Ahmed, R., R., Streimikiene, D., Soomro, R., H. & Streimikis, J. (2022). Digital Transformation and Industry 4.0 Initiatives for Market Competitiveness: Business Integration Management Model in the Healthcare Industry. *Journal of Competitiveness*, 14(4), 6–24. https://doi.org/10.7441/joc.2022.04.01

Digital Transformation and Industry 4.0 Initiatives for Market Competitiveness: Business Integration Management Model in the Healthcare Industry

▪ *Rizwan Raheem Ahmed, Dalia Streimikiene, Riaz Hussain Soomro, Justas Streimikis*

Abstract

The main objective of this research is to examine the concept of industry 4.0 through digital transformation using the business integration management model for market competitiveness in the healthcare industry. Partial objectives are to analyze its effectivity in terms of a value proposition, specifically, value delivery transformation, value capture transformation, patients' empowerment, community-based transformation, market competitiveness, and globalization transformation. We further analyze the role of advanced technology in digital transformation. For this purpose, we employ a structured questionnaire completed by 4429 respondents representing stakeholders from the United States and Pakistan. We use SEM-based multivariate approaches such as exploratory and confirmatory factors analysis and conditional process modeling for the data analysis. The findings of this study demonstrate that the digital transformation integration model significantly and positively affects value delivery transformation, value capture transformation, patients' empowerment, community-based transformation, and globalization transformation for market competitiveness. The findings further reveal that technological advancement has a significant moderating impact between the digital transformation integration model, value delivery transformation, value capture transformation, patients' empowerment, community-based transformation, and globalization transformation that also increase the market competitiveness of healthcare industries, including hospitals, pharmacies, laboratories, pharmaceutical companies, and other related industries. The findings of the undertaken study have imperative theoretical and practical implications. Industry practitioners can gain optimal financial and social competitiveness through digital transformation using the business integration management model.

Keywords: Digital transformation, business integration model, market competitiveness, healthcare sector, value delivery transformation, value capture transformation, patients' empowerment, community-based transformation, globalization transformation
JEL Classification: C12, C42, L8

Received: October, 2021
1st Revision: September, 2022
Accepted: October, 2022

1. INTRODUCTION

According to the Organization for Economic Cooperation and Development (OECD Stat, 2020), health spending is the largest share of public spending, further increasing the burden of the healthcare system against the backdrop of an aging society. Therefore, the healthcare system of Europe and the United States is looking for answers for both quality and cost for market competitiveness. According to Hermes et al. (2020), around 75,000 pre-emptive deaths happen every year in the United States, and health information technology (IT) is assuring a solution to this problem. Alam et al. (2020) and Willie (2019) have documented that health IT serves as a cost-saving lever due to a driver of improved experimental consequences of competitiveness. However, health IT implementation and acceptance are slow (Kruse et al., 2016). Digital transformation (DT) is defined as the process of change in information technology that aims to enhance and improve multiple entities by making important changes to the entity's properties through a combination of information technology, communication, and connectivity (Vial, 2019). The layout of digital growth strategies, the update and change in the organization's hierarchy, competitiveness, the merger and acquisition of digital assets, and all other aspects of the healthcare firm can be affected by digital transformation (Verhoef et al., 2021). These types of situations and phenomena are well known in many aspects of business research, such as the marketing field, information system department of any healthcare firm, strategy formation team, revolutionizing the business world in general, and implementation of the concept of industry 4.0 in the healthcare sector in particular (Machado et al., 2019; Rinker et al., 2021). The healthcare sector of any country refers to the services of all types provided by doctors and other healthcare workers to maintain the physical and mental state of people for their well-being. It has been one of the main sectors where digital transformation is practiced (Hsia et al., 2019; Davidson et al., 2018). According to Verhoef et al. (2021) and Hansen and Baroody (2020), the upgrading and modern digital revolution in healthcare are introducing new opportunities related to the different aspects of the business world. These opportunities generate new and more profitable business models that provide multiple solutions to medical practice problems, generating value for competitiveness and the aging culture and societal issues (Kokhno, 2020). The different organizations of the healthcare sector, including pharmaceutical companies, hospitals, medical test labs, health insurance companies, health workers (doctors, nurses, and technicians), and the general community and patients, respond to many problems in a variety of ways, resolving external and internal problems at the same time (Ahmed et al., 2019; Cennamo, 2021). The supply chain has become the most critical factor for any organization and its competitors (Crisan & Stanca, 2021). Thus, competition in any field moves the business world toward new research approaches, such as better product or service development and improved product quality at a reduced cost factor (Machado et al., 2019).

The main business chain or process component is the information system, which is a hallmark of industry 4.0 (Rinker et al., 2021; Hermes et al., 2020). The information system is formulated with regard to people who share information and material and communicate with different people to gain knowledge (Hanafizadeh & Kim, 2020). The crux of the industry 4.0 concept is that the information system is designed to benefit the employees of an organization and the whole organization itself. It also helps to solve problems and increase market competitiveness

(Rinker et al., 2021; Schallmo et al., 2017). Healthcare organizations' better and more efficient logistic management system is also beneficial in generating profit (Tiwari, 2019). There is better control of the process quality; the whole transaction chain, from the production process to the distribution of the finished goods to its end-user is controlled easily with digital transformation (Bican & Brem, 2020; Crisan & Stanca, 2021). An integrated system of the healthcare sector is essential for survival and growth in the local and international markets (Linkous, 2019). In order to reduce the factor of ineffectivity and inefficiency in the system, it is crucial to move the business from the old approach process to the digital transformation system by using business integration management as an industry 4.0 (Crisan & Stanca, 2021). The whole business process and its operation of the healthcare industry, including pharmaceutical companies, hospitals, medical test labs, health insurance companies, health workers (doctors, nurses, and technicians), and the general community and patients, need to introduce re-engineering and the concept of industry 4.0 (Rinker et al., 2021; Machado et al., 2019). It decreases time, avoids delay, increases productivity, and reduces inefficiency in the different stages of processes (Weinstein & Holcomb, 2020). Gardam (2020), Gökalp and Martinez (2021) have demonstrated that digital transformations in the healthcare industry use the integration approach that is beneficial for the business, and it shapes the business model of healthcare companies into industry 4.0 for market competitiveness. There are many studies on the business model and digital transformation, but the literature does not study the concept of industry 4.0 with new approaches (Crisan & Stanca, 2021). Many industries are moving toward digital transformation due to the novel situation caused by the COVID-19 pandemic (Ahmed et al., 2020). The study is unique because it incorporates the modified conceptual framework including digital transformation as an independent variable, patients' empowerment, community-based transformation, market competitiveness, global transformation, real-time data transformation, and services-based transformation as dependent variables, and advancement in technology employed as a moderating construct. Therefore, this research paper helps healthcare companies to know the benefit of digital transformation using the business integration management approach. This research paper is also helpful for healthcare companies to develop insight into digital transformation and integration business models to convert themselves into industry 4.0 for market competitiveness through sustainable long-term competitive advantage.

2. THEORETICAL BACKGROUND

2.1 Digital Transformation

According to researchers, most companies use digitalization to offer customers more innovative and fast services. Digitalization also transforms their traditional business model into a digital one, enhancing an organization's market competitiveness. Digital transformation affects the country's entire healthcare industry (Martins, 2019). Digital transformation helps a company to build strong coordination and cooperation between the company's different divisions and helps a company to exchange and share data at the right time in the right place (Kokhno, 2020). In other words, the digital transformation model is vital in aligning all the business elements (Schallmo et al., 2017). According to the literature, there is no standard definition of digital transformation. According to Mukha (2019), digital transformation is the ability to gather information, connect

all the company's networks, society, and economy, and analyze gathered information that can translate the information into a plan of action. Furthermore, the changes due to digital transformation can become opportunities and problems (Cennamo, 2021). Another study reveals that digital transformation could be described as the industry's strategic and tactical evolution through technology and digital business model (Clemons, 2019).

2.2 Roadmap for the Digital Transformation of Business Models

According to Schallmo et al. (2017), there are five steps to adopting the digital business model: digital reality, digital ambition, digital potential, digital fit, and digital implementation. Digital reality is to analyze the whole chain of business processes, sketch the estimated business model, and collect data on customer requirements (de Reuver et al., 2018). The digital potential transforms the data into digitalization and builds strategies and business models for future options (Teubner & Stockhinger, 2020). Digital fit checking projects a business model to fit customer requirements. The last step is digital implementation, the action step of implementing the finalized business model (Schallmo et al., 2017). Due to the COVID-19 pandemic, digital transformation is growing vastly, and now more organizations are adopting digital transformation integration (Crisan & Stanca, 2021). The focus is shifted from data to digital form and digitalization to the business process (Caliskan et al., 2021; Teubner & Stockhinger, 2020). By utilizing the critical element of industry 4.0, the manufacturing industries can build and implement the new production process, which enhances market competitiveness (Zubritskaya, 2019). The use of digital transformation enables the company to enhance productivity, increase the platform to share information, and work flexibility, collaboration, and market competitiveness (Machado et al., 2019). The companies transform systems and processes into the digital transformation in which companies adopt the industry 4.0 characteristics, for instance, improving service delivery transformation, inter-connectivity, automation, machine learning, and using real-time data for overall operations, supply chain, marketing, production, and financial teams across all levels of the company (Rinker et al., 2021).

2.3 Services Delivery Transformation

The findings exhibit that the critical opinion of healthcare service delivery transforms into one in which linked and distant care concentrated on prevention is provided by different stakeholders (Schreieck et al., 2019). Such allied, network-based service delivery has been introduced into the healthcare business due to new firms with emergent functions leveraging platform-based business models for competitiveness (Clemons, 2019). As we observed fifteen new emerging segments, it was evident that a massive portion of these segments embraced exchange-based platforms (de Reuver et al., 2018). These new service delivery segments consist of telemedicine deliverers, medical practitioner endorsers, health eCommerce, and several applications for self-care. Telemedicine deliverers enable collaboration between healthcare suppliers and patients, for instance, through video conferencing (doctor Insta) or engaged platforms (Physitrack), while doctor endorsers ease searching, evaluating, and creating contact (Jameda) (Eden et al., 2019). However, the mobile application FitWell provides self-care health trainers and matches users. Healthcare provider companies are directly or indirectly involved in creating these platforms (Crisan & Stanca, 2021; Bican & Brem, 2020; Gardam, 2020). Thus, we framed the following hypothesis:

H1: Digital transformation has a significant and positive relationship with service delivery transformation.

2.4 Real-time Data Transformation

According to Bican and Brem (2020), the new function might activate further efficacy and decrease healthcare facilities' expenses, increasing market competitiveness. The primary concern of the new emergent market segment is the continuous increase in the cost of medicines and healthcare facilities. The increasing cost is due to the existing value chain and adding new services; thus, the emergent market segment enhances the synchronization cost of traditional firms (OECD Stat, 2020). Subsequently, traditional companies confront a gradually diverse and entangled industry (Wirtz et al., 2019). The increasing convolution leads to higher costs in recognizing valued stakeholders, ordinating a growing number of stakeholders, availing their services (Fiebig, 2017; Gardam, 2020), adopting the industry 4.0 approach, and cultivating early prevention and intervention using real-time data analysis through digital transformation (Machado et al., 2019). Real-time data analysis enables health insurance companies, hospitals, physicians, and pharmaceutical companies to make the right decision at the right time and at the right price (Rinker et al., 2021; Crisan & Stanca, 2021). Thus, we used the following hypothesis to ascertain real-time data transformation.

H2: Digital transformation has a significant and positive relationship with real-time data transformation.

2.5 Patients' Empowerment

The conventional healthcare industry did not provide the opportunity to interact with healthcare providers. Primarily, patients had contact with doctors, hospitals, and health insurance providers. At the same time, patients had limited interaction with healthcare providers (Gardam, 2020; Hermes et al., 2020). Patients did not have scientific knowledge of the illness, prognosis, and drug information. They were solely dependent on their doctors. Nevertheless, after digital transformation, patients are fully aware of disease prognosis, treatment options, medication side effects, and choosing suitable health insurance providers (Machado et al., 2019). Therefore, patients can freely discuss the different options with their health providers due to the digital transformation (Gardam, 2020). The digital transformation authorizes patients to control their medical data and its reach and control through blockchain-based personal health records (Crisan & Stanca, 2021; Fiebig, 2017). Thus, we framed the following hypothesis about patients' empowerment:

H3: Digital transformation has a significant and positive relationship with patients' empowerment.

2.6 Community-based Transformation

For the community-based platforms, researchers identified the emergent online learning and market fragment of online community platforms (Crisan & Stanca, 2021; Caliskan et al., 2021). Healthcare companies build social networking platforms for doctors and nurses to comment and post medical images, their experiences, and treatment options, such as Univadis, a prominent online platform for healthcare providers. Similarly, there are several digital platforms for the

community to interact with people with similar medical problems (Hanafizadeh & Kim, 2020; Gardam, 2020). They can ask about their experiences and read reviews and comments regarding a specific disease and its treatment options. The community can now freely discuss disease prognosis, treatment options, drug side effects, and justified health insurance companies (Crisan & Stanca, 2021). General communities can access their medical records and required services through numerous online platforms and mobile applications without visiting their physicians (Dijck et al., 2018; Eden et al., 2019). Hence, digital transformation has provided an effective and efficient online platform for general communities. Therefore, we framed the following hypothesis:

H4: Digital transformation has a significant and positive relationship with community-based transformation.

2.7 Global Transformation

The global transformation has replaced the traditional healthcare provider system, transforming healthcare facilities into remote, connected, and longitudinal healthcare providers, increasing the healthcare industry's market competitiveness (Zavadil et al., 2020; Caliskan et al., 2021). In some cases, the concept of hospital and primary physicians perished altogether, and new online organizations such as telemedicine have acquired the role (Wright, 2021; Smagulov & Smagulova, 2019). Digital information regarding medical problems, treatment options, drug choices, side effects, and other relevant information is universal due to the fast connectivity of the internet (Kokhno, 2020; Agarwal et al., 2020). Similarly, physicians can get information and expert opinions from senior doctors worldwide. Pharmaceutical companies and healthcare providers have built and managed medical websites for doctors in any part of the world (Cennamo, 2021; Alam et al., 2020). Therefore, digital transformation has converted the world into a global transformation. Hence, we framed the following hypothesis:

H5: Digital transformation has a significant and positive relationship with global transformation.

2.8 Advancement in Technology as a Moderator

There is an incredible advancement in information technology, which enables healthcare providers to collect, store, process, analyze, and distribute the data useful for procurement of raw material, production, supply chain management, distribution, finance, and marketing operations that increase competitiveness (Caliskan et al., 2021). The smartphone and other gadgets have revolutionized IT information (Hansen & Baroody, 2020), which supports the capture of longitudinal, real-time health information such as sleep patterns, blood pressure, and heart rate (Kellermann et al., 2013; Joseph, 2018). Advancements in technology enable progress in data analysis, artificial intelligence, machine learning, and language processing, which helps to make novel inferences and better understand newly gathered data (Crisan & Stanca, 2021). Technological advancements increase the digital transformation in the healthcare sector finance, sales, and operation; therefore, it behaves like industry 4.0 (Crisan & Stanca, 2021; Saima et al., 2021). Thus, we framed the following hypotheses:

H6A: Advancement in technology has a significant moderating relationship between digital transformation and services delivery transformation.

H6B: Advancement in technology has a significant moderating relationship between digital transformation and patients' empowerment.

H6C: Advancement in technology has a significant moderating relationship between digital transformation and real-time data transformation.

H6D: Advancement in technology has a significant moderating relationship between digital transformation and community-based transformation.

H6E: Advancement in technology has a significant moderating relationship between digital transformation and global transformation.

3. RESEARCH, METHODOLOGY, AND DATA

3.1 Research Design, Sampling Strategy, and Data Collection

The nature of the undertaken study is explanatory and quantitative, with descriptive and inferential statistics used. According to Ahmed et al. (2019), the targeted population for the undertaken study is the brand and marketing managers of pharmaceutical companies, healthcare professionals (doctors and nurses), the general community, and patients. We have selected respondents who are well aware of digital transformation and its benefits in the healthcare sector. We have used a modified questionnaire shown in Appendix-I. The questionnaire was circulated to pharmaceutical companies, hospitals, pharmacies, doctors, nurses, the general community, and patients. The data collection period lasted from January 2021 to June 2022; the data was collected from the U.S. and Pakistani respondents. For the data collection, the study used both in-person and online procedures; 29% of responses were gathered through in-person interviewers and a self-administered questionnaire. The remaining 71% of responses were taken through online sources, for instance, LinkedIn, Facebook, Google Docs, Instagram, and personal e-mails. The first part of the questionnaire comprised standard demographic questions. Initially, for the data collection, a total of 5000 questionnaires were floated through online and offline modes. Eventually, we received 4429 correctly completed questionnaires. The response rate was thus 88.58%, which is considered reasonable during the COVID-19 pandemic. We have collected 1398 responses from pharmaceutical companies, hospitals, pharmacies, and medical health insurance professionals, 1521 responses from healthcare workers (doctors and nurses), and 1510 responses from the patients and the general community. Based on the research objective, the selected sampling technique is non-probability. Thus, we have employed the purposive sampling technique with a five-point Likert scale structured questionnaire.

3.2 Scales for Measurement and Estimation Techniques

A total of seven variables are considered, with digital transformation as an independent variable. Service delivery transformation, patient empowerment, community-based transformation, real-time data transformation, and global transformation are taken as dependent variables. We have employed advancement in technology as a moderating variable. The adapted items of digital transformations were taken from previous studies such as Schallmo et al. (2017), de Reuver et al. (2018), and Teubner and Stockhinger (2020). The modified items of services delivery

transformation were extracted from Schreieck et al. (2019), Clemons (2019), and de Reuver et al. (2018). Similarly, items of patients' empowerment were taken from previous literature such as Machado et al. (2019) and Fiebig (2017); community-based transformation was adapted from Hanafizadeh and Kim (2020) and Dijck et al. (2018); real-time data transformation from Wirtz et al. (2019), Fiebig (2017), Machado et al. (2019) and Rinker et al. (2021). Similarly, the items of global transformation were extracted from previous studies, for instance, Smagulov and Smagulova (2019), Kokhno (2020), Alam et al. (2020), and Ahmed et al. (2019). The modified items of advancement in technology were adapted from Hansen and Baroody (2020), Kellermann and Jones (2013), and Hsia et al. (2019). The citation details are provided in Appendix I regarding the questionnaire items. The research has used SEM-based multivariate structural modeling for analysis purposes. For this purpose, we have employed SPSS 26, AMOS 26, and Conditional process analysis v2.16.3 software. We have validated the hypothesized measurement model through exploratory factor analysis and the structural model through confirmatory factor analysis. Finally, we have employed conditional process analysis to evaluate direct and indirect relationships between the constructs. The SEM-based multivariate approach accommodates multiple items and constructs simultaneously. It concurrently evaluates the outer model (between items and constructs) and the inner model (between independent, dependent, and moderating or mediating variables). The measurement model evaluation describes the outer model; however, the structural model shows the inner model. The conditional process modeling (SEM-based multivariate) allows to examine multiple direct relationships of independent variables with multiple dependent variables. Similarly, it also provides the prospects to examine multiple mediations and moderation simultaneously.

3.3 Demographic Statistics

We have floated 5000 questionnaires to pharmaceutical companies, hospitals, pharmacies, doctors and nurses, the general community, patients, and health insurance professionals. We have received 4429 responses overall. The data was cleaned through SPSS 26; we checked the missing, outliers, and incomplete values through the software, and, therefore, finally, we have selected 4429 responses out of 5000. The demographic information includes gender, in this research represented by 2402(54.2%) males and 2027(45.8%) females. The age bracket of our demographics is between 18 and over 60 years, in which the most significant proportion of respondents fall into the category of 18–30 years (1578 respondents), followed by 808 respondents in the category of 30–40 years. The category of 50–60 years is represented by 804 respondents. Regarding education, we divided the respondents into high school diploma, graduation, post-graduation, and Ph.D. categories. Similarly, we have considered the working experience of their respondents from 5 years to more than 20 years.

4. RESULTS AND DISCUSSION

4.1 Descriptive statistics

The data were converted into z-scores and analyzed for the descriptive statistics of all the constructs using mean, standard deviation, skewness, and kurtosis. The mean values of respondents were

higher than 3.50, which is a significant number. The values of standard deviation and skewness exhibited the range between ±1.5. Conversely, the readings of kurtosis are between ±3.0, demonstrating that the considered data followed the normality pattern (Ahmed et al., 2020). The normality of data is a prerequisite for employing the SEM-based multivariate approach. Hence, the conditions of the SEM-based multivariate approach are fulfilled; thus, the study can proceed with further analysis.

4.2 Exploratory Factor Analysis – EFA

The exploratory factor analysis validated the hypothesized items and constructs. For this purpose, we employed a rotated component matrix, identification and validation of reliabilities and validities using total explained variance, and Kaiser-Meyer-Olkin (KMO) and Bartlett's analyses. The SEM-based multivariate modeling is mandatory to check the factor loading, Cronbach's alpha, composite reliability, and average variance extracted for every construct and item. Therefore, Table 1 demonstrates that the factor loading of each item (extracted through the rotated component matrix) ranges between 0.80–0.95. The values of Cronbach's alpha and composite reliabilities are more significant than 0.70, and the reading of average variance extracted (AVE) is more significant than 0.50 (Fornell & Larcker, 1981). Hence, the convergent and discriminant validities are attained, and the consistency and validity of each item and construct have been achieved. Thus, the considered hypothesized measurement model is validated.

Tab. 1 – Reliabilities and Validities Analysis. Source: Own research

Factors	Items	FL	CA	CR	AVE
Digital Transformation	DT1	0.933	0.887	0.872	0.789
	DT2	0.882			
	DT3	0.844			
	DT4	0.844			
	DT5	0.934			
Services Delivery Transformation	SDT1	0.932	0.889	0.904	0.795
	SDT2	0.907			
	SDT3	0.765			
	SDT4	0.951			
Real-time Data Transformation	RTDT1	0.933	0.926	0.947	0.857
	RTDT2	0.898			
	RTDT3	0.946			
Patients Empowerment	PE1	0.934	0.883	0.902	0.783
	PE2	0.789			
	PE3	0.834			
	PE4	0.907			
	PE5	0.950			

Community-based Transformation	CBT1	0.932	0.902	0.837	0.814
	CBT2	0.900			
	CBT3	0.861			
	CBT4	0.915			
Global Transformation	GT1	0.925	0.910	0.935	0.829
	GT2	0.897			
	GT3	0.910			
Advancement in Technology	AIT1	0.937	0.895	0.885	0.804
	AIT2	0.789			
	AIT3	0.913			
	AIT4	0.941			

Note: FL=Factor loading; CA=Cronbach alpha; CR=Composite reliability; AVE=Average variance extracted; DT=Digital transformation; Dependent variables: SDT=Services deliver transformation; RTDT=Real-time data transformation; CBT=Community-based transformation; GT=Global transformation; AIT=Advancement in technology.

4.3 KMO and Bartlett's analyses

The value of the Kaiser-Meyer-Olkin (KMO) test is 0.714, which demonstrates a good value as suggested by Ahmed et al. (2020) because it is considered a suitable range between 0.70–0.79. Additionally, Table 2 exhibits the readings of Bartlett's analysis with $p<0.05$ at a 5% interval level. Hence, the correlation between variables and items is significant. Thus, it is further validated that the considered items and constructs could be retained.

Tab. 2 – KMO Analysis & Bartlett's Test. Source: Own research

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.714
Bartlett's Test of Sphericity	Approx. Chi-Square	72847.074
	Df	378
	p-value	<0.001

Note: Df=Degree of freedom

4.4 Total Explained Variance

The total variance explained demonstrates the cumulative variance of seven constructs. The findings show that the cumulative variance is 77.027, which appears to be good against the cut-off value of 0.50. Additionally, the value of every eigenvalue is more significant than one. Hence, we conclude that the considered data is reliable and suitable for SEM-based multivariate modeling (Ahmed et al., 2020).

4.5 Confirmatory Factor Analysis – CFA

According to Hair et al. (2019), the CFA directly examines the hypothesized measurement model. This study considered one independent variable (digital transformation) with five items in the hypothesized measurement model (Ahmed et al., 2020). However, we have taken five dependent

variables: services delivery transformation (with four items) and real-time data transformation (with three items). At the same time, we have considered patients' empowerment (with five items), community-based transformation (with four items), and global transformation (with three items) for the studied hypothesized measurement models. Additionally, we incorporated technological advancement (with four items) as a moderating variable in the hypothesized modified measurement model. Thus, the considered hypothesized measurement model has seven constructs and twenty-eight items. The fit-indices values of the measurement model show that all the readings are within the prescribed range. For instance, GFI=0.96, CFI=0.97, RNI=0.98, IFI=0.97, NFI=0.92, TLI=0.98, PCFI=0.83, PNFI=0.81, and RMSEA=0.034. Hence, the considered hypothesized measurement model is validated.

4.6 Structure equation modeling – SEM

Similarly, the structural equation modeling approach is helpful in examining the hypothesized structural model (Ahmed et al., 2020). The study considered one independent variable (digital transformation) with five items in the hypothesized structural model. However, we have taken five dependent variables, for instance, services delivery transformation and community-based transformation with four items each, real-time data transformation and global transformation with three items each, and patients' empowerment (with five items) for the hypothesized structural model. Moreover, we incorporated advancement in technology (with four items) as a moderating variable in the considered hypothesized modified structural model. Thus, the considered hypothesized structural model has seven constructs and twenty-eight items. The fit-indices values of the hypothesized structural model show that all the readings are within the prescribed range; for instance, GFI=0.97, CFI=0.96, RNI=0.97, IFI=0.96, NFI=0.91, TLI=0.99, PCFI=0.82, PNFI=0.80, and RMSEA=0.039 (Hair et al., 2019). Hence, the considered hypothesized structural model is endorsed.

4.7 Hypothesized Direct Relationship

The direct relationship between the variables shown in Table 3 explains that digital transformation is an independent variable. However, service delivery, community-based transformation, real-time data transformation, patient empowerment, and global transformation are dependent variables. Table 3 demonstrates that digital transformation has a significant and positive relationship with service delivery, community-based transformation, real-time data transformation, patient empowerment, and global transformation. Hence, the hypotheses H1 to H5 are substantiated and accepted ($T>\pm1.96$ and $p<0.05$). The findings of this study are consistent with outcomes of previous literature, such as Machado et al. (2019), Ahmed et al. (2019), and Agarwal et al. (2020), who confirmed that digital transformation is essential because digitalization provides the easiest way to share information at the required time and place. Previous studies also confirmed that the services delivery transformation, real-time data transformation, patients' empowerment, community-based transformation, and global transformation are essential for digital transformation and industry 4.0 initiatives to gain market competitiveness in terms of competitive advantage and long-term sustainable growth (Hermes et al., 2020; Wirtz et al., 2019). Previous literature and current study exhibit that digital transformation increases the information flow within and outside the healthcare sector, and all the stakeholders' benefit (Ganjour et al.,

2020; Mukha, 2019; Davidson et al., 2018). The findings of previous studies also confirmed the new roles and solutions of digital transformation in services, and distribution, which introduced new medical and pharmaceutical industries (Kokhno, 2020; Willie, 2019; Wirtz et al., 2019; Vial, 2019; Machado et al., 2019).

Tab. 3 – Hypothesized Direct Relationship. Source: Own research

	Dependent Variables	Regression Paths	Standardized Regression weights (β)	SE	T	p-value	Decision
H1	Services Delivery Transformation	D.T.→ SDT	0.4474	0.017	25.91	0.000	Supported
H2	Real-time data Transformation	D.T.→ RTDT	1.2048	0.018	64.74	0.000	Supported
H3	Patients Empowerment	D.T.→ PE	0.5678	0.017	32.12	0.000	Supported
H4	Community-based Transformation	D.T.→ CBT	0.6451	0.016	39.60	0.000	Supported
H5	Global Transformation	D.T.→ GT	0.3711	0.016	22.74	0.000	Supported

Note: SE=Standard error; T=T or student-distribution; P=Probability=0.000; Independent Variables= Digital Transformation

4.8 Hypothesized Moderating Relationship

The moderating relationship is examined through model 1 of conditional process analysis. The findings of Table 4 exhibit that technological advancement significantly impacts the relationship between digital transformation and services delivery transformation, community-based transformation, real-time data transformation, patients' empowerment, and global transformation. Thus, it is also concluded that the hypotheses H6A to H6E are accepted ($T>\pm1.96$ and $p<0.05$). The previous studies also exhibited similar results regarding the advancement and usage of technology in healthcare and other sectors. Pharmaceutical companies must adopt the latest technology and integrate their business model through digital transformation (Cennamo, 2021; Clemons, 2019). According to Hsia et al. (2019) and Schallmo (2017), the healthcare sector decreased the cost of production and services by adopting new technologies, enhancing market competitiveness, and long-term sustainable growth with a competitive advantage. It would only happen when the system is digitalized and all the chains are interlinked (Gardam, 2020; Hein et al., 2020). The business model layout depends on the business field knowledge and the adoption of the latest technology (Crisan & Stanca, 2021). Therefore, the findings demonstrate that the evolving digital transformation of the healthcare sector leads to a surplus of innovative market fragments, generic roles, and the disordering of the idiosyncrasy between information

technology, artificial intelligence, and the healthcare industry. Big data analytics, innovation of new IT-based services, digital globalization, and real-time data properties signify the healthcare sector as an industry 4.0, which also increases the market competitiveness in terms of long-term sustainable growth and competitive advantage (Ahmed et al., 2020; Du et al., 2020; Rinker et al., 2021).

Tab. 4 – Moderation Analyses. Source: Own research

Hypotheses	Moderator	Moderation	Coefficient	SE	T	P*	LLCI	ULCI
Moderating Effect of AIT b/w Digital Transformation (D.T.) and Service Delivery Transformation (SDT)								
H6A:	AIT	DT x AIT	–0.0692	0.0050	–13.71	0.0000	–0.0791	–0.0593
Moderating Effect of AIT b/w Digital Transformation (D.T.) and Real-time data Transformation (RTDT)								
H6B:	AIT	DT x AIT	–0.1384	0.0054	–25.68	0.0000	–0.1490	–0.1278
Moderating Effect of AIT b/w Digital Transformation (D.T.) and Patients' Empowerment (P.E.)								
H6C:	AIT	DT x AIT	–0.0860	0.0045	–19.30	0.0000	–0.0947	–0.0772
Moderating Effect of AIT b/w Digital Transformation (DT) and Community-based Transformation(CBT)								
H6D:	AIT	DT x AIT	–0.0930	0.0034	–27.02	0.0000	–0.0997	–0.0862
Moderating Effect of AIT b/w Digital Transformation (D.T.) and Global Transformation (G.T.)								
H6E:	AIT	DT x AIT	–0.0693	0.0044	–8.45	0.0000	–0.0780	–0.0607

Note: Where 'x' is denoted for the multiplicative sign; * Indicates rejection of Null Hypotheses at $p<0.05$

5. CONCLUSION

This paper aims to evaluate the impact of digital transformation on services delivery transformation, real-time data transformation, patient empowerment, community-based transformation, and global transformation. The findings of the study confirm that digital transformation is positively and significantly associated with service delivery, real-time data transformation, patient empowerment, community-based transformation, and global transformation. Therefore, digital transformation has converted the healthcare sector into Industry 4.0, and enhanced market competitiveness. The study concluded that digital transformation increases the information flow within and outside the healthcare sector for all the stakeholders' benefit. Similarly, technological advancement increases the role of digital transformation; therefore, we have treated advancement in technology as a moderating variable. The findings of this research confirmed the moderation of technology advancement between digital transformation, services delivery transformation,

real-time data transformation, patients' empowerment, community-based transformation, and global transformation. The undertaken study shows that the emergent digital transformation of the healthcare sector is leading to an excess of innovative market fragments, value fragments, and generic roles and the muddling of the peculiarity between information technology, artificial intelligence, and the healthcare industry. Machine learning, extensive data analysis, innovation of new IT-based services, digital globalization, and real-time data properties signify the healthcare sector as an industry 4.0, which also increases the market competitiveness in terms of long-term sustainable growth and competitive advantage. The healthcare sector decreases the cost of production and services by adopting digital transformation integration and supplies multiple products and services without any delay in the market. It would only happen when the system is digitalized, and all the chains are interlinked. Digital transformation is essential because digitalization provides the easiest way to share information at the required time and place. Digital transformation can increase the revenue of the healthcare sector, build a strong flow of information, and reevaluate the current business model, which also increases market competitiveness. This research has several strengths and novelty; for instance, it provides a novel conceptual framework for future researchers so that they can replicate this model in other industries and different geographic regions. Similarly, the novel model also presents a solid foundation for the marketers of healthcare industries to incorporate the elements in their future strategies for long-term sustainable growth. The study has certain limitations; for instance, the sample is collected only from two countries, i.e., the United States and Pakistan. Therefore, the outcomes cannot be generalized to the entire world; hence, it is recommended that future researchers may add more countries for more generalizable and robust results. Another limitation of the study is the cause-and-effect relationship, as this research did not employ cause-and-effect models. Thus, it is again suggested that future researchers use cause-and-effect models to ascertain the causation between the variables.

References

1. Agarwal, R., Dugas, M., Gao, G., & Kannan, P. K. (2020). Emerging technologies and analytics for a new era of value-centered marketing in healthcare. *Journal of the Academy of Marketing Science*, 48(1), 9–23. https://doi.org/10.1007/s11747-019-00692-4

2. Ahmed, R. R., Štreimikienė, D., Berchtold, G., Vveinhardt, J., Channar, Z. A., & Soomro, R. H. (2019). Effectiveness of online digital media advertising as a strategic tool for building brand sustainability: Evidence from FMCGs and services sectors of Pakistan. *Sustainability*, 11(12), 3436. http://dxdoi.org/10.3390/su11123436

3. Ahmed, R. R., Štreimikienė, D., Rolle, J. A., & Due, P. A. (2020). The COVID-19 Pandemic and the antecedents for the impulse buying behavior of US citizens. *Journal of Competitiveness*, 12(3), 5–27. https://doi.org/10.7441/joc.2020.03.01

4. Alam, M. Z., Hu, W., & Uddin, A. (2020). Digital transformation in healthcare services sector of Bangladesh: Current status, challenges, and future directions. *Journal on Innovation and Sustainability RISUS*, 11(1), 30–38. https://doi.org/10.23925/2179-3565.2020v11i1p30-38

5. Bican, P. M., & Brem, A. (2020). Digital business model, digital transformation, digital entrepreneurship: Is there a sustainable "digital"? *Sustainability*, 12(13), 5239. https://doi.org/10.3390/su12135239

6. Caliskan, A., Özen, Y. D. Ö., & Ozturkoglu, Y. (2021). Digital transformation of traditional marketing business model in new industry era. *Journal of Enterprise Information Management,* 34(4), 1252–1273. https://doi.org/10.1108/jeim-02-2020-0084

7. Cennamo, C. (2021). Competing in digital markets: A platform-based perspective. *Academy of Management Perspectives,* 35(2), 265–291. https://doi.org/10.5465/amp.2016.0048

8. Clemons, E. K. (2019). *New patterns of power and profit: A strategist's guide to competitive advantage in the age of digital transformation*. Cham: Palgrave Macmillan. https://doi.org/10.1007/978-3-030-00443-9

9. Crisan, E. L., & Stanca, L. (2021). The digital transformation of management consulting companies: A qualitative comparative analysis of Romanian industry. Information Systems and e-Business Management. https://doi.org/10.1007/s10257-021-00536-1

10. Davidson, E., Baird, A., & Prince, K. (2018). Opening the envelope of health care information systems research. *Information and Organization,* 28 (3): 140–151. https://doi.org/10.1016/j.infoandorg.2018.07.001

11. de Reuver, M., Sørensen, C., & Basole. R. C. (2018). The digital platform: A research agenda. *Journal of Information Technology,* 33 (2), 124–135. https://doi.org/10.1057/s41265-016-0033-3

12. Dijck, J. V., Poell, T., & de Waal, M. (2018). *The platform society: Public values in a connective world*. Oxford: Oxford University Press. https://doi.org/10.1093/oso/9780190889760.001.0001

13. Du, J., Peng, S., Song, W., & Peng, J. (2020). Relationship between enterprise technological diversification and technology innovation performance: Moderating role of internal resources and external environment dynamics. *Transformations in Business & Economics,* 19, 2(50), 52–73.

14. Eden, R., Burton-Jones, A., Casey, V., & Draheim, M. (2019). Digital transformation requires workforce transformation. *MIS Quarterly Executive*, 18(1). https://doi.org/10.17705/2msqe.00005

15. Fiebig, D. G. (2017). Big data: Will it improve patient-centered care? *The Patient-Patient-Centered Outcomes Research*, 10(2), 133–139. https://doi.org/10.1007/s40271-016-0201-0

16. Fornell, C., & Larker, D. (1981). Structural equation modeling and regression: Guidelines for research practice. *Journal of Marketing Research*, 18(1), 39–50. https://doi.org/10.1177/002224378101800313

17. Ganjour, O., Widmer, E. D., Viry, G., Gauthier, J.-A., Kaufmann, V., & Drevon, G. (2020). Understanding the reconstruction of personal networks through residential trajectories. *Migration Letters,* 17(5), 621–638. https://doi.org/10.33182/ml.v17i5.694

18. Gardam, M. (2020). Physician experience at the leading edge of the digital healthcare transformation. *Healthcare Quarterly*, 23 (S.P.), 4–7. https://doi.org/10.12927/hcq.2020.26178

19. Gökalp, E., & Martinez, V. (2021). Digital transformation capability maturity model enabling the assessment of industrial manufacturers. *Computers in Industry,* 132, 103522.

20. Hair, J., Risher, J., Sarstedt, M., & Ringle, C. (2019). When to use and how to report the results of PLS-SEM. *European Business Review*, 31(1), 2–24.

21. Hanafizadeh, P., & Kim, S. (2020). Digital business: A new forum for discussion and debate on digital business model and digital transformation. *Digital Business*, 1(1),100006. https://doi.org/10.1016/j.digbus.2021.100006

22. Hansen, S., & Baroody, A. J. (2020). Electronic health records and the logics of care: Complementarity and conflict in the U.S. healthcare system. *Information Systems Research,* 31 (1): 57–75. https://doi.org/10.1287/isre.2019.0875

23. Hein, A., Schreieck, M., Riasanow, T., Setzke, D. S., Wiesche, M., Böhm, M., & Krcmar, H. (2020). Digital platform ecosystems. *Electronic Markets,* 30 (1): 87–98. https://doi.org/10.1007/s12525-019-00377-4

24. Hermes, S., Riasanow, T., Clemons, E. K., Böhm, M., & Krcmar, H. (2020). The digital transformation of the healthcare industry: Exploring the rise of emerging platform ecosystems and their influence on the role of patients. *Business Research,* 13, 1033–1069. https://doi.org/10.1007/s40685-020-00125-x

25. Hsia, T-L., Chiang, A-J., Wu, J-H., Teng, N. N. H., & Rubin, A. D. (2019). What drives e-health usage?: Integrated institutional forces and top management perspectives. *Computers in Human Behavior*, 97, 260–270. https://doi.org/10.1016/j.chb.2019.01.010

26. Joseph, R. P. (2018). Digital transformation, business model innovation and efficiency in content industries: A review. *The International Technology Management Review,* 7(1), 59-70. https://doi.org/10.2991/itmr.7.1.6

27. Kellermann, A. L., Saultz, J. W., Mehrotra, A., Jones, S. S., & Dalal, S. (2013). Primary care technicians: A solution to the primary care workforce gap. *Health Aff (Millwood).* 32(11), 1893–1898. doi: 10.1377/hlthaff.2013.0481

28. Kokhno, P. (2020). High-tech industry in the context of digital transformation. *Obshchestvo i ekonomika*, 1, 66. https://doi.org/10.31857/s020736760008040-3

29. Kruse, C. S., Kristof, C., Jones, B., Mitchell, E., & Martinez, A. (2016). Barriers to electronic health record adoption: A systemic literature review. *Journal of Medical Systems*, 40, 252, 1–7. https://doi.org/10.1007/s10916-016-0628-9

30. Linkous, J. (2019). Healthcare transformation. *Healthcare Transformation,* 2–2. https://doi.org/10.1089/heat.2019.29051.jli

31. Machado, C. G., Winroth, M., Carlsson, D., Almström, P., Centerholt, V., & Hallin, M. (2019). Industry 4.0 readiness in manufacturing companies: Challenges and enablers towards increased digitalization. *Procedia CIRP,* 81, 1113–1118. https://doi.org/10.1016/j.procir.2019.03.262

32. Martins, H. (2019). Digital transformation and digital leadership. *Healthcare Informatics Research,* 25(4), 350. https://doi.org/10.4258/hir.2019.25.4.350

33. Mukha, S. V. (2019). Modern Ukrainian corporate culture and business process transformation. *Business Inform,* 5(496), 204–209. https://doi.org/10.32983/2222-4459-2019-5-204-209

34. OECD Stat. 2020. Health expenditure and financing. https://stats.oecd.org/Index.aspx?ThemeTreeId=9. Accessed 01 July 2020.

35. Rinker, M., Khare, C., Padhye, S., & Fayman, K. (2021). Industry 4.0 digital transformation conference: Has the pandemic accelerated digital transformation? *Journal of Advanced Manufacturing and Processing,* 3(1). https://doi.org/10.1002/amp2.10075

36. Saima, H., Ahmed, R. R., & Shamsi, A. F. (2021). Technology confirmation is associated with improved psychological wellbeing: Evidence from an experimental design. *Transformations in Business & Economics,* 20, 2(53). 177–196.

37. Schallmo, D., Williams, C. A., & Boardman, L. (2017). Digital transformation of business models: Best practice, enablers, and roadmap. *International Journal of Innovation Management,* 21(8). https://doi.org/10.1142/s136391961740014x

38. Schreieck, M., Wiesche, M., Kude, T., & Kremar, H. (2019). Shifting to the cloud: How Sap's partners cope with the change. In Proceedings of the 52nd Hawaii International Conference on System Sciences (January 8–11, 2019), Maui, Hawaii, USA.

39. Smagulov, S., & Smagulova, V. (2019). Challenges of digital transformation in healthcare. *Intellectual Archive,* 8(1). https://doi.org/10.32370/2018/ia_2019_01_si.05

40. Teubner, R. A., & Stockhinger, J. (2020). Literature review: Understanding information systems strategy in the digital age. *The Journal of Strategic Information Systems,* 29(4), 101642. https://doi.org/10.1016/j.jsis.2020.101642

41. Tiwari, A. (2019). Impact of digital transformation for mass healthcare. *Advanced Materials Letters,* 10(2), 79. https://doi.org/10.5185/amlett.2019.1002

42. Verhoef, P. C., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J. Q., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*, 122, 889–901. https://doi.org/10.1016/j.jbusres.2019.09.022

43. Vial, G. (2019). Understanding digital transformation: A review and a research agenda. *The Journal of Strategic Information Systems*, 28(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003

44. Weinstein, R. S., & Holcomb, M. J. (2020). Select healthcare transformation library. *Healthcare Transformation*. https://doi.org/10.1089/heat.2019.0009

45. Willie, M. M. (2019). Digital transformation in healthcare: South Africa context. *Global Journal of Immunology and Allergic Diseases*, 7(1), 1–5. https://doi.org/10.31907/2310-6980.2019.07.01

46. Wirtz, J., So, K. K. F., Mody, M. A., Liu, S. Q., & Chun, H. H. (2019). Platforms in the peer-to-peer sharing economy. *Journal of Service Management,* 30 (4): 452–483. https://doi.org/10.1108/josm-11-2018-0369

47. Wright, A. (2021). Evaluation of two mobile health apps for patients with breast cancer using the Mobile Application Rating Scale. *mHealth*., 7. https://doi.org/10.21037/mhealth-20-161

48. Zavadil, M., Rogalewicz, V., Vaclavikova, A., Gavurova, B., & Bilan, S. (2020). Application of HB-HTA methods in an economic quantification of processes covering laboratory technology in hospitals. *Transformations in Business & Economics*, 19(1, 49), 53–84.

49. Zubritskaya, A. (2019). Industry 4.0: Digital transformation of manufacturing industry of the Republic of Belarus. *Digital Transformation,* 3, 23–38. https://doi.org/10.38086/2522-9613-2019-3-23-38

Contact information

Prof. Rizwan Raheem Ahmed, Ph.D.
Indus University, Pakistan
Faculty of Management Sciences
E-mail: rizwanraheemahmed@gmail.com
ORCID: 0000-0001-5844-5502

Prof. Dalia Streimikiene, Ph.D. (corresponding author)
Institute of Sport Science and Innovations
Lithuanian Sports University
Sportro g. 6, Kaunas, Lithuania
E-mail: dalia@mail.lei.lt
ORCID: 0000-0002-3247-9912

Prof. Riaz Hussain Soomro, Ph.D.
Dow University of Health Sciences, Pakistan
Institute of Health & Business Management
E-mail: riaz.soomro@duhs.edu.pk
ORCID: 0000-0001-5914-2255

Justas Streimikis, M.Sc.
Lithuanian Centre for Social Sciences, Institute of Economics and Rural Development
A. Vivulskio g. 4A-13, LT-03220 Vilnius, Lithuania
E-mail: jutas.streimikis@gmail.com
ORCID: 0000-0003-2619-3229

APPENDIX – I.: Questionnaire

Factors	Items	Statement	Citations
Digital Transformation	DT1	1) Digital transformation is an essential part of industry 4.0.	Schallmo et al. (2017), de Reuver et al. (2018), and Teubner and Stockhinger (2020)
	DT2	2) Digital transformation provided a long-term sustainable and competitive advantage.	
	DT3	3) I usually use the online services of the healthcare	
	DT4	4) Digital transformation provides added advantage to the consumers and customers.	
	DT5	5) I prefer to go online for test reports and other healthcare facilities.	
Services Delivery Transformation	SDT1	1) Digital transformation has played a tremendous role in improving healthcare service delivery.	Schreieck et al. (2019), Clemons (2019), and Reuver et al. (2018)
	SDT2	2) Digital transformation also empowered the healthcare industry, medical services, and health-related institutions.	
	SDT3	3) Digital transformation is a revolution for service delivery in the healthcare sector.	
	SDT4	4) I usually utilize online healthcare services and deliveries.	
Real-time Data Transformation	RTDT1	1) Real-time data is become a revolutionary factor for industry 4.0 and will convert it into industry 5.0.	Wirtz et al. (2019), Fiebig (2017), Machado et al. (2019), and Rinker et al. (2021)
	RTDT2	2) Real-time data provides accurate planning and strategies for the healthcare sector.	
	RTDT3	3) Real-time data transformation provides a sustainable long-term advantage to the healthcare industry.	
Patients Empowerment	PE1	1) Digital transformation empowered patients with online services in the healthcare sector.	Machado et al. (2019), and Fiebig (2017)
	PE2	2) Online clinics, drug information, and other health-related information empower the patients.	
	PE3	3) Patients' empowerment is a critical factor in the healthcare industry.	
	PE4	4) Online user-friendly healthcare services provide significant opportunities.	
	PE5	5) Patients' empowerment is crucial for the healthcare industry due to digital transformation.	
Community-based Transformation	CBT1	1) digital transformation is an imperative source to the general community regarding the healthcare industry.	Hanafizadeh and Kim (2020), and Dijck et al. (2018)
	CBT2	2) As an integrated community, I believe digital transformation has provided us with up-to-date information regarding the healthcare sector.	
	CBT3	3) Community-based transformation empowered the patients and general public regarding healthcare issues.	
	CBT4	4) I have enough resources to interact with communities to enhance my knowledge through technological platforms.	
Global Transformation	GT1	1) Digital transformation is the basis of global transformation in the real business world.	Smagulov and Smagulova (2019), Kokhno (2020), and Alam et al. (2020)
	GT2	2) Global transformation provides opportunities to have a competitive advantage.	
	GT3	3) Global transformation has provided a new marketplace and virtual markets.	
Advancement in Technology	AIT1	1) Technological advancement has provided a new horizon to the healthcare industry.	Hansen and Baroody (2020), Kellermann and Jones (2013), and Hsia et al. (2019)
	AIT2	2) advancement in technology has provided a long-term sustainable competitive opportunity to the healthcare sector.	
	AIT3	3) advancement in technology provides the edge over competitors for long-term growth.	
	AIT4	4) Advancements in technology empowered the consumers in the healthcare industry.	