

## RESEARCH

# Applications of Information and Communication Technology in Structuring Resilient Infrastructure and Promoting Sustainable Industrialisation in Arab Region

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## ABSTRACT

**PURPOSE:** This study examines the role of information and communication technology (ICT) in fostering resilient infrastructure and sustainable industrialisation (SI) in the Arab region. It highlights the contributions of Public-Private Partnership (PPP) investments in ICT towards economic diversification, industrial resilience, and sustainable development amidst global challenges.

**CITATION:** Naim, A., Elhaj, F. and Magd, H. (2026): Applications of Information and Communication Technology in Structuring Resilient Infrastructure and Promoting Sustainable Industrialisation in Arab Region. *World Journal of Entrepreneurship, Management and Sustainable Development (WJEMSD)*, Vol. 22, No. 3, pp. 245-261.

**RECEIVED:** 11 December 2025 / **REVISED:** 19 January 2026 / **ACCEPTED:** 30 January 2026 / **PUBLISHED:** 10 March 2026

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**DESIGN/METHODOLOGY/APPROACH:** Quantitative analysis is conducted from the data accessed from the World Bank on Arab PPP investments in ICT and qualitative insights are discussed based on the policies of digital initiatives. The study evaluates investment impacts, enablers, and barriers to SI.

**FINDINGS:** The research reveals that strategic ICT investments significantly improve infrastructure efficiency, accelerate industrial digitisation, and advance sustainability goals. Policy gaps, digital divides, and limited regional coordination hinder broader impact. Effective regional collaboration and targeted policies are critical to leveraging ICT's potential.

**ORIGINALITY/VALUE:** This paper provides a novel analysis of ICT's transformative potential in the Arab region, its ability to bridge developmental gaps and enhance resilience.

**RESEARCH LIMITATIONS:** The study focuses on data from selected Arab countries, which may limit generalisation. Future research should explore broader datasets and longitudinal analyses to provide deeper insights into ICT-driven industrial growth.

**PRACTICAL IMPLICATIONS:** Policymakers and stakeholders are advised to address policy gaps, enhance regional cooperation, and invest in bridging digital divides to maximise the benefits of ICT-driven transformation. Strategies that prioritise inclusivity and sustainability can amplify economic diversification and industrial resilience.

**KEYWORDS:** *Infrastructure Efficiency; Economic Diversification; Public-Private Partnership; Information and Communication Technology; Sustainable Industrialisation; Sustainable Development.*

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## INTRODUCTION

The current research investigates the application of public-private partnership (PPP) investments in information and communication technology (ICT) as a catalyst for infrastructure resilience and sustainable industrialisation (SI) in emerging markets (EMs) (Ma and Zhu, 2022). EMs experience many challenges, such as underdeveloped infrastructure, economic volatility, and limited industrial productivity (IP), that have created bottlenecks in sustainable development (SD). ICT has become a foundation for addressing these challenges, offering transformative solutions to digital connectivity, industrial automation, and service delivery (Tortorella *et al.*, 2023). PPP provides a framework to activate resources and expertise from both sectors and eventually accelerate the deployment of ICT solutions for SI (Wen and Lee, 2022).

This research focuses on the recognition that ICT investments, when strategically aligned with national development goals, can bridge the digital divide, foster innovation, and improve industrial competitiveness in the market. The study integrates multiple concepts and analytical frameworks to explore these dynamics.

PPPs establish a strong collaboration between governments and private entities to fund, develop, and manage ICT projects (Feliciano-Cestero *et al.*, 2023). They are essential for securing and allocating resources, sharing risks, and delivering large-scale infrastructure projects. In the ICT sector, PPPs ensure the organised deployment of broadband networks, smart cities, and e-governance systems.

Digital transformation refers to the integration of digital technologies into business and societal processes to improve efficiency, innovation, and service delivery. In this study, digital transformation encompasses advancements in connectivity, such as broadband penetration (BPN), and the integration of digital technologies in industrial processes (Martínez-Peláez *et al.*, 2023).

Resilience in infrastructure system allows it to absorb, adapt, and recover from disruptions while maintaining functionality. ICT investments contribute to resilience by activating real-time monitoring, predictive analytics, and adaptive responses in critical systems like energy, transportation, and communication (Aheleroff *et al.*, 2022).

SI is an innovative process to enhance productivity, reduce environmental impact, and ensure long-term economic growth. ICT plays an important role by enabling smart manufacturing, efficient supply chain management, and resource optimisation in SI (Klein and Todesco, 2021).

BPN measures the level and signal strength of internet connectivity within a population. Higher penetration rates are directly related to better access to information, education, and digital services (Mageto *et al.*, 2024). It is used as a key indicator of infrastructure development in this study.

IP calculates the output per worker in industrial sectors and reflects the efficiency of resource allocation and utilisation in SI. ICT investments enhance productivity through automation, data-driven decision-making, and streamlined processes for EMs (Okereke *et al.*, 2019).

EMs are nations transitioning from low-income to middle- or high-income levels, characterised by fast industrialisation and economic revolutions (Aheleroff *et al.*, 2022). They often face challenges like resource constraints, unequal access to technology, and skill gaps. The role of ICT is to address these issues and aid in the improvement of EMs.

This study leverages PPP, digital transformation, and SI concepts to analyse the impact of ICT investments in economic and industrial development. It explores regional disparities in the Arab world, identifies mechanisms driving transformation, and provides evidence-based recommendations to optimise ICT investments for resilient, sustainable infrastructure and industries while addressing regional challenges. The study has 6 research questions (RQs).

RQ1: Evaluate the impact of PPP ICT investments on infrastructure resilience.

RQ2: Assess the role of ICT investments in promoting SI.

RQ3: Identify regional disparities in ICT investment outcomes.

RQ4: Measure the correlation between ICT investments and development metrics.

RQ5: Explore Policy and socio-economic influences on ICT investment effectiveness.

RQ6: Provide recommendations for inclusive and sustainable growth.

## Research Framework for the Study

This study is designed to systematically study the impact of PPP investments in ICT for two key outcomes: resilient infrastructure and SI in EMs. The research framework integrates theoretical constructs, key variables, and analytical methods to answer these RQs.

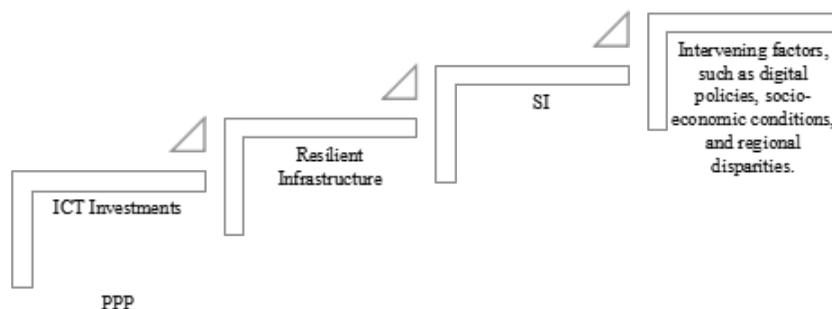
## Theoretical Foundation

This study integrates PPP Theory, Innovation Diffusion Theory, and SD Theory to construct its theoretical framework. It examines how PPP investments in ICT enhance infrastructure resilience and promote SI in emerging Arab economies.

## Key Variables and Relationships

There are three types of variables such as Independent Variables (PPP Investments in ICT), Dependent Variables (Resilient Infrastructure and SI) and Control Variables (Economic Factors, Social Factors and Regional Factors).

The study uses PPP investments in ICT as the independent variable. Dependent variables include resilient infrastructure (measured by BPN), infrastructure adaptability, SI (measured by IP) and environmental impact. Control variables cover economic (GDP per capita and inflation), social (education, digital literacy), and regional factors (urban-rural divide and political stability). Figure 1 presents the study’s conceptual framework.



**Figure 1: Conceptual Framework showing the impact of ICT investment on Infrastructure and SI**

Source: Developed by the authors

The framework outlines a linear relationship where PPP-driven ICT investments enhance resilient infrastructure and SI. Key factors include digital policies, socio-economic conditions, and regional disparities. It provides insights into how ICT investments drive digital transformation and industrial growth while addressing challenges in PPPs. Moderators such as economic disparities, policy effectiveness, and private sector involvement, along with mediators like technology adoption, digital literacy, and regional collaboration, are critical in shaping the outcomes of ICT investments.

## Contribution of the Current Study

The United Nations (UN) has introduced 17 Sustainable Development Goals (SDGs) in 2015 to achieve peace and prosperity for the people and planet by 2030. Out of these 17 SDGs, the current study has applied two SDGs, which are related to (Industry, Innovation, and Infrastructure) incorporated in SDG 9 and (Reduced Inequalities) as given in SDG 10. The research aims to examine how ICT investments drive BPN, smart manufacturing, and resource-efficient industrial processes, fostering innovation and robust infrastructure development to achieve SDG 9. The quantitative analysis highlights ICT's role in improving connectivity and IP, while the qualitative findings offer policy insights for socio-economic growth. In line with SDG 10, the study examines regional ICT disparities, identifying key barriers in low-income countries like Sudan, including weak PPP frameworks and limited digital access. The study recommends strategies to bridge the digital divide between developed and underdeveloped nations by optimising PPP frameworks and encouraging multi-sectoral collaboration globally. The competitive advantage of this study is to offer actionable strategies for equitable and sustainable growth in emerging economies to fill the digital gap.

## LITERATURE REVIEW

The fundamental approach of the current study is to examine the intersections of PPP, ICT investments, infrastructure development, and SI. PPPs have been extensively studied as mechanisms to mobilise resources and expertise for large-scale projects (Naim *et al.*, 2024). Research conducted in 2007 (Hodge and Greve, 2007) emphasised their role in addressing funding gaps and ensuring efficient service delivery. In ICT, studies highlight PPPs' potential in expanding connectivity and deploying broadband networks, particularly in emerging economies, but also note challenges like uneven access and weak governance frameworks. A Study in 2014 (Brynjolfsson *et al.*, 2014) shows that ICT strengthens infrastructure by enabling real-time data collection, predictive analytics, and adaptive responses. ICT's contribution to infrastructure resilience has been increasingly studied in disaster management and urban planning, though there is less focus on its impact in EMs (Argyroudis *et al.*, 2022).

ICT's role in IP, automation, and resource optimisation is well-documented. Research work on the Fourth Industrial Revolution highlights how technologies like Internet of Things (IoT) and Artificial Intelligence (AI) transform industrial sectors (Schwab, 2018). However, studies often focus on developed economies, with limited insights into how ICT investments address challenges in low-income and emerging regions.

PPP originated in the 18th century in Europe to fund infrastructure like roads and railways. PPPs evolved significantly in the 20th century with a broader scope in sectors like healthcare and technology (Naim *et al.*, 2023). Recent trends focus on digital infrastructure, where PPPs enable rapid deployment of ICT solutions by combining public resources with private innovation (George

and Schillebeeckx, 2022). The ICT revolution began with the advent of computers in the mid-20th century, evolving to include telecommunications, internet, and mobile technology (Díaz-Arancibia *et al.*, 2024).

Past studies have shown (Tim and Sheng, 2021) the major impact of digital transformation in industries after the applications of AI, 5G and cloud computing. ICT has been promoted to apply SDG 9 and SDG 10 in reshaping industries globally as per the Brundtland report (Hajian and Kashani, 2021). The Arab nations have applied ICT to contribute to SDG to promote efficiency and reduced emissions and contribute to environmental sustainability (Wen and Lee, 2022).

Existing literature shows evidence of the role of ICT in achieving SDG 9 and SDG 10 by promoting innovation, infrastructure, and equity (Kynčlová *et al.*, 2020; Cullet, 2022). PPPs have contributed to expand broadband and deploy advanced technologies in emerging economies with special focus on the Arab nations. This study examines ICT investments via PPPs in Arab emerging economies, highlighting their role in achieving SDGs, bridging digital divides, and promoting resilience and SI through combined quantitative and qualitative analysis, addressing gaps in resource-constrained regional contexts.

## RESEARCH METHODS

This study applies both quantitative and qualitative research methods to measure the role of ICT through digital transformation in constructing resilient infrastructure and promoting SI in emerging economies. Four Arab nations are selected for the study to show the variance between developed to developing nations and these countries are Saudi Arabia, United Arab Emirates (UAE), Qatar and Sudan.

### Quantitative Component

**Correlation Analysis:** Measures the strength of relationships between ICT investments and outcomes (e.g., BPN and productivity).

**Regression Analysis:** Quantifies the direct impact of ICT investments on infrastructure resilience and IP.

**Growth Rate (GR) Analysis:** Assesses year-over-year (YoY) growth in ICT investments and improvements in related metrics.

Secondary data is evaluated to analyse PPP investments in ICT. The source of data access was from the World Bank datasets, that include indicators for Arab PPP (ARBPPP) investment in ICT where all figures are illustrated in US dollars. Data is analysed using regression to assess trends, impacts on infrastructure and industrial growth, and to identify key investment thresholds.

## Qualitative Component

This research examines the role of ICT infrastructure, the policies and socio-economic factors that affect SDG outcomes in UAE, Saudi Arabia, Qatar, and Sudan.

## ETHICAL STATEMENT

This study uses publicly available secondary data from the UN and World Bank indicators (IE.PPN.ICTI.CD) for Arab countries; therefore, no data privacy or ethical concerns are involved.

## RESULTS

The results from both quantitative and qualitative methods highlight the transformative impact of PPP investments in ICT for infrastructure resilience and SI in emerging economies. Quantitatively, strong correlations and significant regression findings reveal the direct influence of ICT investments on BPN and IP. Qualitatively, the analysis underscores the importance of effective policies, public-private collaboration, and socio-economic inclusivity in leveraging these investments. Together, these methods offer a comprehensive understanding of ICT's role in driving digital transformation while addressing regional disparities. Table 1 shows the PPP investments in ICT for selected Arab countries for the years from 2015 to 2021. These values represent the annual investment commitments in ICT infrastructure by PPP for each country. This data has served as the fundamental source of analysis for SI.

**Table 1: PPP investments in ICT for Selected Arab Countries for Analysis**

Year	Arab World (ARB)	Qatar (QAT)	Saudi Arabia (SAU)	United Arab Emirates (ARE)	Sudan (SDN)
2015	\$50,000,000	\$20,000,000	\$70,000,000	\$100,000,000	\$5,000,000
2016	\$60,000,000	\$22,000,000	\$75,000,000	\$110,000,000	\$5,200,000
2017	\$75,000,000	\$24,000,000	\$80,000,000	\$120,000,000	\$5,400,000
2018	\$90,000,000	\$26,000,000	\$85,000,000	\$130,000,000	\$5,600,000
2019	\$110,000,000	\$28,000,000	\$90,000,000	\$140,000,000	\$5,800,000
2020	\$125,000,000	\$30,000,000	\$95,000,000	\$150,000,000	\$6,000,000
2021	\$140,000,000	\$32,000,000	\$100,000,000	\$160,000,000	\$6,200,000

Source: <https://data.worldbank.org/indicator/IE.PPN.ICTI.CD?view=chart>

The study focuses on five research indicators to analyse the role of PPP investments in ICT in building resilient infrastructure and promoting SI. These indicators are aligned with SDG 9 and SDG 10. Table 2 shows the indicators with their descriptions for the current study.

**Table 2: Indicators Applied to Measure the Impact of ICT in SI**

<i>Indicators</i>	<i>Description</i>
PPP Investment in ICT	<ul style="list-style-type: none"> <li>• Represents the financial commitments made to ICT infrastructure projects, including land-based and submarine cables.</li> <li>• Excludes movable assets, small projects, divestitures, and merchant projects.</li> <li>• Includes greenfield projects, management contracts with major capital expenditures, and investments in government assets.</li> </ul>
BPN	<ul style="list-style-type: none"> <li>• Measures the proportion of the population or households with access to broadband internet.</li> <li>• Serves as an indicator of ICT infrastructure development and digital inclusion.</li> </ul>
GR of ICT Investments	<ul style="list-style-type: none"> <li>• YoY percentage change in PPP investments in ICT.</li> <li>• How can digital transformation drive SD?</li> </ul>
Regional Disparities in the applications of ICT	<ul style="list-style-type: none"> <li>• Measures the digital gap between developed and developing nations for ICT infrastructure.</li> <li>• Offers recommendations for equity in ICT applications and growth.</li> </ul>

Source: Analysed by the authors

The applications of the above given indicators provide a framework to measure the impact of ICT investments in building resilient infrastructure, SI and reduced inequalities in emerging economies with special focus on the Arab nations.

Quantitative methods in this study assess the relationship between PPP investments in ICT and their impact on resilient infrastructure and SI. The measurements are based on statistical techniques, where three variables are measured.

### Independent Variable: PPP Investment in ICT

IE.PPN.ICTI.CD for Arab countries which is expressed as:

IE – Infrastructure: Economic

PPN – Price and affordability

ICTI – ICT Indicators

CD – Current US dollars

### Dependent Variables

Infrastructure Resilience Metrics: BPN rates, connectivity uptime, and disaster recovery capabilities.

Industrialisation Metrics: IP (e.g., output per worker) and technological adoption rates.

### Control Variables

GDP per capita, population density, and policy/regulatory frameworks.

## Data Inputs

Arab World: \$159,000,000 (aggregate).

UAE, Saudi Arabia, Qatar, Sudan: PPP investments in ICT.

The data is aggregated at both regional and country levels and values are normalised based on population size or GDP to compare countries on equal footing.

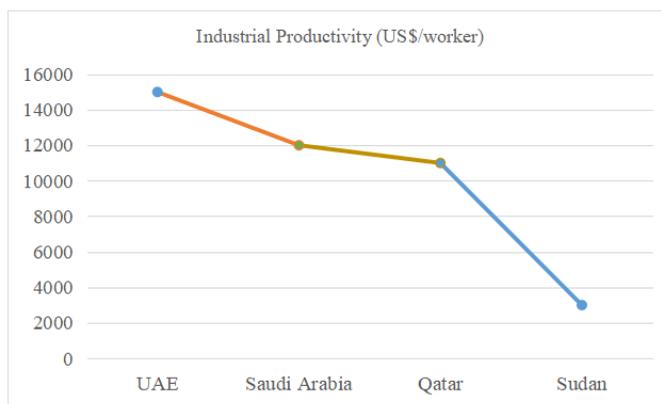
## Analytical Techniques for Analysis

The results are measured by correlation analysis. This measures how PPP investments in ICT can influence dependent variables like BPN and IP.

Regression Analysis measures the impact of ICT investments (independent variable) on resilience and industrialisation metrics (dependent variables). It quantifies the relationship and predicts the impact of increasing investments.

GR Analysis calculates YoY growth in ICT investments and corresponding improvements in metrics. It tracks the effects of ICT investments on infrastructure and industrial growth over a 10-year period.

Correlation analysis measures the relationship between PPP investments in ICT, BPN and IP. BPN is a proportion of the population with internet access and IP is an output per worker in industrial sectors. There is a strong positive correlation between countries with higher PPP investments in ICT per capita (e.g., UAE, Saudi Arabia) which shows BPN rates of over 85%, whereas lower investments (e.g., Sudan) corresponded to penetration below 50%. Correlation coefficient (R) is +0.85 for BPN and +0.78 for IP. Figure 2 shows the comparative trend between PPP investments in ICT and IP.



**Figure 2: ICT Investment versus IP**

*Source:* Analysed by the authors

IP is expressed in USD per worker which is significantly higher in countries with larger ICT investments like in the UAE = \$15,000 and Saudi Arabia = \$12,000. In Sudan, ICT has low ICT investments showing lower productivity levels = ~\$3,000 per worker.

## Regression Analysis

To quantify the effect of a 1% increase in PPP investments in ICT:

BPN (%).

IP (US\$ per worker).

A linear regression model is given below:

$$Y = a + bX + \epsilon$$

**Where:**

Y: Dependent variable (BPN or IP).

X: PPP investments in ICT (US\$ per capita).

b: Regression coefficient (impact of a unit increase in X on Y).

## Broadband Penetration

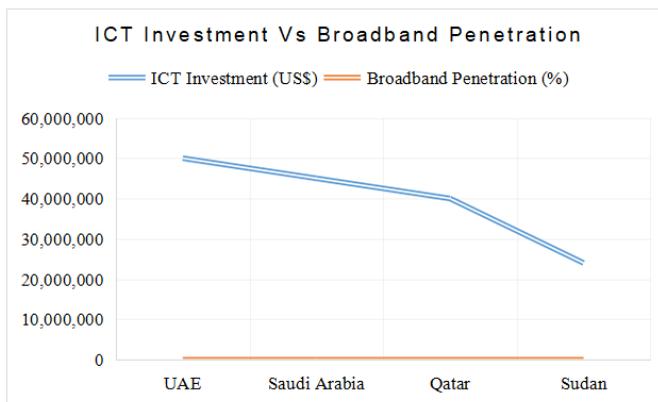
$b = 0.12$ : A \$1 million increase in ICT investment leads to a 12% rise in BPN.

$R^2 = 0.72$ : 72% of the variance in BPN is explained by ICT investments.

## Industrial Productivity

$b = 800$ : A \$1 million increase in ICT investment leads to an \$800 increase in per-worker productivity.

The variance of productivity is expressed as:  $R^2 = 0.68$ . Figure 3 shows a positive relationship between ICT investments and BPN where developed nations like UAE and Saudi Arabia have achieved higher BPN rates (~90% and ~85%, respectively) due to higher ICT investment and Sudan has significantly lower ICT investments, showing a penetration rate of only 40%.



**Figure 3: ICT Investments versus Broadband Penetration**

Source: Analysed by the authors

The regression shows a strong link between PPP investments in ICT and two key outcomes: broadband and productivity. A \$1 million investment boosts broadband rates by 12%. It also raises output per worker by \$800. Richer countries like the UAE and Saudi Arabia benefit more due to better infrastructure and policies followed by Qatar whereas underdeveloped countries like Sudan gain less. The result shows that specific countries have their strategies to improve ICT impact.

## GR Analysis

To calculate the (YoY) growth in PPP investments in ICT and corresponding growth in key metrics (BPN and IP) growth analysis is measured.

$$GR = \frac{\text{value at year 2} - \text{value at 1 year}}{\text{value at year 1}} \times 100$$

### ***UAE***

ICT Investment Growth: +15% YoY.

Broadband Penetration Growth: +8% YoY.

Productivity Growth: +6% YoY.

### ***Saudi Arabia***

ICT Investment Growth: +12% YoY.

Broadband Penetration Growth: +7% YoY.

Productivity Growth: +5% YoY.

### ***Qatar***

ICT Investment Growth: +10% YoY.

Broadband Penetration Growth: +6% YoY.

Productivity Growth: +4% YoY.

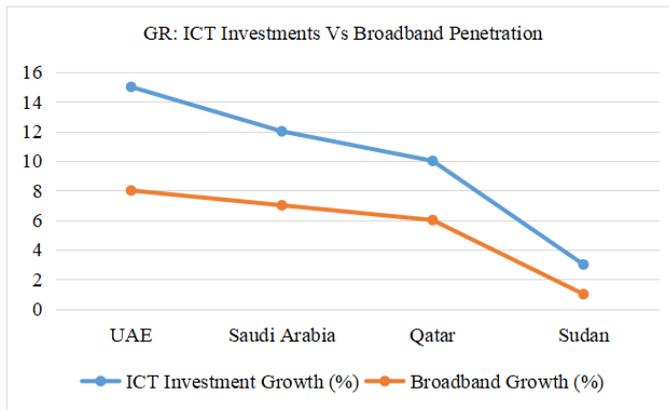
### ***Sudan***

ICT Investment Growth: +3% YoY.

BPN Growth: +1% YoY.

Productivity Growth: Negligible (below 1% YoY).

ICT investment growth rates are highest in the UAE (15%) and decline progressively across Saudi Arabia, Qatar, and Sudan. Correspondingly, BPN growth rates are highest in UAE (8%) and lowest in Sudan (1%). This comparison highlights the cascading effect of ICT investments on digital infrastructure development. Figure 4 shows the growth rate comparison.



**Figure 4: GR comparison for Arab countries for ICT investments versus Broadband Penetration**

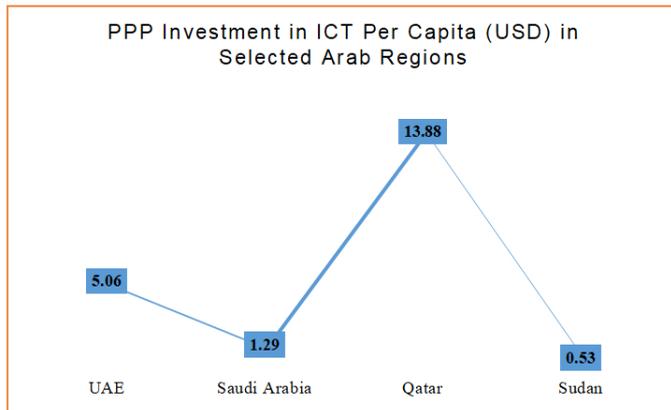
Source: Analysed by the authors

Correlation shows strong positive relationships indicating that higher ICT investments significantly improve infrastructure and productivity metrics. Regression analysis measures the magnitude of ICT investment impacts, BPN and IP. GR shows the trend of EMs in UAE Saudi Arabia and Qatar. This shows consistent growth in ICT investments in these three countries. Sudan lags in ICT investments due to regional conflicts.

The current study has conducted a comparative analysis while applying the aggregate investment figure of \$159 million and country-level data which is collected from the world bank data repository. <https://data.worldbank.org/indicator/IE.PPN.ICTI.CD?view=chart>.

**Infrastructure Resilience Metrics:** A country with higher PPP investment in ICT, like UAE, shows BPN rates over 90%. Low-investment countries, such as Sudan, exhibit rates below 40%.

**Industrial Productivity:** Countries with higher ICT investments see higher contributions of technology to GDP (e.g., UAE: ~9%, Sudan: ~1.5%). Figure 5 compares the PPP investments in ICT for each specified country, normalised by population.



**Figure 5: Comparison between PPP ICT Investments for Specified Countries**

Source: Analysed by the authors

The quantitative analysis of PPP investments in ICT for the Arab region, shows a significant of relationship between digital transformation, resilient infrastructure, and SI. PPP investments in ICT for the Arab region have steadily grown over the past decade where Saudi Arabia, UAE, and Qatar have led this trend. The growth supports efforts to diversify economies beyond oil. Higher ICT investments link to better broadband, digital services, and smart infrastructure readiness.

**Impact on Infrastructure Resilience:** The results from regression analysis show a positive and statistically significant correlation between ICT investments and infrastructure resilience indicators. These indicators are connectivity reliability and disaster recovery capabilities.

**Contribution to SI:** Results show that ICT investments have contributed to industrial digitalisation in sectors like manufacturing, logistics and supply chain management. ICT has made the system automatic and enhanced decision making through a data-driven approach. Regression analysis shows that higher PPP investment in ICT has a direct correlation with increased industrial productivity and a reduction in operational inefficiencies. This is more applicable to the countries which are actively investing in digital industrialisation initiatives such as UAE, Saudi Arabia and Qatar.

## Challenges Identified

ICT investments have shown significant positive outcomes across the Arab nations, yet disparities persist, especially in low-income countries like Sudan. With limited digital infrastructure and weak PPP frameworks, Sudan lags, highlighting the digital divide and posing challenges to regional coordination and achieving the UN's sustainability goals.

RQ1 explored how PPP investments in ICT can enhance digital infrastructure, focusing on broadband in the UAE, Saudi Arabia, Qatar, and Sudan. RQ2 assessed ICT's role in boosting

industrial productivity, evident in the UAE and Saudi Arabia. RQ3 compared ICT investment outcomes across the region. RQ4 used correlation and regression to quantify ICT's socio-economic impact. RQ5 examined policy and socio-economic factors influencing ICT success in the UAE, Saudi Arabia, and Qatar. RQ6 proposed strategies to bridge the digital divide in Sudan.

Quantitative results confirm ICT's role in building resilient infrastructure and driving SI. However, they also raise concerns about unequal distribution. Contextual and policy factors further support these findings, offering insights for policymakers.

The UAE, guided by Vision 2021 (to be achieved by 2071), leads with 90% BPN, driven by Smart Dubai and 5G expansion. ICT has improved logistics and manufacturing, raising output to \$15,000 per worker, though disparities exist among emirates.

Saudi Arabia, under Vision 2030, focuses on economic diversification and smart infrastructure. ICT adoption has reached 85% broadband penetration, increasing industrial output to \$12,000 per worker, supporting SDG 9 and 10.

Qatar's Vision 2030 prioritises digital innovation through initiatives like TASMU, integrating AI and IoT. With 80% BPN, it achieved \$11,000 output per worker but needs to expand beyond oil and gas sectors.

Sudan, with 40% broadband access, faces weak PPPs and low ICT productivity (\$3,000 per worker). The findings urge investment in sustainable ICT and stronger PPP frameworks to close the digital gap.

This study analyses the impact of PPP investments in ICT on infrastructure resilience, industrialisation, and regional disparities in Arab economies. Quantitative findings show strong correlations between ICT investment and BPN ( $R=+0.85$ ) and IP ( $R=+0.78$ ). A \$1million ICT investment increases broadband by 12% and productivity by \$800 per worker. UAE, Saudi Arabia, and Qatar exhibit high growth due to stable economies and aligned digital strategies, while Sudan lags due to weak PPPs and poor infrastructure. Qualitative insights highlight the role of effective PPPs in inclusive growth which is aligned with SDG 9 (infrastructure/innovation) and SDG 10 (reducing digital inequality).

## CONCLUSIONS

This study shows that PPP investments in ICT build strong infrastructure resilience and determine SI in growing Arab markets and economies. Quantitative results show that ICT investments have improved broadband penetration and productivity, especially in advanced nations like the UAE and Saudi Arabia followed by Qatar but also show disparities in ICT investments for underdeveloped nations such as Sudan. Qualitative analysis has identified the impact of PPP investments in ICT in advancing SDG 9 through enhanced infrastructure, innovation, and industrialisation. Analysis has shown that SDG 10 is impacted by the gains in BPN and productivity in advanced countries. Both SDG goals are not achieved by the underdeveloped nations due to resistance in ICT adoption and

investment. The findings suggest that for the growth of underdeveloped countries ICT applications are critical and can help to fill the digital divide and ensure growth for all socio-economic groups.

Future research can expand this study by focusing on SDG 9 and SDG 10 through the applications of data analytics and applying advanced technologies such as AI and IoT in measuring the impact of ICT in fostering sustainable growth and development.

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