

# "Effect of Digital Economy on Environmental Sustainability."

### Dr. Praveen Singh Chawahan<sup>1</sup>,Dr. Vinay Chaturvedi<sup>2</sup>, Dr. Akhilesh Kumar Soni<sup>3</sup>

<sup>1</sup> Assistant Professor, Department of Commerce, Govt. College Gairatganj, Raisen, Madhya Pradesh. Email- praveen.schawahan@mp.gov.in

<sup>2</sup> Associate Professor, Faculty of Management Studies, Dr. APJ Abdul Kalam Technical University, Lucknow, Uttar Pradesh.

<sup>3</sup> Assistant Professor, Department of Physics, Govt. College Gairatganj, Raisen, Madhya Pradesh.

#### Abstract-

Sustainable business is a new trend taking place due to environmental degradation caused by human interference particularly due to wrong and traditional business models. Business models that are based on fossil/carbon fuel, paper-based work, physical transactions, etc., all cause greater amounts of carbon emission resulting in water, air, soil, and other types of pollution that negatively affect flora and fauna's health. A ray of hope emerged due to digitalization as it reduces paper-based work and also reduces carbon emission-based non-fossil-based energy consumption. However, there is no relief for those business that uses traditional energy sources as they cause carbon emissions during energy production. However, the tech-based solution has its limitations such as e-waste generation, and greater energy consumption. People need awareness and commitment towards environmental sustainability. Regression analysis has been conducted using SPSS to conclude and an ideal business model is also proposed to be studied later. SWOT analysis has also been done on India's current situation on digitalization and environmental health.

Keywords- Sustainable business model, Digitalization, Green technology.

#### 1. Introduction

Indian government under the leadership of Honourable Prime Minister Shri Narendra Modi India's digital economy has grown significantly. Since 2014 Indian government focused on digitalization through the Digital India campaign internet penetration rate increased which was also followed by the entry of Jio into the telecommunication market boosting data consumption and the entry of Chinese companies' cheap smartphones increased smartphone adoption. This led to the foundation stone for digitalization in India which caused an increase in technological adaptation and change in behaviour from physical/paper-based resource consumption to tech-based resource utilization and consumption.

#### 2. Review of literature

• Tapscott (1996) [1] first proposed the concept of the digital economy and defined it as an economic system formed under the influence of Internet development and e-commerce;



E-ISSN: 2229-7677 • Website: www.ijsat.org • Email: editor@ijsat.org

- Cai et al., (2023) [2] have observed that with the rapid development of the digital economy, the digital transformation of traditional industries and entirely new economic models have played an increasingly significant role in economic development;
- The negative impacts of environmental degradation are further enhanced and continue to erode all aspects of socioeconomic development (Apergis et al., 2018; Awodumi et al., 2020) [3, 4], thus threatening human sustainable development (Kong et al., 2019) [5]; &
- Bayar et al., (2019) [6] found that advancements in modern information technology are expected to reduce carbon dioxide emissions further.

#### **Objective of the study**

- To know the current scenario of digitalization and environmental health in India through SWOT analysis;
- To know the effect of digitalization on the health of the environment empirically through a simple regression model; &
- To frame a hypothetical model for further analysis.

#### **Data Collection**

- Quantitative data analysis based on secondary sources;
- Panel data from 2015 to 2022 is analyzed;
- Simple Regression Model deployed through SPSS v.27.

Process involved in data collection

- Firstly, we have collected data from different sources based on secondary information available over websites;
- As, we have collected different types of data like in % & quantities(volume) of different scales;
- We have normalized it through Excel by using Z-score; and
- Deployed Simple Regression Model through SPSS v.27.

Chart No. 1- Current Scenario of digitalization and environment health in India through SWOT analysis.

E-ISSN: 2229-7677 • Website: www.ijsat.org • Email: editor@ijsat.org



#### Source- Authored.

SWOT analysis is powerful technique to understand the scenario as it describes internal and external environment. As far as current scenario of digitalisation is concerned Indian Government is world's leader in maintaining and creating digital infrastructure. Government through many digital awareness campaigns enhance and reach at almost every district such as digital India Mission (2015), UMANG (2017) a portal for all govt services, digilocker to access digital documents (2015), BharatNet to connect every gram panchayat through internet (2011) etc. This is surely reducing physical rush less carbon emission happens. As far as Weakness is concerned though digitalisation enhance its footprint in India through all the equipment's needs electricity which is generated mostly through coal is cause of concern India has to look upon. In terms of threats, India faces problem of digital divide, data privacy leaks caused financial, mental and psychological frauds, less focus on physical health as everything happen online like gaming etc., thus India needs look into these matters and increase awareness programmes. Lastly, India has ample amount of opportunities to cater sustainable development in respect of green technology development, government policy framework, more research opportunities to work upon.

#### **Result and discussion**

The present study aimed to evaluate the impact of different modes of payment—namely, paperbased payments and digital payments—on the global annual share of CO<sub>2</sub> emissions. A multiple linear regression analysis was conducted using standardized (Z-score) values to assess how significantly these two predictors influenced CO<sub>2</sub> emissions. The results of the regression model, as derived from SPSS output, offer meaningful insights into the relationship between digitalization in financial transactions and environmental sustainability. As we assume that digitalization in form of digital payments reduces carbon emission and paper-based payments increases carbon emission as it required paper which comes from trees. More demand for paper to print money more trees are cut. Thus, increases carbon footprint. Let's check whether this assumption or common belief is true for India or not.

Mathematical Regression Equation



The general form of a multiple linear regression model is:

 $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \epsilon$ 

Where:

- > Y: Dependent variable (Z-score Share of global annual CO<sub>2</sub> emissions, in %)
- ➤ X<sub>1</sub>: Z-score of Total number of digital payments (Currency volume in lakhs)
- X<sub>2</sub>: Z-score of Paper-based payments (Volume in pieces/lakhs)
- >  $\beta_0$ : Intercept (constant)
- >  $\beta_1$ ,  $\beta_2$ : Regression coefficients for X<sub>1</sub> and X<sub>2</sub> respectively
- $\succ$   $\epsilon$ : Error term (residual)

Table No. 1- Calculated ANOVA Table.

#### ANOVA<sup>a</sup>

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	6.341	2	3.170	24.047	.003 <sup>b</sup>
	Residual	.659	5	.132		
	Total	7.000	7			

a. Dependent Variable: Z-score Share of global annual COâ,, emissions in %

b. Predictors: (Constant), Z-score Total no. of digital payments Currency(Volume in lakhs)9, Z-score Paper based payment(volume in pieceslakhs)9

#### Source- Calculated by SPSS.

The ANOVA table shows that the overall regression model is statistically significant (F = 24.047, p = 0.003), indicating that the predictors included in the model have a meaningful combined effect on the dependent variable. This confirms that changes in the volume of both paper-based and digital payments are significantly associated with changes in global CO<sub>2</sub> emission levels.

Table No. 2- Calculated Coefficients.

		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
Model		В	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	006	.128		046	.965		
-	Z-score Paper based payment(volume in pieceslakhs)9	.320	.138	.320	2.314	.069	.986	1.014
	Z-score Total no. of digital payments Currency (Volume in lakhs)9	.934	.138	.934	6.763	.001	.986	1.014

Coefficients<sup>a</sup>

a. Dependent Variable: Z-score Share of global annual COâ,, emissions in %

Source- Calculated by SPSS.



E-ISSN: 2229-7677 • Website: www.ijsat.org • Email: editor@ijsat.org

Delving into the coefficients table, the Z-score of digital payments (B = 0.934, p = 0.001) emerges as a highly significant positive predictor of global CO<sub>2</sub> emissions. This suggests that as the volume of digital payments increases, there is a corresponding rise in CO<sub>2</sub> emissions. This could be attributed to the environmental costs associated with the digital payment ecosystem—such as energy usage in data centres, increased electricity consumption by electronic devices, and maintenance of internet infrastructure. On the other hand, the Z-score of paper-based payments (B = 0.320, p = 0.069) shows only a marginal level of significance. While the coefficient indicates a positive relationship, the effect is weaker and less statistically robust than that of digital payments. This finding is noteworthy because it challenges the common assumption that digital payments are inherently more environmentally sustainable than traditional methods. Thus, more innovation is required to keep lower CO2 emission by increasing digital infrastructure. Furthermore, the low Variance Inflation Factor (VIF = 1.014) for both independent variables confirm the absence of multicollinearity, ensuring that the predictors are independently contributing to the model without redundancy. Let's jumps to know the Model Summary report.

Table No. 3- Calculated Model Summary.

Model Summary"
----------------

					Change Statistics					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change	Durbin- Watson
1	.952 <sup>a</sup>	.906	.868	.3631001160	.906	24.047	2	5	.003	2.602

a. Predictors: (Constant), Z-score Total no. of digital payments Currency(Volume in lakhs)9, Z-score Paper based payment(volume in pieceslakhs)9

b. Dependent Variable: Z-score Share of global annual COâ,, emissions in %

Source- (	Calculated	by	SPSS.
-----------	------------	----	-------

The model summary indicates a high coefficient of determination ( $R^2 = 0.906$ ), suggesting that approximately 90.6% of the variation in global CO<sub>2</sub> emissions can be explained by the combined effect of paper-based and digital payment volumes. The adjusted  $R^2$  value of 0.868 confirms the robustness of the model, while the Durbin-Watson statistic (2.602) indicates that there is no significant autocorrelation in the residuals, affirming the reliability of the model. Overall, the findings imply that while digitalization has revolutionized financial transactions in India and globally, it also carries hidden environmental costs. The positive and significant association between digital payments and CO<sub>2</sub> emissions points to the need for more sustainable and energy-efficient digital infrastructure. Policy makers, fintech companies, and environmental regulators must collaborate to balance technological advancement with environmental responsibility by investing in green technologies, promoting carbon offset programs, and raising awareness about the ecological footprint of digital financial services. Thus, India needs more innovative technology to make digitalization sustainable.

#### **Proposed model**

Chart. 2- Hypothetical model showing the relationship between the effect of the digital economy on the health of the environment for further study.



E-ISSN: 2229-7677 • Website: www.ijsat.org • Email: editor@ijsat.org



Source- Authored.

The proposed research model posits a complex mechanism wherein the digital economy directly impacts the health of the environment, while government efforts mediate this relationship and technological innovation moderates its strength and direction which has been explained as follows-

1. Digital Economy  $\rightarrow$  Environmental Health

Research on the digital economy's environmental effects is mixed. Some studies highlight its green dividends—for instance, ICT-driven improvements in industrial efficiency and energy use (Ozcan et al., 2018; Schulte et al., 2016) [7, 8], along with reduced carbon intensity in OECD nations (Wang et al., 2021) [9]. Other studies warn of rebound effects, whereby digital infrastructure (data centres, devices) increases energy consumption and CO<sub>2</sub> emissions (Park et al., 2018; Sadorsky, 2012) [10, 11]. The result is often a non-linear (inverted U-shaped) relationship: environmental gains up to a threshold, followed by degradation beyond it. This duality is central to the current model.

#### 2. Government Efforts as Mediator

Government interventions—such as regulation, incentives for green tech, and digital ecosystem frameworks—can shape how digitalization affects the environment. Collaborative governance models show that such efforts can turn digital growth into environmental benefits, especially when combined with public engagement. For example, in China, digital economy initiatives led to reduced pollution in provinces where governments increased environmental governance (Liu et al., 2024) [12]. This supports the mediating role of policy interventions: without them, digital expansion may harm the environment; with them, sustainable outcomes are more likely.

#### 3. Technological Innovation as Moderator

Advances in technology (for example green data centres, cloud computing, IoT, AI) can alter the intensity and even the direction of the digital economy's environmental impacts. Opportunities arise when digital



infrastructure is energy-efficient, carbon-neutral, or embedded within circular economy principles. Digital innovation has been shown to accelerate green technology adoption and support carbon performance, especially when coupled with mature digital ecosystems (Lin et al., 2024) [13]. Thus, technology acts as a critical moderator—amplifying either the positive or negative impacts of digital transformation.

Scope of the study-

- Further study can be done by including more variables to get better insights;
- Primary data based on the survey can also be taken and analyzed to see the relationship between the digital economy and the health of the environment; and
- A multiple regression model using a moderator and mediator can also be done to get more information about the relationship between dependent and independent variables mentioned in this research paper.

#### 3. Authors' Biography

**1** Dr. Praveen Singh Chawahan working as Assistant Professor, Department of Commerce, Govt. College Gairatganj District Raisen, Madhya Pradesh has 05.5 years of teaching experience also received PhD degree from Pt. Deen Dayal Upadhyay University Uttar Pradesh. He is also passed UGC JRF and NET examinations. He has published various research papers in journals and proceedings of various conferences and got two best paper presenter awards. Delivered research lectures at Dr Hari Singh Gour Central University, Sagar Madhya Pradesh and Raja Shankar Shah University, Chhindwara, Madhya Pradesh.

2 Dr. Vinay Chaturvedi is working as Associate Professor, Faculty of Management Studies, Dr. APJ Abdul Kalam Technical University, Lucknow, Uttar Pradesh, has published 10 research papers, 15 years of teaching. He has also written one book. Earlier, he worked as an Assistant Professor with Mahatma Gandhi Antarrashtriya Hindi Vishwa Vidyalaya, Wardha during the period of 2016 to 2021. He also served as a Guest Faculty in KNIT, Sultanpur for a period of one year. Besides, he has seven years of teaching experience at Institute of Technology & Management, Gorakhpur. Before taking as a teaching profession, he served in various industries for ten years in the areas of Production Management, Marketing and Human Resource Management. He has published several research papers in national & international journal.

3 Dr. Akhilesh Kumar Soni working as Assistant Professor Physics in the Department of Physics Govt College Gairatganj, has about 05 years of teaching experience. He received PhD degree in Physics from Dr Hari Singh Gour Central University, Sagar Madhya Pradesh. He also received CSIR UGC NET and MP SET certificate. He has published various research papers in journals and proceedings of various conferences. His area of research includes Digital Techniques, Electronics, Plasma Physics, Renewable energy systems and Material Science.

#### **References-**

- 1. Tapscott, D. (1996). The digital economy: Promise and peril in the age of networked intelligence. McGraw-Hill.
- 2. Cai, X., & Niu, Y. (2023). How does the digital economy impact sustainable development? Journal of Cleaner Production, 396, 136396. https://doi.org/10.1016/j.jclepro.2023.136396



E-ISSN: 2229-7677 • Website: <u>www.ijsat.org</u> • Email: editor@ijsat.org

- 3. Apergis, N., & Payne, J. E. (2010). Renewable energy consumption and economic growth: Evidence from a panel of OECD countries. Energy Policy, 38(1), 656–660. https://doi.org/10.1016/j.enpol.2009.09.002
- 4. Awodumi, O. B., & Adewuyi, A. O. (2020). Environmental Pollution, Energy Resource Import, Economic Growth and Financial Development: Theoretical Exploration and Empirical Evidence from Nigeria. International Journal of Environmental Science and Natural Resources, 26(1), 26–36.
- Kong, Y., & Khan, R. (2019). To examine environmental pollution by economic growth and their impact in an environmental Kuznets curve (EKC) among developed and developing countries. PLoS ONE, 14(3), e0209532. https://doi.org/10.1371/journal.pone.0209532
- Bayar, Y., & Gavriletea, M. D. (2019). Energy efficiency, renewable energy, economic growth: Evidence from emerging market economies. Quality & Quantity, 53(4), 2221–2234. https://doi.org/10.1007/s11135-019-00867-9
- Özcan, Burcu & Apergis, Nicholas. (2018). The impact of internet use on air pollution: Evidence from emerging countries. Environmental Science and Pollution Research. 25. 10.1007/s11356-017-0825-1.
- Schulte, P. A., Bhattacharya, A., Butler, C. R., Chun, H. K., Jacklitsch, B., Jacobs, T., Kiefer, M., Lincoln, J., Pendergrass, S., Shire, J., Watson, J., & Wagner, G. R. (2016). Advancing the framework for considering the effects of climate change on worker safety and health. Journal of occupational and environmental hygiene, 13(11), 847–865. https://doi.org/10.1080/15459624.2016.1179388
- 9. Wang, M., Li, Y., Li, J., & Wang, Z. (2021). Green process innovation, green product innovation and its economic performance improvement paths: A survey and structural model. Journal of Environmental Management, 297, 113282. https://doi.org/10.1016/j.jenvman.2021.113282
- Park, Y., Meng, F., & Baloch, M. A. (2018). The effect of ICT, financial development, growth, and trade openness on CO<sub>2</sub> emissions: An empirical analysis. Environmental Science and Pollution Research, 25, 30708–30719. https://doi.org/10.1007/s11356-018-3108-6
- 11. Sadorsky, P. (2012). Information communication technology and electricity consumption in emerging economies. Energy Policy, 48, 130–136. https://doi.org/10.1016/j.enpol.2012.04.064
- Liu, K., & Ma, F. (2024). The impact of the digital economy on environmental pollution: A
  perspective on collaborative governance between government and public. Frontiers in Environmental
  Science, 12, Article 1435714. https://doi.org/10.3389/fenvs.2024.1435714
- 13. Lin, H., & Zhou, L. (2024). Green innovation and carbon emission performance: The role of digital economy. Energy Policy. https://doi.org/10.1016/S0301-4215(24)00364-1