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Techno-optimism and digital risks in public discourse: The paradox of digitalization in Kazakhstan

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Abstract

This paper examines the phenomenon of techno-optimism in Kazakhstan, focusing on how it interacts with public discussions about the risks and negative effects of digitalization. The study is based on a computer-assisted content analysis of 120,751 messages from 22,909 unique authors across various online public sources, complemented by qualitative analysis of selected messages. The theoretical framework is paradox theory, which is applied to unstructured online discourse. The analysis tests and rejects the hypothesis that discourse on the negative effects of digitalization permeates the broader debate on digitalization. While concerns about risks are evident, they remain isolated from the general discourse on the pace and direction of digital transformation. A paradox of techno-optimism emerges: enthusiasm for digitalization persists alongside awareness of risks, with both discourses coexisting but not intersecting. The study demonstrates that techno-optimism in Kazakhstan is resilient, sustained even in the presence of risk awareness. This coexistence of contradictory discourses without integration reflects the dynamics of digitalization debates in rapidly transforming societies. The findings offer insights for policymakers and practitioners seeking to understand the public perception of digital transformation. They also highlight the importance of considering paradoxical dynamics in digital policy communication and public engagement strategies.

Keywords: Digitalization, Quantitative content analysis, Techno-fixers, Technological optimism (Techno-optimism).

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Institutional Review Board Statement: Ethical review and approval were waived for this study because all the materials are published by their respective authors in various online public discussion forums, news sites, etc. None of the materials used for the analysis in the article is obtained from private interviews or other non-public sources. The study dealt with the published online messages rather than with humans who created and posted them. Nevertheless, for the sake of additional protection of privacy, the authors' names or aliases are removed from the published quotes..
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1. Introduction

This article aims to provide evidence for and discuss the implications of the technological optimism phenomenon that is consistently observed in Kazakhstan [1] as well as in other post-Soviet states [2]. In a sense, techno-optimism balances out the lack of trust in institutions and interpersonal trust in general as factors of innovative development [3]. Thus, in Kazakhstan, 73% of respondents to the World Value Survey questionnaire in 2017 believed that more emphasis on the development of technology was "a good thing," and 34% completely agreed that "science and technology are making our lives healthier, easier, and more comfortable" (while only 5% of respondents completely disagreed with this statement), and 37% believed that "because of science and technology, there will be more opportunities for the next generation" (while only 3% completely disagreed with this statement) [1].

Danaher defines techno-optimism as "the view that technology, when combined with human passion and ingenuity, is the key to unlocking a better world " [4] (p. 54), a definition which was later criticized and amended by Königs [5] as imprecise. The latter author suggests an alternative to define someone as a techno-optimist if this person believes technology to be favorable for human welfare and to have a net-positive impact on human well-being. The associated term is "techno-fixers," which is used by Johnston to define the faith in technological solutions to all social problems [6]. Johnston compares techno-optimism to a love affair:

"…Yet for each of these relevant social groups, the relationship with technical innovation has been akin to falling in love. New technologies represent irresistible appeals and inspire unquestioning acceptance. Technology's responsiveness to our every immediate need, real or imagined, gains our implicit trust. Only in retrospect may such confidence seem naïve and misguided" [7] (p.203).

Techno-optimism is a kind of utopian worldview [8], and it is interlinked with many specific subject areas' perceptions of future development. Currently, there is a vivid debate in environmental studies on whether techno-optimism is justified in our forecasts for the future of climate change mitigation and other environmental issues. Some authors, for example, Keary [9] and Alexander and Rutherford [10], are skeptical and consider techno-optimism to be "a major gamble" [9] (p. 7), while others, for example, LeCain [11], Uekötter [12], and Nydal et al. [13] are cautiously optimistic and provide an example of working techno-fixers. Thus, one can encounter techno-optimists both among academics and the general public, though the former group tends to be more skeptical and less unilateral in their conclusions.

Techno-optimism can take many forms and variations and be found in numerous areas of human activity, making it an unquestionable worldview. Techno-optimists welcome the rapid growth of technologies and technological changes. This mindset is tested anew in light of AI development, which is argued to represent the largest technological change of our times. Khogali and Mekid [14] discuss both fears and optimism related to AI development among students and note that, despite the fears being well-understood, there is also "a strong evidence for an optimistic path to AI breakthroughs boosting the level of confidence in and acceptance of AI across many industries" [14] (p.1). Saúde et al. [15] and Gerlich [16] also provide evidence of a generally optimistic perception of AI among students, while Palla and Kostarella [17] show the generally positive perception among journalists. Avle et al. [18] insist that techno-optimism is an essential part of the set of techniques of modern governance because it is intrinsically linked to scaling, i.e., to progress and development. Therefore, techno-optimism as a concept is relevant for the analysis of more than one social group and more than one society.

In addition to techno-optimism, a new term, "technowashing", was suggested by Ribeiro and Soromenho-Marques [19] to describe "the promotion of techno-science as a product through customer satisfaction techniques and the spectacularization of the offer […] characterized by an excessive optimism around technology" [19] (p. 9). This new concept is promising for research; for example, it helps to characterize consumers' service-oriented techno-optimism.

In the analysis of techno-optimism vs. techno-pessimism, it is important to consider the social context. A study involving 1,849 participants from Arab countries conducted by Al Khoury et al. [20] has found that the participants' fear of AI is more influenced by feelings of pessimism and optimism through the lens of a dark future and is therefore influenced by the general perception of the future of society and an individual within society Al Khoury et al. [20]. Godoe and

Johansen [21] add personal traits, such as a general optimistic worldview, to the equation describing factors of techno-optimism, technological readiness, and acceptance of new technologies [21].

This article delves into the phenomenon of apparently deeply-rooted techno-optimism in Kazakhstan that is now directed mainly towards digitalization, including improvements in Internet access and the expansion of online services. We intend to study how techno-optimism presents itself in the public discourse on digitalization and whether comprehension and discussion of risks related to digitalization, such as digital addiction among children, personal data insecurities, and digital fraud, affect this techno-optimism and enthusiasm for digitalization in any significant way.

Kazakhstan is an interesting case of a rapidly digitalizing society. According to the UN Department of Economic and Social Affairs, Kazakhstan currently ranks 24th in the e-government development index among 193 countries [22]. The Internet penetration is reported at the level of 93.2% of the population, with a growing use of mobile connections (currently 133% of the population) [23]. Therefore, it is important to understand how the perceived risks of digitalization affect the general perception of digitalization and whether techno-optimism discourse adapts in any way to the discussion of digitalization's risks and negative consequences.

As a theoretical approach, this article uses the theory of paradoxes [24-26]. This choice of a framework may seem counterintuitive, since this theory was developed primarily for organizational and managerial analysis, while our research deals with an unstructured pool of messages and comments in social media and other similar sources. Nevertheless, the theory of paradoxes provides a promising approach to the analysis of the phenomenon we registered in our study. The theoretical definition of paradoxes suggested by Lewis, as summarized by Smith and Lewis, is very suitable for our findings: "We define paradox as contradictory yet interrelated elements that exist simultaneously and persist over time" [26] (p.382). Lewis discusses three groups of paradoxes: (1) paradoxes of learning; (2) paradoxes of organizing; and (3) paradoxes of belonging [25]. The paradox identified in our study findings can be described as a paradox of learning, as it concerns the contradiction between a set of beliefs (techno-optimism) and the changes in reality (publicly discussed disadvantages and risks of rapid digitalization). The framework for analyzing paradoxes, developed by the same author, includes three components: (i) tensions (the underlying sources of paradox); (ii) reinforcing cycles; (iii) management. In our study, we have clearly identified the first component, tensions, in the form of mixed messages, and probably the second, reinforcing cycles, in the form of ambivalence, but not yet any attempts at managing the paradox. The theory of paradoxes can contribute to ways of dealing with the paradoxes we observe. The applicability of the theory is enhanced by this study since, while most studies on paradox theory are limited to organizational/managerial contexts, this article innovates by applying paradox theory to online public discourse. This is a theoretical contribution of our study.

2. Materials and Methods

The research method used for this article is the quantitative content analysis of social media, social networks, blog posts, and comments on online news portals in Kazakhstan from 1 July 2023 to 5 August 2024. The general topic was the perception of digitalization, with subtopics being "Security and data protection," "Cybercrime and fraud," "Digital addiction and psychology," "Digitalization of various spheres," "Economic and financial aspects," "Technologies and innovations," "Public policy and services," and "Access and equity." The subtopics were selected by the authors based on initial qualitative analysis of public discourse materials and joint discussion of the research team. In the process of analysis, the computer algorithm also identified a number of topics that appeared in the discussion naturally, related to contemporary news during the studied period. The complete thematic framework, including topics and subtopics, is presented in the Appendix Table 1A.

The matrix of content analysis included other parameters, such as source, intent, tone, involvement, loyalty, audience, and others. Therefore, the exact data-collection method used was a traditional computer-assisted thematic text analysis [27]. Later, this machine analysis was complemented by a semantic analysis performed by the authors.

The data collection was performed using an algorithm programmed to gather information from open online sources, utilizing keywords related to digitalization and Kazakhstan. These keywords included the names of specific companies, technologies, government initiatives, and other relevant terms. The algorithm also employed geo-location filters based on IP addresses, tags, and metadata to exclude all posts not originating from Kazakhstan or related to Kazakhstan.

The algorithm applied natural language processing (NLP) techniques and analyzed messages in both Kazakh and Russian. This was necessary because most discussions in Kazakhstan are bilingual. The primary data then underwent a cleaning and filtering process to remove spam, irrelevant, and duplicate data. The tone of the messages (positive, negative, or neutral) was identified automatically by the same algorithm. In total, the algorithm collected 120,751 messages from 22,909 unique authors. The total number of reactions, including likes, reposts, and comments on the original posts, reached 2,151,558. This represents a significant amount of data for analysis. The large numbers indicate a high level of interest among the people of Kazakhstan in issues related to digitalization and the associated changes in social life, public services, and industries. The peak number of messages per day (1,793 messages) was recorded on November 15th, 2023, coinciding with the announcement of the digital tenge (the national currency of Kazakhstan) by the National Bank of the country [28].

Upon collecting the data, the algorithm identified the tone of each message (positive, negative, or neutral) using machine learning and without human interference. Therefore, the data collection and the initial analysis of data (identification of the tone) were done without human interference, which was noted as one of the weaknesses of the previous computer-assisted text analyses [29]. The next stage of analysis (qualitative analysis of selected messages for each sub-topic) was performed by humans (the authors). This approach combines large-scale NLP-assisted analysis with qualitative reading of subtopics, offering both breadth and depth.

The methodological limitations of this study are:

(1) The messages in the public domain studied in this content analysis were posted by active online users and therefore may not represent the opinions of all social groups in Kazakhstan. However, the large number of unique authors (22,909) reduces bias and enhances the reliability of our study's findings.
(2) The computer algorithm used for assessing "positive", "negative", and "neutral" labels to the tone of each individual message may not account for some cases of sarcastic remarks (for example, positive expressions used to express an opposing, negative opinion); therefore, a limited number of mistakes is possible. However, we believe that the following qualitative analysis of some messages in each category, conducted by humans, helped in mitigating this problem.

3. Results

The general tone of the messages is neutral (93,335 messages or 78.1%). The number of positive messages slightly but consistently exceeds the number of negative ones (11.5% vs. 10.4%). This ratio remained relatively stable throughout data collection, i.e., 13 months. The peaks of positive messages were observed to be linked to new government initiatives, such as the introduction of the digital tenge [28] and the initiative to attract "digital nomads" [30]. The peaks of negative messages are related to the public discussion of the speed and quality of internet connection, cyber fraud problems, tariffs for internet connection and communications in general, and politicians' and senior bureaucrats' statements on these topics.

The heated discussion with the highest quantity of both messages and reactions (Reposts, likes, comments) was related to the discussion of cyber fraud (34.2% of messages). This topic raises the highest interest among the public in Kazakhstan. There are many negative messages related to this and other problems associated with the digital transformation of everyday life (Risks to data security and digital addiction, particularly among children).

Figure 1 shows the tone of the messages (positive, negative, or neutral) by each of the subtopics related to digitalization.

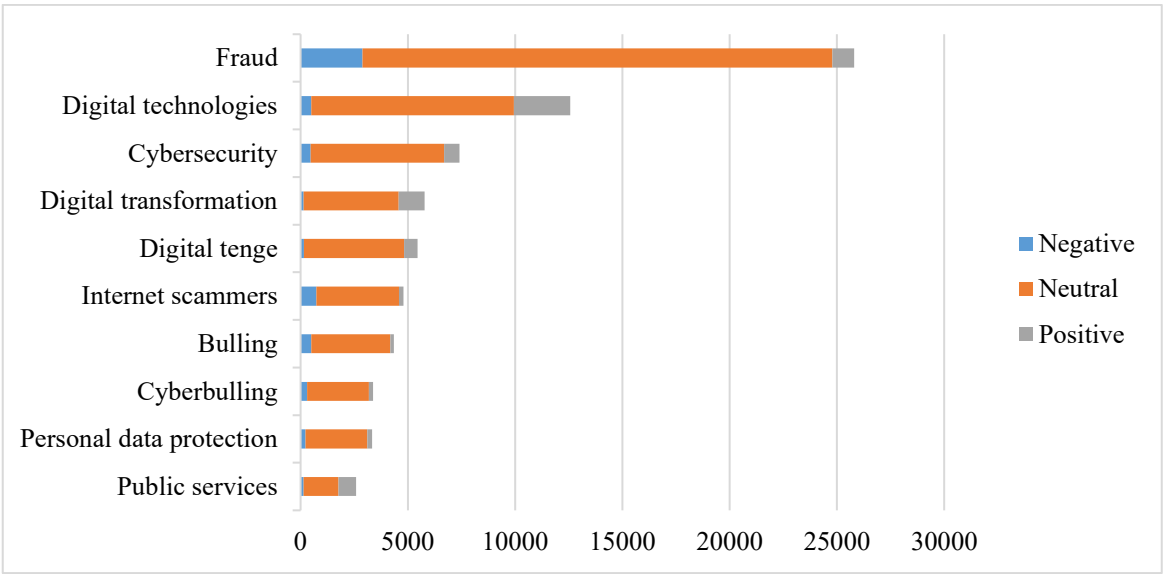

Figure 1.
Tone of the messages (positive, negative, or neutral) for each of the subtopics related to digitalization.

As Figure 1 shows, there is a significant number of negative messages related to Internet fraud; however, this did not affect the subtopic of digital transformation in general. This shows that negativity related to some consequences of digitalization does not penetrate the discussion around digitalization as a process.

The subsequent qualitative analysis has shown that the messages on all the subtopics related to the risks of digitalization demonstrate good public knowledge and understanding of the risks and negative effects of digitalization. Thus, for example, discussing the subtopic of cybersecurity and data protection, the commentators demonstrate a good understanding of modern technologies for data protection (technical knowledge), including biometrics, cloud technologies, electronic digital signatures, and passwords, and their role in ensuring data protection.

The commentators in Kazakhstan understand the risks of digitalization well. The commentators discuss potential threats, such as the possibility of biometric data leaks and forgery, hacking, technology-enabled fraud (e.g., voice spoofing using neural networks), and the sale of personal data. They not only understand the basic principles of data protection systems functioning but also are able to critically evaluate their effectiveness and competently discuss the disadvantages and vulnerabilities of the existing technologies. The commentators actively discuss new cyber fraud technologies related to AI development, such as voice and image forgery, and provide specific examples.

The topic of digital addiction is less discussed, but gradually, the public discourse on this subject is concentrating on the dangers of digital addiction, primarily among children. This is an example of a comment on this topic:

"A smartphone is a tool that can unlock tremendous opportunities, but at the same time, it can cause significant problems. Like any other tool, it must be used correctly. Therefore, conscious use of gadgets is something that needs to be learned."

The paradox of techno-optimism that we observed during our research and introduced in the title of this article manifests itself in the following: when discussing the topic of digital transformation of various spheres of social life, the commentators almost or entirely abandon discussing the risks of digitalization (cyber fraud, digital addiction). The only aspect of the previously discussed digitalization risks consistently mentioned is personal data security. Table 1 shows the findings of quantitative analysis of the subtopic of digital transformation of various spheres of the economy.

Table 1.
The subtopic of digital transformation of the Kazakhstani economy by microtopics (tags).

Microtopics (tags)	Mentions	%	Positive	Neutral	Negative
Digitalization of medical services	153	0.20%	99	53	1
Digitalization of healthcare	122	0.10%	4	116	2
Digitalization of public services	540	0.60%	193	302	45
Company digitalization	79	0.10%	51	28	0
Digitalization of educational services	0	0.00%	0	0	0
Digitalization of business	555	0.60%	250	291	14
Digitalization of business processes	219	0.20%	49	156	14
Digitalization of educational programs	5	0.00%	1	4	0
Digitalization of the education system	2	0.00%	2	0	0

The results indicate that most of the microtopics within digital transformation are perceived positively, and none of them is specifically devoted to the risks or negative consequences of digitalization. The most widely discussed microtopics are the digitalization of business and public services. For both microtopics, the tone of the comments is positive or neutral, with a very limited number of negative comments.

The qualitative analysis for the same subtopic shows that the discussion immediately concentrates on the issues of efficiency and effectiveness of digitalization and transparency of government programs on digital development, as well as the lack of specialists with high levels of digital literacy. The critique of digitalization is related not to digitalization per se, but to excessive spending on government digitalization projects, bad planning, and administration. The commentators are discussing the insufficient pace of digitalization in various spheres, including education and healthcare. Here is an example of a comment on this subtopic:

But there's one question: why is there so little digitalization in education? In preschool, school, higher education, vocational training, professional development, and retraining, as well as in law enforcement, defense, and emergency services. Everything there is still done the old-fashioned way.

In sum, in this context, the public attention is focused on the efficiency of public and business administration of digitalization rather than on the risks of digitalization. The awareness of the risks and negative effects of digitalization does not significantly affect the general optimistic perception of digitalization, with a stable prevalence of positive comments over negative ones. When talking about digitalization in general, the commentators mostly concentrate on its effectiveness and efficiency.

4. Discussion

The findings of our study show that in Kazakhstan's online discourse, awareness and detailed discussion of digitalization's risks coexist with an enduring and largely unaffected techno-optimism toward digitalization in general. The two discourses remain isolated and do not affect each other. These are the "contradictory yet interrelated elements" that form the essence of a paradox according to Smith and Lewis [26] (p. 382). While the existing literature, e.g., [1, 2] states the general tendency towards persistent techno-optimism in post-Soviet countries, our study has empirically confirmed the existence of this paradox in the online public discourse around digitalization.

The risks of digitalization discussed online in Kazakhstan in general comply with the groups of risks identified by Nabbosa and Kaar: the risks to privacy, autonomy, security, balance of power, human dignity, and justice [31]. In this regard, the public discourse in Kazakhstan is not particularly different from the discussions in other countries.

The theory of paradoxes [25, 26], though it is rarely or never applied to non-organized settings of unstructured online discourse, nevertheless helps us to understand and structure our findings. Structuring our findings around the components of the paradox framework developed by Lewis [25], we can arrive at the following:

Table 2.
Application of the paradox theory framework to the findings of this study.

Paradox theory component	Definition (per Lewis) [25]	Manifestation in our findings
Tensions	Contradictory yet interrelated elements that exist simultaneously and persist over time.	High awareness and detailed discussion of risks (e.g., cyber fraud, digital addiction, data security) coexist with a predominantly optimistic discourse on digitalization in general and the demands to make digital transformation more rapid and more efficient.
Reinforcing cycles	Patterns through which tensions are maintained and even strengthened over time.	Optimistic framing of digitalization stimulates further adoption and expansion; expansion generates new risks, keeping risk topics alive, yet risk discourse remains confined to specific subtopics, preserving optimism dominance.
Management	Deliberate strategies to address and integrate tensions.	No evidence of active integration. Paradox is preserved via compartmentalization: risk discourse is concentrated in certain topics, rarely incorporated into the broader narratives about digitalization.

Therefore, we cannot only confirm the existing thesis about the persistence of techno-optimism in Kazakhstan but also trace its paradoxical nature in the visible patterns in the online public discourse, both in tone distribution (quantitative findings) and qualitative examples of selected messages. Our findings not only confirm persistent techno-optimism in Kazakhstan but also demonstrate how paradox theory can illuminate the coexistence of optimism and risk awareness in public discourse.

5. Conclusions

In our study, we have observed how negativity is "quarantined" to some subtopics on digitalization in the public discourse, while the general discourse remains techno-optimistic and modernization-oriented. This provides an interesting empirical illustration of the phenomenon of techno-optimism in a rapidly digitalizing country such as Kazakhstan.

The theory of paradoxes presents a useful tool for analyzing our data. Viewed through the lens of paradox theory, our findings reflect a paradox of learning: there are conflicting beliefs that persist over time without influencing one another. On the theoretical scale, our study presents an innovative attempt to apply the theory of paradoxes to non-organized, non-structured environments without centralized coordinating actors, thus extending this theory beyond its usual organizational contexts. This is a promising direction for further theoretical development in the field.

Further research can be directed at longitudinal analysis to determine whether the dominance of techno-optimism will eventually shatter because of some crisis or crises (for example, major breaches of personal data protection). The digital trust framework is a promising analytical tool for such an analysis in the future [32].

Another promising direction for further research is conducting in-depth qualitative interviews to better understand the patterns observed in the public discourse and to reveal the roots of deeply established techno-optimism in Kazakhstani society.

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Appendix

Table A1.
Thematic matrix of the content analysis of the digitalization.

Subtopics for digitalization	Micro topics for each subtopic
1. Data Security and Protection	Protection of personal data
	Users' personal data
	Personal data security
	Mobile phone protection
	Computer protection
	Cybersecurity
	Parental control
2. Cybercrime and Fraud	Internet fraudsters
	Online scammers
	Cyber fraud
	Fraud
	Cyberbullying
	Cybercrimes and cyber departments
3. Digital Addiction and Psychology	Internet addiction
	Social media addiction
	Cyberpsychology
4. Digitalization of Various Sectors	Digitalization of public services
	Digitalization of medical services
	Digitalization of healthcare

	Company digitalization
	Digitalization of business processes
	Digitalization of educational services
	Digitalization of educational programs
	Digitalization of the education system
5. Economic and Financial Aspects	Digital currency
	Digital tenge
	Digitalization of the economy
	Online transfers
6. Technology and Innovation	Digital transformation
	Digital technologies and innovations
	Digital communications
	Digital service
7. Government Policy and Services	Digital public services
	Digitalization of public administration
	Internet blocking
8. Accessibility and Equality	Digital accessibility
	Digital inequality