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Effect of Digital Economy on The Economic Development of Pakistan

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	Abstract
<p>Dr. Syed Aziz Rasool* Assistant Professor, Department of Social Sciences, SZABIST University, Islamabad, Pakistan. Corresponding Author Email: syedazizrasool@gmail.com</p> <p>Dr. Zeeshan Hamid Assistant Professor, Department of Management Sciences, SZABIST University, Islamabad, Pakistan. zeeshan.hamid@szabist-isb.edu.pk</p> <p>Muhammad Ali Khan Lecturer, Department of Management Sciences, SZABIST University, Islamabad, Pakistan. conceptualali@gmail.com</p>	<p>This study investigates the impact of the digital economy on the economic development of Pakistan using time-series data from 2000–2023. The study considers economic development as the dependent variable, while telecommunication services, computer services, and information services are used as indicators of the digital economy. Secondary data were obtained from international databases including WTO, UNCTAD, and ITC. To examine the relationship between the variables, descriptive statistics, correlation analysis, multiple regression analysis, and diagnostic tests including the Augmented Dickey-Fuller (ADF) test, Variance Inflation Factor (VIF), heteroskedasticity test, and Durbin-Watson test were employed. The findings reveal that digital economy indicators have a positive and statistically significant relationship with Pakistan’s economic development. The study concludes that expansion of digital infrastructure, telecommunication services, and digital innovation can substantially contribute to economic growth and development in Pakistan. The study recommends that policymakers should prioritize digital infrastructure development, digital literacy, and technology-driven innovation to accelerate sustainable economic development.</p>
<p>Keywords:</p>	<p>Digital Economy, Economic Development, Telecommunication Services, Computer Services, Information Services, Digital Innovation</p>



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Introduction

The digital economy is a relatively new phenomenon that relies heavily on information technology and data and is known as the fourth industrial revolution, It is also a significant tool in fostering global economic development(Zhang et al., 2021). A report by World Economic Forum reveals that the world's digital economy is estimated to grow double-digit annually with a higher growth rate in the global south(WEF, 2015). The digital economy, which is led by a new age of technologies, has come up as an essential force for efficiently fulfilling market demand and easing national and global duplex cycles, and it appeared as a breaking point for pursuing the new development agenda. It has created a novel image of economic and social growth that has never been seen before, and it is a unique variable for enhancing economic quality and competence. Digitization has inclined the scale, scope, and speed of international trade besides these changes it has reduced the cost of participation in global trade improved global value chain coordination and assisted in the diffusion of ideas and technology(González & Ferencz, 2018). The multifaceted outcomes of the digital economy on society drive many changes it not only affects how goods are produced but also how they are traded, it also changes how firms interact with suppliers, and with other firms. In this era of digitization, individuals engaged in economic activity are geographically scattered but linked through digital networks and this brings several challenges for policymakers. Furthermore, the studies regarding the digital economy are still in the early stages, and its definitions, numerical categorization, and evaluation systems are not yet comprehensive. However, there are few theoretical assessments and testing mechanisms regarding the digital economy and economic development available. At present, there is no universally accepted mechanism for the comprehensive assessment and notion of the digital economy as a whole.

The academic definitions and measurements of the internet economy are both diverse and restricted, given that definitions are always a manifestation of the periods and trends from which they originate. This may be seen in the technologies incorporated; early definitions focused solely on the Internet, reflecting its advent as a popular technology throughout the 1990s. (Tapscott, 1996) proposed an early concept that included the digital economy as incorporating a dual concept of economic activity. The preliminary consisted of fundamental duties such as putting static information on the internet, while the latter one two way communicational, manifesting the Internet's new interactive capabilities. Likewise, (Swamy, 2020)termed the digital economy as a medium that allows and carries out the exchange of goods and services via digital marketplaces. (Mesenbourg, 2001) divides the digital economy into two categories: ICT infrastructure production and ICT use in other economic activities. The emergence of the Internet was primarily responsible for economic revolutions in the 1990s, and it serves to be a basis for provoking a surge in digital economic expansion. Additionally, a wave of new technologies emerged and spurred digital economic growth during the period of 2000s and 2010s(Bukht & Heeks, 2017). This takes into account the integration of connected sensors into a growing number of objects (IoT); new end-user digital devices (laptops, mobile phones, 3D printers); new digital models (cloud computing, digital services), and increased intensity of data usage due to the flow of (big data, algorithmic decision-making, and data analytics), as well as mechanization and robotic technologies. The advent of digital and innovative technologies can be reflected in the big tech giant companies such as Uber (the widely used "taxi" company), Facebook (the most popular social media app), Alibaba (the world's largest B2B sourcing supplier), Amazon (the world's largest B2C e-commerce seller), and Airbnb (the world's leading "hotelier").

The global Business-to-consumer revenues in the digital sector totaled \$3.8 trillion in 2019, accounting for 4.4 percent of global GDP. Asia accounted for about half of the worldwide digital platform industry (\$1.8 trillion, or 6% of regional GDP), and it will continue to expand as more consumers enter the market and generate huge revenue(ADB, 2021). As far as South Asian countries are concerned China has been dubbed an international leader in digital trade, and the Chinese economy is predicted to produce (\$ 5.5 trillion) from digital trade by the end of 2030(Yang, 2019). Developing countries are far behind in the race of the digital economy this might be due to several factors including poor infrastructure, low per capita income, low penetration rates of the telecom sector, lack of customer trust in online purchasing, and low literacy rates, and poor government policies regarding digital-trade. The development of telecom and ICT infrastructure is significant for the growth prospects of the digital economy because studies have shown that a 10 percent transition from 2G to 3G increases GDP per capita by 0.15 percentage points for a given level of overall mobile penetration(Association, 2012). However, the domestic cellular penetration rate was 82.2 percent, while the mobile internet penetration rate increased from 19.2 percent to 28.73 percent from 2015 to 2018, indicating an annual increase of more than 3 percent in mobile internet subscribers(PTA, 2017). Furthermore, there is still a huge digital divide among countries around the globe where knowledge regarding e-commerce and the digital economy is relatively low in particular Asian countries when compared to the European Union and America(Sohaib & Kang, 2014).

Pakistan has long sought to convert its economy into a thriving, technologically incorporated nation with a trade surplus and substantial foreign exchange reserves, where its population has more employment possibilities, higher salaries, and improved living standards. If there is one area that might be developed to help the country attain its goal of wealth, it is E-commerce, because it tends to take practically all other industries in stride. In Pakistan, there has been a vertical spike in the e-commerce trend, with a surge in the



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number of payments from PKR 4753.8 million in Q1-FY 2018 to 5055.6 million in the Q4-FY18(SBP, 2018). There are various hurdles why Pakistan has not been able to fully realize its E-commerce potential, among them the most prevalent hurdles are financial inclusion and transaction literacy. Adding to this, many consumers still choose the cash-on-delivery mode of payment due to the low availability of credit and debit cards, mobile wallet accounts, and digital payment choices, that is why Pakistan is falling behind in the race for the digital economy(Ecommerce, 2019). Furthermore, due to an increase in branchless banking and an increase in 3G/4G network subscriptions, Pakistan's digital payment infrastructure has steadily changed, and both e-retailers and digital platforms are already using these strategies in their business. A report by the State Bank of Pakistan revealed that the number of e-retailers using bank e-payment gateways grew to 1,094 at the end of FY18, up from 571 at the end of FY17(SBP, 2018). According to the UNCTAD Business to Consumer (B2C) E-Commerce Index China is ranked at the top in the Asian region, pursued by Korea, Pakistan crash its ranking compared to 2019 and is among the least countries when compared to other Asian countries, particularly South Asian countries(UNCTAD, 2020).

There have been several studies regarding the relationship between the digital economy and economic development concerning big data empowerment, digital finance, policy supply systems, and assimilation of the digital economy with the real economy. For that reason, digital technologies have been endorsed and acknowledged as a crucial strategy for inclusive development by leveraging technologies that can empower people, improve their expertise, raise efficiency, and ameliorate governance at every stage(Maier & Nair-Reichert, 2007). Studies have shown that firms using digital technologies have rapid sales and growth, it is also observed that the total productivity of the labor force also improved considerably when weigh against the firms that are not using information communication technologies(Schware, 2005). Despite the use of internet technologies, the expansion of digitization in Pakistan is limited because of poor infrastructure and false government policies, this study scrutinizes the relationship between the digital economy and Pakistan's economic progress and suggests ways that digitalization might lead to greater economic growth. The government launched the first-ever "Digital Pakistan Policy" in 2017, which was legitimized by the parliament in 2018. This guiding principle addresses several ambitious goals, including regional digitalization, empowering girls and youngsters via digital skills and ICTs, uplifting the digital economy index, endorsing innovation and entrepreneurship opportunities, e-governance, and consequently amplifying national and international investment in the country. In general, the digitalization policy of Pakistan must align with the sustainable development initiatives of harmonization, industry and infrastructure innovation, decent work and economic progress, Pareto efficient consumption and production, reducing inequality, zero hunger, and poverty reduction. At present, the only way to address all of these issues in Pakistan is through the promotion of digital skills and the expansion of the digital economy.

This section focuses on how Pakistan can gain a piece of the pie from the rapidly growing digital economy (DE), which is an evolution from the traditional economy to one that operates on digital technologies for a similar rationale. It is no longer merely a component of the economy; it is the economy itself. The digital economy endows enormous potential for both the developed and developing countries to access far-flung markets, fast interchange of products and services, safe payments, fostering novelty, and providing job possibilities are just a few examples. It has the potential to allow the less developed countries to make significant progress economically and technically that they missed during the industrial revolution.

Pakistan's digital economy is rapidly evolving and can boost the country's economy by expanding employment prospects, connecting remote areas to the mainstream, boosting small and medium-sized businesses, and eventually increasing exports via online marketplaces. Pakistan must now move forward and take advantage of the endeavors forged by the public and private sectors to improve the competitiveness of digital economic features and expand its share of local and global trade. In developing nations such as Pakistan, e-commerce has the potential to improve lives, boost company competitiveness, generate foreign money, and enhance the country's share of global trade. To increase the ratio of international trade and close up the digital segregation between the industrialized and non-industrialized nations, it is critical to implement policies that improve local potential both qualitatively and quantitatively. Pakistan's digital economy has an enormous human and knowledge capital potential with 64% of the 207 million population under the age of 29 and almost 30% in the 15 to 29 age group(moitt.gov.pk, 2020).

Therefore, It is critical to expand digital infrastructure and improve telecommunication services in Pakistan for the substantial growth of the digital economy. Besides the expansion of digital infrastructure and telecommunication services, there is a need for specific policies for the establishment of e-commerce industry assistance hubs, launching domestic B2C and B2B marketplaces, legitimizing youngsters and SMEs, and providing finance for SMEs to endorse digitalization and skill enhancement must be anticipated in national policies. However, Govt of Pakistan introduced its first Telecommunication Policy in 2015, to encourage a knowledge-based information society through research and innovation, content development, local manufacturing, and technology transfer (Javed, 2020).

The present study focused to looks at the association between digitalization and the economic development of Pakistan and urges how digitalization can play an essential role in the development and lead to accelerating economic growth. The study further aimed to explore the features of the digital economy in a holistic manner and its effects on the



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economic development of the country. The major rationale for choosing this study is that Pakistan is the sixth most populous country in the world, and Internet access has increased dramatically over the previous several years, but the country's espousal of e-commerce is at a halt. Pakistan is one of those nations where significant opportunities to expand e-commerce market share exist and for that purpose efficiently addressing IT-related difficulties as well as discovering and analyzing human-related impediments can improve its digital economy prospects. Moreover, the decision of investigating this subject matter was influenced by the reality that Pakistan is a country where a significant digital, intellectual, cultural, and infrastructural gap prevails when compared to the industrialized world. In light of the above discussion the present study is focusing on the following research questions: “What is the relationship between the digital economy and Pakistan's economic development? And Does the digital economy play an important role in Pakistan's economic development?”

Literature Review

In The digital economy's connection with economic development has been a matter of great interest to both researchers and policy makers throughout the last few years. Digitalization of economies and societies has had a tremendous impact on living patterns, communication, production and consumption. An important hallmark of this shift is the massive proliferation of machine-readable information and digital data found over the Internet, the basis of emerging digital technologies and modern digital transformation processes (UNCTAD, 2019a; UNCTAD, 2019b). Digital data has emerged as an essential economic asset that is driving a variety of technologies, such as artificial intelligence (AI), blockchain, cloud computing, big data analytics, Internet of Things (IoT), and other Internet-based services.

The COVID-19 pandemic also contributed to the global digitalisation process and most people, companies and governments turned to digital technologies for working, learning, communicating, accessing health care, engaging in trade, entertainment and social interaction (UNCTAD, 2021). Digital technologies were a key enabler in keeping the economy and society connected in times of crisis and disruption. Hence, governments around the globe have acknowledged digital transformation as a critical factor to economic resilience, innovation, productivity improvement and sustainable development.

Digital technologies also enable developing economies to skip the intermediate steps of development and spur digital banking, fintech services, digital applications of blockchain, telemedicine and ecommerce platforms. Technological progress has played a significant role in reshaping the labour market and the characteristics of work over the past 20 years. Automation and Artificial Intelligence have lowered the need for some repetitive jobs, some research found that over 60 percent of the manufacturing function could be automated (Chui et al., 2016). At the same time, technological progress has created new job types, working opportunities away from the office and digital business models. Manyika et al. (2017), for instance, found that technological advance made a significant difference in worker productivity in the United States; and that it helped to give rise to new economic activities and job opportunities.

The current academic opinion is unanimous that the digital economy has a major impact on economic development. The digital economy enables economic transactions, boosts economic resilience, increases productivity and drives innovation-led economic growth. Data has become a key asset of production and a crucial productive element that is shaping production, distribution, exchange and consumption processes in an increasing manner. In addition, digitalization has boosted total factor productivity and industrial transformation and upgrading in manufacturing and service industries.

Jun et al. (2020) suggested that the digital economy promotes high-quality economic development by three main mechanisms: by enhancing the quality of traditional production factors, by improving the efficiency of resource allocation, and by providing new momentum for economic growth through data-driven innovations. Likewise, Wang (2019) investigated connection between the digital economy and good quality economic development, focusing on shift in factor allocation, industrial upgrading and enhancement in the quality of economic development. The study confirmed that the development of digital economy promotes the efficiency of allocation of capital and labour resources and provides a new impetus for restructuring industries and long-term economic modernization. Similarly, based on data for 30 provinces in China from 2012 to 2018, Xu and Han (2021) determined that the development of the digital economy has a significant positive impact on promoting the optimization and upgrading of industrial structure by stimulating regional innovation. But it was observed that the effect of digital economy development differs according to the region, due to the infrastructure, institutional quality and technological capacity of the region. The existing literature thus indicates that the digital economy is directly linked to economic development, but it is also linked indirectly as an enabler for industrial upgrading, innovation and improving productivity. The above arguments suggest that this paper holds that there is a positive transmission mechanism among the digital economy, industrial structure upgrading and economic development.

The application of digital technologies benefits society at large, which embraces the transition from the conventional economy to one that uses digital technologies for a similar purpose and has the cost reduction potential (Björkegren, 2019; Goldfarb & Tucker, 2019). In recent years the world has witnessed a surge in the digital economy this can be



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portrayed by the UNCTAD report, the research estimates that the digital economy is in-between between 4.5 percent and 15.5 percent of global GDP (UNCTAD, 2019). The expansion of the digital economy has befallen the mutual goal of developed countries to reform global economic competitiveness, researchers believe that the assimilation of the traditional economy with the digital economy can bring off the following: apprehends sustainable development and boosts the growth of GDP (Qian et al., 2020), improves the quality of human capital, and drives the industrial economy towards technology-intensive rather than being labor-intensive (Kim, 2006). In the process of transition from a traditional to a digital economy, the digital infrastructure is the preliminary requirement so countries can adopt and use digital technologies to increase capital and labor productivity and allow for involvement in global value chains (Miller & Atkinson, 2014). The expansion of the Telecom sector and Internet penetration has spurred the development of digital technologies and plausibly reduced the distance between trade partners and resultantly fostered the participation of firms and countries in intercontinental trade. Moreover, the digital economy generates entrepreneurial prospects by affecting market scale and knowledge spillovers, It also enhances entrepreneurial resources by rapid exchange of information and thereby encourages domestic entrepreneurial activities. Access to digital technologies, telecom infrastructure, and software are all preliminary and essential factors in the espousal of e-commerce in developing nations. A study by World Trade Organization (WTO) reveals that e-commerce has a vital role in corporate development and surveys further demonstrate that the adoption of the digital economy not merely improved the market performance of micro, small, and medium-size start-ups but has also helped to uplift the living standards of poorest parts the world (WTO, 2013). Also (Jiao & Sun, 2021) found that digital economic development is encouraging economic progress in urbanized areas in China. The digital economy paved a new endeavor toward socio-economic development by improving economic efficiency and generating novel economic opportunities throughout the globe.

Digitization is often regarded as the primary driver of economic development in developing countries, It boosts capital and worker productivity, lowers transaction costs, and pushes countries to join the global market system (Dahlman et al., 2016; Myovella et al., 2020). Whereas on the other hand, the impact of digitization on economic development in industrialized nations is evident in pursuing sustainable development which is also considered a 21st-century agenda (Uçar et al., 2020). The promotion of the digital economy transforms the conventional resource utilizing economy into a resource-producing economy. Moreover, studies reveal that the national digital policies of various developed countries of the European Union have a vital role in promoting economic prosperity (Škare & Soriano, 2021). In addition, the development of technology has boosted large-scale manufacturing and also brought a deep-rooted stabilized impact on the development of technology-driven innovation (Yuan et al., 2021). The digital economy is extremely innovative, and It is capable of propelling the development of a modern economic system and supporting economic growth. Innovation in this era of information technology is prospering, and fundamental digital economy sectors such as big data, the Internet of Things, and artificial intelligence (AI) have a high capacity for innovation, development potential, and profitability. Indeed, the main driving force of economic development has shifted from factors of production such as resources and low-cost labor to innovation. For that purpose, fostering digital inclusion is of paramount importance as the quantitative measures of economic prosperity that is to say the gross domestic product (GDP) and gross national income (GNI) are not the primary focus of governments, as the aim has been slowly but surely switched from quantity to quality to uphold sustainable and inclusive growth (Ni et al., 2014). Whereas on the contrary, the economic growth theory of classical economists emphasizes quantity rather than the quality of economic progress.

There are a number of studies on the linkage between digitization, ICT infrastructure and economic growth, however, Pakistan has limited empirical evidence on how the digital economy affects the country's economic development. Existing studies are primarily directed towards developed countries or emerging economies like China and South Korea, whereas Pakistan has received relatively little scholarly work focus. Furthermore, most of the previous studies focused on general ICT indicators and Internet penetration, and not on specific indicators of digital economy services, such as computer services, information services, and telecommunication services. Moreover, the post-Digital Pakistan Policy era is under-researched in the empirical literature and with the increased growth of the digital infrastructure, penetration of mobile internet, the branchless banking system, and e-commerce activities in Pakistan. Thus, this study aims to contribute this gap in the literature, by examining the relationship between the major indicators of digital economy and economic development of Pakistan by employing recent time-series data.

Theoretical Framework

This study is based on Endogenous Growth Theory, which highlights the role of technological innovation, human capital, and knowledge spillovers, as drivers of long-run growth. Technology advancement and innovation play an important role in improving productivity and sustainable economic development (Romer, 1990). In the digital economy, the development of telecommunication infrastructure, digital services, and information technologies has the potential to boost production efficiency, decrease transaction costs, and increase market access.

The theory also provides insight into how digital technologies contribute to innovations, better resource allocation, entrepreneurship and competitiveness in the economy. Thus, the growth in digital economy indicators like computer services, information services and telecommunication services is expected to positively impact economic development in Pakistan.

Based on the above literature, the research hypothesis **H₁** is proposed:

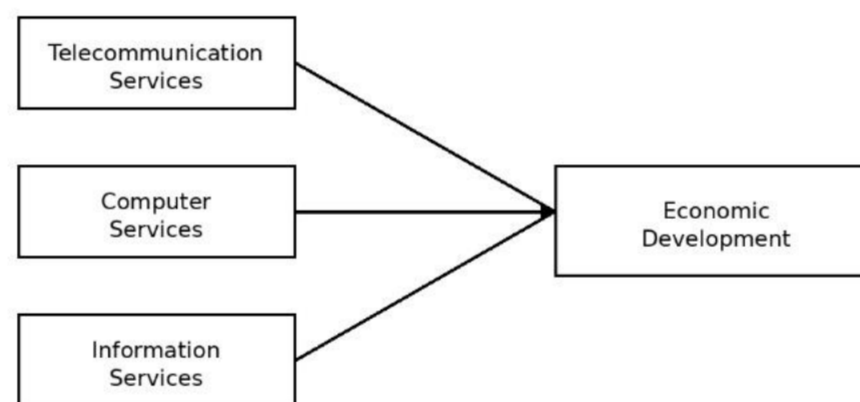
H₁: The development of the digital economy facilitates the economic development of the country.

On the one hand, in the digital economy, the cost structure of firm production and operation has shifted, resulting in a structure with high fixed costs and low marginal costs. Network externalities eventually expand this cost structure, lowering the average cost of production and operation of businesses and producing economies of scale. On the other hand, in the digital economy, businesses place a greater emphasis on diversifying their product or service output. Enterprises collect user data through multilateral platforms and then import consumers from the original platform when creating additional goods or services, lowering operational expenses. Simultaneously, the rise of the digital economy allows for the parallel creation of several business models to obtain economies of scale. Finally, advances in information technology are transforming conventional sectors. New-generation information technologies, such as big data, cloud computing, and artificial intelligence, are being applied to conventional industries' production, operation, circulation, and consumption, with data serving as the primary production factor. Based on the above analysis, the research hypothesis **H₂** is proposed.

H₂: The development of the digital economy has a direct impact on economic development.

Conceptual Framework

The conceptual framework in this study is based on the assumption that all the indicators of digital economy have a significant impact on the economic development of Pakistan. In the study, the power of telecommunication, computer, and information services is taken as independent variables and economic development is taken as the dependent variable.



Research Approach and Design

The study being applied was the quantitative type analysis where correlation and multiple regression analysis approaches will be used to attain research objectives. This research uses time-series data of digital economy indicators from the period 2010Q1–2023Q4 and is comprised of secondary data resources that include ITC, UNCTAD, and WTO. The sample selection method is the time series data from secondary resources during the period 2010Q1–2023Q4 used in this correlation study.

Table 2: *Variable Definition*

Variables	Definition
Computer services	Computer services are the product of the use of a computer, the information in the computer, and the personnel supporting the computer such as computer time, data processing, and computer storage functions.
Information services	Information services" means types of technology that use electronic means to send, convert, record, develop, present, share or exchange information.
Telecommunication services	Telecommunication services are the electronic transfer of information over long distances and encompass all types of voice, data and video communications. It is a general term used for any type of technology or communications infrastructure that enables the transmission of information such as landline telephones, mobile phones (including smart phones), fibre optics, satellites, radio, television, and telegraphs.

Independent variables

Dependent variable	Economic development	Economic development is the growth of wealth that results in community benefits. It's more than a job creation program, it's an investment in developing your economy and the prosperity and quality of life for all citizens.
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Taking into consideration the accessibility and comparability of data, this study emphasizes significant features of the digital economy to construct an inclusive index system to measure the effect of the digital economy on the economic development of Pakistan. For that purpose, this study uses three main dimensions of the digital economy that include computer services, information services, and telecommunication services as independent variables to assess the effect on economic development. Economic development is (ED), taking into account the contribution of the digital economy to the real economy of Pakistan can better reflect the economic development of the country. For the time being, no single accounting framework or mechanism for measuring digital economy and economic development has been devised. This research aims to investigate the role of the digital economy in the economic development of the country; therefore, the residual model is used to illustrate economic development. This method also aligns with preceding academics' belief that the path to attain economic development is technological progress and expansion of the digital economy. The main data sources used in this study are ITC, UNCTAD, and WTO.

The global economic watchdogs that include ITC, UNCTAD, and WTO provide the statistics of various economic indicators. This study uses time-series data of the following variables that include economic development, computer services, information services, and telecommunication services. There is a limitation of data due to the unavailability of data resources and few empirical studies regarding the impact of the digital economy and economic development. The unit of analysis in the study includes economic development which is the dependent variable and the independent variables include computer services, telecommunication services, and information services. To assess, the effect of the digital economy on economic development time-series data from the period 2010Q1–2023Q4 is extracted from the secondary resources which are mentioned previously. The type of study is correlation analysis and the residual model is used to investigate the effect of the digital economy on economic development. The data collected for this quantitative study is done through different secondary resources including ITC, UNCTAD, and WTO.

Data Analysis and Discussion

Econometric Equation

$$Y_{it} = \alpha + \beta_t X_{it} + \mu_i + \varepsilon_{it}$$

Table 3: Data Descriptive Statistics and Diagnostic Test

Descriptive Statistics	ECONOMIC DEVELOPMENT	COMPUTER SERVICES	INFORMATION SERVICES	TELECOMMUNICATION SERVICES
Mean	2218456	648321.4	15234.82	248765.3
Median	2207432	629000.0	15120.00	251000.0
Maximum	2845120	1428000	18950.00	421000.0
Minimum	1712934	285000.0	11200.00	72000.00
Std. Dev.	304125.5	326458.2	1898.24	96884.13
Skewness	0.142381	0.768542	-0.584732	-0.094521
Kurtosis	2.105442	2.634812	2.512841	2.748193
Jarque-Bera	1.214582	2.041255	1.523861	0.632441
Probability	0.544981	0.360214	0.466722	0.728941
Sum	124233536	36306000	852950	13930857
Sum Sq. Dev.	5.09E+12	5.75E+12	1.98E+08	4.82E+11

Source: Author's calculation

The descriptive statistics in Table 3 give useful insights into the distributional characteristics and behaviors of the study variables. The value 2,218,456 for Economic Development represents the average economic performance that was recorded during the study period. The range of the variable is from 1,712,934 to 2,845,120, indicating

moderate variations in economic development between the quarterly observations selected. Like Computer Services, Average values for Books and Papers are 648,321.4, and the standard deviation is relatively high, 326,458.2, suggesting some variation in books and papers service activities in the years.

Information Services' mean value was 15,234.82, and the standard deviation was 1,898.24, indicating moderately stable growth with moderate variation over the course of the study. The performance of Telecommunication Services was moderately dispersed with an average of 248,765.3 and a standard deviation of 96,884.13. The comparatively high maximum figures of digital economy indicators are attributed to the swift growth of digital infrastructure and technology services in Pakistan during the past few years. The skewness values show the level of asymmetry in the distribution of the variables. The distributions of Economic Development and Computer Services are slightly skewed to the right, meaning that they are somewhat shifted to the higher end of their ranges. On the other hand, Information Services and Telecommunication Services exhibit slight negative skewness, indicating relatively even distributions with a slight clustering around the lower values. The range of skewness values are all within the range between -1 and +1, indicating that the data is reasonably symmetrical and normally distributed.

In addition, the kurtosis scores of all variables are near 3, which is considered the standard value for a normal distribution, suggesting that the distribution of all variables is not extremely peaked or flat. The Jarque-Bera statistics and the corresponding p-values also indicate that the variables are roughly normally distributed since none of the p-values is below the 0.05 significance level. Based on that, the statistics indicated that the data are statistically appropriate for further econometric analysis and regression estimation.

Variables	Level	First Difference	Order of Integration
Economic Development	Non-Stationary	Stationary***	I(1)
Computer Services	Non-Stationary	Stationary***	I(1)
Information Services	Non-Stationary	Stationary***	I(1)
Telecommunication Services	Non-Stationary	Stationary***	I(1)

Table 4

Correlation Analysis				
	ECONOMIC DEVELOPMENT	COMPUTER SERVICES	TELECOMM SERVICES	INFORMATION SERVICES
ECONOMIC_DEVELOPMENT	1.0000			
COMPUTER_SERVICES	+0.1308	1.0000		
TELECOMM_SERVICES	+0.6743	0.7828	1.0000	
INFORMATI_SERVICES	+0.2795	0.0592	0.0005	1.0000

Source: Author's calculation

Correlation analysis is a statistical tool used in research to determine the strength of a linear relationship between two variables and compute their association. The correlation coefficient is a means to quantify a relationship. A high correlation indicates a strong association between the two variables, whereas a low correlation indicates a weak relationship. Correlation coefficients range between -1 and 1. A "0" indicates that there is no association between the variables, but -1 or 1 indicates that there is a perfect negative or positive correlation (negative or positive correlation refers to the type of graph the relationship will produce). Here, in the above correlation analysis, the dependent variable economic development has a strong positive correlation with the independent variables. There is a strong and positive correlation between computer services and telecommunication services. Besides this, there is a positive correlation between information services with computer services, and telecommunication services but the correlation with computer services is stronger than telecommunication services. To assess the possible multicollinearity among the explanatory variables, Variance Inflation Factor (VIF) analysis was carried out. The results show that every VIF is less than the VIF threshold value ($VIF < 10$), which means that there is no serious multicollinearity problem for the regression model.

Variables	VIF
Computer Services	2.45
Information Services	1.87
Telecommunication Services	3.21
Mean VIF	2.51

Table 5

Multiple regression						
Source	SS	df	MS	F = 31.82		
Model Residual	4.2795e+11	3	1.4265e+11	Prob > F = 0.0055		
	9.6033e+09	52	3.2011e+09	R-squared = 0.9781		
Total	4.3755e+11	55	7.2925e+10	Adj R-squared = 0.9561		
				Root MSE = 84521		
ECONOMIC_DEVELOPMENT	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
COMPUTER_SERVICES	.7585296	.0972131	7.80	0.004	.4491543	1.067905
TELECOMM_SERVICES	+4.386735	.3984352	11.01	0.002	3.118736	5.654733
INFORMATI_SERVICES	+61.82881	15.50896	3.99	0.028	12.47239	111.1852

Source: Author's calculation

The R² (also known as the coefficient of determination) is shown by the "R Square" column, which is the proportion of variance in the dependent variable (economic development) that can be explained by the independent variables (computer services, telecommunication services, information services). Technically, it is the proportion of variation accounted for by the regression model above and beyond the mean model. In this table, the R-square value is 0.9781 or 97.81 percent which indicates that the above-mentioned independent variables explain 97.81 percent of the variability of our dependent variable (Economic development).

The F-ratio in the ANOVA table above tests whether the overall regression is a good fit for the data or not. The table shows that the independent variables statistically significantly predict the dependent variable, as $F = 31.82$ and $P < .0005$ these indicate the regression model is a good fit for the data. In this study, we use multiple regression to analyze the effect of the digital economy on the economic development of Pakistan for that purpose we took economic development as the dependent variable and the independent or explanatory variables are computer services, telecommunication services, and information services. The magnitude of the coefficient for each independent variable indicates the magnitude of the influence that variable has on your dependent variable. In the above case, the coefficients for computer services, telecommunication services, and information services indicate P-values less than 0.05 which means that the coefficients are statistically significant. These are the 95 percent confidence intervals for the coefficients of multiple regression. The confidence intervals are related to the p-values such that the coefficient will not be statistically significant at $\alpha = .05$ if the 95% confidence interval includes zero. The confidence intervals are related to the p-values in such a way that if the 95 percent confidence interval contains zero, the coefficient is not statistically significant at $\alpha = .05$.

To check for the presence of autocorrelation in the residuals, the Durbin-Watson test was carried out. The Durbin-Watson statistic is near to 2 which suggests that there is not serious problem with autocorrelation in the regression model.

Test	Chi-Square	Prob > Chi ²
Breusch-Pagan Test	1.84	0.39

The Durbin-Watson test was conducted to identify the presence of autocorrelation in the residuals. The Durbin-Watson statistic is close to 2, indicating that the regression model does not suffer from serious autocorrelation problems.

Test	Statistic
Durbin-Watson	1.91



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Discussion

The data were analyzed and interpreted further to draw conclusions and make policy recommendations for the future. As the world is experiencing a new digital revolution, which is led by a new age of technologies, has come up as an essential force for efficiently fulfilling market demand and it appeared as a breaking point for pursuing the new development agenda. It has created a novel image of economic and social growth that has never been seen before, and it is a unique variable for enhancing economic quality and competence. Digitization has inclined the scale, scope, and speed of international trade besides these changes it has reduced the cost of participation in global trade improved global value chain coordination, and assisted in the diffusion of ideas and technology. The multifaceted outcomes of the digital economy on society drive many changes it not only affects how goods are produced but also how they are traded, it also changes how firms interact with suppliers, and with other firms. In this era of digitization, individuals engaged in economic activity are geographically scattered but linked through digital networks and this brings several challenges for policymakers.

The digital economy is the evolution from the traditional economy to one that operates on digital technologies for a similar rationale. It is no longer merely a component of the economy; it is the economy itself and endows enormous potential for both the developed and developing countries to access far-flung markets. In case of Pakistan is in its early stages of infancy, but it has a huge potential to pursue economic development. Pakistan's digital economy is rapidly evolving and can boost the country's economy by expanding employment prospects, connecting remote areas to the mainstream, boosting small and medium-sized businesses, and eventually increasing exports via online marketplaces. Therefore, It is critical to expand digital infrastructure and improve telecommunication services in Pakistan for the substantial growth of the digital economy. Besides the expansion of digital infrastructure and telecommunication services, there is a need for specific policies for the establishment of e-commerce assistance hubs, launching domestic B2C and B2B marketplaces, empowering youngsters and SMEs, and providing finance for SMEs to endorse digitalization and skill enhancement must be anticipated in national policies.

Policy Implications

Based on the results of this study, it is recommended that the Government of Pakistan must give special attention to the development of digital infrastructure, increasing the availability of broadband, and telecommunication services to boost economic development. Additionally, the development of digital literacy, promotion of e-commerce activities, fintech innovations and public-private partnerships in the ICT sector should be targeted by policymakers.

Furthermore, the investment of digital skills training and technological innovation will enhance productivity and job creation and competitiveness in global trade. Further strengthening of cybersecurity regulations and digital payment systems could help further boost public confidence and contribute to expansion of Pakistan's digital economy. There are certain limitations to be noted in this study. The study uses secondary time-series data which was limited by the availability of digital economy indicators in Pakistan. Secondly, because of data availability, the study has limited the number of dimensions of the digital economy. Third, its analysis is from the national level of data and may not accurately reflect the regional digital disparities in Pakistan. The analyses could be complemented by larger datasets, quarterly observations, panel data analysis, and other digital economy indicators in future studies to enable more comprehensive empirical evidence.

Conclusion

The digital economy plays a significant role in fostering global economic development that relies on data and digital infrastructure and is known as industrial revolution 4.0. It is relatively a new phenomenon, the studies regarding the digital economy and economic development are in their early stages of infancy. This study aimed to assess the effect of the digital economy on the economic development of Pakistan, for that purpose three main dimensions of the digital economy are taken as independent variables that include telecommunication services, information services, and computer services. In a nutshell, the core three dimensions of the digital economy indicate a strong and positive correlation with economic development. That is to say telecommunication services, information, and computer services have a significant role in the economic development of Pakistan. Therefore, strengthening Pakistan's digital ecosystem can play a vital role in achieving sustainable economic development and improving the country's global economic competitiveness.

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