Patient Perceptions and Sustainable Healthcare: Understanding Digital Anxiety in Turbulent Economic Environment

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In the healthcare sector, organizations are actively preparing for the challenges and changes associated with a turbulent economic environment. Technological revolutions such as Industry 4.0 and Industry 5.0 are expected to bring trends that will fundamentally change the way healthcare works, like the use of communication tools for patients and medical teams. Many studies show that developments in healthcare are influenced by digital transformation. Innovations are primarily focusing on prevention, early diagnosis, and improvement of quality of life and health. Technologies, such as the use of artificial intelligence, telemedicine, smart devices, and robotics, will simplify and speed up processes and services in healthcare. In the context of evolving healthcare landscapes and the increasing integration of digital technologies, our research investigates patient perceptions and concerns. Through a comprehensive study, we discovered a noteworthy trend: patients exhibit a statistically significant fear of digital healthcare, surpassing levels of distrust or perceived ineffectiveness. This finding prompts a critical inquiry into the underlying reasons behind this fear and seeks to understand how healthcare organizations can effectively address these concerns for sustainable adoption amid a turbulent economic environment. To collect the data, we used a questionnaire survey, that was performed on 437 patients from Slovak Republic.

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1 Introduction

In the current turbulent economic environment, a series of disruptive forces propelled by advancements in science and technology are reshaping not only business dynamics, cultural norms, and societal structures but also influencing our biological frameworks and ethical considerations (Leonhard, 2016).

In this paper, we focus on the healthcare sector, specifically examining the impact of emerging digital technologies on healthcare delivery and exploring the perceptions of clients towards these transformative changes. Several authors (Javaid et al. 2020, Aceto et al. 2020, Cassettari et al. 2019) posit that the future trajectory of the healthcare industry will be profoundly shaped by digital transformation. Advanced technologies are poised to play a pivotal role in preventive care and early diagnosis while fostering closer collaboration among stakeholders and innovative service amalgamations within healthcare delivery. These trends underscore the apprehensions of clients regarding digital healthcare. Consequently, this article aims to explore prospective trends and technologies associated with Industry 4.0 and 5.0, elucidating their potential impacts on client perceptions and concerns within the healthcare sector. Drawing from our research findings, we offer insights into how healthcare clients in the Slovak Republic currently perceive emerging trends and technologies.

2 Theoretical Background

Industry 4.0 epitomizes the pervasive integration of the internet and digitization across virtually every facet of human endeavour. It stands as a prominent fixture within the contemporary landscape, representing a formidable challenge and serving as a principal catalyst for technological advancement poised to propel successive waves of innovation in the ensuing decades (Leonhard, 2016).

The core tenets underpinning Industry 4.0, including interoperability and the seamless integration of systems both horizontally and vertically through novel technologies and information and communication technology (ICT) solutions, are perceived as strategic responses to the turbulent economic environment. These challenges encompass the imperatives of maintaining competitiveness amidst globalization, coping with market volatility, navigating shortened product and

service life cycles, and managing the escalating complexity inherent in products and processes (Kagermann, 2013).

The healthcare sector has a significant opportunity to benefit from Industry 4.0. The use of new technologies can bring many benefits and advantages to healthcare organizations and stakeholders. The COVID-19 pandemic has changed our way of life, work, and education significantly. With the shift to remote learning and work, digital healthcare has become more critical (Taamneh et al., 2022). Digital healthcare use is affected by both psychological and technological factors, such as fear and uncertainty avoidance. During the pandemic, the use of technology has become more crucial than ever. Remote learning, working, and digital healthcare have become vital (Alturki & Aldraiweesh, 2021). Artificial intelligence is being used to assist product and support teams in performing more accurate analyses in various business contexts (Elrehail, 2023; Kar & Kushwaha, 2021). Planning for the future of work requires considering the challenges of obsolescence and the need for ongoing reskilling (Kar et al., 2021). However, the COVID-19 pandemic has also created fear and uncertainty that may influence the acceptance and use of digital healthcare (Raza, Qazi, Khan, & Salam, 2021). A study by Kee (2021) found that the COVID-19 pandemic had a negative impact on the usage of learning management systems, suggesting that fear and uncertainty may have a more significant impact on technology use during a crisis.

3 Methodology

The research methodology is based on the analysis of theoretical knowledge and starting points in the field of the fourth industrial revolution, developments in healthcare and individual trends connected to Industry 4.0 and Industry 5.0. We used data from the questionnaire survey. Our sample consisted of 437 patients from the Slovak Republic. We used stratified random sampling and respondents were selected by the following criteria: gender, workplace demographics (Western Slovakia / Central Slovakia / Eastern Slovakia), and age.

Distribution of the sample by gender of patients:

Table 1: Gender of the patients

	Number	Percent
Men	202	46,2
Women	235	53,8
Other	0	0
Together	437	100,0

4 Results

For the descriptive statistics of individual hypotheses, it is necessary to sketch the variables that are in the hypothesis. In this case, they are the "Score of perception of concern" and "Score of perception of distrust and ineffectiveness".

Table 2: The level of fear of digital healthcare

Score 2 - 10	
N	437
Average	6,57
Median	7,00
Sd. deviation	2,284
Skewness	-,125
Kurtosis	-1,183
Range	8
Minimum	2
Maximum	10

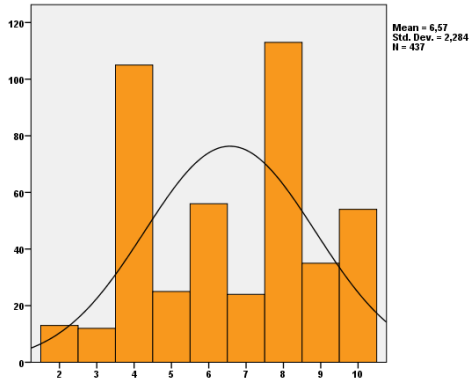

Figure 1: The level of fear of digital healthcare

Table 3: The level of perceived ineffectiveness and distrust towards digital healthcare

Score 2 - 10	
N	437
Average	4,84
Median	4,00
Sd. deviation	1,860
Skewness	,557
Kurtosis	-,037
Range	8
Minimum	2
Maximum	10

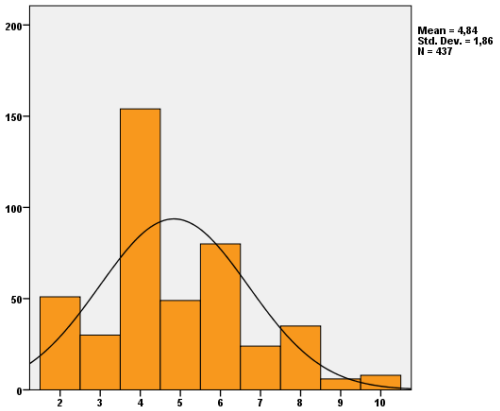

Figure 2: The level of perceived ineffectiveness and distrust towards digital healthcare

To ensure that we selected the appropriate test to verify our hypothesis, we needed to check if the variables in our sample followed a normal distribution, meaning that they followed a Gaussian curve. We used the Kolmogorov-Smirnov normality test to determine whether the data was normal or not, which was essential for us to move forward with verifying our hypothesis, based on the sample size.

Table 4: Normality test

		Kolmogorov-Smirnov		
		Statistic	df	Sig.
	The level of fear of digital healthcare	,197	437	,000
	The level of perceived ineffectiveness and distrust towards digital healthcare	,212	437	,000

We have observed that the average score of the level of fear regarding digital healthcare on a scale from 2 to 12 points is at the level of 6.57 points, based on the results shown in **Table 2.** and **Table 3.** and **Figure 1.** and **Figure 2.** On the other hand, the average score of the level of perception of ineffectiveness and distrust towards digital healthcare on a scale from 2 to 12 points is at the level of 4.84 points. While interpreting the results, we looked at the Sig. column of **Table 4.** We found

that the measured group does not have a normal distribution since there is a value less than 0.05. Therefore, we used non-parametric tests to calculate the hypothesis if at least one of the pairs of groups does not have a normal distribution. As neither group had a normal distribution, we had to use a non-parametric test. We formulated a hypothesis to find out if there is a statistically significant difference between the level of perception of fear about digital healthcare and the level of perception of ineffectiveness and distrust in digital healthcare. For the analysis of the hypothesis, we used the non-parametric Wilcoxon paired test after considering the nature of the variables.

Table 5: and Table 6: Wilcoxon paired test
The level of fear of digital healthcare * The level of perceived ineffectiveness and distrust towards digital healthcare

Z	-11,243
Asymp. Sig. (2-tailed)	,000

Ranks				
		N	Mean Rank	Sum of Ranks
The level of perceived ineffectiveness and distrust towards digital healthcare – The level of fear of digital healthcare	Negative Ranks	288	199,09	57338,00
	Positive Ranks	82	137,77	11297,00
	Ties	67		
	Together	437		

The Wilcoxon paired test is interpreted by **Table 5.** and the line Asymp sig. If there is a value less than 0.05, then we know that there is a statistically significant difference between the variables being compared. In our case, the value is 0.000, which means there is a statistically significant difference between the two variables. **Table 6**. determines the direction of the difference, where we can see the results of the comparison for each variable. The *Negative Ranks* row shows the number of times the first variable (digital healthcare inefficiency and distrust rate score) scored lower than the second variable (digital healthcare concern rate score). The *Positive Ranks* row shows the number of times the first variable scored higher than the second variable. The *Ties* row shows how many times these values matched.

From **Table 6**. we can see that the score of the measure of inefficiency and distrust in digital healthcare was lower than the score of the measure of concern about digital healthcare in 288 cases, higher in 82 cases, and the same in 67 cases. Therefore, we found that **clients are statistically significantly more afraid of digital healthcare than they would distrust it or consider it ineffective.**

5 Discussion

Industry 4.0 and the emerging concepts of Industry 5.0 are pivotal trends shaping modern environments, profoundly impacting dynamics and fostering transformative innovations. The healthcare sector, amidst turbulent economic conditions, stands as a prime example where the integration of digitalization and advanced technologies associated with Industry 4.0 and beyond is conspicuously evident.

The contemporary landscape is marked by an unprecedented level of dynamism driven by rapid technological advancements. In this context, Industry 4.0 emerges as a paramount trend profoundly shaping the trajectory of various industries worldwide. This phenomenon is a direct result of the rapid evolution of technologies with the capacity to revolutionize organizational management paradigms and daily life. Managers are confronted with the imperative to cultivate keen discernment in recognizing the multifaceted opportunities and challenges inherent in the advent of Industry 4.0. The transformative potential of this paradigm shift extends across diverse domains, necessitating proactive engagement and strategic foresight to harness its benefits while mitigating potential pitfalls (Mohiuddin et al., 2022).

In alignment with anticipated shifts, businesses are exhibiting heightened interest in leveraging emerging technologies to drive innovation, sustain long-term competitiveness, and facilitate agile adaptation to evolving market dynamics. A central challenge posed by the advent of Industry 4.0 revolves around achieving heightened levels of digitization. Traditionally, digitization has been construed as the integration of computer and internet technologies aimed at enhancing the efficiency and efficacy of processes involved in value creation within the economic sphere (Reddy and Reinartz, 2017). The evolution of Industry 4.0 is catalyzing pervasive digitization across all sectors, leading to a paradigm shift wherein conventional products or services are either supplanted by digital equivalents or augmented with innovative digital functionalities (Prem, 2015).

6 Conclusion

Based on the results of the Wilcoxon paired test shown in **Table 5.** and **Table 6.** we can conclude that **clients perceive fear of digital healthcare statistically significantly more than distrust or ineffectiveness of digital healthcare**. Our hypothesis was confirmed, and our research highlights a prevalent fear among clients regarding the adoption of digital healthcare, a sentiment surpassing distrust or concerns about its efficacy. This fear underscores the need for proactive measures to educate and reassure the public, fostering a conducive environment for the widespread acceptance of digital health solutions. Slovakia exhibits a notable adoption of eHealth solutions, particularly through electronic prescriptions, indicating an initial foothold in digital healthcare practices. Despite the current dominance of ePrescriptions, other transformative technologies such as auto-diagnostic systems, remote patient monitoring, artificial intelligence, digital data sharing, and 3D printing hold immense potential. Moreover, fostering a culture of innovation and addressing client apprehensions about digital healthcare is imperative for driving further digitization in healthcare. Overcoming fear through education and building trust can facilitate the necessary knowledge exchange and partnerships essential for successful technology implementation. Consequently, embracing these advancements will empower both clients and healthcare providers, enabling personalized medicine, greater autonomy, and ultimately, enhanced healthcare outcomes for all.

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References

Aceto, Giuseppe. Persico, Valerio. Pescapé, Antonio. (2020) Industry 4.0 and Health: Internet of Things, Big Data, and Cloud Computing for Healthcare 4.0. In: Journal of Industrial Information Integration, Netherlands: Elsevier BV, vol. 18. ISSN 2452-414X. https://doi.org/10.1016/j.jii.2020.100129

Alturki, Uthman, & Aldraiweesh, Ahmed. (2021). Application of Learning Management System (LMS) during the COVID-19 Pandemic: A Sustainable Acceptance Model of the Expansion Technology Approach. Sustainability, 13(19), 10991. https://doi.org/10.3390/su131910991

Cassettari, Lucia. Patrone, C. Saccaro. S. (2019) Industry 4.0 and its applications in the Healthcare Sector: a sistematic review. In: XXIV Summer School F. Turco - Industrial Systems

Engineering, Romy, Italy: Associazione Italiana Docenti Impianti Industriali (AIDI), pp. 136–142. ISSN 2283-8996. http://www.summerschool-aidi.it/edition-2019/cms/extra/papers/441.pdf

Elrehail, Hamzah. (2023). HR Analytics and Future of Work: A Systematic Literature review. Proceedings of the 2nd International Conference on Business Analytics for Technology and Security, ICBATS 2023 (2023), https://doi.org/10.1109/icbats57792.2023.10111370

Javaid, Mohd et al. (2020) Industry 4.0 technologies and their applications in fighting COVID-19 pandemic. In: Diabetes & Metabolic Syndrome: Clinical Research & Reviews, Netherlands: Elsevier BV, vol. 14 (4), pp. 419–422. ISSN 1871-4021. https://doi.org/10.1016/j.dsx.2020.04.032

Kagermann, Henning et al. (2013) Recommendations for implementing the strategic initiative Industrie 4.0: Securing the future of German manufacturing industry: Final report of the Industrie 4.0 Working Group. Munich, Germany: acatech & Forschungsunion Wirtschaft – Wissenschaft. https://en.acatech.de/publication/recommendations-for-implementing-the-strategic-initiative-industrie-4-0-final-report-of-the-industrie-4-0-working-group/

Kar, Arpan, Kumar, & Kushwaha, Amit, Kumar. (2021). Facilitators and Barriers of Artificial Intelligence Adoption in Business – Insights from Opinions Using Big Data Analytics. Information Systems Frontiers, 25(4), 1351–1374. https://doi.org/10.1007/s10796-021-10219-4

Kar, Sudatta et al. (2021). Industrial Internet of Things and Emerging Digital Technologies–Modeling Professionals' learning behavior. IEEE Access, 9, 30017–30034. https://doi.org/10.1109/access.2021.3059407

Kee, Chad E. (2021). The impact of COVID-19: Graduate students' emotional and psychological experiences. Journal of Human Behavior in the Social Environment, 31(1–4), 476–488. https://doi.org/10.1080/10911359.2020.1855285

Leonhard, Gerd. (2016) Technology vs. Humanity: The coming clash between man and machine. London, United Kingdom: Fast Future Publishing. ISBN 978-0993295829.

Mohiuddin, Muhammad et al. (2022) Evolution of Industry 4.0 and Its Implications for International Business. In: Global Trade in the Emerging Business Environment, London, United Kingdom: IntechOpen. ISBN 978-1-83969-147-8. https://doi.org/10.5772/intechopen.101764

Prem, Erich. (2015) A digital transformation business model for innovation. Manchester, United Kingdom: The International Society for Professional Innovation Management (ISPIM). https://www.researchgate.net/publication/284682831

Qudrat-Ullah, Hassan., & Khan, Rashid, Ali. (2021). Adoption of LMS in higher educational institutions of the Middle East. In Advances in science, technology & innovation. https://doi.org/10.1007/978-3-030-50112-9

Raza, Syed, Ali et al. (2020). Social Isolation and Acceptance of the Learning Management System (LMS) in the time of COVID-19 Pandemic: An Expansion of the UTAUT Model. Journal of Educational Computing Research (Print), 59(2), 183–208. https://doi.org/10.1177/0735633120960421

Reddy, Srinivas. Reinartz, Werner. (2017) Digital Transformation and Value Creation: Sea Change Ahead. In: Value in the Digital Era, Nuremberg, Germany: GfK Marketing Intelligence Review, vol. 9 (1), pp. 10–17. ISSN 2628-166X. https://doi.org/10.1515/gfkmir-2017-0002

Sein, Maung, Kyaw. (2020). The serendipitous impact of COVID-19 pandemic: A rare opportunity for research and practice. International Journal of Information Management, 55, 102164. https://doi.org/10.1016/j.ijinfomgt.2020.102164

Taamneh, Abdallah, et al. (2022). University lecturers acceptance of moodle platform in the context of the COVID-19 pandemic. Global Knowledge, Memory and Communication, 72(6/7), 666–684. https://doi.org/10.1108/gkmc-05-2021-0087