Technological Readiness and Adoption of Technological Innovations in Companies

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Abstract: Digitalization and technological innovations are key drivers of enterprise transformation in the era of the Fifth Industrial Revolution. This study examines the degree of implementation of selected technological innovations in Slovak enterprises and compares them with the perceived importance of these innovations for future business development. Data were collected through a questionnaire survey of 711 respondents representing enterprises of various sizes and industries. The analysis focused on innovations aimed at customers and employees, including digitalization of analog and biometric data, digital interaction platforms, data analytics, and GDPR-related solutions. The results revealed statistically significant gaps between perceived importance and actual application for most innovations, with importance ratings consistently higher than implementation levels. These gaps were most pronounced in micro and small enterprises, suggesting persistent barriers to transforming innovation awareness into practice. Comparisons between customer-oriented and employee-oriented innovations showed limited differences in implementation, with biometric data usage being more advanced internally. Furthermore, Kruskal-Wallis tests confirmed that implementation levels increase with enterprise size across all analyzed innovations. The Wilcoxon signed-rank test was used for paired comparisons of importance and implementation, while size-based differences were examined using Kruskal-Wallis tests with post hoc analysis. The findings provide a comprehensive insight into the technological readiness of enterprises and underline the need for targeted support measures to accelerate digital transformation, especially among smaller firms.

Keywords: Company Development, Digitalization, Implementation Gap, Technological Innovation

1 Introduction

The Fifth Industrial Revolution represents the current phase of technological evolution, characterized by the convergence of human creativity with advanced artificial intelligence, robotics, and biotechnology. This era emphasizes human-

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machine collaboration and sustainable, personalized solutions, making technological readiness and digital innovation adoption critical determinants of organizational success and long-term sustainability (Schwab, 2016; Vial, 2019).

However, the transition toward comprehensive digitalization presents unprecedented challenges, particularly in post-transition economies. Slovakia exemplifies these difficulties, ranking 23rd out of 27 EU member states in digital competitiveness, with projections indicating continued decline without systematic intervention (KInIT, 2023). This positioning reflects not merely insufficient technological infrastructure but a more fundamental challenge: the persistent gap between recognizing technology's importance and successfully implementing digital innovations.

Despite extensive research on digital transformation in developed EU markets, post-transition economies like Slovakia remain understudied, particularly regarding the mechanisms underlying implementation gaps. While existing studies acknowledge disparities between technology awareness and adoption (Bharadwaj et al., 2013; Matarazzo et al., 2021), three critical research gaps persist. First, prior research has not systematically examined how psychological barriers—including cognitive dissonance and technology anxiety—interact with structural factors such as resources and enterprise size in post-transition contexts. Second, comparative analysis of customer-oriented versus employee-oriented technology adoption remains limited, despite significant implications for strategic resource allocation. Third, the specific mechanisms through which enterprise size influences technology adoption across different innovation types are inadequately understood in Central European contexts, where SMEs constitute the majority of the business ecosystem yet face disproportionate digitalization challenges.

This study addresses these gaps by investigating technological readiness and implementation patterns across 711 Slovak enterprises representing diverse sectors and company sizes. Building upon the Technology-Organization-Environment (TOE) framework (Tornatzky & Fleischer, 1990), we integrate psychological dimensions often overlooked in technology adoption models. Specifically, we examine three interconnected research. The study investigates the following research questions (RQ):

- RQ1: To what extent does the perceived importance of technological innovations differ from their real application in enterprises?

- RQ2: Are there differences in the application of technological innovations between customer-oriented and employee-oriented areas?
- RQ3: How does the application of selected technological innovations differ depending on the size of the enterprise?

The study's novelty lies in its comprehensive integration of psychological, organizational, and environmental factors within a single analytical framework applied to a post-transition economy. Unlike previous studies that examine these dimensions separately, we demonstrate how cognitive barriers operate within all three TOE contexts, with particular emphasis on organizational factors in resource-constrained environments. Furthermore, by systematically comparing customer-oriented and employee-oriented implementations across eight distinct technological innovations, we provide unprecedented insights into how organizations prioritize digital transformation efforts.

This research contributes to theory by extending the TOE framework through empirical validation of psychological factors' influence on technology adoption in post-transition economies, demonstrating that cognitive dissonance and present bias create systematic implementation delays beyond resource constraints alone. For practice, our findings provide actionable guidance for enterprise managers navigating digital transformation, while informing policymakers about targeted intervention strategies needed to address the identified digital divide, particularly among micro and small enterprises that form Slovakia's economic backbone.

2 Theoretical Background

The theoretical framework integrates three complementary perspectives that collectively explain the complex phenomenon of technological innovation adoption and implementation gaps in organizational contexts, drawing on digital transformation theory relevant to post-transition economies (Paul et al., 2024). It builds upon Tornatzky and Fleischer's (1990) Technology-Organization-Environment framework, emphasizing that successful technology adoption requires integrating technological, organizational, and environmental factors.

2.1 Technology-Organization-Environment (TOE) Framework

The Technology-Organization-Environment framework, developed by Tornatzky and Fleischer (1990), provides the foundational theoretical lens for understanding technology adoption in organizational contexts. The TOE framework posits that technology adoption decisions are influenced by three key contexts: technological context (availability and characteristics of technologies), organizational context (firm size, structure, resources, and management support), and environmental context (industry characteristics, market competition, and regulatory environment). Recent research demonstrates that organizations implementing comprehensive digital transformation strategies achieve significant improvements in organizational outcomes, including enhanced operational efficiency and competitive positioning (Matarazzo et al., 2021). These findings are further supported by longitudinal studies showing increased innovation outcomes in organizations with structured technology adoption frameworks (Paul et al., 2024). The engagement of diverse stakeholders, including public institutions, local businesses and citizens, has been shown to be a fundamental driver of successful technology adoption and smart solutions development (Fernando, Wiścicka-Fernando & Misiak-Kwit, 2025).

The framework identifies critical dimensions of technological readiness: awareness enhancement, resource allocation, management responsibility, strategic integration, technology infrastructure, continuous learning, implementation support, and performance evaluation (Eller et al., 2020). These dimensions align with contemporary digital transformation theories that emphasize systematic support for technology adoption through policy development and capability building mechanisms. Previous studies show that enterprise size not only influences the adoption of innovations but also shapes organizational practices, with smaller firms constrained by limited resources and larger organizations relying on structured HR and retention systems (Gelencsér et al., 2024).

Building on Barney's (1991) concept of resource-based competitive advantage, this study examines organizational responses to technological challenges in resource-constrained environments. This theoretical approach is particularly relevant in post-transition economies, where digital transformation needs intersect with structural constraints and evolving market conditions. The framework addresses emerging

challenges in digital literacy and technology implementation (Paul et al., 2024), providing a theoretical basis for examining how organizations can effectively bridge the gap between technology awareness and actual adoption while maintaining competitive advantage in an increasingly digital business environment.

2.2 Technological Readiness and Digital Transformation

Technological readiness refers to an organization's capacity to adopt, integrate, and effectively utilize new technologies to achieve business objectives (Parasuraman, 2000). In the context of the Fifth Industrial Revolution, this concept has evolved to encompass not only the technical infrastructure but also organizational culture, human capital capabilities, and strategic alignment with digital transformation goals that emphasize human-centric innovation and sustainability (Schwab, 2016). Rogers' (2003) diffusion of innovation theory suggests that adoption patterns vary based on organizational characteristics, with larger firms typically demonstrating higher adoption rates due to greater resource availability and risk tolerance. However, recent studies indicate that size alone is insufficient to predict successful technology integration (Zhu et al., 2006). Findings from HRM research confirm that digital tools like big data analytics and digital interaction platforms can enhance efficiency, yet their impact on employee engagement remains contingent on management style and organizational culture (Stachová et al., 2024).

Digital transformation encompasses the comprehensive integration of digital technologies into all aspects of business operations, fundamentally changing how organizations deliver value to customers and stakeholders (Vial, 2019). Research in European contexts has revealed significant variations in digital maturity across different countries and sectors. The European Commission's Digital Economy and Society Index (DESI) consistently shows that while some EU member states lead in digital adoption, Central and Eastern European countries face persistent challenges (European Commission, 2023).

2.3 Psychological Barriers and the Implementation Gap in Post-Transition Economies

Beyond structural and organizational factors, psychological dimensions play a crucial role in understanding implementation gaps. A recurring theme in the

literature is the existence of an "implementation gap" the discrepancy between the recognized importance of technological innovations and their actual adoption in practice (Bharadwaj et al., 2013). This gap is particularly pronounced among SMEs, where resource constraints, lack of technical expertise, and organizational inertia create barriers to digital transformation (Eller et al., 2020).

Cognitive Dissonance and Present Bias

Cognitive dissonance theory (Festinger, 1957) explains how organizations may experience psychological discomfort when their stated beliefs about technology importance conflict with actual implementation behaviors. This dissonance can lead to rationalization of non-implementation through various justification mechanisms, such as emphasizing resource constraints or technical complexity. Recent research in behavioral economics demonstrates that decision-makers often exhibit present bias, giving disproportionate weight to immediate costs and benefits while undervaluing future returns (O'Donoghue & Rabin, 2015). In digital transformation contexts, this bias explains why organizations recognize long-term technological benefits but delay implementation due to immediate resource requirements and implementation challenges.

Technology Anxiety and Resistance

Technology anxiety, defined as the tendency to be uneasy, apprehensive, or fearful about current or future use of technology, represents a significant psychological barrier to adoption (Rosen & Weil, 1995). This anxiety is particularly pronounced among older management cohorts and in traditional industries where technological change represents a departure from established practices.

Research indicates that technology anxiety manifests differently across organizational levels. Senior managers may experience anxiety related to strategic risk and organizational disruption, while operational staff may fear job displacement or skill obsolescence. These multilevel anxiety patterns create complex implementation dynamics that purely rational adoption models fail to capture.

Psychological Safety and Social Identity

Conversely, Edmondson's (1999) concept of psychological safety—the belief that one can speak up without risk of punishment or humiliation—significantly influences technology adoption processes. Organizations with higher psychological safety demonstrate greater willingness to experiment with new technologies and

openly discuss implementation challenges. The relationship between psychological safety and digital transformation is bidirectional: while psychological safety facilitates technology adoption by reducing fear of failure, successful technology implementation can also enhance psychological safety by demonstrating organizational support for innovation and learning.

Social identity theory suggests that individuals derive part of their self-concept from group memberships (Tajfel & Turner, 1979). In organizational contexts, professional and departmental identities can either facilitate or hinder technology adoption depending on how technological change aligns with group identity and values. Traditional industries may exhibit stronger resistance to digital transformation when such changes are perceived as threatening established professional identities. Conversely, organizations that successfully integrate technological innovation into their identity narrative demonstrate higher adoption rates and lower implementation gaps.

Implementation Challenges in Post-Transition Economies

Awareness and intention to adopt do not automatically translate into successful implementation due to organizational and technical barriers (Venkatesh et al., 2012). Digital transformation requires a multidisciplinary approach, occurring in three stages from digitization to digitalization and finally digital transformation, with each stage presenting unique challenges (Paul et al., 2024). The complexity of modern technological solutions often requires complementary investments in training, process redesign, and organizational change management that many firms underestimate (Kane et al., 2015). SMEs face particular challenges in technological transformation due to their lack of resources and the complexity of technology assimilation combined with business model innovation (Matarazzo et al., 2021).

In post-transition economies like Slovakia, these challenges are amplified by specific structural and contextual factors. Slovakia's digital competitiveness position is particularly illustrative, ranking 23rd out of 27 EU member states in DESI 2022, with a gradual decline since 2014 (KInIT, 2023). Evaluation research by Gažová (2021) found that Slovakia lags significantly behind in digitalization, ranking 22nd of 28 evaluated countries, with projections of further decline to 24th position by 2025. This concerning trend is attributed to insufficient progress in all

relevant indicators, including integration of digital technology, which has not improved enough to keep pace with the EU average.

Contemporary research on Slovak SMEs reveals persistent barriers to digital transformation. While 90% of Slovak enterprises intend to continue with Industry 4.0 implementation projects, only 27% of domestic enterprises without foreign capital are involved in digital transformation, compared to 79% of enterprises with foreign capital (Čierna & Sujová, 2021). This disparity highlights the critical role of financial resources and international expertise in facilitating digital adoption. The COVID-19 pandemic has further highlighted these disparities, revealing significant differences in adaptive capacity across different enterprise sizes and sectors (Paul et al., 2024). Human potential and talent development represent critical preconditions for effective adoption of Industry 4.0 technologies, particularly in sectors where technological transformation requires workforce skills adaptation (Hitka & Ližbetinová, 2023).

3 Material and methods

The research was designed as a quantitative questionnaire survey aimed at analyzing differences between the perceived importance and the actual implementation of selected technological innovations in enterprises. Particular attention was paid to distinguishing whether these innovations are implemented primarily toward customers or employees. Such a division allows for a more precise identification of the areas in which enterprises concentrate their digital transformation efforts, while also analyzing potential differences in implementation priorities.

From this research objective, three main research questions (RQs) were formulated to guide the data collection and analysis process:

RQ1: To what extent does the perceived importance of technological innovations differ from their actual implementation in enterprises?

RQ2: Are there differences in the application of technological innovations between customer-oriented and employee-oriented domains?

RQ3: How does the implementation of selected technological innovations vary depending on enterprise size (measured by the number of employees)?

The research sample consisted of 711 respondents representing enterprises of various sizes and industries operating in the Slovak Republic. Respondents were approached via electronic communication and online distribution channels.

The questionnaire was divided into several sections, with the blocks related to technological innovations being central to this study. The questions were formulated so that respondents evaluated innovations along two dimensions:

- Current application – the extent to which the given technology is currently implemented in the enterprise.
- Perceived future importance – the estimated relevance of the technology for enterprise development in the coming years.

Technological innovations were further categorized according to their primary target group – customers or employees (Table 1).

Table 1. Overview of evaluated technological innovations

No.	Innovation domain	Codes (Reality / Importance)	Target group	Example / focus
1	Digitalization of analog data	RC_1 / IC_1 RE_1 / IE_1	Customers Employees	Reduction of paper documentation HR information system
2	Digitalization of biometric data	RC_2 / IC_2 RE_2 / IE_2	Customers Employees	Biometric verification Access rights
3	Digital interaction platforms	RC_3 / IC_3 RE_3 / IE_3	Customers Employees	Customer communication Internal communication
4	Big data analytics	RC_4 / IC_4 RE_4 / IE_4	Customers Employees	Marketing analytics Employee motivation analysis
5	Real-time analytics	RC_5 / IC_5 RE_5 / IE_5	Customers Employees	Instant external feedback Internal feedback
6	Predictive analytics	RC_6 / IC_6 RE_6 / IE_6	Customers Employees	Marketing predictions Performance management
7	GDPR compliance	RC_7 / IC_7 RE_7 / IE_7	Customers Employees	Customer data protection Employee data protection
8	Use of social networks	RE_8 / IE_8	Employees	Recruitment and selection

Each innovation was evaluated on a five-point ordinal scale. Data analysis was carried out in several steps. First, a descriptive analysis was performed, which included the calculation of means, medians, and standard deviations for each

innovation and each evaluation dimension (application vs. importance). These results provided a basic picture of the level of implementation and perception of individual technologies.

To address RQ1, the Wilcoxon signed-rank test was used. This nonparametric test enables the comparison of two related samples of ordinal data and the identification of statistically significant differences between the assessment of importance and the assessment of application of a given innovation. For each pair of items (e.g., digitization of analog data – importance vs. application), the test was conducted on the same sample of respondents, with only cases where both values were available included in the analysis.

To address RQ2, the Wilcoxon signed-rank test was also applied, since the compared values (application of innovations oriented toward customers vs. application of the same innovations oriented toward employees) originated from the same respondents. The test was conducted for each corresponding pair of innovations (e.g., digitization of analog data – application for customers vs. application for employees) in order to determine whether a systematic difference exists in the level of implementation depending on target orientation.

To address RQ3, enterprises were divided into size categories (micro, small, medium-sized, and large enterprises), and the degree of application was compared using the Kruskal–Wallis test, which is appropriate for comparing more than two independent groups in the case of ordinal data.

4 Results

The aim of the first research question was to determine whether statistically significant differences exist between how respondents perceive the future importance of technological innovations and the extent to which these innovations are currently implemented in their enterprises. For the analysis, respondents' answers for individual innovations were paired and compared using the Wilcoxon Signed-Rank Test, which is suitable for ordinal data and when the assumption of normality is not met (Table 2).

Table 2. Descriptive statistics of importance and current application of technological innovations

	RC_1	RC_2	RC_3	RC_4	RC_5	RC_6	RC_7	
N	663	576	618	576	605	561	635	
Mean	2.95	2.32	3.01	2.66	2.99	2.72	3.50	
S. Deviation	1.002	1.170	1.011	1.160	1.066	1.177	0.880	
	IC_1	IC_2	IC_3	IC_4	IC_5	IC_6	IC_7	
N	634	541	599	572	611	566	632	
Mean	3.30	2.88	3.40	3.14	3.37	3.19	3.58	
S. Deviation	0.923	1.145	0.867	1.014	0.858	1.005	0.786	
	RE_1	RE_2	RE_3	RE_4	RE_5	RE_6	RE_7	RE_8
N	626	599	612	577	604	574	632	619
Mean	2.90	2.53	2.99	2.65	2.97	2.73	3.47	3.01
S. Deviation	1.064	1.134	1.046	1.149	1.082	1.131	0.872	1.073
	IE_1	IE_2	IE_3	IE_4	IE_5	IE_6	IE_7	IE_8
N	613	564	609	586	613	590	628	607
Mean	3.17	2.92	3.24	3.11	3.27	3.12	3.59	3.23
S. Deviation	1.035	1.138	0.963	1.023	.940	1.005	0.779	0.988

Descriptive analysis showed that respondents, on average, rated the importance of technological innovations higher than their current level of implementation in all cases. For instance, digitization of analog data aimed at customers (IC_1) achieved an average score of 3.30, while its application (RC_1) was only 2.95. A similar trend appeared in other items, with the most notable differences found in innovations such as digitization of biometric data (IC_2 vs. RC_2) and big data analytics for marketing purposes (IC_4 vs. RC_4). High ratings of importance compared to lower levels of application indicate the existence of barriers between awareness of technological significance and its practical implementation (Table 3).

Table 3. Wilcoxon Signed-Rank Test for differences between perceived importance and application

Test Statistics[a]

	IC_1 RC_1	IC_2 RC_2	IC_3 RC_3	IC_4 RC_4	IC_5 RC_5	IC_6 RC_6	IC_7 RC_7	
Z	-9.338[b]	-9.427[b]	-8.834[b]	-9.305[b]	-9.240[b]	-7.697[b]	-2.120[b]	
Asymp. Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.034	
	IE_1 RE_1	IE_2 RE_2	IE_3 RE_3	IE_4 RE_4	IE_5 RE_5	IE_6 RE_6	IE_7 RE_7	IE_8 RE_8
Z	-7.514[b]	-8.637[b]	-6.351[b]	-9.511[b]	-7.894[b]	-8.771[b]	-3.721[b]	-5.422[b]
Asymp. Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

a. Wilcoxon Signed Ranks Test
b. Based on negative ranks.

The results of the Wilcoxon Signed-Rank Test confirmed statistically significant differences between perceived importance and application for most of the examined innovations ($p < 0.001$ in all cases except IC_7 and IE_7, where $p < 0.05$). This means the differences between mean ratings are not random. They reflect a systematic tendency of respondents to assign higher future importance to innovations than their current level of implementation. From the perspective of innovations directed at customers, the most pronounced differences were observed in the digitization of analog data ($Z = –9.338$; $p < 0.001$), digitization of biometric data ($Z = –9.427$; $p < 0.001$), and real-time analytics ($Z = –9.240$; $p < 0.001$). For innovations oriented toward employees, significant differences were identified in the digitization of biometric data ($Z = –8.637$; $p < 0.001$), predictive analytics ($Z = –8.771$; $p < 0.001$), and digitization of analog data ($Z = –7.514$; $p < 0.001$).

The exceptions were GDPR-related innovations (IC_7 and IE_7). Here, differences between perceived importance and actual application were the smallest. Although statistically significant, they were accompanied by relatively low Z-values (-2.120 and -3.721). This may suggest that in the field of data protection, enterprises are already relatively aligned between what they consider important and what they implement in practice.

Overall, the results support the claim that a clear gap exists between the strategic perception of the significance of technological innovations and their practical adoption in enterprises. This discrepancy is present across different types of technologies. It applies both to innovations targeted at customers and those directed toward employees. These findings provide an important basis for subsequent analyses within RQ2 and RQ3, which explore how these differences manifest depending on the target orientation of innovations and enterprise size.

In addressing RQ2, the Wilcoxon Signed-Rank Test was conducted once again. In this case, the comparison involved the level of implementation of the same technological innovation directed at customers (RC) versus employees (RE). The analysis was performed for seven pairs of innovations.

Descriptive statistics showed that the average application values between customer and employee orientations were relatively similar, with differences typically in

tenths of a point. For example, in the case of digitization of analog data (RC_1 vs. RE_1), the average application value for customers was 2.95 and for employees 2.90 (Table 4). A similar level was observed for most of the other items, with higher values appearing in some cases for customer orientation (e.g., RC_1), and in others for employee orientation (e.g., RE_2).

Table 4. Wilcoxon Signed-Rank Test for customer- and employee-oriented application

Test Statistics[a]

	RE_1 RC_1	RE_2 RC_2	RE_3 RC_3	RE_4 RC_4	RE_5 RC_5	RE_6 RC_6	RE_7 RC_7
Z	-2.273[b]	-5.137[c]	-0.645[b]	-0.276[b]	-0.762[b]	-0.450[b]	-1.232[b]
Asymp. Sig. (2-tailed)	0.023	0.000	0.519	0.783	0.446	0.653	0.218

a. Wilcoxon Signed Ranks Test
b. Based on positive ranks.
c. Based on negative ranks.

The results of the Wilcoxon Signed-Rank Test confirmed statistically significant differences between application directed at customers and employees in only two innovations. The first case was digitization of analog data (RC_1 vs. RE_1), where the difference was significant at $p = 0.023$, with the average value being slightly higher for customers. The second case was digitization of biometric data (RC_2 vs. RE_2), where the difference was even more pronounced ($p < 0.001$), with a higher level of application recorded for employees.

For the remaining technological innovations (digital interaction platforms, big data analytics, real-time analytics, predictive analytics, and GDPR), the differences between customer- and employee-oriented applications were not statistically significant ($p > 0.05$). This result suggests that enterprises generally exhibit a similar level of implementation regardless of whether innovations are primarily intended for customers or employees. The exceptions are specific technologies in data digitization.

In summary, systematic differences between customer- and employee-oriented implementation appear only rarely, which may indicate that enterprises approach the introduction of technological innovations in a relatively balanced way across internal and external processes. More pronounced deviations are mainly related to

areas where the use of technology is naturally linked to a specific group of users (e.g., biometric data for employees).

To answer RQ3, the Kruskal–Wallis test was employed, which enables the comparison of more than two independent groups of ordinal data. Enterprises were divided into four categories according to the number of employees: micro (up to 10), small (11–50), medium (51–250), and large (more than 250). Comparisons were carried out separately for each of the analyzed technological innovations, both for customer orientation and employee orientation (Table 5).

Table 5. Mean ranks of application of technological innovations by enterprise size

Ranks

	Size	N	Mean Rank		Size	N	Mean Rank
	Micro	276	289.04		Micro	263	247.78
	Small	180	339.13		Small	169	335.15
RC_1	Medium	117	364.60	RE_1	Medium	110	345.68
	Large	90	407.10		Large	84	433.57
	Total	663			Total	626	
	Micro	239	248.05		Micro	248	255.06
	Small	152	294.55		Small	169	313.50
RC_2	Medium	104	315.50	RE_2	Medium	103	316.80
	Large	81	361.84		Large	79	390.28
	Total	576			Total	599	
	Micro	260	273.55		Micro	253	258.67
	Small	167	332.99		Small	168	323.37
RC_3	Medium	109	330.81	RE_3	Medium	107	321.64
	Large	82	347.33		Large	84	397.54
	Total	618			Total	612	
	Micro	236	227.02		Micro	249	236.62
	Small	157	312.88		Small	157	302.43
RC_4	Medium	104	326.31	RE_4	Medium	98	319.92
	Large	79	373.95		Large	73	397.26
	Total	576			Total	577	
RC_5	Micro	257	252.34	RE_5	Micro	260	259.10

	Small	159	329.39		Small	164	325.40
	Medium	105	326.80		Medium	101	313.86
	Large	84	378.29		Large	79	383.28
	Total	605			Total	604	
	Micro	241	231.48		Micro	244	240.83
	Small	151	311.01		Small	156	308.30
RC_6	Medium	94	312.54	RE_6	Medium	99	303.74
	Large	75	340.17		Large	75	374.64
	Total	561			Total	574	
	Micro	258	281.21		Micro	256	278.33
	Small	174	336.17		Small	176	326.06
RC_7	Medium	115	341.89	RE_7	Medium	116	332.87
	Large	88	358.70		Large	84	390.21
	Total	635			Total	632	
					Micro	250	269.65
					Small	172	325.56
				RE_8	Medium	117	333.26
					Large	80	368.61
					Total	619	

The ranking of mean values indicated a clear trend: in most cases, the level of application of technological innovations was higher in larger enterprises. This trend was consistent for both customer-oriented (RC) and employee-oriented (RE) innovations. For example, in the digitization of analog data directed at customers (RC_1), micro-enterprises had a mean rank of 289.04, while large enterprises achieved a mean rank as high as 407.10. Similar differences were observed in other items, with the lowest values typically associated with micro-enterprises and the highest with large enterprises (Table 6).

Table 6. Kruskal–Wallis Test for differences in application by enterprise size

Test Statistics[a,b]

	RC_1	RC_2	RC_3	RC_4	RC_5	RC_6	RC_7
Chi-Square	35.386	35.677	21.260	67.215	48.076	45.119	27.815

df	3	3	3	3	3	3	3	
Asymp. Sig.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	RE_1	RE_2	RE_3	RE_4	RE_5	RE_6	RE_7	RE_8
Chi-Square	86.050	43.315	48.411	64.631	40.581	47.405	37.128	27.777
df	3	3	3	3	3	3	3	3
Asymp. Sig.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

a. Kruskal Wallis Test

b. Grouping Variable: Size

The results of the Kruskal–Wallis test confirmed that the differences among size categories are statistically significant for all analyzed innovations ($p < 0.001$). The chi-square values ranged from 21.260 (RC_3 – digital interaction platforms for customers) to 86.050 (RE_1 – digitization of analog data for employees), indicating different levels of implementation across enterprise size groups.

These findings clearly suggest that enterprise size is an important factor influencing the level of implementation of technological innovations. Larger enterprises likely have greater financial, technical, and human resources. These allow them to adopt modern technologies more quickly and on a broader scale. In contrast, smaller enterprises, and especially micro-enterprises, lag in implementation, which may be a consequence of limited resources or differing strategic orientations. This trend applies equally to technologies oriented toward external processes with customers as well as internal processes involving employees.

5 Discussion

This study investigated technological readiness and the adoption of digital innovations in Slovak enterprises, examining the implementation gaps between perceived importance and actual application of technological innovations. The research was grounded in the Technology-Organization-Environment framework and addressed three research questions examining implementation differences, customer versus employee orientations, and enterprise size effects. Data were collected from 711 enterprises across diverse sectors and company sizes.

The systematic nature of implementation gaps supports the psychological aspects of technology adoption discussed in the theoretical framework. This validates cognitive dissonance theory where organizations experience psychological discomfort when stated beliefs about technology importance conflict with actual implementation behaviors (Festinger, 1957). The results also reflect present bias (O'Donoghue & Rabin, 2015). Slovak enterprises recognized long-term technological benefits but struggled with immediate implementation challenges. This finding is particularly significant given Slovakia's ranking of 23rd out of 27 EU member states in digital competitiveness (KInIT, 2023). It suggests that awareness alone is insufficient for digital transformation success.

These findings extend the TOE framework by demonstrating that psychological factors (cognitive dissonance, present bias) operate within all three contextual dimensions rather than as separate influences. Organizational context emerged as the most influential dimension in post-transition economies. Notably, GDPR-related innovations showed the smallest implementation gaps. This supports the environmental context dimension of the TOE framework where regulatory pressure effectively reduces implementation barriers. This finding suggests that policy interventions creating environmental pressures can successfully drive technology adoption beyond voluntary organizational initiatives.

Regarding RQ2, comparison between customer-oriented and employee-oriented implementations revealed limited systematic differences, with significant differences only in digitalization of analog data favoring customers and biometric data processing favoring employees. This balanced approach reflects the technological context dimension of the TOE framework, where technology characteristics influence adoption patterns more than stakeholder orientation. The finding challenges assumptions about systematic differences between internal and external technology applications, suggesting that technological readiness manifests similarly across stakeholder orientations when organizational and environmental factors are comparable. The finding that biometric data processing is more advanced for employees aligns with practical considerations around workplace security and access control systems, which represent more mature technological applications compared to customer-facing biometric solutions.

Concerning RQ3, enterprise size emerged as the most critical determinant of technology adoption success. The Kruskal-Wallis test confirmed significant size-

based differences across all innovations ($p < 0.001$), with mean ranks consistently increasing from micro to large enterprises. This validates Rogers' (2003) diffusion of innovation theory and the organizational context dimension of the TOE framework, demonstrating substantial resource-based advantages in technology implementation for larger organizations. The magnitude of size-based differences suggests a resource-based digital divide in the Slovak economy, where smaller enterprises face systematic disadvantages that may create permanent competitive gaps. This is particularly concerning given that SMEs constitute the majority of Slovak businesses, potentially limiting the country's overall digital competitiveness.

5.1 Theoretical and Practical Implications

This study extends the TOE framework by demonstrating that psychological factors (cognitive dissonance, present bias) operate within all three contextual dimensions rather than as separate influences. Enterprise size affects adoption across all technology types. This validates resource-based theory while revealing that organizational context may be the most influential TOE dimension in post-transition economies.

The research provides comprehensive empirical validation of the TOE framework in a post-transition economy context. All three dimensions demonstrate significant influence on technology adoption patterns. The systematic implementation gap represents more than simple awareness-action disconnects. It reflects deeper challenges in organizational change management requiring systematic attention to both psychological and structural barriers. These findings extend cognitive dissonance theory to organizational technology adoption contexts. They show how conflicting beliefs about technology importance and implementation readiness create systematic adoption delays. The research also validates resource-based view predictions (Barney, 1991) while highlighting psychological factors often overlooked in purely rational choice models of technology adoption.

Investigation revealed that technological readiness manifests similarly across stakeholder orientations within organizations. This challenges assumptions about systematic differences between internal and external technology applications. This finding suggests that organizations approach digital transformation holistically

rather than prioritizing specific stakeholder groups. This has important implications for technology providers and implementation strategies.

Enterprise size findings confirm a resource-based digital divide in the Slovak economy. Smaller enterprises face systematic disadvantages that threaten to create permanent competitive gaps for Slovakia's predominantly small business sector. The systematic nature of implementation gaps across different technology types and organizational contexts underscores the complexity of digital transformation challenges facing Slovak enterprises.

Based on these findings, organizations should develop systematic approaches addressing all three TOE contextual dimensions. Smaller enterprises particularly need collaborative approaches, external technical support, and graduated implementation strategies matching their resource capabilities. GDPR implementation success demonstrates how environmental pressures can effectively drive technology adoption. Policymakers should consider developing regulatory frameworks or incentive structures creating environmental pressures supporting digital transformation beyond data protection. For Slovakia's digital competitiveness, particular attention must be paid to supporting smaller enterprises through targeted policies and collaborative mechanisms. These should address both resource constraints and implementation barriers identified in this research.

Technology providers should develop solutions acknowledging implementation challenges through simplified processes, graduated complexity approaches, and comprehensive support mechanisms. These should address both technical and psychological barriers. For Slovak enterprises specifically, our findings suggest that integrated technology platforms serving both customer and employee constituencies may be more effective than specialized solutions. This is given the balanced adoption patterns observed across stakeholder orientations. This research demonstrates that awareness of technological importance is necessary but insufficient for successful digital transformation. Bridging the implementation gap requires systematic attention to the interplay between technological, organizational, and environmental factors while acknowledging the psychological dimensions of organizational change.

5.2 Limitations and Future Research

The cross-sectional design limits understanding of how implementation gaps evolve over time and cannot establish causal relationships between TOE framework dimensions and implementation success. Self-reported implementation levels may underestimate actual implementation gaps due to social desirability bias or cognitive dissonance mechanisms. The study focused on specific technological innovations and may not capture the full spectrum of digital transformation challenges.

Future research should examine TOE framework dimensions' influence on technology adoption over extended time periods through longitudinal studies. Research should examine interventions addressing psychological barriers through experimental studies testing approaches for reducing technology anxiety, managing cognitive dissonance, and enhancing psychological safety. Comparative research across Visegrad Four countries (Czech Republic, Poland, Hungary, and Slovakia) could examine how different national contexts within post-transition economies influence TOE framework dimensions' relative importance and technology adoption patterns.

6 Conclusion

This research provides comprehensive empirical evidence of significant implementation gaps in technological innovation adoption among Slovak enterprises. Through systematic analysis of 711 enterprises, the study confirms disparities between perceived importance and actual implementation across multiple technology types. Enterprise size emerged as the primary determinant of adoption success.

The analysis revealed three main findings. First, statistically significant implementation gaps exist across most technological innovations. Organizations consistently rate importance higher than current implementation levels. These gaps were most pronounced for core digitalization technologies, while GDPR-related

innovations showed smaller gaps due to regulatory pressure. Second, customer-oriented and employee-oriented technology implementations show limited systematic differences. This suggests that technological readiness manifests similarly across stakeholder orientations. Third, enterprise size serves as the most critical determinant of technology adoption success. This confirms a resource-based digital divide that may perpetuate competitive disadvantages for smaller enterprises in Slovakia's predominantly SME-based economy.

Theoretically, this study extends the TOE framework by demonstrating that psychological factors (cognitive dissonance, present bias) operate within all three contextual dimensions rather than as separate influences. Organizational context emerged as the most influential dimension in post-transition economies. The research validates diffusion of innovation theory while highlighting psychological factors often overlooked in technology adoption models.

For practice, successful technology implementation requires integrated approaches combining structural support with psychological dimensions of organizational change. Organizations need systematic approaches addressing implementation barriers through graduated strategies matching resource capabilities. Policymakers should develop targeted interventions addressing the identified digital divide, particularly through support mechanisms for micro and small enterprises.

Bridging the implementation gap requires systematic attention to the interplay between technological, organizational, and environmental factors while acknowledging psychological dimensions of organizational change. Only through such comprehensive approaches can Slovakia improve its competitive position in the global digital economy.

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