Institutional Quality and `Digitalization's Role in Attaining Sustainable Development: Study of G-8 & SAARC Countries

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Abstract

The importance of Institutional Quality and Digitalization in sustainable development has led to increased academic research. This study aims to investigate the relationship between Institutional Quality, digitalization and sustainable development in SAARC and G8 countries. A sample of SAARC and G8 countries was selected for a nineteen-year period from 2004 to 2021. Digitalization is measured through Digital Innovation, E-Governance, ICT Exports and Internet Users. Panel Regression used for the analysis. The findings suggest that Institutional Quality and digitalization are crucial factors in achieving sustainable development and that G8 countries have higher levels of Institutional Quality and digitalization than SAARC countries. The study concludes with recommendations for policymakers to efficiently improve institutional quality and digitalization for achieving sustainable development.

Keywords: *Institutional Quality, Digitalization, Digital Innovation. E-Governance Index. ICT Exports and Internet Users. Sustainable Development, SAARC, G8 Countries.*

Introduction

Sustainable development is economic, social and environmental sustainability that meets the needs of the present without compromising the ability of future generations to meet their needs in equal time. The Sustainable Development Goals (SDGs) were adopted by the United Nations in 2015 to eradicate poverty, protect the environment, and promote peace and health by 2030 (Yuan, 2021). As social, economic and environmental factors are interrelated, achieving these goals requires international cooperation of governments, businesses, citizens and people. The Sustainable Development Goals set long-term plans that support economic growth and social and environmental sustainability. The Sustainable Development Goals are therefore important to achieve a better future for all in the years ahead.

Institutional quality refers to the characteristics, effectiveness, and standards of organizations that shape social, economic, and political interactions, such as government bodies, educational institutions, and legal systems, with factors such as transparency, accountability, and the provision of public goods influencing its evaluation and influencing trust, economic development, and overall well-being in a society or organization. Strong institutions can ensure that policies and regulations are enforced fairly and consistently, reduce corruption, foster trust in government, and increase public participation. Furthermore, countries with high institutional quality have higher income levels, better health outcomes, greater access to education and services, and are more resilient to external shocks (Kruk et al., 2016). In conclusion,

institutional quality is a critical component of sustainable development because it supports economic growth, social progress, and environmental protection while promoting equitable, inclusive, and sustainable development.

Digitization is the process of converting analogue information, such as text, images, or sound, into digital formats that can be stored, manipulated, and transmitted using electronic devices and computer systems. This transformation involves the representation of data as discrete numerical values, allowing for efficient storage, retrieval, analysis, and sharing of information via digital technologies. Digitization can contribute to sustainable development by optimizing the use of resources, reducing the environmental footprint and promoting a circular economy. Digitization is the process of changing operations through the use of technologies such Digital innovation, E-Government, ICT and Internet Users. Digital innovation and sustainable development are two concepts linked by their ability to shape the future. Together, these two ideas have the potential to create a better and safer future by creating new opportunities for economic growth, social welfare, energy and environmental security (Irimia-Vladu, 2014). Digital innovation can improve social and economic development, which are essential components of sustainable development. Digital innovation can increase access to education, healthcare, and financial services, contributing to poverty reduction and reducing inequality (Esses, Csete, & Németh, 2021).

E-government index is the use of information and communication technology (ICT) by the government to improve the efficiency, transparency and accountability of public services and processes. E-government has the potential to contribute to sustainable development by promoting Institutional Quality, promoting public participation and supporting environmental policies (Othman, Razali, & Nasrudin, 2020). E-government can also help reduce corruption, improve public services and increase the participation of marginalized groups in decision-making processes (Kim, 2014). To support sustainable development, governments and other stakeholders should use ICT in Institutional Quality.

ICT Exports refer to the export of electronic and communication equipment used to access, process, store and share information (Racela & Thoumrungroje, 2020). The export of ICTs can contribute to sustainable development through access to information, social and economic development, sustainable production and consumption patterns, energy efficiency and resource management. Integrating ICT exports into sustainable development strategies can yield benefits such as improved environmental sustainability and economic growth (Houghton, 2010). To contribute effectively to sustainable development, policy makers and development professionals must prioritize investment in ICT export infrastructure and capacity building initiatives.

People who access the Internet and use it for communication, information inquiry, entertainment and online business are called Internet users. The growth of the Internet has led to a large number of Internet users worldwide. The Internet has the potential to contribute to sustainable development by promoting economic growth, improving access to education and healthcare, and facilitating communication (Asi & Williams, 2018). The United Nations recognizes the important role of the Internet in achieving the Sustainable Development Goals, particularly in the areas of education, economic development, innovation and cities and communities. Internet-based education and training programs, e-commerce platforms, other online business models can stimulate job growth and job creation, stimulate growth and development (Ulas, 2019).

Significance of Study

The study on the role of institutional quality and digitalization in achieving sustainable development in G-8 and SAARC countries holds significant importance for several reasons. It offers valuable insights into the factors that contribute to sustainable development, enabling policymakers and businesses to develop strategies aligned with sustainable development goals. Additionally, the study emphasizes the critical role of institutional quality in fostering an environment conducive to sustainable development, highlighting the need for strong institutions. Furthermore, it recognizes the increasing importance of digitalization as

a driver of economic growth and social development, allowing policymakers to identify opportunities for leveraging digital technologies effectively. The study's unique contribution lies in its investigation of the interaction between institutional quality, digitalization, and sustainable development within the distinct contexts of the G-8 and SAARC countries. By analyzing a comprehensive dataset, the study aims to enhance the existing literature on the significance of institutional quality and digitalization in achieving sustainable development.

The G8 countries wield significant economic and political power, accounting for roughly 45% of global GDP and a combined population of over 900 million people. They have been instrumental in making world-changing decisions through annual summits and collective efforts. Furthermore, the G8 nations contribute more than 70% of global official development assistance (ODA), drive technological advancements with more than 60% of global R&D spending, and frequently set international standards and norms. Despite criticism for their lack of representation, their importance in global governance and crisis management is undeniable. The Group of Eight (G-8) countries are significant economies with a significant impact on the global economy and growth. They promised to use Sustainable Development Goals funds for poverty reduction, gender equality, security, and energy sustainability, among other things. While the G-8 countries have made significant progress in promoting sustainable development, much more work remains to be done, including the implementation of climate change policies, the promotion of sustainable energy, and the provision of sustainable development assistance to developing countries. Sustainable development in general is a critical issue for developing countries, and the G-8 is committed to continue to work on it for developing countries sustainable development and economic growth (Imran, Alam, & Beaumont, 2014).

The South Asian Association for Regional Cooperation (SAARC) is one of eight regional organizations (Saez, 2012). As of 2021, the population of the eight-member countries of the South Asian Association for Regional Cooperation (SAARC) is approximately 1.8 billion people which is approximately 23% of total world population and per capita of these countries is lower than G-8 countries. Given the social, economic and environmental challenges, SAARC countries should focus on sustainable development. Poverty reduction, renewable energy, sustainable agriculture, biodiversity conservation and disaster risk reduction are important aspects of sustainable development in the region. To create a sustainable and prosperous future for their citizens, these regions need the cooperation of all stakeholders, including governments, non-governmental organizations, private organizations and individuals (Yan, Lin, & Clarke, 2018).

Researchers and policymakers have increasingly focused on the interaction between institutional quality and digitalization in order to address the complex challenges associated with sustainable development. The study, titled "Institutional Quality and Digitalization's Role in Achieving Sustainable Development: A Study of G-8 and SAARC Countries," seeks to shed light on the complex relationship between these two critical factors and their implications for the SDGs.

In recent years, digitalization has transformed various sectors, offering new avenues for economic growth, innovation, and improved governance. However, the impact of digitalization on sustainable development outcomes remains a topic of debate. Meanwhile, the quality of institutions, encompassing governance structures, rule of law, and regulatory frameworks, has been recognized as a fundamental determinant of development progress.

In recent years, digitalization has transformed various sectors, creating new opportunities for economic growth, innovation, and improved governance. However, the long-term impact of digitalization on development outcomes is still being debated. Meanwhile, the quality of institutions has been identified as a critical determinant of development progress, including governance structures, the rule of law, and regulatory frameworks.

This article follows literature review in chapter 2, Chapter 3 outlines the research methodology employed in the study, results and discussion of the study are presented in chapter 4, Chapter 5 summarizes the conclusions and finally, chapter 6 provides a comprehensive list of references used in the article.

Literature Review
Empirical Review
Sustainable Development

Sustainable development has emerged as a critical global goal, encompassing economic, social, and environmental dimensions. The literature provides useful insights into the factors influencing the outcomes of sustainable development, with institutional quality and digitalization being two key variables of interest (Hanelt, Bohnsack, Marz, & Antunes Marante, 2021).

Institutional quality is widely acknowledged as a key driver of long-term development. Strong institutions, such as government agencies, regulatory bodies, and civil society organizations, are critical in fostering an environment conducive to sustainable development (Utting, 2000). Numerous studies have found a link between institutional quality and sustainable development outcomes (Bekhet & Latif, 2018). For example, that countries with better Institutional Quality and institutional frameworks were more successful in meeting sustainable development goals. Similarly, (Ahmed, Quadeer, & McKay, 2020) emphasized the importance of effective institutions in fostering long-term economic growth and social well-being. These findings highlight the significance of addressing institutional quality as a critical determinant of long-term development.

Digitalization, defined by the increased use of digital technologies, has also gained attention as a potential catalyst for long-term development. Digital technologies have the potential to stimulate economic growth, improve social well-being, and aid in environmental conservation (Linkov, Trump, Poinsatte-Jones, & Florin, 2018). Several studies have been conducted to investigate the role of digitalization in various sectors such as education, healthcare, and agriculture, as well as its impact on long-term development outcomes (Gregurec, Tomičić Furjan, & Tomičić-Pupek, 2021). Jameel & Ahmad (2018), emphasized the transformative power of digital technologies in advancing sustainable development in developing countries. They emphasized the importance of digital platforms and innovations in fostering inclusive economic growth and reducing social inequalities. Furthermore, Rowshan, Barzegar, & Yaghoubi (2020) discovered that digitalization positively influenced environmental sustainability by increasing resource efficiency and decreasing environmental impacts. These studies demonstrate how digitalization has the potential to contribute to sustainable development in a variety of ways.

The literature emphasizes the critical importance of institutional quality and digitalization in achieving long-term development (Alhawari, Awan, Bhutta, & Ülkü, 2021). Strong institutions help to create an enabling environment, while digitalization has the potential to transform the economy, society, and environment. Understanding the relationship between institutional quality, digitalization, and sustainable development in specific country contexts can provide policymakers with valuable insights and guide future research in this area.

Institutional Quality and Sustainable Development

Several studies have examined the relationship between Institutional Quality and sustainable development. According to (Kooiman, 2003), Institutional Quality is essential for sustainable development, as it ensures transparency, accountability, and participation in decision-making. Similarly, (Kaufmann, 2007)argue that Institutional Quality is positively associated with economic growth, social development, and environmental sustainability. In their study, they found that countries with higher levels of Institutional Quality tend to have better sustainable development performance.

However, the relationship between Institutional Quality and sustainable development is not always straightforward. Some scholars argue that the concept of Institutional Quality is Western-centric and does

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not take into account the cultural and institutional contexts of developing countries. They suggest that local Institutional Quality structures and traditional practices may be more effective in promoting sustainable develo^{p}ment in these contexts (Häikiö, 2012).

It is widely acknowledged that Institutional Quality plays a crucial role in achieving sustainable development. This is reflected in the Sustainable Development Goals (SDGs), which include targets related to Institutional Quality and institutions (Bartram, Brocklehurst, Bradley, Muller, & Evans, 2018). In particular, SDG 16 aims to promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable, and inclusive institutions at all levels (Milton, 2021).

Several studies have explored the relationship between Institutional quality and sustainable development. For instance, a study by (Robinson & Acemoglu, 2012) found that countries with better institutional quality tend to have higher levels of economic growth, which is an important component of sustainable development. Similarly, a study by (North & Staatswissenschaft, 1993) found that the quality of institutions has a significant impact on economic performance, and that this impact is particularly pronounced in developing countries.

Other studies have looked at the relationship between institution quality and environmental sustainability. For example, a study by (Arrow, Dasgupta, & Mäler, 2003) found that institutions play a key role in promoting sustainable natural resource management, and that institutional quality is a key determinant of whether or not natural resources are managed sustainably. Similarly, a study by (Tietenberg & Lewis, 2012) found that institutions are crucial in promoting sustainable energy policies, and that countries with higher levels of institutional quality tend to have more effective and efficient energy policies.

Studies suggest that institutional quality is an important determinant of sustainable development. Countries with better institutional quality tend to have higher levels of economic growth, better natural resource management, and more effective energy policies (Moshiri & Hayati, 2017). Therefore, policymakers should focus on improving institutional quality in order to promote sustainable development.

H₁.   Institutional quality has positive and significant impact on sustainable development

Digitalization
Digital Innovation and Sustainable Development

Numerous studies have investigated the relationship between digital innovation and sustainable development (Godil, Yu, Sharif, Usman, & Khan, 2021). It has been found that digital innovation can positively impact sustainable development by reducing resource consumption and environmental impact. Studies by (Zhao et al., 2020) found that the adoption of digital technologies in manufacturing and agriculture respectively, can reduce energy consumption, carbon emissions, water consumption, and pesticide usage.

Moreover, digital innovation can facilitate entrepreneurship and job creation, particularly in the knowledge economy. However, scholars have raised concerns regarding the potential negative impact of digital innovation on sustainable development like E-waste, Energy consumption, Digital divide, Job displacement and Privacy and security concerns (Sharma et al., 2021). The rapid growth of digital platforms has led to increased energy consumption and resource consumption. Furthermore, the use of digital technologies has been linked to ethical and social issues, such as privacy violations and algorithmic bias (Floridi et al., 2018)

The complex relationship between digital innovation and sustainable development highlights the need for a careful and responsible approach to digital innovation (Weber-Lewerenz, 2021). It is important to consider the potential negative impacts of digital technologies on the environment, society, and economy

and take steps to mitigate negative impacts and promote sustainable development. While digital innovation has the potential to contribute to sustainable development by reducing resource consumption, enhancing social and economic development, and promoting innovation, there are some potential negative impacts that need to be addressed like E-waste, Energy consumption, Privacy and data security, Displacement of jobs and Environmental impact of digital infrastructure (Prakash et al., 2010). Consequently, policymakers and stakeholders should consider the trade-offs and unintended consequences of digital innovation and take measures to promote a sustainable digital future.

H₂. Digital innovation has positive and significant impact on sustainable development.

E-Governance and Sustainable Development

The use of technology in governance has the potential to increase transparency, accountability and public participation which are key elements of long-term development. According to (Alsharafat, 2021), E-government will have a positive impact on sustainable development by improving the performance of public services, reducing corruption and increasing public participation.

Likewise, (Jones et al., 2020) found that E-government can play an important role in achieving the Sustainable Development Goals by improving communication between citizens and governments, improving services by engaging the public. E-government can help achieve the SDGs by providing citizens with access to information, by encouraging information exchange and best practices, and by involving citizens in decision-making.

Raza, Qazi, Khan, and Salam, (2021) highlights the importance of E-governance in promoting sustainable development in developing countries. E-governance can help countries solve sustainable development problems such as poverty, lack of infrastructure and limited access to resources. They argue that e-governance can help improve security and services, by providing information & services to the public, by increasing transparency and accountability, and by improving the performance of public services.

Literature shows that E-governance can play an important role in promoting sustainable development by improving public transparency, accountability and participation. However, E-government implementation is difficult in developing countries, and more research is required to understand how technology can be used to achieve development goals (Chen, Chen, Huang, & Ching, 2006).

H₃. E-governance positively and significantly impacts sustainable development.

ICT Exports and Sustainable Development

ICTs have been identified as a key factor in sustainable development. It can contribute to all aspects of sustainable development, including economic growth, social development and environmental protection (Wu et al., 2018). Access to information and communication is one of the ways ICT can contribute to sustainable development. This helps improve governance, increase transparency and accountability and encourage public participation (Gajendra, Xi, & Wang, 2012).

ICTs can also contribute to long-term economic growth by promoting jobs, innovation and productivity (Machiba, 2011). Mobile devices, social media and cloud computing help create new businesses, increase market reach and increase competitiveness (Schwertner, 2017). For example, mobile banking provides financial services to rural people, enabling them to participate in the economy.

ICT can also facilitate social development through access to education, health and other services. Online learning platforms, tele-medicine and health applications have the potential to improve the quality and accessibility of medical services. This can also provide access to education and training that develops skills and employment (Senbekov et al., 2020).

ICT has the potential to significantly contribute to sustainable development by improving information access, promoting economic growth, facilitating social inclusion and promoting environmental sustainability. However, it is critical to ensure that ICT is used in a way that is inclusive, equitable, and long-term (Turner-Cmuchal & Aitken, 2016). Policymakers and stakeholders must collaborate to create an enabling environment that encourages the sustainable deployment of ICT, thereby contributing to the achievement of the SDGs.

H4.   ICT exports has positive and significant impact on sustainable development.

Internet Users and Sustainable Development

Several studies have been conducted to investigate the relationship between internet users and sustainable development. For example, (Pan et al., 2020) conducted a survey of Chinese internet users and discovered that those with a high level of environmental awareness are more likely to engage in sustainable behaviors. Similarly, (Alareeni & Hamdan, 2020) discovered that social media can be an effective tool for promoting sustainable development among university students in their study.

The presence of internet users plays a crucial role in driving positive sustainable development outcomes, as revealed by a comprehensive literature review. The internet empowers individuals and communities by granting access to information and knowledge, enabling them to make informed decisions regarding environmental conservation, renewable energy, and sustainable lifestyles (Sørensen, 2018). Social media platforms and online communities further facilitate collaboration, knowledge sharing, and collective action, mobilizing people around environmental and social causes (Obar, Zube, & Lampe, 2012). Internet users also contribute to sustainable business practices by advocating for transparency and accountability through online platforms, encouraging companies to adopt environmentally friendly policies (Markman, Russo, Lumpkin, Jennings, & Mair, 2016). Additionally, the internet's support of e-commerce and remote working options helps reduce carbon emissions associated with traditional businesses and commuting.

The negative impacts of internet users on sustainable development are evident in various aspects (Wang et al., 2022). Firstly, the proliferation of electronic devices and the inadequate management of e-waste contribute to pollution and health risks due to toxic substances (Rautela et al., 2021). Secondly, the energy-intensive nature of digital infrastructure, such as data centers and networks, strains power grids and increases carbon emissions, thus contributing to climate change (Cunliff, 2020). Additionally, the digital divide deepens marginalization and inequality, as certain communities lack access to technology and reliable internet connectivity (Jamil, 2021). Privacy issues arise from the collection and misuse of personal data, compromising individuals' privacy rights. The establishment and maintenance of digital infrastructure also have environmental consequences, including habitat destruction and resource depletion.

According to the literature, the internet users have both positive and negative effects on sustainable development (Ulucak & Khan, 2020). While the internet has increased access to information and collaboration on sustainable development policies, it has also increased energy consumption, electronic waste, and carbon emissions (Jahanger & Usman, 2022). As a result, internet users should practice sustainable practices to reduce their carbon footprint. Furthermore, closing the digital divide is critical for promoting sustainable development because unequal access to the internet and digital technologies can lead to social and economic disparities.

H5.   Internet users have significant impact on sustainable development.

Theoretical Review

Modern growth theory serves as a foundational framework for our study of Institutional Quality. The importance of institutions in fostering economic development and sustainability is emphasized in modern

growth theory. High-quality institutions, such as strong legal systems, efficient governance structures, and well-defined property rights, are known to foster economic growth and long-term progress. As a result, we anticipate that institutional quality will have a significant impact on long-term development outcomes.

Following that, in terms of Internet users, social network theory sheds light on the role of network connections and communication in shaping social behavior and outcomes. The theory suggests that the interconnectedness of individuals through online platforms can facilitate knowledge exchange, collaboration, and collective action in the context of internet users. As internet penetration grows, there is a greater opportunity for greater dissemination of sustainable development information, digital inclusion, and grassroots mobilization for sustainable initiatives as a result, we anticipate a positive relationship between internet users and long-term development.

Digital innovation management theory provides valuable perspectives on how organizations and societies drive and harness innovation in the digital era. Digital innovation, which includes technological advancements and digitalization across multiple sectors, is poised to reshape economies and societies towards more sustainable practices. Adopting digital innovation can result in increased resource efficiency, improved environmental monitoring, and the development of long-lasting products and services. As a result, we hypothesize a positive relationship between digital innovation and long-term development outcomes.

Finally, the theoretical review emphasizes the importance of modern growth theory, social network theory, and digital innovation management theory in forming the research model. We hope to gain a comprehensive understanding of the interplay between institutional quality, E-governance, internet users, digital innovation, ICT exports, and their collective impact on sustainable development by incorporating these theories into our research. We hope that this research will add to the existing knowledge base and provide practical insights for policymakers and stakeholders seeking to promote sustainable development in the digital age.

Research Methodology
Population and Sample of Study

The G8 and SAARC countries chosen as the population in this research paper provide a diverse and representative sample, encompassing both highly developed economies and emerging economies facing unique challenges. The study aims to investigate the potential impacts on sustainable development from various socioeconomic perspectives by including institutional quality, digital innovation, ICT exports, E-governance, and internet users as independent variables. This comprehensive approach allows for a more holistic analysis of the relationship between these variables and sustainable development, providing valuable insights for policymakers and stakeholders in both sets of countries.

Table-1

G-8 Countries		SAARC Countries	
Country Name	**Continent Name**	**Country Name**	**Continent Name**
France	Europe	Bangladesh	Asia
Germany	Europe	Bhutan	Asia
Italy	Europe	India	Asia
Japan	Asia	Maldives	Asia
United Kingdom	Europe	Nepal	Asia
United States	North America	Pakistan	Asia
Canada	North America	Sri Lanka	Asia
Russia	Asia & Europe	Afghanistan	Asia

The population of this study included countries that were part of the G8 and SAARC groups, which included the United States, Canada, United Kingdom, France, Germany, Italy, Japan, and Russia, as well as Afghanistan, Bangladesh, Bhutan, and India. Maldives, Nepal, Pakistan and Sri Lanka. However due to non-availability of data some SAARC countries like Afghanistan, Bhutan, Maldives and Nepal were excluded. The work will run from 2004 to 2021.

To conduct the research, a sample is drawn from the population under study. The sample consists of a subset of countries drawn from the G8 and SAARC. The independent variables are institutional quality, E-governance Index, digital innovation, ICT exports, and internet users, while the dependent variable is sustainable development.

Data and Variables Measurement
Table-2

Indicator	Data Description, Measurement, and followed studies	Data Website
Dependent Variables		
Sustainable Development (SD)	Sustainable Development index Hickel 2020	World Bank (WDI)
Independent Variables		
E-Governance (E-Gov)	It is represented by the scope and quality of the e-government development index, internet service index, human capital index and telecommunication infrastructure index. Later proxy and hypothesis development Ullah et al. (2021a), (Mishra, M., & Bhatti, Z. A. (2021)	UN E-governance Knowledge Database
Digital Innovation (DI)	Patent applications, residents (Sharma, A., & Bhimavarapu, V. M. (2021)	World Bank Development Index.
Institutional Quality (IQ)	Institutional quality is a PCA combination of government stability, capital status, corruption, law and order, accountability of democracy, and bureaucratic quality. Many studies have followed this representative and hypothetical growth. (Islam et al. 2020; Khan et al. 2020; Khan et al. 2019; Kutan et al. 2017), (NGUYEN, & HA, D. T. T. (2021)	International Country Guide Risk
ICT Exports (ICT)	ICT service exports (% of service exports, BoP) (Joia, L. A., & Santos, R. P. D. (2017)	World Bank Development Index.
Internet Users (IU)	Individuals using the Internet (% of the population) (Lenka, S. K., & Barik, R. (2018)	World Bank, United Nations

Econometric Model

A multiple linear regression framework can be used to model the relationship between Sustainable Development (SD) and its determinants. The model is expressed as follows:

$$SD = \beta_0 + \beta_1 E\text{-}Gov + \beta_2 DI + \beta_3 IQ + \beta_4 ICT + \beta_5 IU + \varepsilon$$

Where:

SD = Sustainable Development, E-Gov = E-Governance, DI = Digital Innovation, IQ = Institutional Quality, ICT = ICT Exports, IU = Internet Users, ε = error term

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The model assumes that E-Governance, Digital Innovation, Institutional Quality, ICT Exports, Internet Users and Exports are functions of Sustainable Development,

The coefficients β_1, β_2, β_3, β_4, β_5, β_6, β_7 represent the marginal effect of each independent variable on Sustainable Development, holding all other variables constant. The intercept term β_0 represents the expected value of Sustainable Development when all independent variables are zero.

Estimation Technique

The use of a random effects model in our study is justified by the heterogeneity that may exist among the sample units, given the differences between SAARC and G8 countries. Furthermore, the exclusion of certain SAARC countries such as Afghanistan, Nepal, and Bhutan may introduce unobserved individual effects, which the random effects model effectively accounts for, allowing for more efficient coefficient estimates taking into account within-country variations over time, especially when independent variables such as institutional quality or E-governance remain constant during the observation period.

The model is expressed as follows:

$$SD_{it} = \beta_0 + \beta_1 E\text{-}Gov_{it} + \beta_2 DI_{it} + \beta_3 IQ_{it} + \beta_4 ICT_{it} + \beta_5 IU_{it} + \beta_6 Ex_{it} + \beta_7 ER_{it} + \varepsilon_{it}$$

Where:

The model assumes that E-Governance, Digital Innovation, Institutional Quality, ICT Exports, Internet Users, Exports, Exchange Rate are functions of Sustainable Development, while controlling for other factors that may affect Sustainable Development but are not of primary interest in this study. The individual-specific intercept term i allows for unobserved heterogeneity across individuals, which may have an impact on Sustainable Development.

To estimate the model, we would need panel data for a group of individuals over time on Sustainable Development, E-Governance, Digital Innovation, Institutional Quality, ICT Exports, Internet Users, Exchange Rate, and Exports. The coefficients estimated using statistical software Stata, and the significance of the independent variables, as well as the presence of individual-specific effects, tested.

Research Model
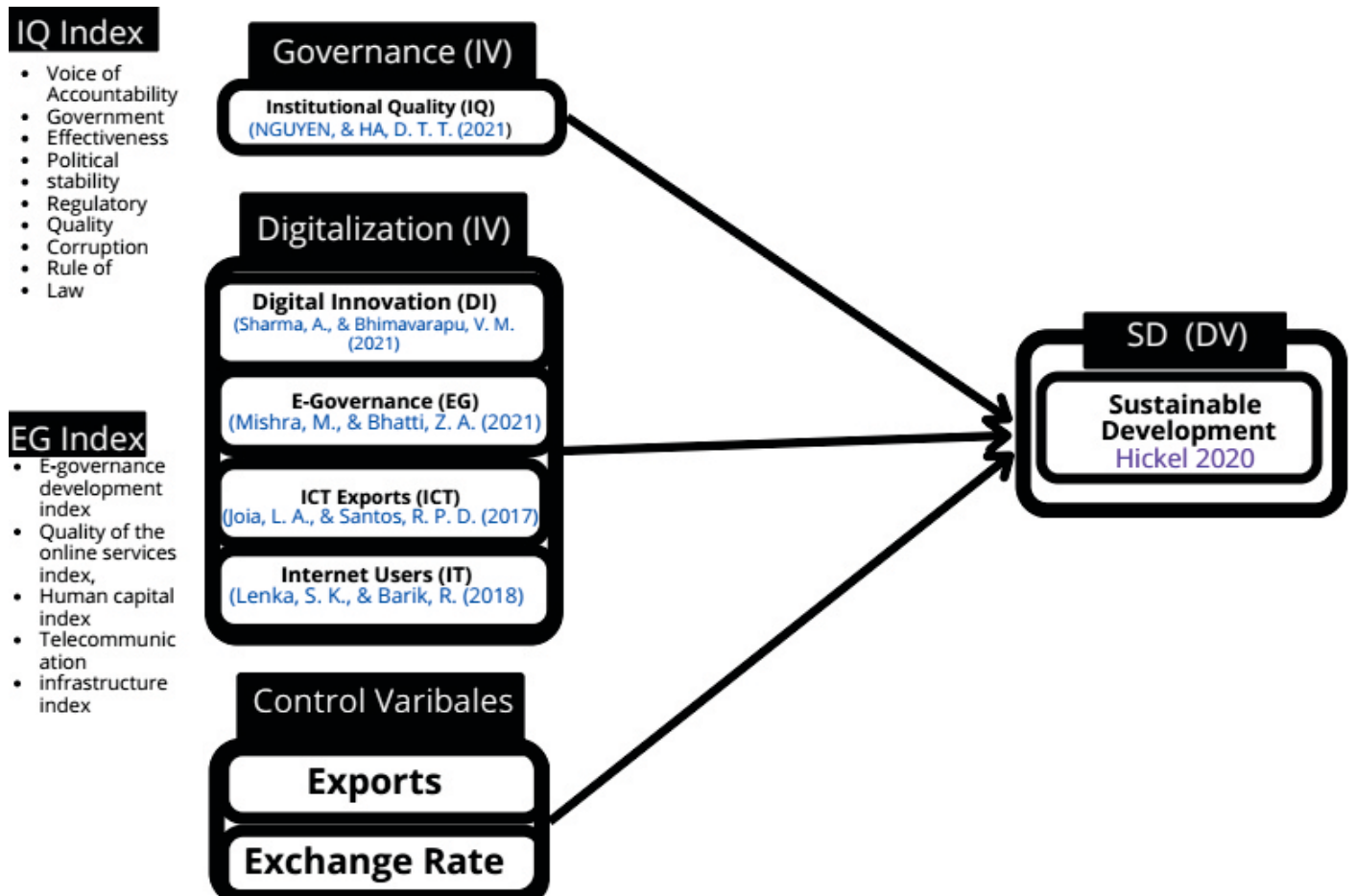
Results and Discussion

Table 3 show the descriptive summary of the variable along with mean, standard deviation, and minim and maximum value from data from 2004 to 2021. The measure of central tendency for the entire sample is explained by the mean in descriptive statistics, whereas the variability of the data is explained by the minimum, maximum, and standard deviation. The standard deviation of the mean value suggests that there is a typical number of dispersions all around the mean and that values are typically fairly close to the sample mean.

Descriptive Statistics

Table-3

	No of Obs	Mean	Std. Dev.	Min	max	Skewness	kurtosis
E-Government	227	.608	.267	0.000	.927	-.784	2.497
IQ	227	0	2.301	-3.860	2.83	-.331	1.436
ICT Exports	227	11.641	11.552	0.000	52.088	2.357	7.537
Internet Users	227	48.627	34.491	0.000	96.97	-.218	1.387
Exchange Rate	227	42.635	49.262	0.500	198.764	.847	2.713
SDI	227	.452	.233	0.000	.843	-.475	2.369
Exports	227	.048	.127	-0.420	.365	-.608	4.501
LNDI	227	.017	.159	-0.821	.727	.335	11.309

This table contains descriptive statistics for 11 variables. The mean column shows the mean for each variable, while the Standard Deviation column shows the standard deviation. The line shows the change

or distribution around the mean. The Min and Max rows show the minimum and maximum values for each variable. The skewness and kurtosis curves give information about the shape of the distribution.

The first variable, Country ID, has a mean of 6.5 and a standard deviation of 3.46. The minimum and maximum are 1 and 12, respectively. The skewness of 0 indicates that the distribution is relatively symmetrical, and the positive kurtosis of 1.783 indicates that it is slightly more peaked than a normal distribution.

The mean of the year variable is 2012 and its standard deviation is 5.489. The lowest value is 2004 and the highest is 2021. Both skewness and kurtosis are positive, indicating that the distribution is slightly right-skewed with a higher peak than the normal distribution.

The mean of the E Government Index variable is 0.608 and its standard deviation is 0.267. The minimum and maximum values are 0 and 0.927, respectively. A positive kurtosis of 2,497 indicates that the distribution is skewed to the left, and a negative skewness of -0.784 indicates that the distribution is skewed to the left.

The mean of the IQ Index variable is 0 and its standard deviation is 2.301. The minimum and maximum values are -3.86 and 2.83, respectively. The distribution is slightly skewed to the left as indicated by the slight negative skewness. With 1.436 kurtosis, the distribution is slightly sharper than the normal distribution.

The mean of the ICT Export variable is 11.641 and its standard deviation is 11.552. The minimum and maximum values are 0 and 52.088, respectively. A positive skewness of 2.357 indicates that the distribution is skewed to the right, and a positive kurtosis of 7.537 indicates that it is sharper than the normal distribution.

The mean of internet users is 48.627 and the standard deviation is 34.491. The minimum and maximum values are 0 and 96.97, respectively. A slight negative skewness indicates that the distribution is skewed to the left, while a positive kurtosis of 1.387 indicates that the distribution is slightly higher than normal.

The mean of the exchange rate is 42.635 and its standard deviation is 49.262. The minimum and maximum values are 0.5 and 198.764 respectively, do. A positive skewness of 0.847 indicates that the distribution is skewed to the right, and a positive kurtosis of 2.713 indicates that it is sharper than the normal distribution.

The mean of the variance of the SDI is 0.452 and the standard deviation is 0.233. The minimum and maximum values are 0 and 0.843, respectively. A positive kurtosis of 2.369 indicates that the distribution is sharper than normal, and a negative skewness of -0.475 indicates that the distribution is skewed to the left.

Exports' variance has a mean of 0.048 and a standard deviation of 0.127. The minimum and maximum values are -0.42 and 0.365 respectively. A negative skew of -0.608 indicates that the distribution is skewed to the left, and a positive skewness indicates that the distribution is skewed to the right.

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Pairwise correlations
Table-4

Variables	(SDI)	(DI)	(EG)	(IQ)	(ICT-Ex)	(Internet User)
SDI	1.000					
DI	0.089	1.000				
EG	0.017	-0.107	1.000			
IQ	-0.023	0.065	-0.303	1.000		
ICT-Exports	0.337	0.220	-0.052	-0.065	1.000	
Internet-User	-0.512	-0.172	0.135	0.009	-0.382	1.000

The pairwise correlation analysis of the given table (Table 4) is as follows:

The correlation coefficient analysis between the independent variables and the dependent variable, Sustainable Development, reveals a variety of associations. Digital Innovation has a weak positive correlation with Sustainable Development (correlation coefficient of 0.089), implying a possible link to improved sustainability outcomes. Similarly, E-Government has a weak positive correlation (correlation coefficient of 0.017), indicating the potential benefits of e-governance practices for long-term development. Institutional Quality, on the other hand, has a weak negative correlation (correlation coefficient of -0.023), implying that higher institutional quality may not guarantee significant improvements in sustainability. ICT-Exports, on the other hand, show a moderate positive correlation (correlation coefficient of 0.337), indicating that international trade and technology transfer in the information and communication technology sector may have a positive impact on sustainability outcomes. The strong negative correlation observed for Internet Users (correlation coefficient of -0.512) raises concerns, implying that higher rates of internet use may be associated with lower levels of sustainable development. These findings provide important insights for policymakers and stakeholders seeking to promote sustainable development in the context of changing digital landscapes. Consideration of these correlations in evidence-based policy formulation, as well as additional research and multivariate analysis, will provide a thorough understanding of the intricate relationships between these independent variables and their implications for achieving sustainable development goals.

The study looks at the relationships between several independent variables, including E-Government (EG), Digital Innovation (DI), Institutional Quality (IQ), ICT-Exports (ICT-Ex), and Internet Users, and the dependent variable, Sustainable Development. The correlation values provide useful information about the direction and strength of these relationships. A positive correlation indicates that an increase in one variable is associated with an increase in another, indicating potential synergy. A negative correlation, on the other hand, indicates that an increase in one variable is linked to a decrease in another, implying a possible trade-off or opposing influence. The magnitude of the correlation coefficient indicates the strength of the relationship, with values near 1 indicating a stronger correlation. This comprehensive analysis sheds light on the interconnections between the variables studied and their potential implications for efforts to achieve sustainable development goals.

Note: The values in parentheses represent the p-values for the corresponding correlation coefficients.

Hausman Test
Table-5

	Coef.
Chi-square test value	9.305
P-value	.097

As "**p**" value is more than .05 so we need random effect model to apply for this study.

Cross Sectional Dependency Test
Table-6

Variable	CD-test	p-value	average joint T	mean ρ	mean abs(ρ)
SDI	32.429	0.000	18.00	0.94	0.94
E-Government	22.318	0.000	18.00	0.65	0.68
IQ	.584	0.009	17.42	0.02	0.24
ICT-Exports	11.983	0.000	18.00	0.35	0.47
Internet-Users	26.686	0.000	18.00	0.77	0.77
DI	.543	0.007	18.00	0.02	0.27

The CD test results show that all variables (SDI, E-Government, IQ, ICT-Exports, Internet-Users, and DI) have significant cross-sectional dependence or spatial autocorrelation among the panel units. This implies that the values of these variables for each unit are related to the values of neighboring units, indicating potential spatial patterns or data interdependence.

Results of Panel Regression (Random Effect)
Table-7

SDI	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
E-Gov Index	.415	.065	6.38	0	.287	.542	***
IQ-Index	-.075	.023	-3.20	.001	-.121	-.029	***
ICT-Exports	-.005	.002	-2.07	.038	-.01	0	**
Internet-Users	-.001	.001	-1.19	.235	-.002	.001	
DI	.084	.061	1.38	.168	-.036	.204	
Constant	.556	.118	4.72	0	.325	.786	***

Mean dependent var	0.454		SD dependent var	0.231	
Overall r-squared	0.345		Number of obs	227	
Chi-square	105.524		Prob > chi2	0.000	
R-squared within	0.327		R-squared between	0.393	

*** p<.01, ** p<.05, * p<.1

The presented regression model (Table.7) is a random effects model that investigates the relationship between several independent variables and a dependent variable. The dependent variable is not stated explicitly, but it is referred to as the "mean dependent var" with a mean of 0.454 and a standard deviation of 0.231.

E-Government, IQ, ICT Exports, Internet Users and LNDI variable are the model's independent variables. For each variable, the coefficients, standard errors, t-values, and p-values are reported. The confidence intervals and level of statistical significance (at 1%, 5%, and 10%) are also provided.

The model's overall r-squared value is 0.345, indicating that the independent variables explain approximately 34.5% of the variance in the dependent variable. The model employs a total of 227 observations.

The chi-square value is 105.524, with a p-value of 0.000, indicating that the model is overall significant. The within and between r-squared values are also reported, indicating that the independent variables explain 32.7% of the variance in the dependent variable within groups and 39.3% of the variance between groups.

When looking at the individual variables, the results show that the E-Government and IQ Index are statistically significant at the 1% level, indicating a strong relationship with the dependent variable. At the 5% level, the ICT Exports are significant, indicating a moderate relationship with the dependent variable. At the 10% level, the Internet Users and LNDI variables are not statistically significant, implying that they have little to no relationship with the dependent variable.

This random effect regression model in general, sheds light on the relationship between various independent variables and a dependent variable. The findings indicate that some variables are more strongly related to the dependent variable than others, which can be used to guide future research and decision-making.

Our research highlights the interconnected impact of various factors on sustainable development in SAARC and G8 countries. E-Government, in particular, has a significant positive impact on sustainable development, aligning well with previous research and theoretical frameworks. E-Government is a valuable driver for achieving sustainable development goals because it promotes transparent governance, social inclusivity, environmental sustainability, citizen engagement, and economic growth.

Our research shows that institutional quality has a negative and significant impact on sustainable development. This finding contradicts theoretical frameworks such as institutional theory and modern growth theory, which have been supported by previous research and reports from reputable organizations such as the World Bank. However, the disparity with previous studies suggests that more research into specific characteristics or policy contexts within SAARC and G8 countries is needed to better understand this relationship.

Third, our findings show that ICT exports have a negative but statistically insignificant impact on long-term development. In contrast, previous empirical studies have suggested that economic growth, knowledge dissemination, and global participation have a positive impact on sustainable development. The observed disparity may be attributed to diverse ICT export products and varying levels of technology adoption across regions, necessitating additional research to gain a better understanding of this complex relationship.

Fourth, our research shows that internet users have a negative but statistically insignificant impact on sustainable development, which contradicts theoretical perspectives and prior research that emphasizes internet users' pivotal role in advancing sustainable development through the effective use of digital technologies. The observed discrepancy in our results may be attributed to the varied degrees of internet penetration and usage patterns prevalent across SAARC and G8 countries, necessitating further research to better understand the complex relationship between internet users and sustainable development outcomes.

Finally, our findings suggest that digital innovation has a positive but statistically insignificant impact on long-term development, which is consistent with existing theoretical frameworks and empirical evidence. Digital innovation has the potential to address environmental issues, promote social inclusion, and drive long-term economic growth, making it an important tool for achieving sustainable development goals. However, more research into specific digital innovation initiatives and policies within the SAARC and G8 countries is needed to gain deeper insights into their relationship with sustainable development

outcomes, which will provide valuable guidance for policymakers and stakeholders seeking to harness the full potential of digital innovation for sustainable development.

Conclusions and Policy Recommendations
Conclusion

Our findings shed light on the interrelationships of various factors and their implications for sustainable development. The correlations between the independent variables and the outcomes of sustainable development reveal intriguing patterns. While higher institutional quality may not guarantee significant improvements, digital innovation and E-Government show potential links to improved sustainable development. ICT exports have a moderately positive correlation, indicating their potential impact on long-term development outcomes. Higher internet user rates, on the other hand, may be associated with lower levels of Sustainable development.

The regression analysis results provide important insights into the relationship between Sustainable Development and various independent variables. According to the findings, the E-Government Index and the IQ-Index have a statistically significant impact on the SDI, with positive and negative coefficients, respectively. As a result, the H1 hypothesis (Institutional quality) is statistically significant at the 99% level but has a negative coefficient, whereas the H3 hypothesis (E-Government index) is accepted at the 99% level and has a significant positive impact on sustainable development. As a result, countries with higher E-Government Index scores are more likely to have improved Sustainable development. Higher IQ-Index scores, on the other hand, may pose difficulties in achieving higher levels of sustainable development.

Furthermore, ICT-Exports have a statistically significant negative influence on the SDI, implying that higher levels of ICT-Exports may result in lower long-term development outcomes. As a result, the H4 hypothesis (ICT exports) is statistically significant at the 95% confidence level but has a negative coefficient. However, the analysis shows that the number of Internet users and Digital Innovations have no statistically significant associations with the SDI, implying that these variables may not have a significant impact on social development levels. The H_2 and H_5 hypotheses are both statistically insignificant.

In the context of sustainable development, our research sheds light on the intricate relationships between institutional quality, E-Government, ICT exports, internet users, and digital innovation. While higher institutional quality does not guarantee significant improvements in sustainable development, it is still an important factor in shaping the development landscape. To create a conducive environment for sustainable development initiatives, policymakers should prioritize efforts to strengthen governance structures, promote transparency, and combat corruption. Furthermore, our research highlights the potential of E-Government to promote transparent governance, social inclusion, and citizen engagement, resulting in improved sustainable development outcomes. However, managing the impact of ICT exports should be done with caution, as our analysis suggests that higher levels may result in poorer sustainable development outcomes. Furthermore, while internet users and digital innovation are important in today's world, our findings show that these factors do not have statistically significant associations with levels of sustainable development. To effectively drive sustainable development, policymakers are encouraged to take a comprehensive approach that integrates various factors and strategies. Finally, these insights can help policymakers and stakeholders advance sustainable development goals in their respective regions.

Policy Recommendations

Policymakers and stakeholders should focus on several key areas to improve sustainable development. To begin, it is critical to prioritize and invest in robust E-Government initiatives that promote transparent governance, social inclusion, and citizen engagement via digital technologies. This can result in better service delivery, greater accountability, and increased public participation. Second, efforts should be made

to improve institutional quality by fortifying governance structures, ensuring the rule of law, and combating corruption. Effective institutions are critical for achieving sustainable development goals and creating a conducive environment for progress. Third, encouraging ICT exports and innovation is critical for driving economic growth and sustainable development outcomes. Encouragement of information communication technology exports, support for innovative startups, and fostering an environment conducive to digital innovation can all have a positive impact on sustainable development. Fourth, closing the digital divide is critical for increasing internet access in underserved areas and empowering citizens to actively participate in sustainable development initiatives.

Furthermore, aligning national policies with the Sustainable Development Goals (SDGs) of the United Nations is critical for collectively addressing global challenges and creating a more sustainable future. Encouraging public-private partnerships can also lead to innovative solutions and hasten progress towards sustainable development goals. Finally, prioritizing inclusive development strategies that take into account the needs of marginalized and vulnerable populations ensures that sustainable development efforts are equitable and leave no one behind, fostering a more sustainable and inclusive future.

References

Ahmed, S. F., Quadeer, A. A., & McKay, M. R. (2020). Preliminary identification of potential vaccine targets for the COVID-19 coronavirus (SARS-CoV-2) based on SARS-CoV immunological studies. Viruses, *12*(3), 254.

Alareeni, B. A., & Hamdan, A. (2020). ESG impact on performance of US S&P 500-listed firms. Corporate Governance: *The International Journal of Business in Society, 20*(7), 1409-1428.

Alhawari, O., Awan, U., Bhutta, M. K. S., & Ülkü, M. A. (2021). Insights from circular economy literature: A review of extant definitions and unravelling paths to future research. *Sustainability, 13*(2), 859.

Alsharafat, M. E. A. (2021). A theoretical discussion of factors affecting the acceptance of M-learning by integrating is success model with Tam model. *Journal of Theoretical and Applied Information Technology, 99*(17), 4213-4259.

Arrow, K. J., Dasgupta, P., & Mäler, K. G. (2003). The genuine savings criterion and the value of population. *Economic theory, 21*, 217-225.

Asi, Y. M., & Williams, C. (2018). The role of digital health in making progress toward Sustainable Development Goal (SDG) 3 in conflict-affected populations. *International journal of medical informatics, 114*, 114-120.

Bartram, J., Brocklehurst, C., Bradley, D., Muller, M., & Evans, B. (2018). Policy review of the means of implementation targets and indicators for the sustainable development goal for water and sanitation. *NPJ Clean Water, 1*(1), 3.

Bekhet, H. A., & Latif, N. W. A. (2018). The impact of technological innovation and governance institution quality on Malaysia's sustainable growth: Evidence from a dynamic relationship. *Technology in Society, 54*, 27-40.

Chen, Y. N., Chen, H. M., Huang, W., & Ching, R. K. (2006). E-government strategies in developed and developing countries: An implementation framework and case study. *Journal of Global Information Management (JGIM), 14*(1), 23-46.

Cunliff, C. (2020). Beyond the energy techlash: The real climate impacts of information technology. Information Technology and Innovation Foundation.

Esses, D., Csete, M. S., & Németh, B. (2021). Sustainability and digital transformation in the Visegrad group of central European countries. *Sustainability, 13*(11), 5833.

Floridi, L., Cowls, J., Beltrametti, M., Chatila, R., Chazerand, P., Dignum, V., ... & Vayena, E. (2018). AI4People— an ethical framework for a good AI society: opportunities, risks, principles, and recommendations. *Minds and machines, 28*, 689-707.

Gajendra, S., Xi, B., & Wang, Q. (2012). E-government: Public participation and ethical issues. *Journal of e-Governance, 35*(4), 195-204.

Godil, D. I., Yu, Z., Sharif, A., Usman, R., & Khan, S. A. R. (2021). Investigate the role of technology innovation and renewable energy in reducing transport sector CO2 emission in China: a path toward sustainable development. *Sustainable Development, 29*(4), 694-707.

Gregurec, I., Tomičić Furjan, M., & Tomičić-Pupek, K. (2021). The impact of COVID-19 on sustainable business models in SMEs. *Sustainability, 13*(3), 1098.

Häikiö, L. (2012). From innovation to convention: Legitimate citizen participation in local governance. *Local government studies, 38*(4), 415-435.

Hanelt, A., Bohnsack, R., Marz, D., & Antunes Marante, C. (2021). A systematic review of the literature on digital transformation: Insights and implications for strategy and organizational change. *Journal of management studies, 58*(5), 1159-1197.

Houghton, J. (2010). Icts and the environment in developing countries: Opportunities and developments. The development dimension ICTs for development improving policy coherence: improving policy coherence, 149.

Imran, S., Alam, K., & Beaumont, N. (2014). Reinterpreting the definition of sustainable development for a more ecocentric reorientation. *Sustainable development, 22*(2), 134-144.

Irimia-Vladu, M. (2014). "Green" electronics: biodegradable and biocompatible materials and devices for sustainable future. *Chemical Society Reviews, 43*(2), 588-610.

Jahanger, A., & Usman, M. (2023). Investigating the role of information and communication technologies, economic growth, and foreign direct investment in the mitigation of ecological damages for achieving sustainable development goals. *Evaluation Review, 47*(4), 653-679.

Jameel, A. S., & Ahmad, M. A. A. (2018). Determine some factors that affect to adoption of e-commerce among small and medium enterprises in Erbil. *Polytechnic Journal, 8*(1).

Jamil, S. (2021). From digital divide to digital inclusion: *Challenges for wide-ranging digitalization in Pakistan. Telecommunications Policy, 45*(8), 102206.

Jones, H. S., Floyd, S., Stangl, A., Bond, V., Hoddinott, G., Pliakas, T., ... & HPTN 071 (PopART) Study Team. (2020). Association between HIV stigma and antiretroviral therapy adherence among adults living with HIV: baseline findings from the HPTN 071 (PopART) trial in Zambia and South Africa. *Tropical Medicine & International Health, 25*(10), 1246-1260.

Kaufmann, D., & Kraay, A. (2008). Governance indicators: where are we, where should we be going?. *The World Bank Research Observer, 23*(1), 1-30.

Kim, C. K. (2014). Anti-corruption initiatives and e-government: a cross-national study. *Public Organization Review, 14*, 385-396.

Kooiman, J. (2003). Societal governance (pp. 229-250). vs Verlag für Sozialwissenschaften.

Kruk, M. E., Kujawski, S., Moyer, C. A., Adanu, R. M., Afsana, K., Cohen, J., ... & Yamey, G. (2016). Next generation maternal health: external shocks and health-system innovations. The Lancet, 388(10057), 2296-2306.

Linkov, I., Trump, B. D., Poinsatte-Jones, K., & Florin, M. V. (2018). Governance strategies for a sustainable digital world. *Sustainability, 10*(2), 440.

Machiba, T. (2011). Eco-innovation for enabling resource efficiency and green growth: development of an analytical framework and preliminary analysis of industry and policy practices. In International economics of resource efficiency: eco-innovation policies for a green economy (pp. 371-394). *Heidelberg: Physica-Verlag HD.*

Markman, G. D., Russo, M., Lumpkin, G. T., Jennings, P. D., & Mair, J. (2016). Entrepreneurship as a platform for pursuing multiple goals: A special issue on sustainability, ethics, and entrepreneurship. *Journal of Management Studies, 53*(5), 673-694.

Milton, S. (2021). Higher education and sustainable development goal 16 in fragile and conflict-affected contexts. *Higher Education, 81*(1), 89-108.

Moshiri, S., & Hayati, S. (2017). Natural resources, institutions quality, and economic growth; a cross-country analysis. *Iranian Economic Review, 21*(3), 661-693.

North, D. C. (1993). Institutions and credible commitment. *Journal of Institutional and Theoretical Economics (JITE)/Zeitschrift für die gesamte Staatswissenschaft,* 11-23.

Obar, J. A., Zube, P., & Lampe, C. (2012). Advocacy 2.0: An analysis of how advocacy groups in the United States perceive and use social media as tools for facilitating civic engagement and collective action. *Journal of information policy, 2,* 1-25.

Othman, M. H., Razali, R., & Nasrudin, M. F. (2020). Key factors for e-government towards sustainable development goals. *International Journal of Advanced Science and Technology, 29*(6), 2864-2876.

Pan, Y., Guan, H., Zhou, S., Wang, Y., Li, Q., Zhu, T., ... & Xia, L. (2020). Initial CT findings and temporal changes

in patients with the novel coronavirus pneumonia (2019-nCoV): a study of 63 patients in Wuhan, *China. European radiology*, 30, 3306-3309.

Prakash, S., Manhart, A., Amoyaw-Osei, Y., & Agyekum, O. O. (2010). Socio-economic assessment and feasibility study on sustainable e-waste management in Ghana. Öko-Institut eV in cooperation with Ghana Environmental Protection Agency (EPA) & Green Advocacy Ghana, Ministry of Housing, Spatial Planning and the Environment, VROM-Inspectorate.

Prichard, W., Custers, A. L., Dom, R., Davenport, S. R., & Roscitt, M. A. (2019). Innovations in tax compliance: Conceptual framework. *World Bank Policy Research Working Paper*, (9032).

Racela, O. C., & Thoumrungroje, A. (2020). Enhancing export performance through proactive export market development capabilities and ICT utilization. *Journal of Global Marketing, 33*(1), 46-63.

Rautela, R., Arya, S., Vishwakarma, S., Lee, J., Kim, K. H., & Kumar, S. (2021). E-waste management and its effects on the environment and human health. *Science of the total environment*, 773, 145623.

Raza, S. A., Qazi, W., Khan, K. A., & Salam, J. (2021). Social isolation and acceptance of the learning management system (LMS) in the time of COVID-19 pandemic: an expansion of the UTAUT model. *Journal of Educational Computing Research, 59*(2), 183-208.

Robinson, J. A., & Acemoglu, D. (2012). Why nations fail: The origins of power, prosperity and poverty (pp. 45-47). *London: Profile*.

Rowshan, S. A., Barzegar, K., & Yaghoubi, M. (2020). Designing a basic model for talent management system. *Public Management Researches, 13*(47), 161-188.

Saez, L. (2012). The South Asian association for regional cooperation (SAARC): An emerging collaboration architecture. Routledge.

Schwertner, K. (2017). Digital transformation of business. *Trakia Journal of Sciences, 15*(1), 388-393.

Senbekov, M., Saliev, T., Bukeyeva, Z., Almabayeva, A., Zhanaliyeva, M., Aitenova, N., ... & Fakhradiyev, I. (2020). The recent progress and applications of digital technologies in healthcare: a review. *International journal of telemedicine and applications, 2020*(1), 8830200.

Sharma, H. B., Vanapalli, K. R., Samal, B., Cheela, V. S., Dubey, B. K., & Bhattacharya, J. (2021). Circular economy approach in solid waste management system to achieve UN-SDGs: Solutions for post-COVID recovery. *Science of the Total Environment*, 800, 149605.

Sørensen, K. (2018). Health literacy: A key attribute for urban settings. In Optimizing health literacy for improved clinical practices (pp. 1-16). IGI Global.

Tietenberg, T., & Lewis, L. (2018). Environmental and natural resource economics. *Routledge.*

Turner-Cmuchal, M., & Aitken, S. (2016). ICT as a tool for supporting inclusive learning opportunities. In Implementing inclusive education: Issues in bridging the policy-practice Gap (Vol. 8, pp. 159-180). *Emerald Group Publishing Limited.*

Ulas, D. (2019). Digital transformation process and SMEs. *Procedia computer science*, 158, 662-671.

Ulucak, R., Danish, & Khan, S. U. D. (2020). Does information and communication technology affect CO2 mitigation under the pathway of sustainable development during the mode of globalization?. *Sustainable Development, 28*(4), 857-867.

Utting, P. (2000). Business responsibility for sustainable development (No. 2). Geneva 2000 Occasional Paper.

Wang, J., Wang, W., Ran, Q., Irfan, M., Ren, S., Yang, X., ... & Ahmad, M. (2022). Analysis of the mechanism of the impact of internet development on green economic growth: evidence from 269 prefecture cities in China. *Environmental Science and Pollution Research*, 1-15.

Weber-Lewerenz, B. (2021). Corporate digital responsibility (CDR) in construction engineering—ethical guidelines for the application of digital transformation and artificial intelligence (AI) in user practice. *SN Applied Sciences*, 3, 1-25.

Wu, J., Guo, S., Huang, H., Liu, W., & Xiang, Y. (2018). Information and communications technologies for sustainable development goals: state-of-the-art, needs and perspectives. *IEEE Communications Surveys & Tutorials, 20*(3), 2389-2406.

Yan, X., Lin, H., & Clarke, A. (2018). Cross-sector social partnerships for social change: The roles of non-governmental organizations. *Sustainability, 10*(2), 558.

Yuan, M. (2021). Geographical information science for the United Nations' 2030 agenda for sustainable development. *International Journal of Geographical Information Science, 35*(1), 1-8.

Zhao, S., Lin, Q., Ran, J., Musa, S. S., Yang, G., Wang, W., ... & Wang, M. H. (2020). Preliminary estimation of the basic reproduction number of novel coronavirus (2019-nCoV) in China, from 2019 to 2020: A data-driven analysis in the early phase of the outbreak. *International journal of infectious diseases, 92*, 214-217.