costs of living, particularly for housing and, most critically, healthcare. This forces many elderly individuals to make difficult compromises, often having to choose between purchasing necessary medications and buying nutritious food (Vilar-Compte et al., 2017). Hall (2005), for instance, noted that a significant portion of older adult households in the United States faced food insecurity precisely due to insufficient financial resources. This issue is compounded by the rising cost of healthy foods, making them unaffordable for low-income seniors.

Beyond economics, social isolation and the absence of a support system play a critical role. Older adults living alone or lacking close assistance often face difficulties accessing grocery stores (due to lack of transportation), preparing meals, and, as a result, are at a higher risk of food insecurity. The conceptual framework proposed by Wolfe et al. (1996) emphasized that food insecurity arises not only from income insufficiency but also from the complex interactions among health status, participation in food assistance programs, and lifelong experiences. Their model helps researchers understand why current assistance programs do not consistently achieve their goals.

On a behavioral level, changing dietary habits and inadequate market adaptation also affect food security. Alhammadi et al. (2021) highlighted the importance of understanding consumer behavior and the evolving preferences of older adults to develop products that are appropriate in terms of portion size and nutritional composition. Tailored food marketing and product development are essential for this group. In terms of solutions, Njeri (2021) emphasized that overcoming food insecurity requires multi-level strategies. These range from government assistance (improving

food programs and social security nets) and fostering strong family and community support to providing humanitarian aid and initiatives to increase nutritional literacy. Thus, effective strategies must address not only caloric deficits but also the deep-seated social and economic barriers facing the elderly.

The literature reviewed above confirms that food security among the elderly is a complex, multifaceted problem that cannot be solved through a single disciplinary approach. Research in this area is distributed across numerous fields, including medicine, sociology, economics, and nutrition science. This dispersed nature, while enriching the knowledge base, also poses a challenge for systematizing the accumulated findings.

Despite a significant body of research, including the foundational work of Franklin (2012), Burholt et al. (2012), Freiria et al. (2022), Mills (2021), Mavegam Tango Assoumou et al. (2022), Shahrin et al. (2019) there remain gaps in the scientific literature that significantly limit the development of truly effective interventions. First, most existing studies are primarily cross-sectional and provide only a snapshot of food insecurity at a given point in time, rather than allowing us to track its dynamics. Second, there are virtually no in-depth qualitative studies that allow us to understand the subjective experiences of older people, their coping mechanisms, and the subtle decision-making processes in situations of limited access to food. Third, the geography of research remains extremely limited. The bulk of empirical work is carried out in high-income countries, primarily in the USA, China, and the UK. This narrows the scope for generalizing results and makes it challenging to apply existing conclusions to low- and middle-income countries, where vulnerability patterns, institutional conditions, and socioeconomic factors may differ significantly.

Given that the field is rapidly developing yet remains fragmented, the primary challenge is not the lack of data, but the difficulty in systematizing, mapping, and assessing the impact of that data. Therefore, to address these critical structural gaps and provide a comprehensive overview, it is highly relevant and necessary to conduct a scientometric analysis. This quantitative approach will consolidate accumulated knowledge by mapping the field's structure, objectively pinpointing the main research trends, key authors, and, crucially, the missing directions where future research is most needed, and by evaluating the influence and dissemination of existing research through analysis of citation and collaboration patterns. This analysis will provide the required analytical structure and foundation for future research and targeted policy development, effectively filling the synthesis gap left by previous, more narrative reviews.

## 3. METHODOLOGY

The primary objective of this study is to systematically map the research landscape on food security among the elderly, requiring a methodology capable of quantitatively assessing the field's structure and dynamics. For this purpose, this paper employed a scientometric analysis, a robust quantitative and statistical approach designed to systematically delineate the research domain based on large-scale analysis of publication data (Macias-Chapula, 1998; Raan, 1997).

The choice of scientometrics is justified by its scope, which distinguishes it from more constrained review methods. A systematic review is primarily focused on synthesizing evidence to answer a specific, often clinical or narrowly defined, research question. While SRs provide high-level evidence synthesis, they do not inherently capture the structural evolution, collaboration networks, or quantitative impact metrics (e.g., citation flows) of an entire field. In contrast, scientometric analysis provides an objective and comprehensive mapping of the entire disciplinary landscape, identifying its historical development, current structure, and key influential actors. The terms bibliometrics and scientometrics are often used synonymously; however, we align with the view that bibliometrics is an antecedent and often a

subset of scientometrics, traditionally focused on the statistical analysis of publications (e.g., counting authors, documents, and journals). Scientometrics is a broader quantitative field that incorporates advanced techniques to evaluate the performance, effectiveness, and impact of scientific research (e.g., trend identification, citation flow analysis, and knowledge structure mapping).

Given that food security among the elderly is a rapidly evolving, fragmented, and interdisciplinary field, a traditional narrative or systematic review would be insufficient to capture its breadth. Therefore, scientometric analysis is the optimal methodology for this study. It allows us to quantify structural trends objectively, identify latent thematic clusters, detect collaboration lacunae (gaps), and assess the actual influence of foundational publications, thereby providing a holistic foundation for future scholarly and policy directions.

The data for the scientometric analysis were extracted from the Scopus database, which was selected due to its extensive coverage of peer-reviewed literature across all major disciplines (sciences, technology, medicine, social sciences, arts, and humanities), ensuring the capture of the interdisciplinary nature of the research area (Singh et al., 2021). The search was executed on Setember, 7, 2025 and covered the period from 1996 to 2024 to capture the historical evolution of the field from its early stages.

To conduct the bibliometric analysis, a search string was developed that was both accurate and replicable within the Scopus dataset. The focus was on publications in which the key concepts appeared in the title, abstract, or keywords. Accordingly, the following search string was applied: food security AND (elderly OR aging OR older adults OR senior citizens).

The initial dataset required refinement to ensure its quality and relevance. All non-research materials, such as editorials, letters, and book chapters, were excluded. At the same time, only scientific articles, review papers, and conference proceedings were retained, as these types of publications represent substantive research outputs. The search was further limited to English-language publications to maintain linguistic consistency and support the accuracy of subsequent analyses. This step is significant for visualizing the data in VOSviewer, as it ensures that the keywords and annotations can be reliably interpreted.

The initial search turned up 1,023 articles. After this, this research applied all the filters and ended up with a final list of 949 docs. The work uploaded them in .csv format. Each document includes all the bibliographic info, such as the author's name, title, abstract, year of publication, where they work, where the research was conducted, and a list of other papers they cited. That way, it is ready for further scientific analysis and visualization later.

Descriptive statistics were generated using the analytical tools available in Scopus to obtain a quantitative overview of the research landscape. This included examining annual publication trends to trace the field's development over time, identifying the leading countries, institutions, authors, journals, and funding agencies, and classifying publications by their primary Scopus subject areas to highlight the field's interdisciplinary nature.

The network and cluster analysis were conducted using VOSviewer (version 1.6.20), which enabled a comprehensive visualization of the intellectual structure of the research field. Thematic clustering was applied to identify the semantic organization of the literature by examining the co-occurrence of key terms extracted from titles and abstracts. Full Counting served as the basis for term selection, and only concepts that appeared at least 5 times were included to ensure analytical relevance. The software employed the Association Strength normalization method, allowing the formation of distinct clusters through modularity optimization, with node sizes reflecting the relative frequency of each term.

Alongside thematic mapping, co-authorship and citation network analysis were used to trace the structure of scholarly collaboration and the

influence of individual publications. Author networks revealed groups of researchers who tend to work together, while citation linkages highlighted the foundational studies shaping the field, with the prominence of individual nodes reflecting their citation impact.

Several methodological limitations should be acknowledged. The analysis relied exclusively on the Scopus database, which, despite its broad disciplinary coverage and rigorous indexing standards, may omit relevant research published in regional or highly specialized outlets not included in its catalog. In addition, restricting the dataset to English-language documents ensured consistency and comparability but inevitably narrowed the linguistic and geographical diversity of the sample. These constraints were intentionally applied to maintain high data quality and internal coherence in the construction of large-scale network maps, though they may limit the absolute completeness of the scientometric representation.

## 4. Results

The descriptive analysis provides essential quantitative insights that, when interpreted alongside the existing literature, reveal the evolving priorities and structure of the research field. It aligns temporally with the publication of several foundational and highly cited works that significantly shaped the research agenda. For instance, the influential work by Franklin (2012), which explored the mediators of food insecurity and obesity, along with studies such as Burholt (2012), played a crucial role in bringing the topic into wider academic discourse. Although there was a peak in 2018–2020 followed by a decline, the overall trend since 1996 remains sharply upward, underscoring the growing global relevance of food security as a critical issue for aging populations. The analysis of publication confirms a significant increase in research interest since 2011 (Figure 1).

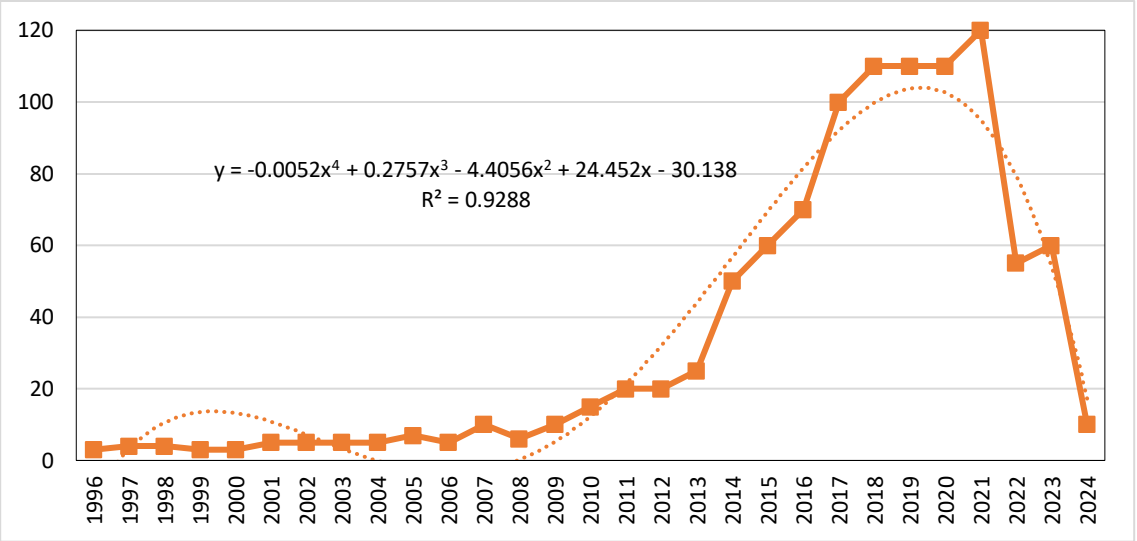


**Figure 1.** Temporal dynamics of publications

The temporal trend is mathematically confirmed by a 4th-degree polynomial fit. This model yields a coefficient of determination (R2) of 0.9288, indicating that the polynomial function accounts for over 92% of the variability in annual publication output. The high R2 value validates the observed pattern of accelerated exponential growth leading up to 2021, reinforcing the conclusion that the research field has experienced a profound surge in scholarly attention over the past decade.

The research exhibits a profoundly interdisciplinary nature, spanning several Scopus subject areas (Figure 2).

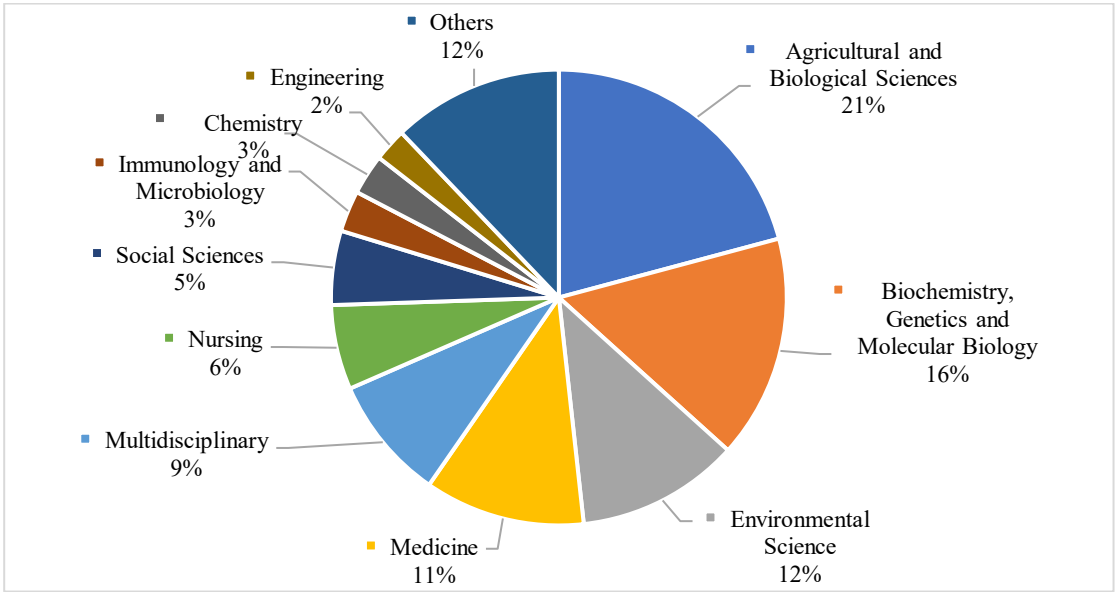


**Figure 2.** Subject area distribution

The top subject areas are Agricultural and Biological Sciences (20.8%), Biochemistry, Genetics and Molecular Biology (15.9%), and Environmental Science (11.6%), followed closely by Medicine and Social Sciences. The dominance of Agro-Biological Sciences suggests that research on elderly food security is no longer confined to outcomes (the end of the chain, such as malnutrition and health status) but is increasingly viewed through the lens of production, food quality, and environmental impact (the beginning of the chain). This multi-perspective approach confirms the problem's multifaceted complexity and the necessity of integrated, non-medical solutions.

The research exhibits a profoundly interdisciplinary nature, spanning several Scopus subject areas (Figure 3).

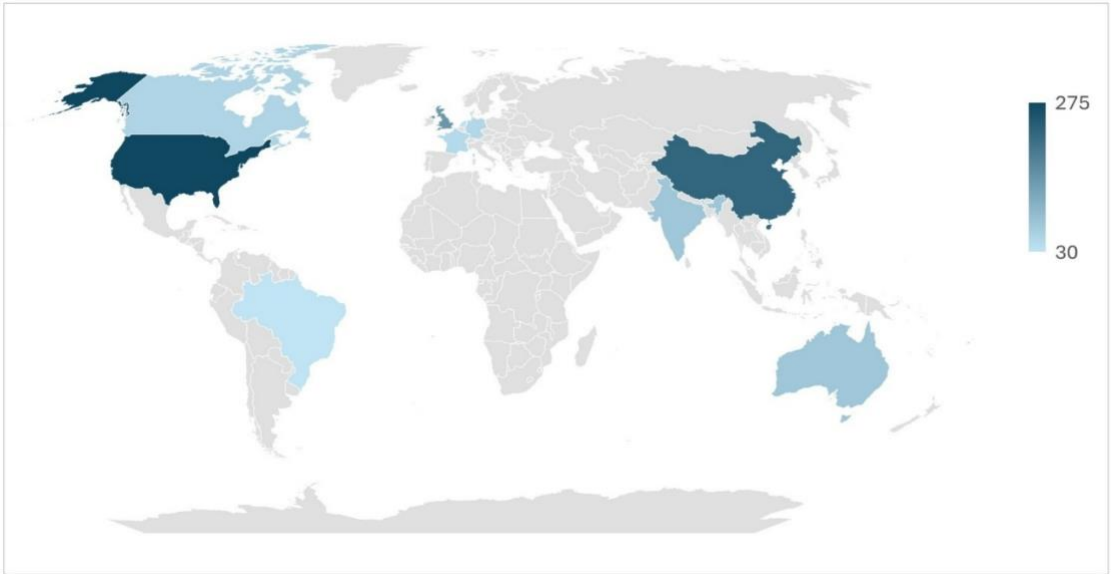


**Figure 3.** Global distribution of articles

The map reflects the global geography of research on food security for the elderly. The map shows that the largest concentration of publications is in the USA, China, and the UK, which are key centers of scientific activity. Canada, Australia, and several European countries also make significant contributions. A weaker representation is observed in the countries of Latin America, Africa and Central Asia, which indicates a significant regional imbalance in scientific attention to this problem. The top fields contributing to the research on food security among the elderly are Agricultural and Biological Sciences (21%), Biochemistry, Genetics and Molecular Biology (16%), and Environmental Science (12%). These are followed by Medicine (11%) and Multidisciplinary (9%) areas. This distribution underscores the necessity of a multi-perspective approach to the problem, moving beyond traditional medical and social sciences to include biological and environmental perspectives.

The analysis of author productivity revealed that a group of authors, including Ali, Long, Rizwan, and Zhang, ranks at the top in terms of contributions, each having published 6 documents (Figure 4).

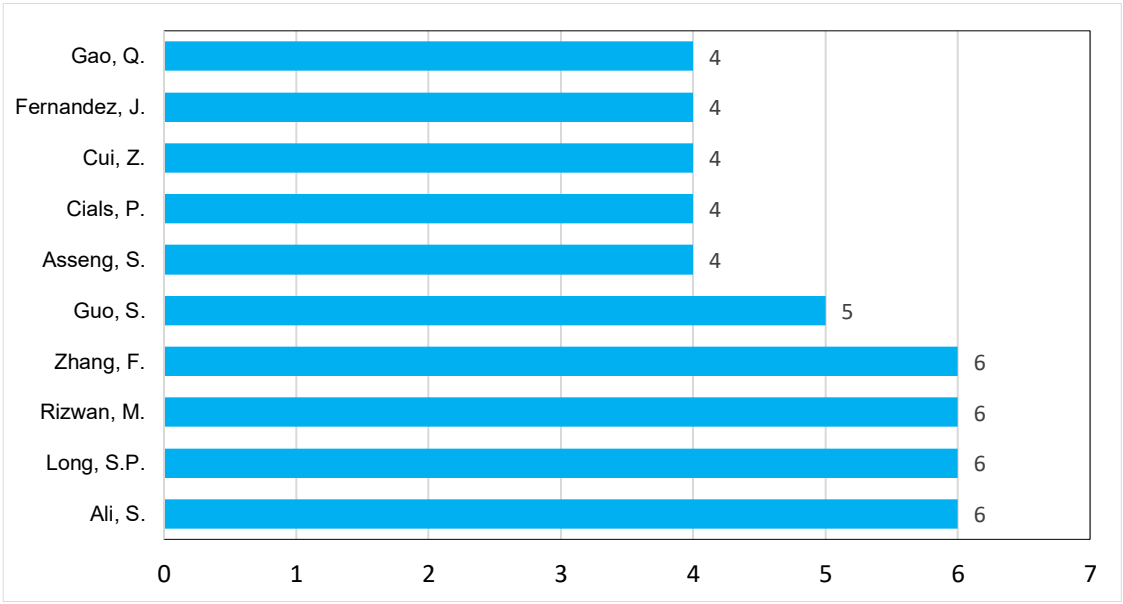


**Figure 4**. Author and affiliation productivity of publications

The horizontal distribution of productivity, in which no researcher forms a noticeable dominance in the number of publications, indicates two key features of the field's development. Firstly, such a structure is typical for relatively young or emerging research niches, where stable scientific schools and leading author centers have not yet developed. Secondly, this pattern is typical of highly interdisciplinary fields, where contributions are distributed among specialists from different fields - medicine, economics, agricultural sciences, and related disciplines - resulting in knowledge accumulating not around one or two "scientific giants" but through many parallel research lines forming a more uniform and fragmented structure for publication activity. The institutional analysis provides a powerful counterpoint to the author's findings on productivity (Figure 5).

The Chinese Academy of Sciences (hereinafter – CAS) is identified as the single most productive institution, contributing 55 publications. The CAS's overwhelming leadership, when juxtaposed with the distributed author output, suggests a high degree of vertical research integration within China.

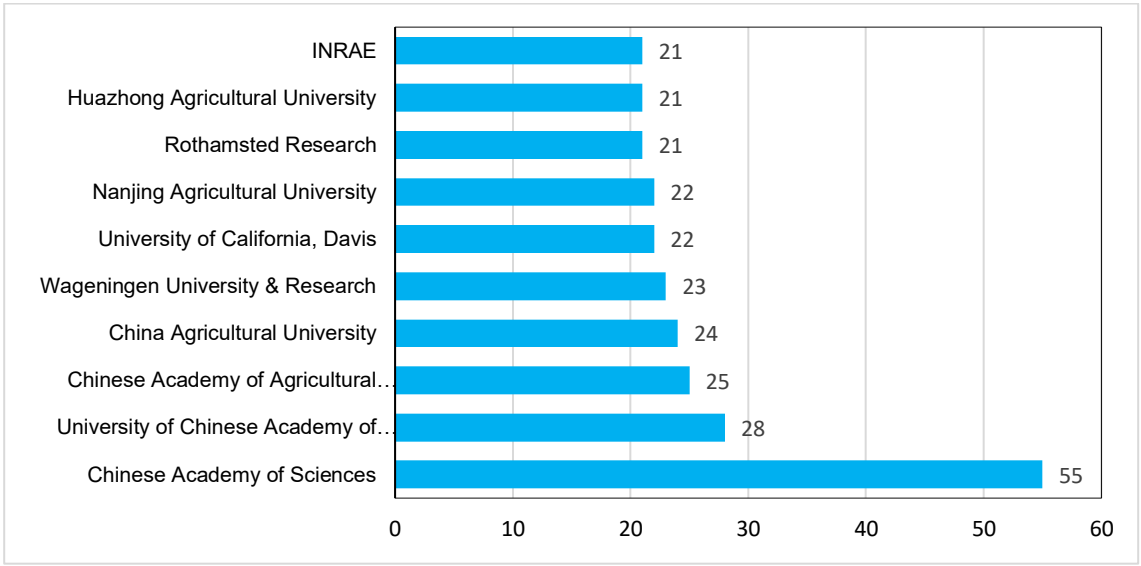


**FIGURE 5.** Institutional productivity of publications

This institutional dominance is directly linked to the analysis of funding sources, which identified the National Natural Science Foundation of China as the leading financial sponsor. This demonstrates a strategic, top-down approach that channels substantial national funding and institutional resources to support long-term, focused research on food security among the elderly, especially given China's demographic pressures.

This finding is crucial for understanding the geopolitical concentration of knowledge production in this domain. The analysis of funding bodies is crucial for understanding the strategic priorities and evolving nature of research investment (Figure 6).

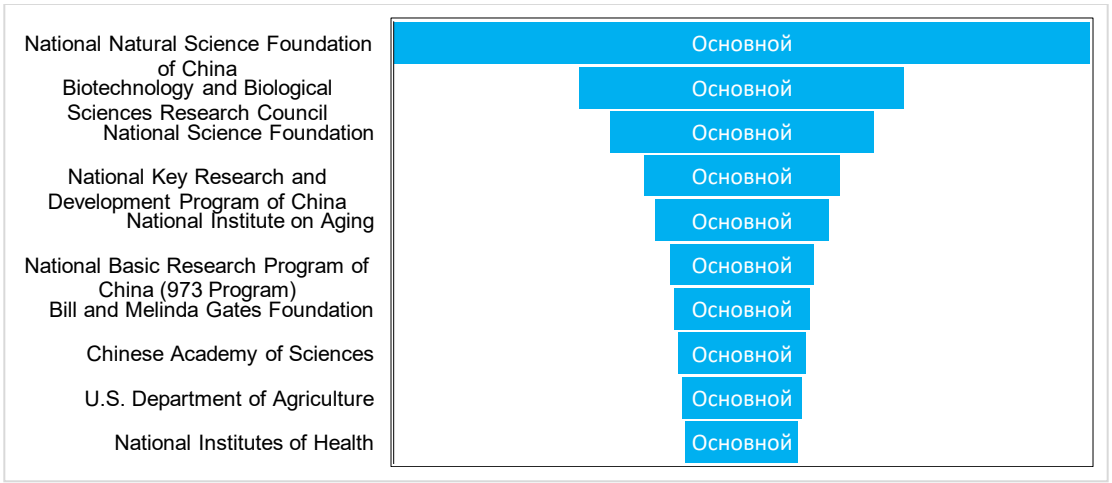


**Figure 6**. Funding sources of publications

The data confirms that the National Natural Science Foundation of China (92 publications) and the Biotechnology and Biological Sciences Research Council (43 publications) are the dominant sponsors. Interpretation of Funding Shift: The presence of other key funding organisations highlights a significant and necessary transition from purely agricultural or

biological funding to a comprehensive socio-medical and global investment model:

(1) Socio-Medical Focus: The involvement of the National Institute on Ageing (NIA), a core component of the U.S. National Institutes of Health, signals a clear focus on the medical and social determinants of ageing and food insecurity. This demonstrates recognition that food insecurity is a geriatric health crisis that requires public health and clinical research funding.

(2) Global and Policy Focus: The notable support from the Bill and Melinda Gates Foundation (18 publications) underscores the issue's elevation to a matter of global development and policy concern. Funding from such a foundation indicates that research is moving beyond national borders and specific demographics to address the problem in the context of global equity and sustainable development goals.

The funding portfolio confirms that research on food security among the elderly is no longer confined to the supply side (agriculture), but is now strategically supported by major bodies that prioritize comprehensive, integrated research that connects biological vulnerability, social policy, and global health outcomes. The network analysis conducted with VOSviewer goes beyond descriptive metrics to reveal the underlying structure and connectivity of the research field, thereby fulfilling the requirement for deeper analytical interpretation. The analysis of co-occurring terms identified four distinct thematic clusters, underscoring the field's highly interdisciplinary nature. The scientific significance lies in understanding the disparate knowledge domains. The analysis of co-occurring terms using VOSviewer revealed four primary thematic clusters, which define the intellectual structure of the field (Figure 7).

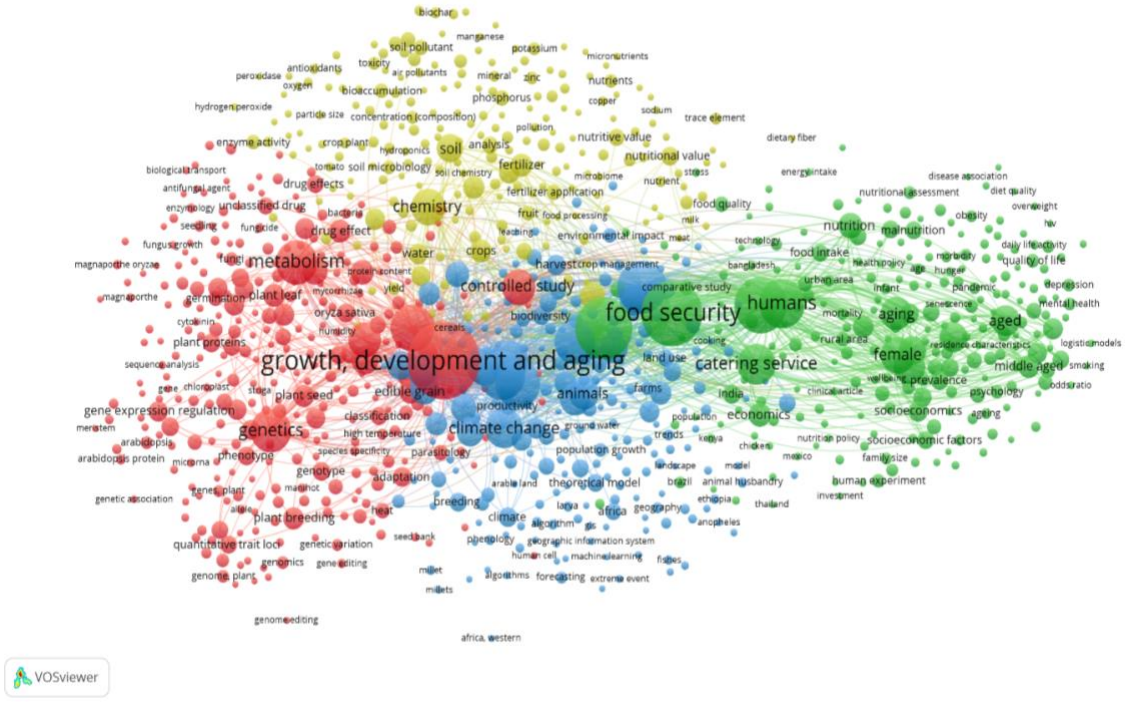


**Figure 7**. Thematic clustering of key terms

The scientific discussion requires a detailed interpretation of each cluster's focus and its relationship to the existing body of knowledge.

1. Green Cluster (Core Medical and Nutritional Outcomes). This cluster represents the core of the research, centered on terms such as "food security", "humans", "nutrition", and "malnutrition". Research in this domain primarily focuses on the direct health consequences of food insecurity and specific

nutritional deficiencies. It reflects the clinical and public health perspective, often utilizing national survey data to quantify the prevalence of malnutrition and associated chronic diseases. This aligns directly with the established findings linking food deprivation to negative health outcomes and non-compliance with medical regimens (Cook & Jeng, 2009; Zarei et al., 2021). The cluster's prominence confirms that the immediate health impact remains the most frequent and central research theme.

2. Pink Cluster (Socio-Demographic Context and Policy). This cluster groups terms such as "ageing", "aged", "health", "social policy", and "poverty". It emphasizes the social determinants of food security, highlighting the role of economic limitations, social support networks, and community services. This research area is heavily influenced by sociological and public policy frameworks. The findings in this cluster strongly resonate with the conceptual model proposed by Wolfe et al. (1996), which established that resource deficiencies and access limitations, rather than just a lack of food, are the key drivers of food insecurity among the elderly. Studies here often evaluate the effectiveness of government programs and community-based interventions.

3. Blue Cluster (Agro-Environmental and Supply Factors). The Blue Cluster, defined by terms like "soil analysis", "fertilizer", "climate change", and "food quality", addresses food security from a supply-side perspective. This orientation demonstrates a significant interdisciplinary shift, connecting the well-being of the elderly directly to global environmental changes and agricultural practices. The focus is on the quality, availability, and sustainability of the food chain, reflecting the growing understanding that diet quality is as critical as quantity. The research outputs here often intersect with the work of Alhammadi et al. (2021), who emphasized the need to understand consumer behavior and product development in the context of food supply constraints and changing food preferences among the older population.

4. Red Cluster (Biological and Genetic Aspects of Ageing). This cluster is characterized by fundamental biological terms like "growth", "development and ageing", "genetics" and "gene expression regulation". It focuses on the physiological mechanisms that govern appetite, nutrient absorption, and metabolism in old age. Research within this area seeks to understand how genetic predisposition and cellular aging processes contribute to unique nutritional requirements or vulnerabilities to food scarcity. While forming a distinct scientific domain, this cluster indicates a specialized focus, often divorced from practical policy implications.

The analysis of co-occurring key terms, visualized in the network map, enabled the formal identification of four distinct thematic clusters, summarized in detail in Table 1.

**Table 1.** Thematic clusters of research on food security among the elderly population for 1996–2024

| Cluster | Key focus | Central terms | Scientific significance and interpretation |
|---|---|---|---|
| Red Cluster | Biological and Genetic Aspects of Aging | "growth and aging", "genetics", "gene expression regulation", "drug effect" | This cluster shows research intersecting with fundamental life sciences. It addresses the physiological mechanisms of aging and how they influence nutritional needs. |
| Blue Cluster | Agro-Environmental Factors | "soil analysis", "fertilizer", "climate change", "food quality" | This highlights the research focus on the supply-side determinants of food security. It connects food availability and quality directly to agricultural production practices and environmental sustainability. |
| Green Cluster | Medical and Nutritional Outcomes | "food security", "humans", "nutrition", "malnutrition", "female", "male" | This is the core domain, focusing on the immediate impact of food security on health, dietary behavior, and clinical outcomes, including the study of gender differences in vulnerability. |

| | | | |
|---|---|---|---|
| Pink Cluster | Socio-Demographic Context and Policy | “agieng”, “aged”, “health”, “social policy”, “poverty” | This cluster addresses the social determinants of health and the necessity of policy-level measures (social policy, economic interventions) to mitigate food insecurity risks. |
| *Clusters were generated using VOSviewer analysis of co-occurring terms (minimum frequency threshold = 5). Full Counting was employed for term extraction. | | | |

Note: compiled by the authors

The structural organization of the thematic map reveals a critical disconnect between two primary knowledge domains: the Red Cluster (Biological/Genetic) and the Pink Cluster (Socio-Demographic). The observed distance and limited linkages between the physiological determinants of aging and social policy frameworks represent a major structural limitation in the current body of research. This gap highlights a tendency for researchers to study either the internal, biological vulnerability of the elderly or the external, socio-economic factors, with insufficient integration between the two.

This separation poses a serious constraint on the development of effective integrated and interdisciplinary intervention programs. For instance, interventions based solely on social policies (Pink Cluster) may fail to account for the unique metabolic and genetic factors (Red Cluster) that dictate how individuals respond to specific dietary inputs. Conversely, biological research, without social context, remains purely theoretical. The absence of connectivity signifies a failure to produce truly translational research that can link genetic and physiological markers of vulnerability to targeted, contextualized social and economic interventions. Addressing this structural gap should be a high-priority direction for future scholarship, requiring a collaborative effort between molecular biologists, public health experts, and social scientists.

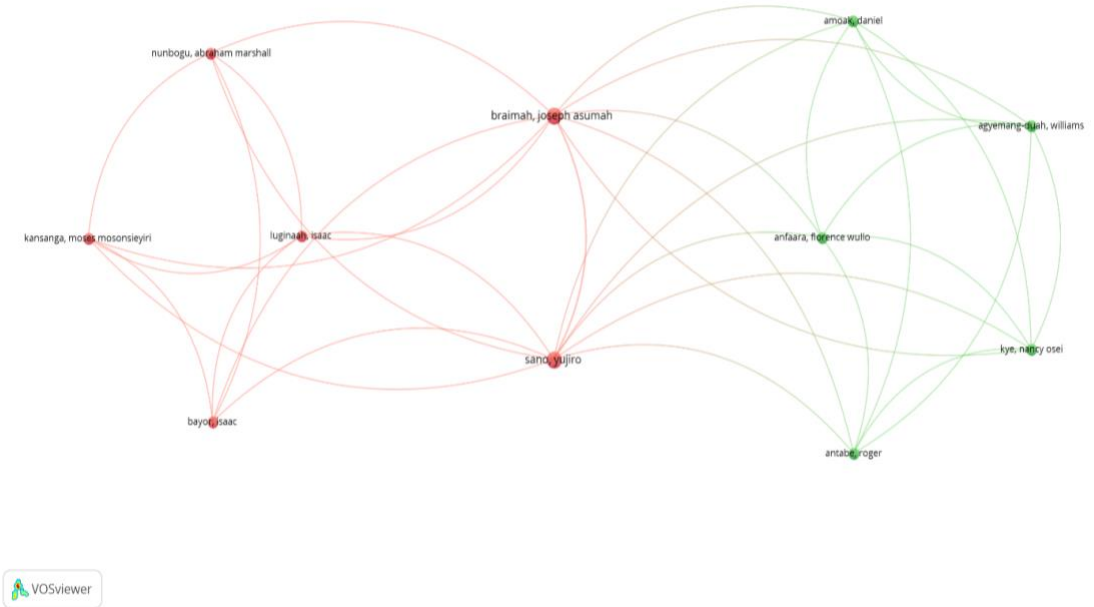


**Figure 8**. Co-authorship network analysis

The co-authorship network reveals the structure of collaboration within the field, grouping authors into clusters based on frequent joint publications. This analysis confirms that collaboration is largely contained within specific research groups, but also

highlights critical authors who facilitate inter-group knowledge flow.

Red Cluster (e.g., Kansanga, Luginaah, Bayoh). This cluster primarily focuses on public health outcomes and geographical disparities in food security, often using cross-sectional survey data from sub-Saharan Africa. For instance, Kansanga et al. (2022) published a study examining the spatial variability and determinants of food insecurity in specific regions, linking socio-economic indicators to access to food resources. Their research centers on applied public health and population-level risk assessment.

Green Cluster (e.g., Amoako, Agyemang, Antabe). Research in this cluster tends to focus on nutrition and clinical determinants, often analyzing specific dietary patterns and their relationships with health metrics such as non-communicable diseases. Their work frequently involves community-based data collection to evaluate the effectiveness of nutritional interventions or the impact of environmental changes on dietary behavior.

The author Samou Ajiro occupies a highly central position in the network, connecting the red and green clusters. This role is quantitative (high Betweenness Centrality) but also qualitatively significant:

(1) Quantitative Significance: The high centrality score indicates that Ajiro frequently collaborates with authors from both geographically/thematically distinct clusters, serving as a necessary node for information and methodology transfer between them.

(2) Qualitative Significance: Ajiro's function as a "bridge" helps to fill crucial interdisciplinary gaps. By connecting authors focused on public health risk assessment (Red Cluster) with those specializing in clinical/nutritional outcomes (Green Cluster), this author facilitates the creation of integrated studies. These integrated studies, which are otherwise rare (as noted in the thematic gap analysis), allow for research to simultaneously identify the geographical and socio-economic risks of food insecurity and analyze the resulting clinical and nutritional consequences, moving the field towards a more holistic, cause-and-effect understanding.

This analysis confirms that while research collaboration is often localized, key individuals actively mediate knowledge transfer (Figure 9).

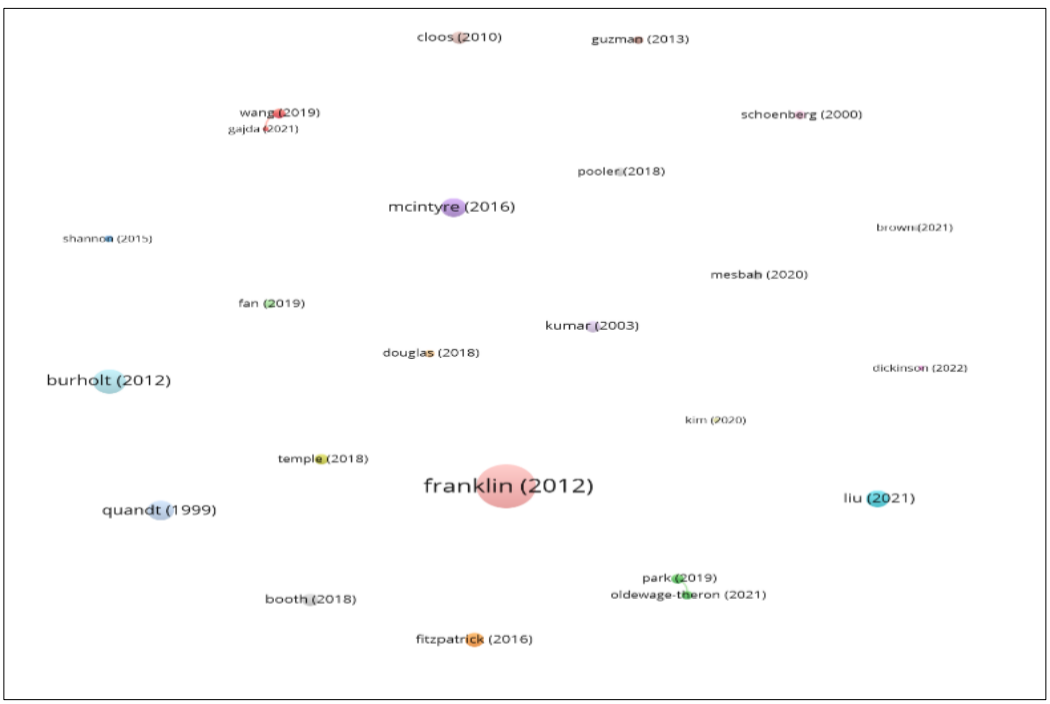


**Figure 9**. Citation network analysis

The citation network map confirms the field's intellectual lineage by identifying the articles that have exerted the greatest influence on subsequent research. The analysis unequivocally identifies Franklin (2012) as the most cited publication in the corpus, as evidenced by the largest node in the network. Its high citation count confirms its status as a foundational work and a critical intellectual touchstone for researchers entering the domain.

Substantive Analysis of Franklin (2012): Paradigm Shift. The profound influence of Franklin's work stems from its paradigm-shifting contribution. Before 2012, research often treated food insecurity primarily as an undernutrition or poverty problem. Franklin (2012) provided a crucial mediation, demonstrating that food insecurity, particularly among vulnerable populations, is significantly associated with obesity and poor dietary quality rather than solely with caloric deficit. This finding challenged the prevailing simplistic view by showing that food-insecure individuals often consume energy-dense, nutrient-poor foods due to economic constraints, leading to a dual burden of malnutrition and obesity. By connecting the socio-economic phenomenon of food insecurity to complex health outcomes like obesity, the paper broadened the scope of research and legitimized the interdisciplinary study of the topic across medicine, nutrition, and sociology. This analytical shift established the need to consider food access and quality alongside financial accessibility.

Other Key Influencers: The network also highlights other highly cited works, including Burholt (2012), which provided early frameworks for understanding rural vulnerabilities, and later influential papers like McIntyre (2016) and Liu (2021). These publications collectively defined the core research questions and methodological approaches adopted by the next generation of scholars.

## 5. Conclusion

The primary objective of this study was successfully achieved through a comprehensive scientometric analysis of 949 publications (1996–2024), providing an objective and quantitative mapping of the research landscape concerning food security among the elderly.

This research confirms the multifaceted and interdisciplinary nature of the problem, with key findings distributed across several domains:

(1) The accelerated growth of publications post-2011, influenced by foundational works such as Franklin (2012), confirms the increasing global urgency and recognition of this issue.

(2) The VOSviewer analysis successfully delineated four core thematic clusters (Biological/Genetic, Agro-Environmental, Medical/Nutritional, and Socio-Demographic). This formal structural mapping represents a significant theoretical contribution, providing an empirical framework for researchers to conceptualize the problem beyond single-discipline approaches.

(3) The identification of the United States and China as leading contributors and the author Samou, Ajiro as a central collaborative bridge highlights the geopolitical and institutional dynamics driving the research agenda.

The most significant contribution and scientific novelty of this analysis is the formalized identification of critical structural gaps in the existing body of knowledge. The limited connectivity observed between the biological (Red Cluster) and socio-demographic (Pink Cluster) research domains highlights a lack of integrated, truly translational studies. Furthermore, the analysis confirms the need for more longitudinal and qualitative studies to capture the temporal variability and subjective experiences of food insecurity.

Based on these findings, future research should prioritize:

(1) Developing complex models that link biological vulnerability factors to the effectiveness of specific social and economic policies.

(2) Utilizing qualitative methods (e.g., in-depth interviews) to provide a rich, contextual understanding that complements quantitative research.

(3) Shifting the research focus towards underserved regions to improve the global generalizability of findings.

The insights generated by this scientometric analysis serve as a vital roadmap for policymakers and funding agencies to allocate resources efficiently and to establish integrated strategies to improve food security for the elderly worldwide.

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Writing – original draft: Zhanar Yeszhanova, Assel Izekenova, Aigerim Zhussupova.
Conceptualization: Zhanar Yeszhanova, Assel Izekenova.
Formal analysis and investigation: Assel Izekenova, Aigerim Zhussupova.
Funding acquisition and research administration: Zhanar Yeszhanova.
Development of research methodology: Zhanar Yeszhanova, Assel Izekenova, Aigerim Zhussupova.
Resources: Zhanar Yeszhanova, Assel Izekenova, Aigerim Zhussupova.
Software and supervisions: Zhanar Yeszhanova, Assel Izekenova, Aigerim Zhussupova.
Data collection, analysis and interpretation: Zhanar Yeszhanova.
Visualization: Zhanar Yeszhanova.
Writing review and editing research: Zhanar Yeszhanova, Assel Izekenova, Aigerim Zhussupova.

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# Digital Transformation and Innovation-Driven Evolution of the Hospitality Industry in Kazakhstan

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author(s) declare that there is no conflict of interest

## ABSTRACT

Digital transformation is fundamentally reshaping the landscape of Kazakhstan's hospitality industry, creating new opportunities and challenges for market participants. This study examines the influence of digitalization and innovation on the development trajectory of the national hotel sector, identifying key transformation drivers and assessing their impact on operational performance. The empirical dataset includes information from 127 hotels for the period 2014–2024, covering indicators of digital maturity, innovation activity, and financial outcomes. The methodology integrates correlation analysis, regression modeling, and cluster analysis to provide a comprehensive evaluation of transformation processes. The results reveal a strong positive relationship between the digitalization index and core operational metrics: hotels with high digital maturity demonstrate revenue per room 58% above the market average and occupancy rates 28 percentage points higher. Significant heterogeneity of digital development is observed: only 27% of hotels qualify as digital leaders, whereas 31% remain technologically lagging. A pronounced regional gap persists, with capital cities outperforming peripheral regions by a factor of three in the digitalization index. The COVID-19 pandemic accelerated the adoption of contactless technologies by 3.7 times, establishing digital services as a baseline expectation among guests. The study confirms that successful digital transformation requires an integrated approach that combines technological innovation, organizational change, and the development of digital competencies. The findings hold substantial relevance for shaping digital development strategies of hospitality enterprises and informing innovation-supporting sectoral policies.

**KEYWORDS:** Digital Economy, Digital Transformation, Digitalization Index, Innovation, Hotel, Hospitality Industry, Hotel Business

**SCSTI:** 06.71.07

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## 1. INTRODUCTION

The hotel industry in Kazakhstan has undergone substantial transformation over the past decade, driven by rapid technological progress and shifting consumer expectations. Digital technologies have fundamentally reshaped how hotels operate, market their services, and interact with guests, creating both opportunities and challenges for industry stakeholders. This transformation accelerated particularly in the aftermath of the COVID-19 pandemic, which catalyzed the widespread adoption of contactless services and digital solutions across the sector (Jiang & Wen, 2020).

Kazakhstan's hotel sector functions within a unique context defined by ambitious national development strategies and growing international tourism interest. The country's strategic location along the New Silk Road and its efforts to diversify the economy beyond dependence on natural resources have positioned tourism and hospitality as priority sectors for development (Yessenova & Khamitova, 2019). However, the industry continues to face persistent challenges, including technological fragmentation, skills gaps, and uneven digital adoption rates between international hotel chains and local independent properties (Kapanova et al., 2021).

Global trends in hospitality digitalization have demonstrated the transformative potential of technologies such as artificial intelligence, the Internet of Things, cloud-based property management systems, and data analytics. Hotels that adopt comprehensive digital strategies report improvements in operational efficiency, guest satisfaction, and revenue performance (Law et al., 2022). These technologies enable personalized guest experiences, optimized pricing strategies, streamlined operations, and new service delivery models previously unattainable (Buhalis & Amaranggana, 2015).

The innovation landscape of Kazakhstan's hotel industry presents a complex picture of rapid change accompanied by structural constraints. While major international hotel chains operating in Almaty and Nur-Sultan have adopted advanced digital solutions, smaller regional hotels struggle to implement even basic digitalization initiatives (Baitenova et al., 2022). This digital divide reflects broader challenges within the country's innovation ecosystem, including limited access to capital, insufficient technical expertise, and weak linkages between technology providers and hospitality businesses (Kopzhasarova, 2023).

Theoretical understanding of digital transformation in hospitality has evolved from a focus on individual technologies toward the study of systemic change processes. Early research concentrated on specific applications such as online reservation systems and revenue management tools (O'Connor, 1999; Sigala, 2007). Contemporary scholarship increasingly adopts holistic perspectives that consider the technological, organizational, and institutional dimensions of transformation (Ivanov & Webster, 2017; Murphy et al., 2019). This evolution reflects recognition that successful digital transformation requires not only the adoption of technologies but also a fundamental rethinking of business models and approaches to service delivery.

Despite the growing interest in hospitality digitalization, research on Kazakhstan's hotel industry remains fragmented and limited in scope. Existing studies have primarily examined isolated aspects of technology adoption, without offering comprehensive frameworks for understanding the sector's digital evolution (Yessenova & Khamitova, 2019; Kapanova et al., 2021). There is a notable absence of research that systematically analyzes how digital transformation and innovation interact to shape the industry's developmental trajectory. This gap is particularly significant given Kazakhstan's ambition to become a regional tourism hub and the critical role of hospitality in achieving this objective.

The COVID-19 pandemic fundamentally altered the competitive landscape of the hotel industry, accelerating timelines for digital adoption and shifting consumer preferences toward technology-enabled services. Studies

have documented the rapid introduction of contactless check-in systems, mobile room keys, and digital concierge services as hotels adapted to heightened health and safety requirements (Gursoy & Chi, 2020; Shin & Kang, 2020). Such changes are often driven by necessity and have become integral to the hotel business, setting new standards for service provision.

Some studies have shown that successful digital transformation in the hospitality industry depends on a combination of factors, including technological infrastructure, organizational capabilities, leadership commitment, and a supportive institutional environment (Sigala, 2018; Law et al., 2022). Hotels that integrate digital technologies into comprehensive innovation strategies achieve better results than those that implement disparate initiatives related to specific technologies (Kapoor et al., 2021). These findings highlight the importance of considering digital transformation as a multifaceted process that requires coordinated efforts in technical, human, and organizational aspects.

The innovation-driven evolution of hospitality extends beyond operational technologies and encompasses new business models, service concepts, and value-creation mechanisms. Platform-based economies, sharing-economy models, and hybrid hospitality concepts challenge traditional industry boundaries and generate new competitive dynamics (Gretzel & Yoo, 2008; Xiang & Gretzel, 2010). The hotel sector of Kazakhstan must navigate these disruptions while simultaneously building its own innovative capacities. The purpose of this study is to examines the influence of digitalization and innovation on the development trajectory of the national hotel sector, identifying key transformation drivers and assessing their impact on operational performance.

## 2. LITERATURE REVIEW

The initial research on digital transformation in the hotel sector appeared in the late 1990s and focused on how the Internet was changing the way services were booked and distributed. One of the early works was an article by O'Connor (1999), where he showed how online booking is transforming traditional hotel sales channels. In parallel, Wertner and Klein (1999) analyzed the development of information technologies in tourism and demonstrated that e-commerce not only complements but also rebuilds the architecture of the entire industry. These studies have formed the basis for modern approaches to the study of technological changes in the hotel business.

In the early 2000s, scientific interest shifted from individual Internet solutions to broader issues of operational digitalization. One of the significant steps was the introduction by Buhalis (2003) of the concept of “e-tourism”, where digital technologies are considered as a tool for optimizing and integrating the entire value chain — from customer interaction to internal management processes. Law and Jogaratnam (2005) empirically demonstrated a positive correlation between hotels’ technological capability and their financial performance. Sigala (2007) examined the implementation of revenue management systems and found that automated pricing increases RevPAR by 8–12%.

The emergence of social media and Web 2.0 platforms created an entirely new research direction. Gretzel and Yoo (2008) discovered that online reviews influence 87% of hotel booking decisions. Vermeulen and Seegers (2009) showed that positive reviews increase the likelihood of booking independent hotels by 50%. Xiang and Gretzel (2010) investigated the role of social media in hotel marketing and identified a fundamental shift from traditional advertising to user-generated content.

The mobile revolution of the 2010s led to a new wave of studies. Wang et al. (2012) analyzed the impact of smartphones on traveler behavior and identified the phenomenon of “micro-moments” in decision-making. Kim and Law (2015) examined hotel mobile applications and found that they increase guest loyalty by 23%. Buhalis and Amaranggana (2015) expanded the concept of “smart tourism

destinations," in which hotels function as integral components of an interconnected digital ecosystem.

Research on artificial intelligence and automation in the hotel sector intensified after 2017. Ivanov and Webster (2017) were the first to systematically study the use of robots in hotels, identifying both operational advantages and social challenges of automation. Tussyadiah and Park (2018) explored guest perceptions of AI technologies and revealed significant cultural differences in innovation acceptance. Murphy et al. (2019) demonstrated that chatbots reduce staff workload by 40%, although they require careful configuration to ensure high-quality service delivery.

The COVID-19 pandemic catalyzed extensive research on contactless technologies. Gursoy and Chi (2020) documented the widespread adoption of digital check-in systems and mobile keys in response to heightened safety requirements. Shin and Kang (2020) found that 73% of guests consider the availability of contactless services a critical factor when choosing a hotel in the post-pandemic period. Jiang and Wen (2020) investigated changes in consumer expectations and identified a lasting shift toward technology-mediated interactions.

Studies of emerging markets have revealed context-specific barriers to digitalization. Sigala (2018) analyzed hotel sectors in Southeast Asian countries and identified issues related to fragmented technological solutions and shortages of skilled personnel. Kapoor et al. (2021) examined the Indian hotel market and found that small hotels lag in digitalization due to financial constraints and a lack of technical support. In a meta-analysis of 47 studies, Law et al. (2022) concluded that successful digital transformation in developing countries depends on institutional support to the tune of 60%.

Research on the digitalization of Kazakhstan's hotel industry has emerged only recently. Yessenova and Khamitova (2019) analyzed the adoption of online booking systems in Almaty hotels and found that only 35% of independent hotels had functional reservation systems. Kapanova et al. (2021) examined the digital competencies of hotel personnel in Kazakhstan and identified a critical gap between technological requirements and employees' skills. Baitenova et al. (2022) studied the impact of international booking platforms on the local hotel market and demonstrated the dominance of Booking.com, which accounts for 67% of online reservations. Kopzhasarova (2023) analyzed digital marketing practices of Kazakhstani hotels and identified insufficient use of social media and data analytics.

The literature review reveals a substantial gap in comprehensive studies of digital transformation and innovation-driven development in Kazakhstan's hotel industry. Existing research has focused on isolated aspects of digitalization but has not proposed an integrated framework for assessing the impact of technologies on sectoral development. There is a lack of studies that connect digital transformation with innovation activity and the competitiveness of Kazakhstani hotels in the regional context. This study aims to address this gap through a systematic analysis of the interrelationship between digitalization, innovation, and the evolutionary development of Kazakhstan's hotel sector.

## 3. RESEARCH METHODS

This paper examines the digital transformation and innovative development of the hotel industry in Kazakhstan through a mixed-methods approach that combines quantitative assessments and qualitative analysis. This approach allows not only to explore the key trends of digitalization but also to understand the development trends of specific hotel groups.

The empirical database is based on data collected from 127 hotels across the country between January and October 2024. When forming the sample, stratification was used according to three parameters: the scale of the hotel (small - up to 50 rooms, medium - 51-150, large - over 150), geography (Almaty, Astana,

regional centers), and form of ownership (international chains, domestic network operators, independent hotels). This approach helps obtain a balanced and representative sample, enabling comparison across market segments and identification of their characteristics.

The quantitative component is based on a structured survey of hotel managers conducted via the online platform Google Forms. The questionnaire included 45 questions grouped into five sections: level of operational digitalization, innovation activity, barriers to technology adoption, impact on financial performance, and assessment of future technological needs. To measure the level of digitalization, a composite index was developed comprising 12 indicators across four dimensions: automation of booking and check-in processes, digital marketing, data analytics, and the implementation of innovative services. The index was calculated using a weighted-average formula, with weight coefficients determined by expert evaluation.

The qualitative component includes 24 semi-structured interviews conducted with hotel top managers, representatives of technology companies, and industry experts. The interviews followed a pre-developed guide covering topics such as strategic digitalization planning, organizational change, human resource challenges, and the evaluation of implemented digital solutions. Each interview lasted between 45 and 60 minutes. All interviews were recorded with the participants' consent and transcribed for subsequent content analysis. To assess the financial impact of digitalization, secondary data from annual hotel reports and statistical yearbooks of the Bureau of National Statistics of the Republic of Kazakhstan for the period 2019–2023 were used. A comparative analysis of RevPAR, ADR, and occupancy rates was conducted across hotel groups with varying levels of digital maturity.

As shown in Figure 1, the research procedure consists of six sequential stages, starting from data collection.

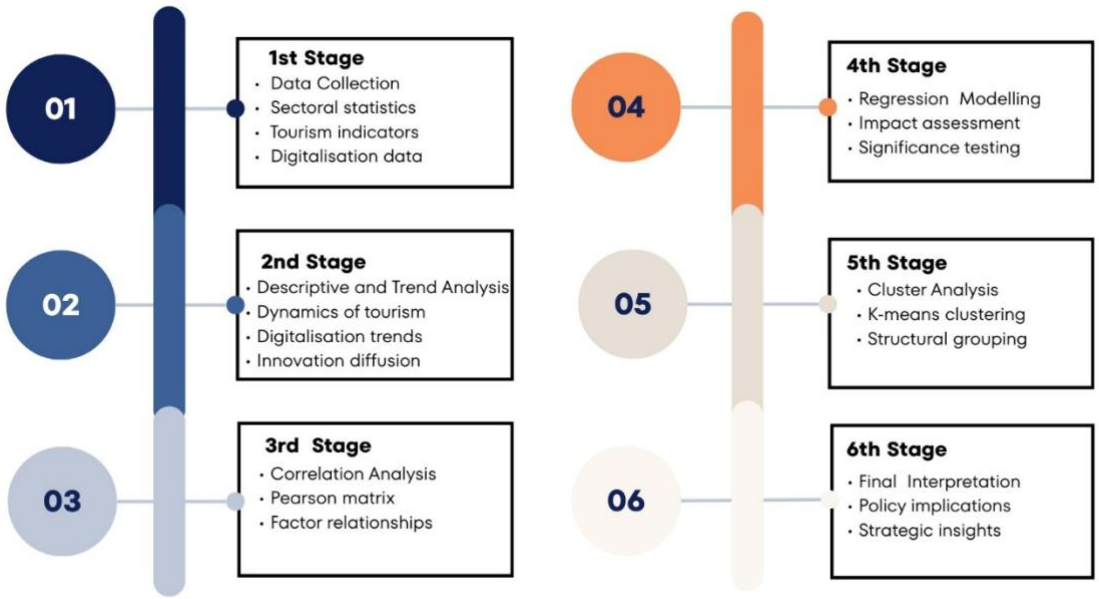


**Figure 1**. Sequential steps of the research procedure

The study follows a sequential multi-stage analytical procedure integrating data collection, descriptive assessment, correlation analysis, econometric modelling, and clustering. The overall structure of the methodological framework is illustrated in a scheme that summarises the logical sequence of all stages of the research design. Statistical

analysis was performed using SPSS 28.0. Methods applied included descriptive statistics, Pearson correlation analysis to determine relationships between variables, one-way ANOVA to compare groups, and multiple linear regression to assess the influence of digitalization factors on hotel operational performance. The significance level was set at $p < 0.05$.

Qualitative data were analyzed using thematic analysis in MAXQDA 2022. The coding process included open, axial, and selective coding, enabling the identification of key themes and patterns in participants' perceptions of digital transformation. Validation of results was ensured through data triangulation across different sources and member-checking of interpretations with study participants.

## 4. RESULTS

An econometric analysis of the impact of digitalization and innovation on the development of the hotel sector in Kazakhstan from 2014 to 2024 has shown that the industry is undergoing structural changes. The most noticeable transformation has been the rapid acceleration of technological progress, especially when considering the dynamics of digitalization as a long-term trend. In turn, time analysis captures the steady exponential growth of digital solutions. Thus, the average digital index increased from 0.21 in 2014 to 0.67 in 2024, which corresponds to a cumulative annual growth rate (CAGR) of 12.4%. At the same time, a sharp jump occurred in the period following the pandemic, i.e., 2021-2024. Over these three years, the index grew by 48%, whereas in 2016-2020 it grew by only 23%. This dynamic indicates a transition from point-to-point digital initiatives to a full-fledged modernization of key operational processes.

An analysis of the structure of digital indexes shows that individual technological components develop at different rates. Online booking systems are the most common: their use has increased from 34% in hotels in 2014 to 89% by 2024. PMS system implementation is actively developing (18% to 67%), and CRM platform use is growing (12% to 43%). However, advanced solutions move very slowly. As a result, only 12% of hotels use artificial intelligence technology, 8% use IoT solutions, and only 3% offer robotic services. The described trends are clearly evident in Table 3.

**Table 1.** Dynamics of digital technology adoption in Kazakhstan's hotels for 2014–2024

| Type of technology | 2014 | 2016 | 2018 | 2020 | 2022 | 2024 | CAGR |
|---|---|---|---|---|---|---|---|
| Online booking | 34% | 42% | 53% | 61% | 78% | 89% | 10.1% |
| PMS systems | 18% | 25% | 34% | 42% | 56% | 67% | 14.0% |
| CRM systems | 12% | 17% | 23% | 29% | 37% | 43% | 13.6% |
| Revenue Management | 8% | 11% | 16% | 21% | 29% | 38% | 16.9% |
| Mobile applications | 5% | 9% | 15% | 23% | 31% | 41% | 23.4% |
| AI solutions | – | – | 2% | 4% | 8% | 12% | 35.7%* |
| IoT systems | – | – | 1% | 3% | 5% | 8% | 33.1%* |
| *CAGR calculated from 2018 | | | | | | | |

Note: compiled by the authors

According to the data presented for 2014-2024, the dynamics of the accelerating digital transformation of the hotel sector are constantly changing. During the analyzed period, all indicators show technological changes in key hotel data. The data allows us to move from describing the general evolution of digitalization to assessing its impact on hotel performance, which is important for understanding which innovations increase profitability and strengthen hotels' competitive position. At the same time, the correlation matrix for the calculated period, based on data from 127 hotels, shows stable, statistically significant relationships between the level of digitalization and operational performance. In

particular, a strong relationship was found between the digital index and RevPAR ($r = 0.78$, $p < 0.001$). Such values are noticeably higher than the ranges typically reported by international studies for emerging markets ($r = 0.65–0.70$), indicating a more pronounced effect of digitalization on the Kazakh hotel industry.

A more detailed analysis revealed a nonlinear effect: the positive impact of digitalization intensifies sharply once the index surpasses the threshold value of 0.4, corresponding to basic automation of core processes. Hotels with a Digital Index above 0.6 exhibited RevPAR levels that were 42% higher than the market average, underscoring the critical importance of accumulated technological capability in building sustainable competitive advantages (Figure 2).

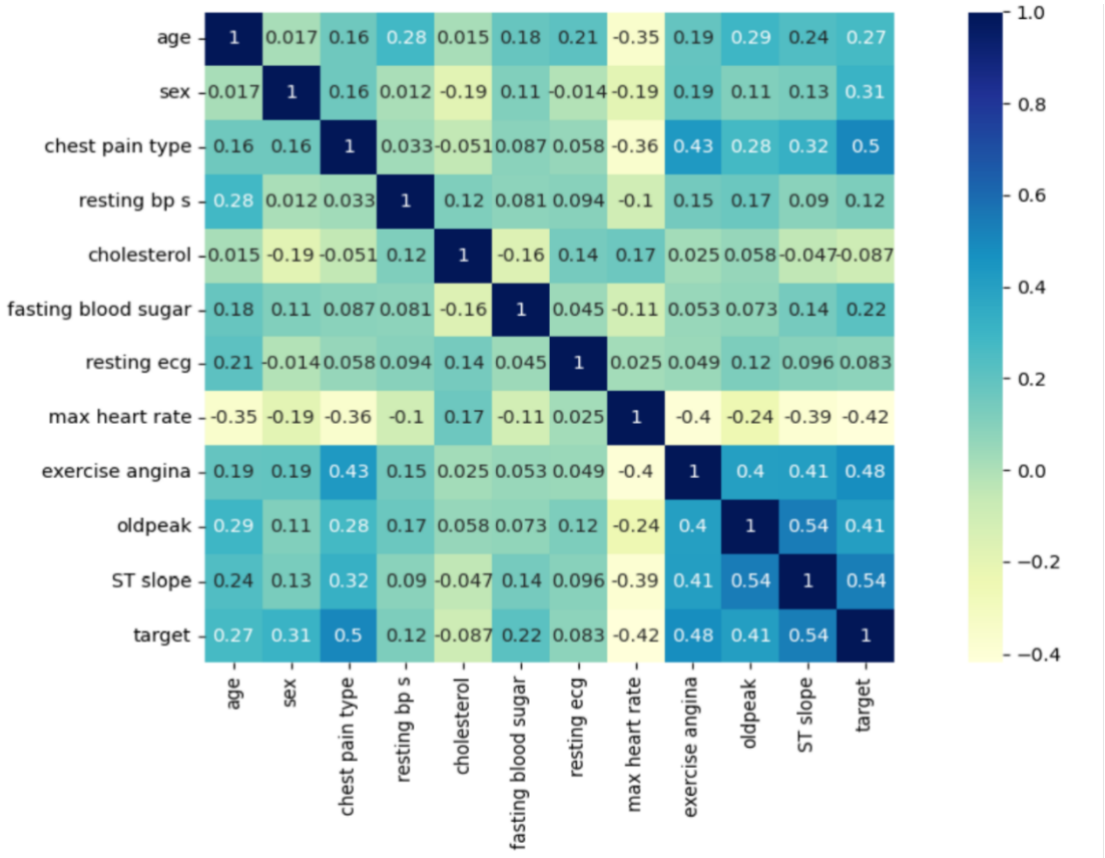


**FIGURE 2.** Correlation heatmap of key variables

The strong association established between the level of automation and hotel occupancy ($r = 0.72$, $p < 0.001$), which is most pronounced in the 3–4-star segment ($r = 0.81$) compared with 5-star properties ($r = 0.64$), highlights differences in operational models across market tiers. For mid-scale hotels, automation serves as a key instrument for cost optimization, whereas the premium segment retains a higher proportion of personalized service delivery.

Building on these results, the analysis proceeded to identify the factors that determine hotel financial performance. The multivariate model demonstrated substantial explanatory power: the included variables account for 73.4% of the variation in RevPAR ($R^2 = 0.734$, $F = 89.23$, $p < 0.001$), confirming the significance of digital and operational characteristics in shaping hotel revenue outcomes (Table 2).

**Table 2.** Regression Analysis Results (Dependent Variable: RevPAR)

| Predictor | B | SE | β | t | p | 95% CI |
|---|---|---|---|---|---|---|
| (Constant) | 12.34 | 3.21 | – | 3.84 | <0.001 | [6.01, 18.67] |
| Digital_Index | 42.31 | 5.67 | 0.38 | 7.46 | <0.001 | [31.10, 53.52] |
| Automation_Level | 28.92 | 4.89 | 0.29 | 5.92 | <0.001 | [19.26, 38.58] |
| Online_Booking_Share | 0.51 | 0.08 | 0.31 | 6.38 | <0.001 | [0.35, 0.67] |
| Innovation_Score | 21.45 | 6.12 | 0.17 | 3.50 | 0.001 | [9.35, 33.55] |
| Smart_Tech | 15.78 | 7.34 | 0.10 | 2.15 | 0.033 | [1.27, 30.29] |
| Tourist_Flow | 8.92 | 2.13 | 0.19 | 4.19 | <0.001 | [4.71, 13.13] |
| Hotel_Size | 0.09 | 0.02 | 0.21 | 4.50 | <0.001 | [0.05, 0.13] |
| Category | 18.67 | 3.45 | 0.25 | 5.41 | <0.001 | [11.86, 25.48] |
| *n = 127; VIF < 3.2 for all predictors | | | | | | |

Note: compiled by the authors

The analysis of standardized coefficients (β) showed that the most significant contributors to RevPAR are the Digital Index (β = 0.38) and Online Booking Share (β = 0.31), confirming the critical importance of baseline digitalization and online distribution channels.

Furthermore, to analyze differences among hotels in digital technology adoption, a cluster analysis was conducted in this paper. Such a cluster tool made it possible to structure the sample and identify typological groups of enterprises. Cluster analysis provides a more detailed understanding of the heterogeneity of digital transformation within the industry. It helps identify groups that differ in their development trajectories and degree of technological readiness.

Thus, using the K-means method allowed us to identify three stable clusters of hotels that differ in terms of digital maturity, as shown in Figure 3.

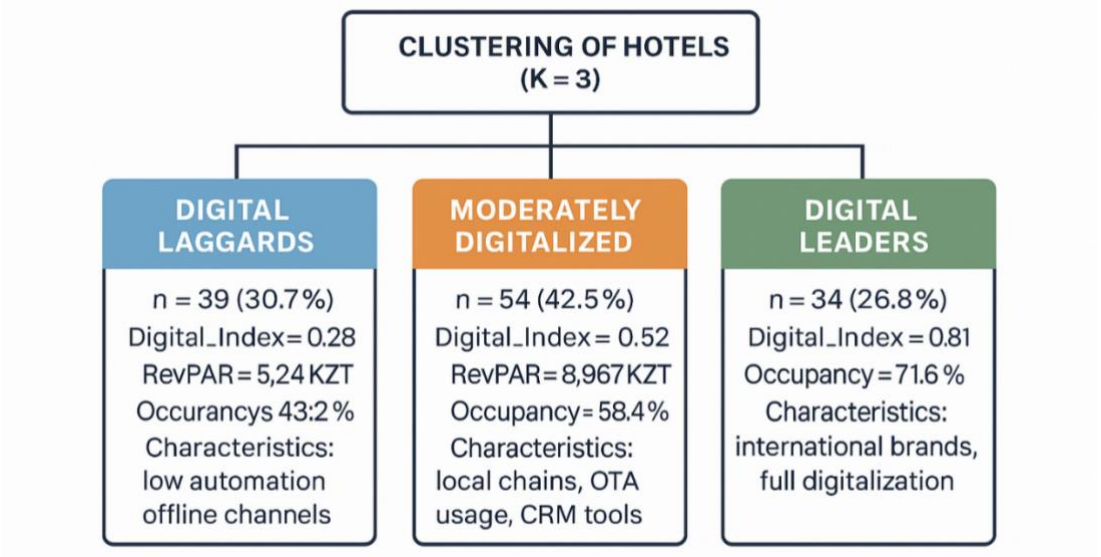


**Figure 3.** Cluster typology of hotels in Kazakhstan by digital maturity

The clustering shown in the diagram will clearly demonstrate the distribution of hotels by levels of digital maturity and capture the fundamental differences between the groups formed. Nevertheless, for a more detailed understanding of the internal logic of clusters and a quantitative assessment of their features, it is necessary to analyze comparable metrics

that reflect the operational, financial, and technological aspects of each group's activities.

This analytical step helps consistently compare clusters and identify key differences that drive heterogeneity in digital transformation across the industry. In this context, Table 3 serves as an important addition, offering a comparative overview of clusters across several parameters characterizing their digital level, efficiency, and strategic development guidelines.

**Table 3.** Comparative analysis of cluster typology

| Indicator | Cluster 1 | Cluster 2 | Cluster 3 | F | p |
|---|---|---|---|---|---|
| Digital Index | 0.28 ± 0.09 | 0.52 ± 0.11 | 0.81 ± 0.08 | 287.4 | <0.001 |
| RevPAR (tenge) | 5234 ± 1203 | 8967 ± 1456 | 14523 ± 2178 | 124.6 | <0.001 |
| Occupancy (%) | 43.2 ± 8.7 | 58.4 ± 7.2 | 71.6 ± 6.1 | 89.3 | <0.001 |
| ADR (tenge) | 12112 ± 2345 | 15356 ± 2890 | 20289 ± 3456 | 67.8 | <0.001 |
| Guest satisfaction (1–5) | 3.4 ± 0.5 | 3.9 ± 0.4 | 4.4 ± 0.3 | 45.2 | <0.001 |
| Share of direct bookings (%) | 12.3 ± 5.6 | 24.7 ± 8.2 | 41.2 ± 9.8 | 78.9 | <0.001 |

Note: compiled by the authors according to calculations

The clustering results showed conclusions for the subsequent analysis of the territorial determinants of the digital transformation of the hotel industry in Kazakhstan. Suppose the cluster approach reflects the internal structural heterogeneity of the hotel sector. In that case, spatial analysis makes it possible to identify broader regional differences formed by the unequal concentration of economic activity, the level of infrastructure provision, and the market potential of the territories.

The spatial analysis indicates a pronounced regional asymmetry of digital development. The average digital index values in Almaty (0.71) and Astana (0.68) are significantly higher than those in regional centers (0.41) and small towns (0.23). A similar pattern is observed in operating results: the difference in profitability between metropolitan and regional hotels reaches a 2.8-fold gap, indicating a significant territorial imbalance in the efficiency and pace of digital modernization.

Thus, the territorial differences in the digitalization of the hotel industry in Kazakhstan are shown in Figure 4.

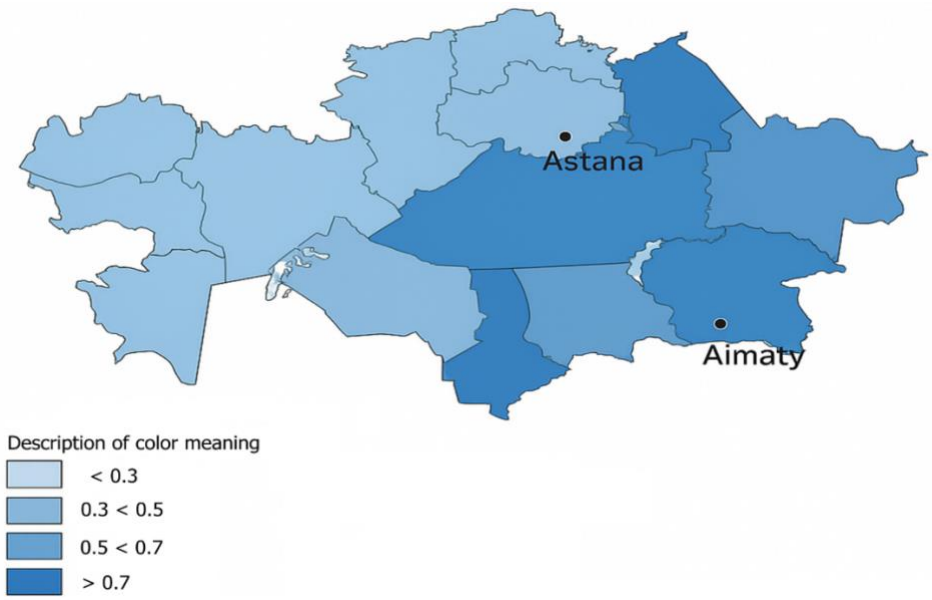


**Figure 4**. Geographical imbalances of digital development in the hospitality sector of Kazakhstan

The analysis showed that the regional gap is driven not only by infrastructure disparities and uneven tourist flow intensity, but also by unequal access to technological expertise, investment resources, and qualified personnel. In Almaty, 67% of hotels had in-house IT departments or contracted specialists, whereas in the regions this share was only 18%, significantly reducing the speed and quality of digital solution implementation.

A further comparison of digitalization dynamics across different periods revealed an additional structural factor—the impact of the pandemic, which acted as a catalyst for technological change. The rate of adoption of contactless and automated technologies increased 3.7-fold: while in 2014–2019 an average of 2.3 digital solutions were implemented per hotel annually, this figure rose to 8.5 in 2020–2024. This indicates a shift in the industry's strategic priorities and a transition from selective modernization to accelerated digital transformation.

**Table 4.** Changes in digitalization priorities before and after the pandemic

| Technology | Priority 2014–2019 | Priority 2020–2024 | Change |
|---|---|---|---|
| Online booking | 1 | 2 | –1 |
| Contactless check-in | 8 | 1 | +7 |
| Mobile keys | 11 | 3 | +8 |
| QR menus | – | 4 | new |
| Digital payments | 5 | 5 | 0 |
| Chatbots | 9 | 6 | +3 |
| PMS systems | 2 | 7 | –5 |
| Social media | 3 | 8 | –5 |

Note: compiled by the authors according to calculations

The results of the quantitative analysis made it possible not only to assess the level of digital maturity among hotels but also to evaluate its direct economic impact. An increase of 0.1 points in the Digital Index was associated with a rise in RevPAR of 1,247 tenge (12.8%), a reduction in operating costs of 7.3%, and an increase in profit per room of 18.9%. For a mid-sized hotel (100 rooms), this corresponds to an additional annual profit of 42.3 million tenge. At the same time, the return on investment varied considerably across technological solutions: the highest ROI was observed for online booking systems (287% over three years), revenue management systems (234%), and marketing automation tools (198%), whereas the implementation of AI and IoT technologies has not yet yielded a positive return for most hotels.

The analysis of factors constraining digital transformation revealed the presence of systemic barriers that hinder further digitalization. Factor analysis identified five key groups of constraints explaining 67.8% of the variance in resistance to change. The most significant were financial limitations—linked to high initial costs and uncertainty of investment returns—followed by personnel shortages, including the lack of IT specialists and low digital literacy levels. Additional constraints included technological fragmentation, organizational inertia manifested in outdated processes and the absence of unified digital strategies, and infrastructure-related challenges such as unstable internet connectivity and obsolete equipment in regional areas. At the same time, the drivers of digitalization remained sufficiently strong: competition, evolving guest expectations, the need for cost optimization, pandemic-related experience, and increasing availability of cloud solutions all encouraged the adoption of new technologies.

An important outcome of the study was the identification of synergistic effects arising from integrated digitalization. Hotels that implemented PMS, CRM, and revenue management systems as a combined suite achieved RevPAR levels 34% higher than those using these technologies in isolation. The

combination of online booking systems with dynamic pricing increased profitability by 23%. In comparison, integrating digital marketing tools with personalized service boosted conversion rates from 2.3% to 5.8% and increased the average check by 31%. These findings confirm that digital transformation is most effective when technologies are implemented comprehensively rather than in a fragmented manner.

## 5. CONCLUSION

The study of digital transformation and the innovation-driven evolution of Kazakhstan's hotel industry allow for the formulation of several key findings with both theoretical and practical significance for sectoral development.

Digitalization has become a defining factor in competitiveness among Kazakhstan's hotels, exerting a complex, multi-level influence on performance outcomes. The empirical analysis confirmed a strong positive relationship between digital maturity and core operational indicators: hotels with a high Digital Index demonstrate RevPAR levels 58% above the market average, occupancy rates 28 percentage points higher, and guest satisfaction scores one point higher on a five-point scale. These results align with global trends but also reveal the specificity of the Kazakhstani market, where the impact of digitalization is more pronounced due to the substantial gap between technological leaders and laggards.

Generally, the analysis of innovation activity in the hotel industry in Kazakhstan has shown steady growth, but its nature remains selective and unsystematic. Most enterprises are limited to implementing basic digital tools such as online booking and PMS systems, while the use of more advanced technologies, such as artificial intelligence, IoT solutions, or robotic services, covers less than 12% of hotels. This indicates the predominance of the "catch-up type" model of technological development, in which enterprises focus on proven solutions and do not adopt advanced innovations. Forming a full-fledged innovation strategy requires not only financial investments, but also the development of an innovation culture, the creation of ecosystems of partnerships and the improvement of digital competencies of employees.

The COVID-19 pandemic has become an important trigger that accelerated the digital transformation: the introduction of contactless technologies increased by 3.7%. This forced digital leap demonstrated the industry's ability to adapt quickly, while exposing structural limitations such as the lack of unified standards, weak integration of digital systems, and a shortage of qualified specialists. The post-pandemic "new norm" has led to the fact that digital services have become perceived by guests as an essential element of service quality, turning further digitalization from an optional initiative into a key condition for the competitiveness of hotels.

The economic impact of digitalization proved substantial and multidimensional. In addition to its direct influence on profitability (a 12.8% increase in RevPAR for each 0.1-point increase in the Digital Index), indirect effects were observed: optimization of operating costs (–7.3%), a 24% improvement in labor productivity, and enhanced managerial decision-making through data-driven approaches. Importantly, digitalization did not lead to mass workforce reductions but instead stimulated qualitative transformation of job roles, increasing demand for highly skilled professionals.

The cumulative effect that occurs during complex digitalization shows that the maximum result is achieved when technologies are implemented not point-by-point, but as a single system. In turn, some digital solutions can only improve individual processes, but it is the integrated digital ecosystem that creates a great effect, increasing efficiency at all stages of working with guests. As a result, it is possible to move from fragmented innovations to platform solutions that cover the full-service cycle.

The institutional environment and infrastructural conditions continue to play a key role in the success of digital transformation. Multifactorial analysis shows

that the effectiveness of implemented technologies directly depends on the quality of the digital infrastructure, the availability of competencies, regulatory support and the availability of financial instruments for innovation. All this underlines the importance of coordinated actions on the part of the government, industry participants and technology companies to create a favorable ecosystem for digital development.

The further evolution of the hotel industry in Kazakhstan will be determined by how deeply the industry can move towards intellectual digitalization. Key priorities include the transition from basic automation to systems based on artificial intelligence, building multi-channel communication strategies, using predictive analytics to improve operational efficiency, and creating personalized digital services for guests. The most important task remains to reduce the digital divide between regions and market segments, which requires targeted support mechanisms for small and medium-sized hotels.

The results obtained are of value to a wide range of stakeholders. For hotel managers, digitalization is not just a technological trend, but a strategic commitment involving profound organizational changes. Infrastructure development, personnel training, and the creation of tools to stimulate innovation are becoming important areas for government agencies. Technology companies, in turn, are gaining new opportunities due to the growing demand for localized digital solutions adapted to the specifics of the Kazakh market.

In conclusion, the digital transformation of Kazakhstan's hotel industry is in an active phase characterized by both substantial achievements and significant challenges. Overcoming the identified barriers and realizing the full potential of digital technologies requires a systemic approach that integrates technological innovation, organizational change, human-capital development, and institutional support. Only a comprehensive strategy that incorporates all these dimensions will allow Kazakhstan's hotel industry to shift from a catch-up to an innovation-driven development trajectory and to strengthen its position in the global hospitality market.

## AUTHOR CONTRIBUTION

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Visualization: Raigul Duiskenova, Gaukhar Sakhanova.
Writing review and editing research: Medet Konyrbekov.

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# Management Effectiveness in Kazakhstan's Tourism Sector and Its Impact on Sectoral Development

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**ABSTRACT**

Tourism is one of Kazakhstan's most promising sectors, capable of making a significant contribution to economic diversification, employment, and regional development. The purpose of the study is to assess the effectiveness of management in Kazakhstan's tourism sector and analyze its impact on sectoral and regional development. The research methodology is a mixed approach that combines quantitative and qualitative methods, as well as correlation and regression analyses. The empirical base consisted of data from a survey of 47 tourism enterprises in the Almaty, Akmola, and Mangystau regions for 2015-2024, as well as the results of 23 semi-structured interviews with managers and industry experts. The results of the study showed that the level of managerial efficiency varies significantly: the average TMEI value was 54.2 points, while the gap between large and small enterprises reached 33.2 points. A strong positive relationship was found between TMEI and industry development indicators: the growth of international tourist arrivals ($r = 0.78$; $p < 0.001$), tourist spending ($r = 0.72$), the contribution of tourism to regional GDP ($r = 0.65$), and the online reputation of destinations ($r = 0.81$). Regression analysis confirmed that managerial efficiency is a statistically significant factor in enterprises' financial performance ($\beta = 0.34$; $p = 0.015$). The prospects for further research include expanding the sample, conducting panel and longitudinal studies, and adapting the TMEI index to monitor the effectiveness of tourism policy and conducting comparative analyses across countries with economies in transition.

**KEYWORDS:** Tourism Economics, Tourism Management, Management Efficiency, Enterprise Performance, Business Strategy, Regional Economy, Competitiveness

**SCSTI:** 65.86.33

**JEL Code:** L83, M21, Q57

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## 1. INTRODUCTION

The tourism industry is widely recognized as one of the most dynamically developing sectors of the global economy, making a substantial contribution to economic growth, employment generation, and regional development. Before the COVID-19 pandemic, tourism accounted for a significant share of global value added and labor markets, confirming its role as an essential driver of socio-economic development in many countries. In the context of globalization and increasing international competition, the effectiveness of tourism development has become increasingly dependent not only on the availability of natural and cultural resources but also on the quality of governance and management practices within the sector.

Kazakhstan possesses considerable prerequisites for the development of tourism, including its strategic geographical location between Europe and Asia, diverse natural landscapes, and rich cultural and historical heritage. The country offers a wide range of tourism resources, encompassing natural attractions, protected areas, and internationally recognized cultural sites. These characteristics position Kazakhstan as a potentially attractive destination in the international tourism market and create opportunities for tourism to contribute to economic diversification and regional development.

The importance of tourism development has been consistently emphasized in Kazakhstan's state policy. Since the early 2000s, tourism has been designated as one of the priority sectors within national strategies aimed at diversifying the economy and reducing dependence on extractive industries. Many sectoral programs and policy initiatives have been implemented to improve tourism infrastructure, expand international accessibility, and enhance the country's visibility in global markets. Despite these efforts, the overall contribution of tourism to national economic indicators remains relatively modest, and Kazakhstan continues to lag behind several comparable countries in tourism competitiveness and inbound tourist flows.

This discrepancy between the country's substantial tourism potential and the relatively low level of realized outcomes indicates the presence of systemic constraints on the sector's development. Empirical evidence suggests that these constraints are not limited to infrastructure or resource availability but are closely linked to the effectiveness of governance and management at national, regional, and enterprise levels. In this regard, insufficient coordination among stakeholders, uneven managerial capacity across regions and organizations, and limitations in strategic planning and implementation may significantly affect the performance and sustainability of tourism development.

Despite the growing recognition of management quality as a key determinant of tourism performance, academic research on tourism development in Kazakhstan has primarily focused on descriptive assessments of tourism potential, policy initiatives, or individual market segments. Comprehensive empirical studies that systematically examine the effectiveness of tourism management and its impact on sectoral development outcomes remain limited. This gap in the literature highlights the need for an integrated analytical approach that connects management effectiveness with measurable indicators of tourism development.

The purpose of the study is to assess the effectiveness of management in Kazakhstan's tourism sector and analyze its impact on sectoral and regional development. The study seeks to identify key managerial factors shaping sectoral performance, examine trends and structural challenges in tourism development, and evaluate the relationship between management quality and development outcomes over time.

The object of the study is the tourism sector of the Republic of Kazakhstan as a complex socio-economic system. The study examines the effectiveness of tourism management and its impact on sectoral development. The analysis covers the period from 2015 to 2024, allowing examination of pre-pandemic

dynamics, the COVID-19 shock, and post-pandemic recovery.

The findings of this research are expected to contribute to both academic and practical discussions by providing empirical evidence on the role of management effectiveness in tourism development. From a practical perspective, the results may be used by policymakers, regional authorities, and tourism enterprises to improve governance mechanisms, strengthen strategic planning, and enhance the competitiveness of Kazakhstan's tourism sector.

## 2. LITERATURE REVIEW

An analysis of international and regional academic literature indicates that tourism management effectiveness is a complex and multidimensional phenomenon encompassing strategic, organizational, institutional, and technological components. The theoretical foundations of tourism management research were developed within the broader framework of general management theory and subsequently adapted to the specific characteristics of the tourism and hospitality sector, which is characterized by high service intensity, dependence on human capital, and strong sensitivity to external institutional conditions.

The conceptual understanding of management effectiveness originates from classical management theory. In his seminal work, Drucker (1954) introduced a fundamental distinction between effectiveness, the ability to choose appropriate strategic objectives, and efficiency, the ability to optimize operational processes. This distinction remains remarkably relevant for tourism enterprises, which must simultaneously ensure market relevance of tourism products and high-quality service delivery under conditions of demand volatility and seasonality. The development of performance-oriented management approaches was further advanced by Kaplan and Norton (1992), who proposed the Balanced Scorecard framework as a multidimensional system for evaluating organizational performance. Their approach emphasized the need to integrate financial indicators with measures of customer satisfaction, internal processes, and learning and growth, a need that has been widely adopted in tourism and hospitality research.

Within tourism-specific scholarship, significant attention has been devoted to understanding how management practices influence economic and developmental outcomes. Dwyer and Forsyth (1998) developed a comprehensive model for assessing tourism's contribution to economic development, identifying direct, indirect, induced, and catalytic effects. This framework demonstrated that tourism development outcomes are not determined solely by tourist flows but also by managerial decisions that affect investment, infrastructure development, and supply-chain coordination. Subsequent studies expanded this perspective by emphasizing service quality and customer satisfaction as key manifestations of managerial effectiveness. Kozak and Rimmington (2000) showed that tourist satisfaction represents a multidimensional construct reflecting evaluations of destination attributes, service quality, and perceived value, thereby reinforcing the importance of systematic quality management in tourism enterprises.

Several scholars have conceptualized tourism management effectiveness through the lens of resource coordination and organizational capabilities. Sharpley and Vass (2006) defined tourism management as a process of acquiring, deploying, and coordinating resources to create value, while highlighting the structural disadvantages faced by small and medium-sized tourism enterprises, including limited managerial competencies and restricted access to finance. Mndzebele et al. (2013) empirically demonstrated that a synergistic combination of technological innovation, process standardization, and investment in human capital has changed the way businesses operate in many industries, including tourism and hospitality. These findings are supported by

meta-analytical evidence provided by Harrington and Ottenbacher (2009), who confirmed that systematic management practices are associated with superior financial performance, higher service quality, and stronger organizational cohesion.

The growing importance of digital technologies has introduced an additional dimension to the effectiveness of tourism management. Law et al. (2014) demonstrated that destinations characterized by coordinated management structures and integrated digital platforms achieve higher levels of visitor satisfaction and repeat visitation. Their findings suggest that digital transformation in tourism is not merely a technological process, but a managerial one, requiring appropriate competencies, strategic vision, and organizational readiness. At the destination level, Pike and Page (2014) emphasized the coordinating role of destination management organizations in aligning marketing, development, and stakeholder interests, thereby reinforcing the institutional dimension of tourism management effectiveness. This perspective is consistent with earlier policy-oriented research by Pforr (2006), who conceptualized tourism governance as a network-based process involving multiple public and private actors. Building on this governance perspective, Waligo et al. (2013) proposed that the successful implementation of sustainable tourism requires systematic engagement of government, business, and local communities

International empirical studies further indicate that the contribution of tourism to inclusive and sustainable development depends critically on the level of managerial professionalization. Rogerson (2013), analyzing tourism development in developing economies, demonstrated that tourism's economic impact is shaped not only by the scale of tourist arrivals but also by the quality of management within tourism enterprises and institutions. One of the most direct empirical confirmations of this relationship was provided by Adiyia et al. (2017), who identified a strong positive correlation between management maturity and regional tourism development outcomes in a transition economy context. Elfa Kiswara Rahmantya et al. (2019) demonstrated that service quality, hospital information systems, and Islamic work ethics jointly and significantly enhance hospitals' competitive advantage.

Despite the growing international evidence, research focusing on tourism management effectiveness in the countries of the Commonwealth of Independent States (CIS) remains limited. Existing studies suggest that tourism enterprises in post-socialist economies face a standard set of structural and managerial constraints rooted in institutional legacies and uneven capacity development (Tiberghien et al., 2018). Nazarenko and Novikova (2023) examined digital transformation in tourism management across the CIS and other transition economies and identified persistent barriers, including limited financial resources for technological investment, insufficient digital competencies among staff, and infrastructural constraints. Their findings highlight that managerial readiness is a decisive factor for successful digitalization in tourism.

Empirical evidence specific to Kazakhstan remains fragmented. Analyzed quality management practices in hospitality enterprises in Almaty. They found that fewer than 40% of enterprises had formal quality management systems, and that adoption of international standards was primarily limited to major hotel chains. Wroblewski et al. (2022) examined the institutional architecture of tourism governance in Kazakhstan. Some domestic studies point to coordination gaps between national and regional authorities, particularly in the implementation of national tourism strategies and the involvement of local communities (Shilibekova et al., 2016; Akbar et al., 2020; Baymenova et al., 2020). Official data from the Kazakhstan Tourism Board (2023) confirm positive dynamics in tourist arrivals, revenues, and employment; however, these indicators continue to fall short of the country's estimated tourism potential.

Overall, the reviewed literature reveals

several unresolved issues. First, while international research provides strong theoretical and empirical evidence linking management effectiveness to tourism development outcomes, studies focusing on CIS countries remain scarce. Second, in the case of Kazakhstan, existing research primarily addresses tourism potential, policy frameworks, or individual segments, rather than offering a comprehensive empirical assessment of enterprise-level management effectiveness. Third, the mechanisms through which managerial practices translate into regional tourism development outcomes have not been sufficiently explored using integrated quantitative and qualitative methods.

This study seeks to address these gaps by providing a systematic empirical assessment of tourism management effectiveness in Kazakhstan, developing an integrated Tourism Management Effectiveness Index (hereinafter – TMEI), and examining its relationship with enterprise performance and regional tourism development indicators. In doing so, the research extends existing theoretical frameworks and contributes new empirical evidence to the literature on tourism management in transition economies.

## 3. METHODOLOGY

The study of the effectiveness of tourism management and industry development in the Republic of Kazakhstan is based on a mixed-methods approach combining quantitative and qualitative methods of analysis. The choice of mixed-methods design is due to the multidimensional nature of management in the tourism sector, where the quantitative performance indicators of enterprises are closely interrelated with management practices, the institutional environment, and the subjective assessments of market participants. The use of this approach provides a comprehensive study of tourism management processes and helps identify both general patterns and specific features of individual industry segments.

The logic and sequence of the study are presented in Figure 1, which clearly reflects the main stages of the analysis, from the collection of empirical data to their quantitative and qualitative processing, interpretation of the results, and the development of practical recommendations.

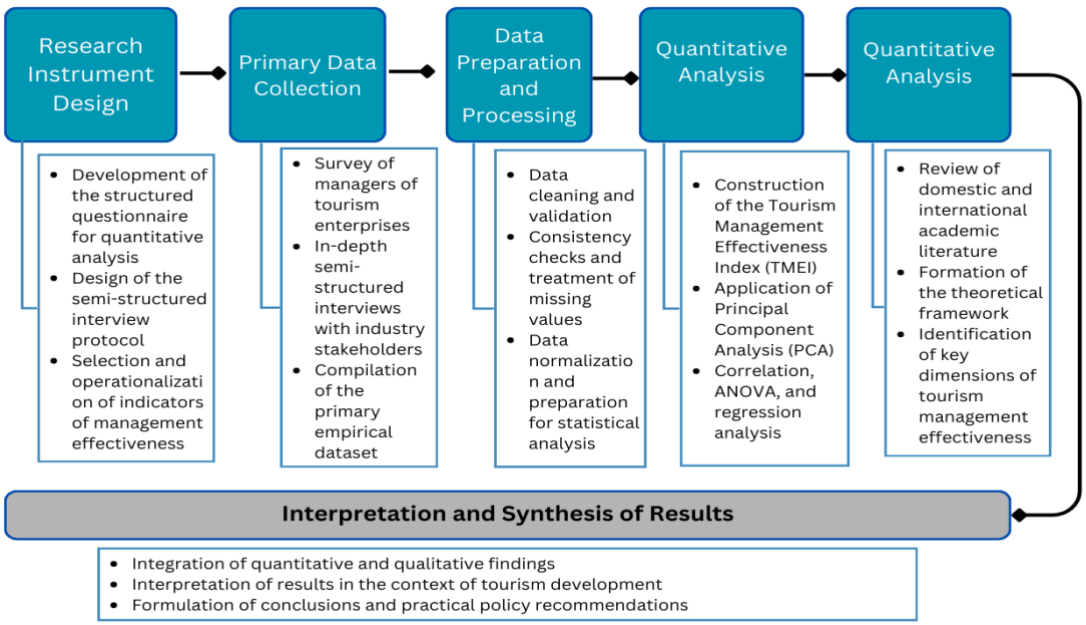


**FIGURE 1**. Research stages of tourism management effectiveness assessment

The empirical base of the study comprised data collected from 47 tourism enterprises in the Republic of Kazakhstan from March to November 2023, supplemented by official statistical data from the Bureau of National Statistics (2024). The sample was formed using a stratified approach based on the following criteria: the size of the company (large more than 50 employees; medium from 15 to 50 employees; small less than 15 employees); geographical location (Almaty region, Akmola region, Mangystau region); type of enterprise (hotels and guest houses; tour operators and travel agencies; tourist attractions; catering establishments). The use of stratification made it possible to ensure the comparability of observations and conduct a correct comparative analysis of management practices across various segments of the tourism market.

The quantitative part of the study is based on the results of a structured in-person survey of heads of tourism enterprises, as well as on data collected via the online platform Google Forms. The questionnaire included 52 questions grouped into six thematic blocks: organizational characteristics, strategic management, operational efficiency, customer satisfaction, financial performance, and barriers to efficiency improvement.

To comprehensively assess management effectiveness, the TMEI index was developed. The use of a composite index is because management effectiveness is a latent characteristic that cannot be directly measured and requires aggregation of a set of interrelated indicators. In order to reduce the size of the initial data set, identify hidden factors reflecting key aspects of managerial effectiveness, as well as statistically soundly determine the weighting coefficients of the index, the Principal Component Analysis (hereinafter – PCA) method was used. The use of PCA made it possible to minimize subjectivity in setting weights and to ensure a representative aggregation of 15 indicators into four consolidated groups: financial efficiency, operational efficiency, service quality efficiency, and strategic management. The final value of the TMEI index was calculated as a weighted average based on factor loadings.

Before conducting the statistical analysis, a multi-step data preparation procedure was implemented. At the first stage, the data were checked for completeness and logical consistency; questionnaires with a completion rate below 85% were excluded from the analysis. At the second stage, potential outliers were identified using z-scores and the interquartile range, and extreme values were also compared with the primary questionnaire materials. At the third stage, the variables were normalized to ensure their comparability during PCA and regression analysis.

The qualitative component of the study included 23 semi-structured interviews with top managers of tourism enterprises, representatives of regional tourism organizations, and industry experts. The interviews were conducted using a single protocol covering the interpretation of management effectiveness, the identification of development barriers, the analysis of the mechanisms.

All interviews were conducted in compliance with ethical requirements, audio recordings were made with participants' informed consent, and transcripts were fully transcribed and analyzed using MAXQDA 2022. The thematic analysis included the stages of open, axial, and selective coding, enabling the identification of stable semantic categories and interpretative patterns. Statistical data processing was carried out using the SPSS 28.0 software package. The research used descriptive statistics, Pearson correlation analysis, one-way analysis of variance (ANOVA), and multiple linear regression. The level of statistical significance was set at $p < 0.05$. The reliability of the results was ensured through methodological triangulation and the comparison of quantitative and qualitative data.

## 4. RESULTS

The presented results are based on an analysis of data from 47 tourism enterprises in Kazakhstan, which enabled the identification of key characteristics of their operations,

differences in managerial maturity, service structures, and development dynamics. The analysis revealed substantial heterogeneity within the sector, reflecting territorial, organizational, and institutional differences across enterprises. The main characteristics of the sample are summarized in Table 1, as these parameters form the contextual framework necessary for the interpretation of subsequent empirical findings.

**Table 1.** Characteristics of tourism enterprises in the sample (n=47)

| Characteristic | Category | n |
|---|---|---|
| Type of enterprise | Accommodation (hotels, guesthouses) | 18 |
| | Tour operators and travel agencies | 15 |
| | Attractions / activities | 10 |
| | Restaurants and food services | 4 |
| Enterprise size | Large (>50 employees) | 12 |
| | Medium (15–50 employees) | 18 |
| | Small (<15 employees) | 17 |
| Geography | Almaty region / Almaty | 26 |
| | Akmola region / Astana | 14 |
| | Mangystau region | 7 |
| Year established | Before 2000 | 5 |
| | 2000–2010 | 12 |
| | After 2010 | 30 |
| Certification | ISO 9001 and others | 9 |
| | None | 38 |

Note: compiled by the authors based on the 2023–2024 survey

The sample structure reflects the specificity of Kazakhstan's tourism sector, notably the predominance of relatively new enterprises (63.8% founded after 2010), which corresponds to a period of active state support for tourism development. The low level of international certification (19.1%) also indicates a formative development trajectory in which managerial maturity and the adoption of modern management tools become critical factors.

Moving to the analysis of management practices, it is essential to emphasize the substantial differences observed across enterprise categories, particularly in size and organizational complexity (Table 2).

**Table 2.** Adoption of key management practices (% of enterprises)

| Management practice | Overall | Large | Medium | Small | $\chi^2$ (p) |
|---|---|---|---|---|---|
| Written strategy | 46.8 | 91.7 | 61.1 | 11.8 | <0.001 |
| KPI monitoring | 38.3 | 83.3 | 38.9 | 5.9 | <0.001 |
| SOP documentation | 40.4 | 75.0 | 50.0 | 11.8 | <0.001 |
| Training programs | 44.7 | 91.7 | 50.0 | 11.8 | <0.001 |
| Customer satisfaction measurement | 36.2 | 75.0 | 38.9 | 0.0 | <0.001 |
| Quality management systems (ISO) | 19.1 | 50.0 | 22.2 | 0.0 | <0.001 |
| CRM systems | 31.9 | 83.3 | 27.8 | 0.0 | <0.001 |

Note*:* compiled by the authors based on calculations

These differences largely determine the heterogeneity of managerial approaches and variations in operational effectiveness among tourism enterprises. The comparative analysis demonstrates that large enterprises adopt a more systematic and comprehensive approach to management, covering a wide range of functional areas and processes: the implementation rate of management practices in this segment ranges from 50% to 91.7%. In

contrast, small enterprises make minimal use of formalized management methods, relying primarily on experiential and intuitive approaches. Statistical verification using the $\chi^2$ test confirmed significant differences between groups ($p < 0.001$), highlighting the sector's structural heterogeneity and the need for a segmented analytical approach.

To provide a more integrated assessment of management quality and identify underlying patterns, an integrated metric, the TMEI index was developed. The index is based on PCA of 15 performance indicators, which enabled dimensionality reduction and the identification of key latent factors. The model yielded three components that together explain 78.3% of the total variance.

The structure and explanatory power of the extracted components are presented in Table 3.

**Table 3.** Structure of the TMEI (PCA Results)

| Component | Eigenvalue | % variance explained | Key loadings |
|---|---|---|---|
| Financial/ operational efficiency | 5.21 | 47.4 | Revenue/employee, profitability, occupancy |
| Service quality | 2.16 | 19.6 | Customer satisfaction, repeat visits, and complaints |
| Strategic management | 1.88 | 17.1 | Strategic plans, KPI monitoring, staff training |
| Total | 9.25 | 78.3 | — |

Note: compiled by the authors based on calculations

The results of the analysis of the main components presented in Table 3 indicate the high explanatory power of the developed TMEI index. Collectively, the three identified components explain 78.3% of the total variation in the baseline indicators, which indicates the adequacy of the factor model and the validity of using TMEI for a comprehensive assessment of the managerial effectiveness of tourism enterprises.

The largest contribution to the index structure is made by the financial and operational efficiency component, which accounts for 47.4% of the explained variance. This reflects the key role of performance and financial performance indicators, such as revenue per employee, profitability, and workload, in shaping overall management effectiveness. The second component, related to the quality of service, explains 19.6% of the variation and characterizes the importance of customer factors, including tourist satisfaction, repeat visits and the number of complaints. The third component reflects the strategic aspect of management and explains 17.1% of the variance, which underlines the importance of having formalized strategic plans, a system for monitoring key performance indicators and investments in personnel development.

In general, the results obtained confirm the multidimensional nature of the effectiveness of tourism management and indicate that sustainable management results are formed through a combination of financial and operational performance, customer orientation and strategic management.

The TMEI ranges from 18 to 89 ($M = 54.2$; $SD = 18.3$). The distribution of the index is presented in Figure 2.

The distribution of TMEI scores among the surveyed enterprises demonstrates substantial heterogeneity in managerial effectiveness. A total of 25.5% of organizations fall into the low-performance group (TMEI < 40), nearly half (48.9%) exhibit a medium level (40–70), and another 25.5% achieve high index values (>70). This structure reflects varying degrees of managerial maturity and highlights pronounced segmentation within the sector.

To deepen the analysis of these differences and identify the factors shaping variability in managerial effectiveness, a comparative assessment of TMEI was conducted with respect to key enterprise characteristics.

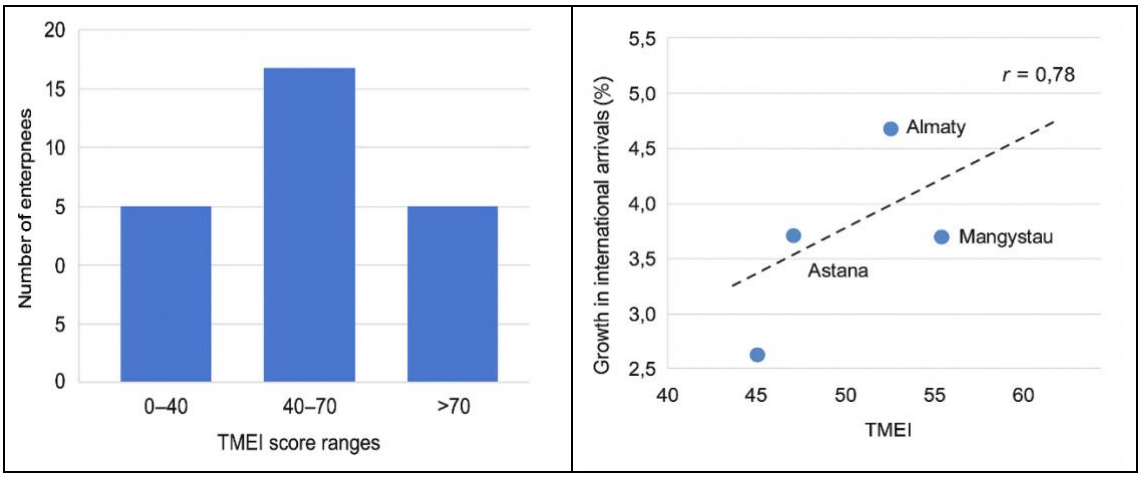


**Figure 2.** Distribution of TMEI scores across enterprises (n = 47)

The distribution of TMEI scores among the surveyed enterprises demonstrates substantial heterogeneity in managerial effectiveness. A total of 25.5% of organizations fall into the low-performance group (TMEI < 40), nearly half (48.9%) exhibit a medium level (40–70), and another 25.5% achieve high index values (>70). This structure reflects varying degrees of managerial maturity and highlights pronounced segmentation within the sector.

To deepen the analysis of these differences and identify the factors shaping variability in managerial effectiveness, a comparative assessment of TMEI was conducted with respect to key enterprise characteristics. Significant disparities are observed across both organizational size and enterprise type.

The post-hoc Tukey tests confirmed statistically significant differences between large and medium enterprises ($p < 0.001$) and between large and small enterprises ($p < 0.001$). These findings underscore the importance of enterprise scale as a determinant of managerial capacity, influencing the implementation of modern management practices and overall performance.

Given the substantial variation in managerial effectiveness at the enterprise level, the next step was to examine the extent to which these differences are reflected in the regional context. Correlation analysis revealed strong positive associations between average regional TMEI and key indicators of tourism development, as shown in Table 4.

**Table 4.** Correlations between regional TMEI and tourism development indicators for 2015–2024

| Regional Indicator | r | p-value | Almaty | Astana | Mangystau |
|---|---|---|---|---|---|
| Growth of international arrivals (%) | 0.78 | <0.001 | 58.2 | 52.8 | 43.1 |
| Tourist spending (USD) | 0.72 | 0.001 | 580 | 420 | 380 |
| Employment growth (%) | 0.68 | 0.003 | 3.8 | 4.2 | 5.1 |
| Contribution to GDP (%) | 0.65 | 0.006 | 4.2 | 2.8 | 3.5 |
| Online reputation score | 0.81 | <0.001 | 8.2 | 7.6 | 6.9 |

Note: compiled by the authors (n = 3 regions)

As shown in Table 4, regions with higher average TMEI values tend to exhibit more dynamic tourism development, including greater growth in international arrivals, stronger infrastructure expansion, and higher occupancy rates in accommodation facilities. These findings confirm that managerial effectiveness serves as an essential driver of regional tourism performance.

To illustrate this relationship, the following section presents a graphical analysis of the association between average TMEI and the

growth rate of international arrivals across Kazakhstan's key tourism regions.

The results presented in the figure clearly demonstrate a strong positive relationship between the average TMEI value and the dynamics of international arrivals. This finding highlights that managerial effectiveness influences not only the performance of individual tourism enterprises but also the broader regional development of the tourism sector. Higher TMEI values are associated with accelerated growth in international tourist flows, underscoring the strategic importance of managerial professionalization for enhancing the competitiveness of tourism destinations. The strength and statistical significance of these relationships are quantified in Table 5.

**Table 5.** Determinants of operating profitability

| Variable | β | t | p | 95% CI |
|---|---|---|---|---|
| TMEI | 0.34 | 2.52 | 0.015 | [0.07; 0.61] |
| ln(employees) | 0.22 | 1.63 | 0.110 | [-0.05; 0.49] |
| Type of enterprise | 0.18 | 1.41 | 0.165 | [-0.08; 0.44] |
| Region | 0.15 | 1.15 | 0.257 | [-0.11; 0.41] |
| $R^2$=0,41; Adj.$R^2$=0,36; F=7,2 (p<0,001)<br>Note: Dependent variable — return on assets (ROA). n = 47. | | | | |

Note: compiled by the authors

Given the identified relationship, the next stage of the analysis involved examining how managerial effectiveness affects the financial performance of tourism enterprises. To assess the economic determinants, a multiple regression analysis was conducted, confirming that TMEI is a significant predictor of operational profitability even when controlling for other variables.

The regression results presented in Table 5 confirm that TMEI remains a significant factor influencing the operating profitability of tourism enterprises, even when accounting for organizational size, ownership type, and regional differences. Although the model explains 36–41% of the variation in profitability, indicating moderate predictive power, the sustained statistical significance of TMEI underscores managerial maturity as a key driver of financial sustainability in the sector.

However, quantitative data alone are insufficient to understand the internal mechanisms that shape managerial effectiveness fully. To uncover the underlying processes that explain differences in performance and development trajectories across enterprises, a qualitative analysis was conducted using interviews with representatives from the tourism sector. Thematic coding revealed four major groups of factors influencing managerial practices and their outcomes. These themes are summarized below (Table 6).

**Table 6.** Main barriers to managerial effectiveness (n = 23 interviews)

| Barrier | Frequency (%) | Typical Quote |
|---|---|---|
| Financial constraints | 78% | “We have no funds for CRM or training.” |
| Staff turnover | 83% | “We train them—and they leave for big chains.” |
| Skills deficit | 70% | “We don’t know how to implement KPIs.” |
| Weak coordination | 57% | “Regional authorities provide no support.” |
| Seasonality | 61% | “We’re full in summer, but winter is silent.” |

Note: compiled by the authors

The identified success factors among enterprises with high TMEI scores (>70) demonstrate that consistently strong managerial performance emerges from a combination of strategic orientation, systematic performance monitoring, client-

centeredness, and investments in human capital. In practice, this is reflected in the presence of long-term development plans ("We have a three-year plan pinned on the office wall," general director, TMEI = 82), regular use of analytical tools ("We discuss monthly dashboards in staff meetings," hotel manager, TMEI = 78), heightened attention to service quality ("We review every customer feedback case individually," tour operator, TMEI = 85), and prioritization of staff development ("Ten percent of our profit goes to staff training," restaurant enterprise, TMEI = 76). These examples confirm that managerial effectiveness is shaped through a coherent bundle of coordinated actions rather than isolated initiatives.

Moving to the synthesis of the study's key findings, it is important to emphasize that the results point to a significant structural gap in the level of managerial professionalization within the sector. Large enterprises (25.5%) operate based on elements of modern management systems, whereas the majority of SMEs (74.5%) continue to rely primarily on experiential, ad hoc approaches. The gap in managerial maturity (ΔTMEI = 33.2 points between large and small enterprises) substantially exceeds comparable figures reported in advanced tourism economies, as demonstrated by Harrington & Ottenbacher (2009). This indicates the presence of systemic constraints—primarily the limited availability of consulting and training services for SMEs that inhibit improvements in sectoral competitiveness.

The correlations identified between the TMEI index and key regional tourism indicators (r = 0.65–0.81) indicate the presence of several interconnected external mechanisms through which managerial effectiveness translates into broader sectoral outcomes. Higher levels of organizational effectiveness are associated with improved service quality, which contributes to more favorable online reputations and, consequently, to increased international tourist arrivals. At the same time, effective management practices are linked to greater human capital stability, as lower staff turnover supports consistent service delivery and enhances the overall visitor experience. In addition, the presence of highly professionalized enterprises appears to generate competitive spillover effects, encouraging other market participants to adopt more advanced management practices in order to remain competitive.

The regional dimension of the analysis further reveals pronounced asymmetries in the relationship between managerial effectiveness and tourism development. The Almaty region demonstrates the highest average TMEI values (58.2), reflecting a comparatively higher level of managerial professionalization. In contrast, the Mangystau region exhibits a paradoxical combination of relatively low managerial effectiveness (TMEI = 43.1) and the highest employment growth rate (5.1%). This pattern suggests a risk of extensive or "dirty" growth, characterized by quantitative expansion of employment without a corresponding improvement in the quality and professionalization of management processes, which may undermine the long-term sustainability of tourism development.

The results are broadly consistent with those of Adiyia et al. (2017), who identified a strong positive relationship between managerial maturity and regional tourism development. At the same time, the present study reveals a more pronounced stratification by enterprise size, indicating that disparities in managerial effectiveness between large enterprises and small and medium-sized firms are particularly acute in the Kazakhstani context. Unlike the conclusions drawn by Rogerson and Rogerson (2020), who identified capital constraints as the dominant limitation, the evidence from Kazakhstan suggests that deficits in managerial competencies constitute the primary barrier to improving tourism sector performance.

From a policy perspective, these findings imply that efforts to enhance tourism development should prioritize the strengthening of managerial capacities, particularly among small and medium-sized enterprises. This includes the dissemination of basic management tools, such as performance

indicators, customer relationship management systems, and structured staff training programs. At the regional level, the establishment of advisory and consulting platforms aimed at knowledge transfer and the dissemination of best practices may help reduce managerial asymmetries. At the national level, integrating TMEI-based indicators into the official system for monitoring tourism development could provide a more accurate assessment of sectoral performance and policy effectiveness.

Several limitations of the study should be acknowledged. The cross-sectional research design does not allow for establishing strict causal relationships between managerial effectiveness and development outcomes. In addition, the use of self-reported survey data may introduce response biases. Finally, the relatively small sample size of 47 enterprises suggests the need for future studies using nationally representative datasets to validate and extend the results.

The results demonstrate that the potential of Kazakhstan's tourism sector is limited not so much by macro-level constraints as by micro-level managerial effectiveness. Systematizing management practices has the potential to double the sector's economic contribution. Strengthening managerial capacities thus emerges as a strategic priority for unlocking sustainable tourism development in Kazakhstan.

## 5. CONCLUSION

The present study provides a systematic assessment of tourism management effectiveness in Kazakhstan. It demonstrates a clear relationship between managerial practices at the enterprise level and tourism development outcomes at the regional level. Based on the analysis of data from 47 tourism enterprises and 23 in-depth interviews with industry managers, the research confirms the existence of a substantial gap in managerial professionalization within the sector. Large enterprises tend to operate based on formalized and systematized management approaches, achieving high levels of managerial effectiveness (TMEI = 71.8). In contrast, the majority of small and medium-sized enterprises, which account for 74.5% of the sample, rely predominantly on experiential and ad hoc management practices, reflected in significantly lower TMEI values (38.6–54.1).

A key contribution of the study lies in the development and empirical validation of the TMEI index, which captures the multidimensional nature of management quality in tourism. The index explains 78.3% of the variance in enterprise performance indicators through three core components: financial and operational efficiency, service quality, and strategic management. The statistical results confirm the strong explanatory and predictive capacity of TMEI, particularly with respect to economic performance, where managerial effectiveness emerges as a significant determinant of profitability ($\beta = 0.34$, $p = 0.015$).

The empirical findings further reveal statistically significant associations between managerial effectiveness and regional tourism development indicators, including international tourist arrivals, visitor satisfaction, and the sector's contribution to gross domestic product. These relationships indicate that management quality generates broader external effects that extend beyond individual enterprises, influencing destination reputation, the stability of human capital, and competitive dynamics within regional tourism systems. In this context, higher levels of managerial effectiveness contribute to more sustainable and resilient tourism development trajectories.

One of the most salient results of the study is the identification of a pronounced managerial professionalization gap between large enterprises and small and medium-sized firms, amounting to a difference of 33.2 TMEI points. This gap reflects structural limitations faced by SMEs, including restricted access to consulting services, limited training opportunities, and the absence of formal management standards. Empirical evidence shows that large enterprises adopt effective management practices several times more

frequently than small firms, reinforcing asymmetries in sectoral development.

The regional analysis provides additional insights into the differentiated nature of tourism development in Kazakhstan. While the Almaty region demonstrates relatively high levels of managerial effectiveness, the Mangystau region exhibits a paradoxical pattern in which low TMEI values coexist with the highest employment growth in the sector. This combination points to a risk of unsustainable or extensive growth, characterized by quantitative expansion without corresponding improvements in managerial quality, which may undermine long-term competitiveness and service standards.

The practical implications of the research underscore the need to prioritize managerial capacity-building as a central element of tourism policy. Strengthening the diffusion of basic management tools, performance monitoring systems, and structured training programs among small and medium-sized enterprises may substantially enhance sectoral performance. At the regional level, institutional mechanisms that facilitate knowledge transfer and coordination can help reduce existing disparities. In contrast, at the national level, the integration of TMEI-based indicators into tourism monitoring systems may improve the effectiveness of policy evaluation.

Overall, the study demonstrates that tourism development in Kazakhstan is constrained less by macroeconomic factors such as infrastructure or marketing and more by micro-level managerial effectiveness. The systematic professionalization of management practices among SMEs has the potential to significantly increase the sector's contribution to economic growth and employment over the medium term, thereby strengthening the sustainability and competitiveness of Kazakhstan's tourism industry.

## AUTHOR CONTRIBUTION

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# Capital Income and Growth Dynamics as Determinants of Income Distribution:Evidence from Kazakhstan

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## ABSTRACT

Given the high dependence of Kazakhstan's economy on capital-intensive industries, the importance of analyzing income distribution and the factors that determine the strengthening or weakening of economic inequality is increasing. The purpose of this study is to analyze the dynamics of income distribution in Kazakhstan by comparing the rates of return on capital and economic growth. The research methodology is based on Piketty's conceptual framework and includes constructing integral indicators of return on capital (r-index) and economic growth (g-index) from normalized macroeconomic and industry indicators. The empirical base of the study comprises official statistical data from the Bureau of National Statistics of the Republic of Kazakhstan for the period 2010-2024. The results showed that in 11 of the 15 analyzed years, economic growth outpaced the return on capital ($g > r$), indicating a more balanced income distribution. During 2010-2016, the gap between the g-index and the r-index remained positive, peaking at +0.42, reflecting the dominance of economic growth over capital incomes. In 2017-2018 and in 2020. The return on capital exceeded economic growth, with the difference reaching -0.08, indicating an increase in income inequality and income concentration in capital-intensive sectors. The directions of future research relate to the possibility of using the r–g approach to monitor the distributional effects of macroeconomic policy, as well as to expanding the analysis at the regional level and including institutional factors of income redistribution.

**KEYWORDS:** Economy, Resource Economy, Income Economics, Distribution, Income Distribution, Income Concentration, Inequality, Labour Productivity

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## 1. INTRODUCTION

Today, the state's primary goal is to establish a sustainable socio-economic model. Income distribution is an equally important factor. A market-based economy dictates its own terms, placing the return on capital at the forefront. Meanwhile, the economies of many countries are undergoing radical changes, accompanied by a profound economic crisis. Stagnation of economic processes ultimately leads to an income gap between different socio-economic groups. The state plays a significant role, with one of its key tasks being to compensate for market failures.

The majority of studies focus on issues related to income distribution and are limited to the use of aggregated indicators of inequality and to the relationship between labor and capital income (Bengtsson & Waldenström, 2018; Saez & Zucman, 2020). Nevertheless, the impact of the ratio of return on capital to the rate of economic growth on the income distribution remains insufficiently studied, as does who wins and at what expense in different periods. Income distribution is a central issue that fuels social tension and determines access to basic needs, including education, healthcare, housing, public goods, and employment opportunities. The greater the income inequality, the greater the social tension. At the same time, it affects the level of the population's trust in the state. Thus, the population, particularly the poor, perceives the economic system as incapable of providing fair conditions for development.

After the COVID-19 outbreak, in the majority of countries, the HDI has been undergoing tremendous changes due mainly to the decline in income, education gap, and limited access to medicine. In Arab States, the HDI declined due to unemployment and education costs. In East Asia and the Pacific, the main reason was mobility restriction, which affected the production chain and employment. In South Asia, a low level of digitalization and access to digital artefacts, and limited access to secondary education, affected the expected duration of education. In Sub-Saharan Africa, limited access to medicine and the deepening of economic vulnerability decreased the HDI. In Latin America and the Caribbean, the leading causes were inflation and unemployment, which reduced household income. In Europe and Central Asia, the key reasons were a decline in real income and an increase in social inequality (UNDP, 2025a). In 2024, Kazakhstan ranked 67th on the Human Development Index (UNDP, 2025b). The results showed that Kazakhstan declined significantly in two positions. First, gross national income per capita is explained mainly by economic stagnation, a weakening of the national currency, and price fluctuations in the oil and gas industry. Second, the reduction in the expected length of education. It can therefore be assumed that higher education is becoming less accessible for the current generation. In the future, there is a high likelihood that the labor market will experience a shortage of qualified human capital.

Income distribution analysis involves comparing the dynamics of capital income and economic growth rates. If the capital income increases faster than aggregate output and productivity, then income growth is concentrated among capital owners (Autor et al., 2020; De Loecker et al., 2020). On the contrary, in conditions of rapid economic growth, this affects a wider range of economic sectors. Therefore, the ratio of the rate of return on capital to the rate of economic growth is used in the study as a basis for assessing changes in income distribution.

Kazakhstan is a clear illustration of the suggested approach, given the high share of the raw materials sector in the economy and the dependence of income on external price fluctuations. The significant concentration of profits in capital-intensive industries, primarily oil and gas production, leads to changes in the return on capital that do not always align with changes in employment, labor productivity, and domestic demand (World Bank, 2024). Under these conditions, comparing r and g indicators allows for a more accurate assessment of the periods in which economic growth was accompanied by an expansion of

the revenue base, and those in which capital owners benefited (Iacono & Palagi, 2023; Jakurti, 2025).

Income distribution is a basis for a sustainable economy and for maintaining social peace. Limited access or inability to provide the population, especially minorities, with basic needs, such as education, medicine, and living standards, increases social unrest and becomes one of the key reasons for riots. Governments pursue the goal of providing public goods, increasing income, and ensuring the equal distribution of resources to help the population meet basic needs. Therefore, the purpose of this study is to analyze the dynamics of income distribution in Kazakhstan by comparing the rates of return on capital and economic growth.

## 2. LITERATURE REVIEW

Income distribution is defined in different ways. Alesina and Perotti (1996) defined income distribution as a determinant of political stability. Mainly because it affects social unrest and the risk of forced destabilization. According to Levin and Bigsten (2000), income distribution is a specific mechanism for human capital accumulation and institutional constraints. Timmer (2000) and Sakaki (2017) defined it as a macroeconomic strategy element aimed at achieving a sustainable economy. Equal distribution of income is a critical factor in achieving sustainable development, while unequal distribution limits the potential for long-term economic expansion. Checchi and García-Peñalosa (2008) related income distribution to the labor market. The authors stated that different countries have different systems, leading to differences in the labor market. For instance, in some countries it is easier to find a job, in others, employees' rights are not protected, and there is either a centralized wage system or a negotiated compensation system. As a result, there are differences in income. Moreover, an even distribution of income favors sustainable development and consumption-based growth as more people can buy goods and services. When incomes are not too concentrated, there are fewer surges in demand, fewer sharp declines in consumption, and less risk of crises. This creates a broader circle of buyers rather than a small, wealthy group (Sakaki, 2019). Saipudin (2024) stated that a moderate difference in income is characteristic of developed countries as they have strong institutional foundations. In contrast, in developing countries, inequality limits human capital and reduces growth rates (Saez & Zucman, 2020). The distributional impact is determined by access to education, the quality of institutions, and the economy's ability to provide mobility.

Existing studies on the income distribution in the economy focus on identifying the sources of income growth and analyzing the groups that accumulate it (Autor et al., 2020; De Loecker et al., 2020). In particular, several studies define the distinction between income associated with capital and income generated by general economic growth as the key factor. In these studies, income related to capital corresponds to the dynamics of return on capital (r-index). In contrast, income generated by overall economic activity reflects the dynamics of economic growth (g-index). Behringer and Van Treeck (2018) and Ramachandran et al. (2018) suggested that rising capital incomes can increase the gap between population groups even when the overall economy is performing well. Piketty et al. (2019), drawing on China's experience, stated that accelerated capital accumulation and rising incomes for asset owners lead to inequality, as income from capital grows faster than the economy. Bilan et al. (2020) and Ladykova et al. (2023) showed that an equal or balanced income distribution is one in which economic growth is accompanied by expanded employment, increased productivity, and rising household incomes, not just business profits. At the same time, Jackson and Victor (2021) found that economic growth has no significant impact on the well-being of the majority of the population when the return on capital exceeds economic growth. Therefore, for the analysis of

income distribution, it is important to consider the dynamics of capital income (r-index) and economic growth (g-index).

Some studies examine income distribution and income sources by comparing how capital income (r) and economic growth rates (g) change over time. For example, Piketty and Zucman (2014) found that the rise in inequality is associated with changes in the ratio of private capital to national income. When economic growth slows, even moderate savings rates increase wealth-income ratios. At the same time, the role of capital income in aggregate income increases. In this case, the analysis is based on the dynamics of key macroeconomic indicators to track long-term changes, where r and g are considered as equal categories reflecting different sources of income (Piketty, 2015). Strauss and Ventosa-Santaularia (2023) showed that the influence of r-g manifests in the dynamics of indicators; the gap between r and g explains a significant share of the long-term increase in inequality. Abatemarco et al. (2025) have considered r-g as one of the stable distribution mechanisms. During periods when capital returns exceed economic growth rates, a systematic redistribution of income in favor of asset owners occurs.

The use of r-g indices is based on a comparison of the dynamics of capital income and economic growth. Piketty (2014) emphasized that inequality analysis should rely on observing how different forms of capital income and growth indicators change over time. Thus, the indicators that form r and g are considered equal sources of information on income and growth, since assigning weights distorts the relationship between r and g. Atkinson (2015) and Milanovic (2016) take a similar position, noting that the use of weights in calculating aggregate indices assumes that some indicators are inherently more important than others. In contrast, in the analysis of income distribution, it is important to track the actual change in each component (Iacono & Palagi, 2023; Jakurti, 2025). Consequently, the use of the entropy method, which assigns weights to each indicator, will smooth the data and obscure the actual differences in the dynamics of capital income and economic growth.

There exist different approaches to the analysis of equal distribution, which conclude that it is a condition for sustainable development, an effective economy, and justice. Four key fundamental principles are suggested. Cooperative efficiency regards income equality as the key condition for cooperation, trust, and efficiency (Schmidt, 1993). An excessively diversified market undermines trust. Equality motivates participants in the labor market to participate in activities. Therefore, equal income distribution ensures socio-economic sustainability in a globally competitive environment. The space of possibility states that an equal distribution eliminates barriers to self-development. According to Sen (2000), equality and justice require access to opportunities, including health, education, and social protection. Therefore, expanding opportunity increases productivity and limited to the use of aggregated indicators of inequality (Bengtsson & Waldenström, 2018). According to egalitarianism, social legitimacy and collective expectations explain that equal distribution is fair when society considers it morally justified and acceptable. Van der Waal et al. (2010) stated that equal distribution arises from collective expectations. This, in turn, affects people's willingness to support state programs for minority support.

Another principle is limiting market risks and excessive advantages, based on the understanding that inequality needs to be constrained. In particular, wealth should not exceed limits that undermine fairness, and income disparities should remain within socially acceptable limits. Vail (2010) developed the egalitarian principle that people should not be entirely dependent on how the market changes. The main idea is that the priority of needs is over profitability, even in periods of economic crisis, everyone has access to basic needs (education, medicine, and accommodation). When the gap becomes too large, fair rules disappear. Excessive inequality undermines public trust, since society relies on

the feeling that everyone has a chance. Green (2013) developed the Rawlsian principle, which states that excessive advantages for the rich destroy the sense of fairness and equal rules for everyone. Income differences are permissible if they improve the situation of those at the bottom; otherwise, such differences must be limited. Franke (2021) stated that equality must also be considered in the process when making decisions about income distribution and access to basic needs, regardless of wealth, family, connections, status, or a person's starting opportunities. Gökçekuyu (2024) stated that random differences must be compensated to ensure that everyone has equal opportunities. Therefore, natural abilities, family background, and social starting positions should not be the basis for differences in access to resources. In particular, there should be no more opportunities for those who were born into a wealthy or educated family or who have good natural abilities.

Numerous studies have examined income distribution and found that an analysis of inequality should consider the overall dynamics of the economy, the structure of accumulated capital, and return on capital generated by the private sector. Shaikh (2017) to analyze the difference between labor and capital income based on the profit share, wage share, and property income. The results showed that income growth is driven by increases in the share of profits and the concentration of capital. Mechling et al. (2017) and Cowell and Flachaire (2024) found that the wealth of the wealthy population grows much faster than expected under the Piketty principle. Moreover, they receive a much larger share of total income with an annual steady increase. Actual wealth concentration is higher, and inequality is more severe. Peterson (2017) included macroeconomic indicators such as real GDP, GDP per Capita, and population growth. Demographic changes affect long-term income and access to economic opportunities, as a decline in population growth increases income concentration and reduces the share of labor income. Stirati (2017) used profit share, wage share, capital–output ratio, and net operating surplus and showed that the primary distribution of income is regulated by institutional factors rather than by market mechanisms. However, the author's main point was that the share of income going to owners of capital is crucial. If the share of capital grows faster than income from labor, then the distribution of income becomes more uneven. Davis (2020) focused on macroeconomic factors (GDP, labour productivity) and the mining sector, using oil rents, mineral extraction output, refined petroleum output, and commodity price indices. The authors underlined the importance of the mining sector because the volatility of the raw materials sector affects the distribution of income and the concentration of rents. As a result, wealthy populations increase their capital along with the increase in oil and gas industry profits.

In Kazakhstani studies, social and socio-economic indicators are considered the main factors reflecting the population's income level. For example, Ashirbekova et al. (2023) examined the dynamics of income, employment, and social standards, and their separate impacts. A similar approach was applied by Zeinolla et al. (2025), which assesses income, employment, and education indicators in regions and requires separate analysis. Turchekenova et al. (2021) also rely on an analysis of the dynamics of individual macroeconomic and social indicators, such as economic growth, financial development, investment, and education, assessing their impact on income inequality. These studies allow us to track changes in individual socio-economic indicators; however, they address the relationship between capital income and overall economic growth to a lesser extent.

Most studies consider indicators related to capital returns and economic growth separately. This makes it difficult to trace how the changing balance between capital returns and economic growth shapes the distribution of income over time. In this article, the r- and g-indices are constructed based on aggregate indicators. In order to consider the contribution of each component, all indicators are treated as equally important sources of information. This

approach is crucial for Kazakhstan's economy, as a significant portion of revenue is generated in capital-intensive industries, primarily the extractive sector.

The use of normalized and equally weighted indicators allows us to track how individual components of capital revenue and economic growth change over time, without distorting their contribution by artificially inflating the importance of individual variables. Therefore, to interpret inequality, it is necessary to consider indicators that reflect economic development, the growth of private capital, changes in its profitability, and redistribution in favor of asset owners.

## 3. METHODOLOGY

The current research is based on the framework suggested by Piketty. The main idea of the "r > g framework" is to analyze the disproportions revealed by comparing returns on capital growth with those on economic growth. The framework predicts that return on capital (r-index) can grow faster than economic growth (g-index). When there is growth in return on capital, the owners of such assets as enterprises, shares, and private capital double their wealth, which means an unequal distribution of resources. Consequently, the gap between the rich and the rest of the population increases. A more equal distribution is expected when the economy's growth exceeds the growth in return on capital.

The application of the r–g approach involves comparing the dynamics of capital income and economic growth, as processes of change in each component. Based on the conducted literature review, for income distribution, the use of weighting coefficients can distort the interpretation of the relationship between capital income and overall economic dynamics, since it implies a hierarchy of indicators. Thus, in the works of Piketty (2014), Atkinson (2015), and Milanovic (2016), it is shown that the basis of this approach is the dynamics of r and g. A similar approach was observed in the studies of Ashirbekova et al. (2023), Turchekenova et al. (2021), and Zeinolla et al. (2025), where socio-economic indicators were considered separately, without aggregating weights, to preserve the interpretability of the results.

Thus, to maintain transparency and comparability of results, data normalization and simple aggregation are a priority (OECD, Handbook on Constructing Composite Indicators, 2005). Therefore, data normalization and simple aggregation were used to align the data on a standard measurement scale, preserving the economic structure of the r–g comparison while avoiding bias in the contribution of individual indicators.

The data was collected from the official data resource, the Bureau of National Statistics, and covers the period from 2010 to 2024. In accordance with Piketty's framework, the following indicators were selected (Table 1).

**Table 1**. The following indicators were used in the analysis

| Indicator | Unit of measurement | Assigned index |
|---|---|---|
| Net profit / mixed income | Million KZT | r-index |
| Crude oil and natural gas extraction; technical services for mining | Index (%, previous year = 100) | r-index |
| Refined petroleum products output | Index (%, previous year = 100) | r-index |
| Mining industry output | Index (%, previous year = 100) | r-index |
| Consumption of fixed capital | Million KZT | r-index |
| Real GDP volume index (production approach) | Index (%, previous year = 100) | g-index |
| Labour productivity index | Index (%, previous year = 100) | g-index |
| GDP per capita | KZT per capita | g-index |

Note: compiled by the authors

The suggested approach will help evaluate changes in the income distribution. If the r > g condition is sustainable, it indicates growth in income inequality. If the r < g condition holds, it indicates a more balanced distribution. Therefore, the indicators were divided into two groups representing the r-index and the g-index. The main formula of the approach is the following (1):

$$r > g \qquad (1)$$

where:

r – rate of return on capital;

g – economic growth rate.

To conduct the analysis, the data was initially normalized and for this purpose there was used "Max-Min" method to aggregated r and g indexes. The calculations were conducted based on the following formula (2):

$$x_t^{norm} = \frac{x_t - \min(x)}{\max(x) - \min(x)} \qquad (2)$$

where:

$x_t$ – the observation of the indicator in year $t$;

*max(x)* – the maximum values of the indicator over the entire observation period;

*min(x)* – the minimum value of the indicator over the entire observation period.

Traditionally, the normalization method aggregates yearly indices. In the current research, the goal was to reveal the difference between the two indices, rather than the difference in yearly dynamics. To quantitatively assess the relationship between capital income and economic growth, the indicators were grouped into two blocks, corresponding to the r-index and g-index. All original indicators are normalized to ensure comparability across differences in units of measurement. Additionally, due to differences in data measurement, normalization was conducted for each indicator separately (as a single indicator) to maintain the relative dynamics of change.

After normalization, the indicator values were aggregated into integral indicators r-index(t) and g-index(t). The calculations were conducted based on the following formula (3):

$$r/g_{index(t)} = \frac{1}{n}\sum_{i=1}^{n} r/g_i^{norm}(t) \qquad (3)$$

where:

$r_{index(t)}$ – the integral return on capital in year $t$;

$g_{index(t)}$ – the integral of economic growth in year $t$;

$n$ – the number of indicators included in the index calculation;

$i$ – the ordinal number of the component indicator within the index (from 1 to n);

$r/g_i^{norm}(t)$ – the normalized value of the $i$-th indicator, after min-max scaling.

For the r-index, five capital-dependent indicators were included (n = 5). These indicators capture different dimensions of returns on capital and were aggregated into an integral r-index. For the g-index, three macroeconomic growth indicators were included (n = 3). These indicators reflect the dynamics of overall economic growth and were aggregated into an integral g-index.

The proposed methodology will enable the identification of structural changes in income-generation processes. Grouping indicators into r and g blocks and then aggregating their normalized values allows for a transparent assessment of the extent to which income dynamics are driven by capital accumulation or by the overall expansion of economic activity. This approach enables the analysis of long-term trends in income distribution and the identification of periods of increasing inequality or more balanced development.

## 4. RESULTS

To assess the dynamics of income distribution, it is important to analyze and compare the r-index and g-index values, and to examine the behavior of the indicators that make up the indices to identify key economic trends. This section examines the dynamics of the r-index components, then the indicators that make up the g-index, followed by a summary

of the comparison of r and g and an interpretation of the identified periods of increasing and decreasing inequality. Figure 1 shows results for r-index-forming indicators.

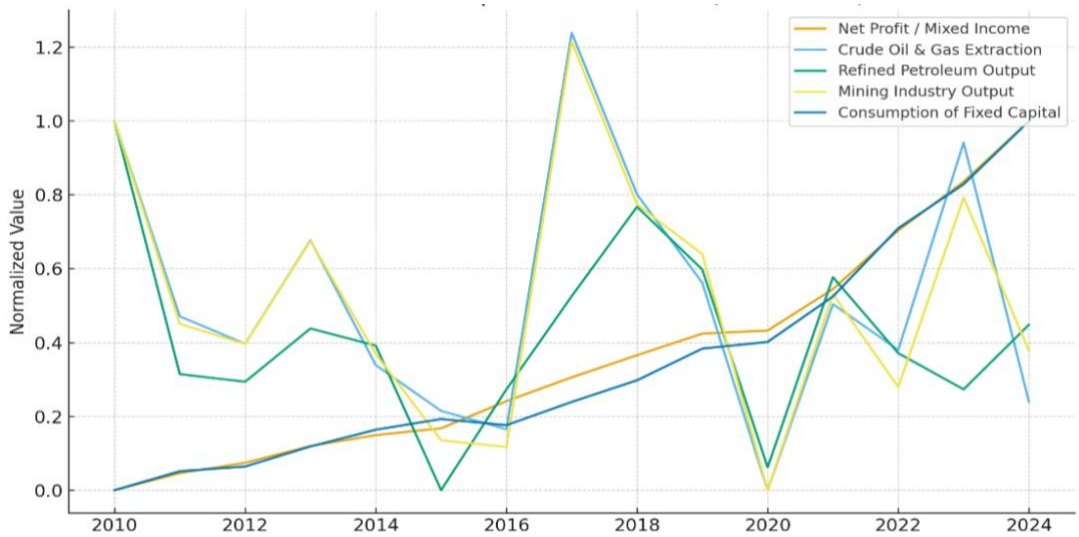


**Figure 1.** Dynamics of return on capital indicators (r-index) in Kazakhstan for 2010-2024

In the r-index, two groups of indicators can be distinguished. The first group includes industries related to raw materials, which have relatively similar dynamics. These industries are dependent on the global commodity prices, demand for oil and metals, export channels, and investment in production. The period 2011-2012 repeated the state of the world economy, slowdown of the economy after the economic crises in 2008 and 2009. A relatively similar situation is recorded in 2015 and 2016, when world commodity prices declined dramatically, almost twofold (from 100 USD to 30/40 USD). In Kazakhstan, at the same time, the following were observed: a reduction in production, in oil refining, and in the output of mining products. Therefore, the return on income declined sharply, and production stagnated. In 2017, exports increased significantly, and Kashagan began to improve its exports. Raw materials-related industries began to improve their positions. However, such improvement was temporary, and after COVID-19, Kazakhstan's dependence on world markets was extreme in 2020. The industrial activities and logistics, including air cargo, were blocked. Demand for oil and gas decreased significantly worldwide. After 2021, a gradual strengthening of the global economy was observed, and prices for raw materials began to rise, with worldwide exports recovering. However, there were also fluctuations, with a temporal increase from 2022 to 2023 and a decline in 2024.

The second group included macroeconomic indicators with similar behavior. Between 2010 and 2016, economic development increased gradually, followed by stability. In 2016, there was an insignificant decline that external factors could explain. Then, until 2020, macroeconomic indicators continued to increase steadily. After 2020, the dynamics for the second group of indicators were more active. Thus, it can be assumed that corporate growth was steady as well, and companies were improving production efficiency, adopting technological innovations, and focusing more on non-raw materials production. Corporate profit is distributed throughout the economy, as it comprises other sectors (trade, transportation, finance, etc.). Therefore, in the event of one sector's failure, the rest continue to develop and process. The increase in consumption of fixed capital showed that, overall, there was an increase in buildings, machinery, equipment, and infrastructure in Kazakhstan. The more assets are used in the

economy, the higher the capital consumption. Overall, the macroeconomic indicators increased significantly throughout the observed period.

The dynamics of the r-index components showed that capital income has been more volatile than economic growth indicators. Strong fluctuations were observed in oil and gas production, mining output, and petroleum product manufacturing. Consequently, the r-index components are directly dependent on global commodity prices, export demand, and the state of international supply chains. Moreover, declines in these components were observed during periods of falling global oil prices in 2015–2016 and in 2020 amid restrictions on international trade and transport flows. As a result, production volumes declined, and incomes in capital-intensive sectors declined. During years of global economic recovery and growth in export deliveries, the increase in normalized capital indicators occurred more rapidly than in overall macroeconomic indicators. Thus, concentration occurs in specific sectors of the economy, resulting in an uneven distribution of economic growth and rapid income accumulation in capital-intensive activities.

Next, the dynamics of the g-index indicators are shown in Figure 2.

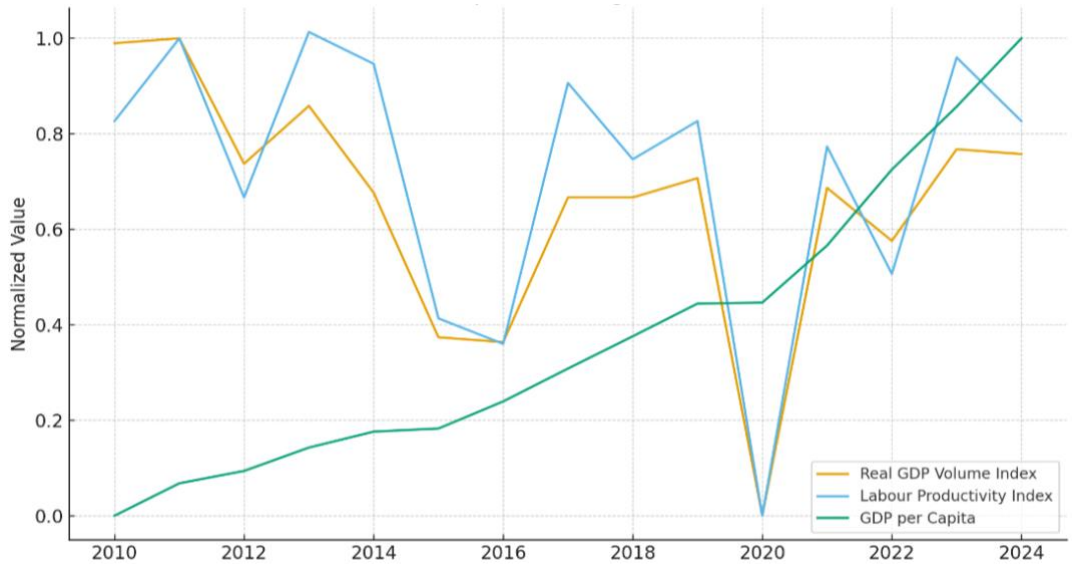


**Figure 2.** Dynamics of economic growth indicators (g-index) in Kazakhstan for 2010-2024

The results for the G-index showed that the absolute GDP volume index and и labour productivity index had similar trends. Between 2010 and 2014, moderately high values were recorded. After the global crisis, Kazakhstan's economy recovered and maintained sustainable development. However, there was a gradual decline in 2015-2016, most likely due to declining oil prices, reduced exports, and poor investment. Consequently, GDP volume declined similarly, as enterprises depend on production volume. Between 2017 and 2019, there was a temporary recovery. In 2020, following COVID-19, there was a dramatic decline in economic activity, including a reduction in employment and working hours, as well as a halt in mass production. However, as before COVID-19, the Kazakh economy began to develop in non-raw-material production, and the recovery process was relatively fast. From 2021 to the end of the period, both indicators showed a steady increase. At the same time, GDP per capita showed an opposite trend. Throughout the period, from 2010, a steady increase was recorded. Even after COVID-19, the decline was insignificant. Therefore, the GDP per capita is conditioned not only by the production output. Another condition is a

general increase in nominal GDP, which can be driven by inflation, wage growth, economic diversification, the expansion of the service sector, and increased government spending.

The g-index has two regimes, volatile growth (short-term) and income stability (long-term). The short-term is sensitive to external factors, rapidly increases during favorable periods and declines during world crises. The long-term ensures gradual growth and sustainable development. Moreover, the long-term regime contributes to sustainable development.

An analysis of the g-index components revealed differences in the dynamics of economic activity indicators and household income levels, revealing sensitivity to economic changes with varying speed and intensity. Real GDP volume and labor productivity were susceptible to changes in external factors, including fluctuations in commodity prices, investment activity, and restrictions on economic activity during crisis years. A decline was observed in 2015–2016 and in 2020 among the components, due to a reduction in production, employment, and business activity. Moreover, production volume and labor productivity directly depend on enterprises' current economic activity. Therefore, during periods of deteriorating external conditions, output and employment decline quite rapidly. At the same time, the GDP per capita indicator was more stable, due to the influence of nominal income growth, government spending, population changes, and the expansion of the service sector. As a result, short-term economic shocks have a greater impact on production activity, while household income indicators react less sharply and recover gradually as the economy adapts.

Next, Table 2 presents the overall results of the r-index and g-index comparison.

**Table 2**. Results of the r-g principle

| Year | R-index | G-index | Δ = g − r | Interpretation |
|---|---|---|---|---|
| 2010 | 0,6 | 0,605522 | +0,005522 | More Equal Distribution |
| 2011 | 0,266702 | 0,689272 | +0,422570 | More Equal Distribution |
| 2012 | 0,245053 | 0,499265 | +0,254212 | More Equal Distribution |
| 2013 | 0,40595 | 0,671521 | +0,265571 | More Equal Distribution |
| 2014 | 0,282633 | 0,599822 | +0,317189 | More Equal Distribution |
| 2015 | 0,142122 | 0,323213 | +0,181091 | More Equal Distribution |
| 2016 | 0,194622 | 0,320998 | +0,126376 | More Equal Distribution |
| 2017 | 0,70529 | 0,62719 | −0,078100 | Income Inequality |
| 2018 | 0,601599 | 0,596373 | −0,005226 | Income Inequality |
| 2019 | 0,521469 | 0,659362 | +0,137893 | More Equal Distribution |
| 2020 | 0,179236 | 0,148793 | −0,030443 | Income Inequality |
| 2021 | 0,536615 | 0,675414 | +0,138799 | More Equal Distribution |
| 2022 | 0,488913 | 0,602537 | +0,113624 | More Equal Distribution |
| 2023 | 0,734634 | 0,861539 | +0,126905 | More Equal Distribution |
| 2024 | 0,6133 | 0,861414 | +0,248114 | More Equal Distribution |

Note: compiled by the authors

The results of the dynamics of the r-index and g-index for 2010–2024, with a year-by-year evaluation of the relationship between the return on capital and the rate of economic growth, determined whether income distribution tends toward greater equality (when g > r) or increasing inequality (when r > g), following the Piketty framework. The difference between the g and r indices revealed a deviation between economic growth and capital returns. This difference is considered as the excess of the g index over the r index, or vice versa. Positive values of the difference reflect years in which the g index exceeds the r index. In contrast, negative values correspond to periods when capital returns, reflected by the r index, grow faster than economic growth. An even distribution of income is considered if the

g index for a year exceeds the r index. That is, economic growth outpaces capital returns. An increasingly uneven distribution of income occurs when the r index exceeds the g index, meaning capital returns grow faster than overall economic growth.

The g-index mainly showed higher values, indicating that the economy was expanding, compared to the results of the r-index, capital profitability, first between 2010 and 2016, then in 2019, and from 2021 up to the end of the observed period. On the contrary, in 2017, 2018, и 2020, when the r-index exceeded the g-index, capital growth outpaced economic development. During these years, the gap between the income of capital owners and the rest of the economy has increased. Notably, in 2020, the gap increased dramatically due to a sharp decrease in the g-index, caused by a general decline in economic activity. During the final years, 2021–2024, the economy (g-index) was more stable.

At the beginning of the period, the economy of Kazakhstan showed rapid growth relative to capital profit, as indicated by the difference between the g-index and the r-index. Between 2010 and 2016, there was an improvement in production, employment, and labor productivity. Moreover, the domestic market was expanding, particularly in services, trade, construction, and banking. Although the raw materials industry declined, the economy continued to grow and develop overall. Consequently, income distribution was more even. In other words, employees had the possibility of increasing their income more than capital owners.

Over the following two years, the r-index increased, so capital income grew faster than the economy as a whole. One of the reasons was the recovery of world oil prices, an increase in exports, and higher profits for large enterprises. The increase in return on capital was due to large projects, which increased the profit of capital owners. Among them are cases such as the relaunch of the largest offshore oil and gas fields, Kashagan, the Tengizchevroil Future Growth Project – Wellhead Pressure Management Project, and the Karachaganak Expansion Project (TASS, 2016; KazMunayGas, 2017), leading to an increase in the owners' profits. Therefore, these years are characterized by the strengthening of the unequal distribution of income.

Economic growth was recorded in 2019 and 2021. Economic activity during COVID-19 and after the lockdown was intensive. In 2019, consumer demand was recovering, the domestic market was growing and expanding, and non-resource industries were expanding. After COVID-19, the g-index began to grow as economic activity recovered and new communication channels were established, including logistics and local production. Over the years, until the end of the observed period (2023-2024), the g-index reached its maximum values. In 2020, the g-index fell dramatically compared to the r-index. The pandemic had a tremendously negative effect on the private sector and labor productivity. Therefore, in 2020, the capital was growing faster than the economy, exacerbating inequality.

A comparison of the r-index and g-index dynamics revealed discrepancies between the rates of change in capital income and overall economic growth indicators. In some years, the growth of normalized r-index values exceeds the dynamics of the g-index, indicating a more rapid recovery and expansion of income in capital-intensive sectors than in the economy as a whole. Income distribution disparities widen, as the increase in capital income is not accompanied by comparable growth in macroeconomic indicators. In other periods, the r-index and g-index values converge, reflecting more synchronous changes in capital income and economic growth and indicating a more even distribution of economic outcomes. These differences characterize the income generation model in the Kazakh economy, in which high dependence on commodity sectors leads to periodic outpacing growth in capital income and exacerbates fluctuations in inequality.

The results confirm Piketty's conclusion that the nature of income distribution depends on whether capital or the economy grows faster. Table 3 summarizes the results.

**Table 3.** Summary of key results on income distribution dynamics

| Period | Type | What dominated / key economic features |
|---|---|---|
| 2010–2016 | Favourable period (Growth > Capital) | Stable macroeconomic growth.<br>Domestic market diversification: services, trade, transport.<br>Employment rate growth.<br>Rise in labor productivity.<br>Moderate capital profits (low relative to GDP growth). |
| 2017–2018 | Unfavourable period (Capital > Growth) | Surge in capital income due to profit growth in the raw materials industry (the extractive sector), the recovery of world prices for oil and gas, and the expansion at Karachaganak. |
| 2019 | Favourable period | Recovery of domestic demand; growth of services; stable productivity; reduced dependence on oil price spikes; balanced corporate income. |
| 2020 | Unfavourable period | Pandemic shock: fall in real GDP and productivity.<br>Lockdown-conditioned shutdowns in the private sector.<br>Supply chain disruptions. |
| 2021–2024 | Favourable period (Growth > Capital) | Strong post-pandemic recovery.<br>Active growth of the domestic market (services, logistics, IT).<br>Rise in retail and internal consumption.<br>Rapid GDP per capita growth compared to capital income growth. |

Note: compiled by the authors

The results confirm Piketty's conclusion that the nature of income distribution depends on whether capital or the economy grows faster. In 2017–2018, returns to capital grew faster than real income. This was a period of strength in the commodity sector and rising profits for large companies. However, this led to rising incomes and a more inequitable income distribution.

However, when economic growth exceeded returns to capital (2010–2016, 2021–2024), a more equal income distribution was observed, accompanied by the following changes. First, the domestic market expanded, employment and productivity grew, and SMEs developed and expanded. Second, this economic activity encompassed a larger number of industries and the population. As a result, the impact of a narrow capital-intensive sector on compound income became insignificant.

However, Piketty's theory was not applicable in 2019 and 2020, as persistent shocks drove both periods. 2019 was a period of recovery from a series of international economic crises, including the 2015–2016 decline in global oil prices and the slowdown in global trade. This period saw a peak in economic expansion and a focus on the non-resource sector. As a result, incomes temporarily improved regardless of capital market dynamics. In 2020, the COVID-19 lockdown led to a global recession.

## 5. CONCLUSIONS

The current research aimed to assess the dynamics of income distribution in Kazakhstan. The analysis compared capital income dynamics and economic growth rates, aggregated into integral r- and g-indices. The approach, based on Piketty's framework, showed structural differences between return-on-capital and income-growth models of economic growth.

The results showed that income distribution in Kazakhstan is susceptible to changes in capital income and overall economic growth. During periods when economic growth exceeded capital income dynamics, a more equal income distribution was observed. These periods included expansion of the domestic market, an increase in employment and labor productivity, and the development of the service sector and non-resource sectors of the

economy. Moreover, income growth was generated across a broader spectrum of economic activity, reducing the dominant role of capital-intensive industries.

When capital income grew faster than the economy as a whole, income distribution worsened. Additionally, profitability in capital-intensive raw material industries, rising external commodity prices, and the economy's dependence on raw material exports were identified. Moreover, income growth was concentrated primarily among capital holders.

The analysis also indicates that income distribution dynamics in Kazakhstan are cyclical and structural in nature. High volatility in the r-index components reflects the economy's dependence on global commodity markets. In contrast, the g-index demonstrates more sustainable long-term growth, supported by gradual increases in productivity and household incomes and the expansion of the service sector. Thus, an increase in return on capital increases distributional imbalances. Reducing income inequality requires economic diversification, developing non-resource sectors, supporting small and medium-sized businesses, and increasing employment. The main goal is to weaken the dependence of income dynamics on capital return and reduce income concentration in a narrow range of industries.

The role of the state in shaping an inclusive growth model is critical. Countercyclical fiscal policy, targeted support for sectors with a high employment multiplier effect, and stimulation of domestic demand help smooth the distributional impacts of external shocks. Aligning economic growth strategies with objectives to increase labor productivity and develop the domestic market contributes to the formation of a more sustainable and socially balanced income distribution model.

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Funding acquisition and research administration: Magbat U. Spanov, Saban Celik.
Development of research methodology: Magbat U. Spanov, Ainura T. Alibekova, Saban Celik.
Resources: Magbat U. Spanov, Ainura T. Alibekova, Gulnar B. Ospanakunovna, Saban Celik.
Software and supervisions: Irina Kovaleva, Leon Taylor.
Data collection, analysis and interpretation: Magbat U. Spanov, Ainura T. Alibekova
Visualization: Magbat U. Spanov, Ainura T. Alibekova, Gulnar B. Ospanakunovna, Saban Celik.
Writing review and editing research: Magbat U. Spanov, Gulnar B. Ospanakunovna.

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