**Assessing Digital Infrastructure in Internet Use: A Comparative Study of Southeast Asia and Balkan Region**

**Muhamad Hilman Roselan,**

Universiti Teknologi MARA

Arshad Ayub Graduate Business School.

Shah Alam, 40450

Malaysia

e-mail: hilmanroselan@yahoo.com.my

**Nataša Kovač**

University of Donja Gorica,

Faculty of Applied Sciences

Podgorica, 81000

Montenegro

e-mail: natasa.kovac@udg.edu.me

**Abstract**

*This study investigates the role of digital infrastructure—specifically Internet affordability, quality, and availability—in driving economic growth, with a focus on Southeast Asia and the Balkan Region. Through a comparative analysis of these digital infrastructure indicators, the research evaluates their collective impact on GDP growth in both regions. Additionally, the study assesses which digital infrastructure factor exerts the most significant influence on economic growth within these areas. The analysis emphasizes how technological affordances, such as coverage and affordability, directly influence Internet adoption and usage, while high-quality and reliable connectivity serves as a key driver for increased subscription and engagement. Furthermore, Internet availability is shown to enhance sectors like education and healthcare while reducing societal inequalities. The COVID-19 pandemic has underscored the importance of digital infrastructure, exposing a stark urban-rural digital divide that hinders equitable access to online services. This study compares Southeast Asian countries, including Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam, with Balkan nations such as Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Montenegro, North Macedonia, Romania, Serbia, Slovenia, and Turkey, highlighting the transformative potential of digital infrastructure in emerging markets. Addressing the disparities in digital access and literacy is essential for promoting inclusive socioeconomic development. Bridging this digital divide is critical for ensuring balanced opportunities and contributing to global efforts toward socioeconomic equality.*

**JEL classification**: L 86, R 11

**Keywords**: Internet Use, Internet Affordance, Internet Quality, Internet Availability

1. **Introduction**

 Researchers are increasingly interested in studies on economic growth, as this presents a core challenge for nations. Numerous studies have explored the determinants of economic growth by analyzing various influencing indicators, providing a comprehensive understanding of the factors involved. Lately, there's a growing interest among researchers in exploring the digital economy and e-commerce transactions, alongside their impacts on economic growth (Toska & Fetai, 2023). In the traditional economy, suppliers held the power. However, in the Internet economy, this power has shifted to customers. These customers, armed with easier access to information and the ability to voice their opinions, can hold businesses accountable if their demands are not met (Jashari-Mani & Zeqiri, 2023). Social media usage has facilitated this shift, as it is utilized not only by customers but also by businesses to better connect, communicate, and exchange information with their audiences (Kwon & Wen, 2010).

The increasing importance of digital infrastructure in today’s global economy cannot be overstated. As more countries aim to integrate digital technologies into their economies, understanding the role of Internet infrastructure becomes essential for policymakers and economists alike. In both developed and developing regions, Internet affordability, quality, and availability are seen as critical factors that can significantly influence economic growth. These factors impact productivity, access to markets, innovation, and overall economic performance. However, the effects of digital infrastructure on economic outcomes may vary across regions with differing levels of development, geographical characteristics, and policy environments. This study aims to provide a comprehensive analysis of how these three pillars of digital infrastructure affordability, quality, and availability affect GDP growth in two distinct regions of Southeast Asia and the Balkan Region. Melgaço (2021) highlights that regions with robust Internet infrastructure have the potential to attract socio-economic activities. Marler (2018) supports this by stating that individuals and organizations with Internet access are more empowered and better positioned to engage in the global economy, thereby enhancing their socio-economic status. A significant example of this demand is the Sustainable Development Goals Indicators – a framework established by the United Nations Statistics Division to monitor and evaluate progress in 17 different areas of human living conditions. This framework demonstrates how countries worldwide measure over 150 indicators to track their progress in various fields, underscoring the importance of data and statistics in this context. According to Andrés et. al., (2010) recent studies have found a correlation between Gross Domestic Product (GDP) and Internet adoption levels by region. The interaction between the Internet and key dimensions of development was examined by Madon (2000) and some conclusions were derived for government intervention, including the important role of intermediary institutions in linking the local to the global development’s goals. The empirical work that was conducted using panel data for the Association of Southeast Asian Nations (ASEAN) from 1998–2011 suggests that broadband penetration has a significantly positive relationship with GDP growth (Ng et al., 2013).

The Internet and its associated technologies are becoming more widely used worldwide. Over the past decades, Internet use has grown exponentially among all age groups. Currently, there are 4.66 billion active Internet users globally, making up 60% of the global population, with the highest number of online users originating from Asia (World Bank, 2022). This trend became even more pronounced during the COVID-19 pandemic (Masaeli & Farhadi, 2021). Compared to 2019, global GDP fell by as much as 3.63%, and that fall was greater than in 2009 when it amounted to 1.3% (World Bank, 2020). The developing countries were the most severely affected, with a drop of over 6.5% (Maliszewska *et al*., 2020). The Internet revolution and the rapid development of technology have transformed many developed countries into digital powerhouses. Digitization has become a key factor in these countries' prosperity and progress. This digital standard has prompted numerous countries to follow in the footsteps of developed nations, aiming to digitize their actions and organizations. For instance, the Malaysian Communications and Multimedia Commission (MCMC) reported that 87.4% of the Malaysian population were Internet users in 2018, up from 76.9% in 2016. This significant increase underscores the global trend towards greater Internet penetration and utilization (MCMC, 2018).

The advent of the Internet revolution, coupled with remarkable technological advancements, has indeed positioned most developed countries as digital powerhouses. In these nations, digitization is not just an economic strategy but a fundamental pillar of both individual and collective progress (Karras, 2023). This digital benchmark, synonymous with prosperity, has created a domino effect, as countries worldwide strive to replicate the success of their more digitized, mature counterparts (Broz et al., 2022). As countries across the globe continue to embrace digitization, the interplay between technology and economic growth becomes increasingly evident. The digital economy not only enhances efficiency and connectivity but also opens new avenues for innovation and development. This global shift towards a more digitized world is reshaping traditional economic models and creating a more interconnected and dynamic global economy.

Today, the Internet has become an important part of our lives in every field with the developments in technology ([Sevinç & Taş, 2020](https://www-sciencedirect-com.uitm.idm.oclc.org/science/article/pii/S0883941722001534%22%20%5Cl%20%22bb0170)). It is obvious that modern people meet their information needs, and carry out activities such as communication, entertainment, daily work, financial affairs and meetings on the Internet easily ([Buneviciene & Bunevicius, 2021](https://www-sciencedirect-com.uitm.idm.oclc.org/science/article/pii/S0883941722001534%22%20%5Cl%20%22bb0065)). The advancement and proliferation of the Internet and advanced technology, such as mobile technology, virtual reality, big data, artificial intelligence and the Internet of Things (IoT) have connected consumers, suppliers, businesses, regulators, devices, data and processes across sectors and countries (Ha & Chuah, 2023). According to the *Digital 2022 Global Overview Report: The Essential Guide to the World's Connected Behaviours* published by [We are Social and Hootsuite (2022)](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref049), among the 7.91 billion of the world population, 67.1% are mobile phone users, 62.5% are Internet users, and 58.4% are active social media users. In SEA, the Internet penetration rate is 75.6% with over 400 million Internet users in most SEA countries except Laos, Myanmar and Timor-Leste ([von Kameke, 2023](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref048)).

The growth of Internet users is also evident in the EU region, with the most notable progress observed in the Balkan region. These countries have begun to take serious and rapid steps toward developing a knowledge and information economy and digitizing their economies and societies, akin to the European Union's more developed nations (Apostu et al., 2023). Although not all Balkan countries are currently EU member states, such as Kosovo, Montenegro, North Macedonia, and Serbia, they are making significant strides. The Balkans region can offer new insights into the role of economic globalization in structural change due to their implemented comprehensive policies to revamp their economy after facing political and economic turmoil. Moreover, most of these countries aspire to be a part of the EU and have therefore adopted various reforms to align their economies with globalization and establish a market-based economy. These countries are currently in a transitional phase, which makes it important to analyse the relationship between economic globalization and structural changes in this region (Cengiz & Manga, 2023).

This study seeks to compare the digital infrastructure indicators between Southeast Asia and the Balkan Region and evaluate their collective impact on economic growth. These two regions are chosen due to their contrasting levels of economic development and digital penetration, which offers a unique opportunity to investigate how similar factors influence growth in different contexts. Furthermore, this study aims to identify which component of digital infrastructure has the most significant influence on economic growth in each region. By answering these questions, the study provides valuable insights into the role of digital infrastructure in fostering economic development and offers guidance for policymakers to prioritize investments in areas that can maximize economic benefits. The objectives of this research are twofold: first, to conduct a comparative analysis of the three key digital infrastructure indicators such as Internet affordability, quality, and availability and their collective influence on economic growth in Southeast Asia versus the Balkan Region. Second, to evaluate the specific contribution of each digital infrastructure component to GDP growth, thus identifying which factor has the greatest potential to drive economic expansion in these regions. This study will contribute to the broader literature by providing empirical evidence on the economic significance of digital infrastructure, while also offering policy recommendations tailored to the unique challenges and opportunities within Southeast Asia and the Balkan Region.

**2. Literature Review**

The rapid development of digital technologies, including the Internet of Things, cloud computing, and big data, has made it imperative for manufacturing enterprises to undergo digital transformation to achieve high-quality development (Li et al., 2018). This section presents a brief review of the literature on how the Internet affects economic development. Few studies have explored multiple impacts within a single community over time to understand the impacts of improved Internet for example at a regional level by Palmer-Abbs et al. (2021). Economic and social outcomes include impacts that allow participants to increase their earning potential and engage in economic development activities (Valentín-Sívico et al., 2023). In particular, social impacts aim to reduce social inequities (e. g., health, education, employment) (Tomer et al., 2020). These effects were consistently observed even before schools were forced to move online due to COVID. Digital transformation has facilitated business recovery after the COVID-19 pandemic. Due to the disruption of the COVID-19 pandemic across the globe, the process of digitalisation has been accelerated in all sectors of the economy ([Kochetkov et al., 2021](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html%22%20%5Cl%20%22ref028)), played a critical role in crisis recovery ([Banga & te Velde, 2020](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref007)), and had great impacts on individuals, businesses and society ([Schneider & Kokshagina, 2021](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref039)).

However, those without access to a reliable and robust Internet connection cannot participate in virtual school options (Kelley & Sisneros, 2020). In the context of healthcare, Internet access enables patient-centred care, which uses health information technologies (Sun et al., 2013). For example, people in rural areas with poor Internet access know that it should be easier to access the Internet to take advantage of entertainment options and have information readily available at their fingertips. This frustration can have ripple effects, such as challenges in recruiting and retaining teachers and doctors in rural areas (Valentín-Sívico et al., 2022). Internet access is also associated with mental health benefits, such as social connectivity, emotional support, and reduced isolation (Kearns & Whitley, 2019). A study by Dao (2017) with a sample of 150 developing and developed countries was used, and the results shown that Internet use is influenced by Internet quality, Internet affordability, and Internet application.

***2.1 Economic Landscape of Southeast Asia and Balkan Region***

The eleven countries in Southeast Asia (SEA), namely Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, the Philippines, Singapore, Timor Leste, Thailand and Vietnam, have different political regimes and different levels of socio-cultural development. While these countries have different economic structures, development, growth rates and patterns, most of them put effort into embarking on the digital transformation journey that is expected to contribute to the development of their economies. The nations of Southeast Asia contain 661 million people (in 2019), or 8.6% of the world's population ([World Bank, 2021](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/FREP-03-2021-0021/full/html#ref011)). Indonesia alone is the world's fourth-largest country in terms of population, but outside the region, little attention has been paid to Southeast Asia's experience of economic development. This is to be regretted because the region shares many of the historical characteristics of other parts of the developing world in ways that the much better-known experience of Northeast Asia (Japan, Korea, Taiwan, and Taiwan and Hong Kong in Greater China) does not. Malaysia in 2019 remained by far the richest country after Singapore, Thailand had risen to third place and the Philippines had fallen to fourth place, only slightly ahead of Vietnam and Laos. Myanmar has risen above Indonesia and Cambodia if the figures can be believed since its economic data are suspect (Perkins, 2021).

The economies of Southeast Asia are diverse, with countries like Singapore and Malaysia exhibiting high levels of economic development and advanced infrastructure, while others like Cambodia and Laos are still developing. Key sectors driving growth across the region include manufacturing, services, agriculture, and increasingly, the digital economy. According to the [International Monetary Fund (IMF) (2018)](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref026), there is a correlation between the gross domestic product (GDP) per capita and the usage of the digitalization index (UDI) (2016), i.e. the higher the GDP per capita is, the higher the usage digitalisation index. Singapore has the highest UDI, followed by Malaysia, Thailand, the Philippines and Vietnam. Myanmar has the lowest UDI, whereas Indonesia, Cambodia and Laos are in between these two groups. In terms of the ICT value-added volumes as a proportion of GDP, there is a significant difference among SEA countries, ranging from 0.7% to 5.4% ([Monetary Authority of Singapore, 2018](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref033)). Malaysia and Singapore have a high level of ICT development, followed by Indonesia and the Philippines. The ICT investment in ASEAN countries also reached more than US$100 billion in 2014, and this volume increases by about 15% every year ([AT Kearney, 2020](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref006); [Monetary Authority of Singapore, 2018](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref033)). Countries such as Vietnam and Indonesia have become major manufacturing hubs, attracting substantial foreign direct investment (FDI) due to their favourable business environments and competitive labour costs.

The Balkan region, comprising a diverse array of countries in Southeastern Europe, has undergone significant economic transformation over the past few decades (Kovac et al., 2024). The Balkan countries, a crucial region on the European continent, despite historical challenges such as political instability and economic fragmentation that led the Balkan region to fall behind Western Europe economically over the past 30 years due to their national strategies and financial constraints (Ndou et al., 2019). However, many view digital transformation as an opportunity to catch up and realize their potential (Hawach et al., 2022). The Digital Agenda for Europe 2020-2030 aims to improve digital skills, infrastructure, and the availability of electronic public services for all (EC website, 2023). To support the digital transition across the entire European region, the EU launched the Digital Agenda for the Western Balkans in 2018, encouraging research and innovation and strengthening digital infrastructure, the digital economy, and society (EC press release, 2018). The bold steps taken by the Balkan States towards addressing political issues have also spurred economic and banking integration, as well as advancements in digital infrastructure and individual digital knowledge, aligning with European Union standards (Boshkov et al., 2023). This commitment to digital transformation is seen as a pivotal move for the Balkan States. It not only aims to modernize their economies but also to foster greater integration with the broader European economic and digital landscape. Enhanced digital skills and infrastructure are expected to lead to more efficient public services, better connectivity, and a more competitive market. These changes are likely to attract investment and create new opportunities for growth and development in the region. Moreover, the digital agenda emphasizes the importance of digital literacy, ensuring that citizens are well-equipped to participate in the digital economy.

The digital economy is a critical driver of growth and innovation in Southeast Asia and the Balkan region. All the data for this research were collected from the Overcoming Digital Divide in Europe and Southeast Asia (ODDEA) dataset that is available from Zenedo (Přívara, 2024). Effective strategic planning and government support are essential for harnessing the benefits of the digital revolution. Each country in the study is making significant strides in integrating advanced technologies and implementing government initiatives to foster digital transformation. While Internet penetration rates are high, each country faces unique challenges, such as ensuring digital inclusion, addressing cybersecurity concerns, and overcoming the digital divide between urban and rural areas. Continued focus on these areas will be essential for sustaining and enhancing their digital economies in the future. The journey of these nations underscores the transformative power of technology in reshaping economies in the digital age.

***2.2 GDP Growth Rate of Southeast Asia and Balkan Region***

The GDP per capita growth (annual %) serves as a critical indicator of economic performance and living standards over time. In this study, GDP per capita growth (annual %) is used as the dependent variable. This measure reflects the annual percentage change in GDP per capita, providing a per-person perspective on economic growth. It is particularly useful for comparing economic growth across countries with varying population sizes and understanding how improvements in digital infrastructure translate to economic growth experienced by the average individual. By focusing on GDP per capita growth, this study aims to provide a nuanced view of the impact of Internet affordability, Internet quality, and overall availability of Internet services on economic development in Southeast Asia and the Balkan region from 2010 to 2022. Understanding these growth rates provides insights into the economic trajectories and development patterns within these nations.

On the basis of data from the World Bank ([2023](https://www-sciencedirect-com.uitm.idm.oclc.org/science/article/pii/S1757780224001574#rsp312709-bib-0088)), the services sector makes up the most significant portion of the GDP, at 52.2%. Gnangnon and Iyer (2018) show that increasing Internet usage should improve countries’ integration into the world trade in the commercial services market. ASEAN continues to face problems in translating into reality the concepts of a people-centred community, as set out in the ASEAN vision 2020-2025. The AEC represents a significant milestone for regional economic integration and is expected to boost the region’s GDP by 5 per cent by 2030 ([Chia, 2017](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/MEDAR-04-2019-0476/full/html#ref012)). The path for the ASEAN vision 2020-2025 has been established to ensure the continuation of the integration process over the next ten years by adopting the Kuala Lumpur Declaration on “SEAN 2025: Forging Ahead Together” which sets targets to be met by 2025 ([Adhariani,](https://www-emerald-com.uitm.idm.oclc.org/insight/search?q=Desi%20Adhariani) 2020). According to the draft *ASEAN Cybersecurity Cooperation Strategy* (2021–2025) report by the ASEAN Secretariat (2021), the rapid adoption of digitalisation has facilitated the development of the digital economy in the region, but it has also posed new and novel challenges.

Malaysia had the slowest GDP per capita growth rate of the three countries that avoided long-stagnant periods. Nevertheless, Malaysia still achieved more than a ninefold increase in per capita with-it steady GDP per capita growth over the past decade. The country’s diversified economy, driven by manufacturing, services, and a robust digital sector, has supported consistent economic expansion. From 2010 to 2023, Malaysia's GDP per capita growth rate averaged around 3.1% annually (World Bank, 2023). This growth is attributed to strategic government policies, substantial investments in infrastructure, and a favourable business environment. Thailand grew over elevenfold, but it had started with only half the per capita income of Malaysia and so had only caught up to 65% of Malaysia's per capita GDP (Perkin, 2021). The Philippines had slower growth than most other countries during the 20th century and also had two decades of no growth. As a result, Philippine GDP per capita – almost equal to that of Malaysia in 1960 – fell to less than one-third of Malaysian GDP by 2019. The Balkan annual average growth rate has been 2.3% since 2010. However, this is lower than the period's growth rate, spanning 2001–2008 with 5.8% (Cengiz & Manga, 2023).

The GDP per capita growth rates of Southeast Asia and the Balkan region countries from 2010 to 2023 highlight diverse economic trajectories and development patterns. While some countries have achieved robust growth through strategic investments and economic reforms, others face ongoing challenges that hinder faster development. Understanding these growth rates provides valuable insights into the economic performance and potential of these nations, underscoring the importance of digital infrastructure and strategic planning in driving future economic growth.

Table 1 summarizes the GDP per capita growth rates (annual %) for Southeast Asia and Balkan region countries from 2010 to 2023. These growth rates provide insights into the economic performance and development patterns within these nations. Understanding these growth rates is crucial for comprehending the economic dynamics of Southeast Asia and the Balkan region, particularly in the context of their digital infrastructure development and overall economic performance.

Table 1: Average GDP per Capita Growth (Annual %) 2010-2023

|  |  |
| --- | --- |
| **Country** | **GDP per Capita Growth**  |
| Albania | 3.32% |
| Bosnia and Herzegovina | 3.69% |
| Brunei | -0.75% |
| Bulgaria | 3.25% |
| Cambodia | 4.42% |
| Croatia | 2.73% |
| Greece | -0.51% |
| Indonesia | 3.67% |
| Laos | 4.37% |
| Malaysia | 3.10% |
| Montenegro | 2.81% |
| Myanmar | 3.13% |
| North Macedonia | 2.67% |
| Philippines | 3.51% |
| Romania | 3.30% |
| Serbia | 2.98% |
| Singapore | 3.10% |
| Slovenia | 1.68% |
| Thailand | 2.17% |
| Timor Leste | 2.19% |
| Türkiye (Turkey) | 4.58% |
| Vietnam | 5.02% |

Sources: World Bank (2023)

***2.3 Internet Affordance (purchase / subscription)***

Infrastructure development is a topic of paramount interest regarding national, regional and local economic growth. Infrastructure plays a vital role in enabling economic activities in the first place ([Daido & Tabata, 2013](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/JED-10-2022-0199/full/html#ref015)). In developing countries, infrastructure investments are expanding dramatically to boost economic growth and reduce poverty. For instance, Southeast Asia is one of the regions in the world advancing the fastest, both in terms of infrastructure and economic development, and countries in this region, such as Thailand and Vietnam, have experienced rapid economic growth in the last decades ([World Bank, 2021](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/JED-10-2022-0199/full/html#ref054)).

In communication theory, affordances, ironically, most frequently refer to what users and their sociality get from a technology (Nagy & Neff, 2015). In the field of management information systems, the concept of technological affordances refers to the potential actions that technological tools provide for actors to help them achieve expected goals (Markus, 2008). Since then, technological affordances have gradually been applied to various research topics in the information system field, from adoption and use to analysing the impact of technological tools on organizational behaviour, structure, and change, providing a new perspective for explaining how actors can effectively utilize technological tools to realize expected goals (Leonardi, 2011). The concept of technological affordances plays a crucial role in assisting scholars in developing theories related to the utilization of technological tools (Seidel et al., 2013). According to Gibson (1979), technological affordances are the qualities or properties of a technology that enable certain actions by users. These affordances emerge from the interaction between the user's capabilities and the technological features. Affordances arise from the interaction between humans and technological tools, rather than being inherent properties of the tools themselves. Technological tools do not possess inherent affordances; instead, affordances emerge when behavioural agents utilize the properties of tools to achieve specific goals (Volkoff & Strong, 2013). This distinction is made between technological affordances and their actualization as separate concepts. Affordances represent the potential to achieve goals and are possibilities for realization relative to those goals. Actualizing affordances requires behavioural agents to possess certain capabilities and engage in practical actions (Lehrer et al., 2018).

Affordances can include the expectations and beliefs of users, whether or not they are “true” or “right.” Affordances can and should be defined to include properties of technologies that are “imagined” by users, by their fears, their expectations, and their uses, as well as by those of the designers that will lead to purchase or subscription (Nagy & Neff, 2015). Subscription intention refers to the likelihood of purchasing a given product or service by a consumer (Menon, 2022) for some time as specified by the manufacturer or service provider. Once the specific period is over, consumers have to subscribe or activate the service again by paying the specified subscription fees. Subscription intention often depends upon the consumer’s pre-purchase satisfaction (Kaur et al., 2020). In the present study, the subscription intentions of online streaming platforms were investigated. Recent research has shown that slower Internet speeds may be the result of homes subscribing to slower-speed plans despite the availability of faster Internet plans and not necessarily poor access (Paul et al., 2022). Because of this, using simple speed availability as a proxy for end-user speed is somewhat problematic.

Internet affordability is a vital component of digital infrastructure that influences the level of Internet access and usage within a country. The literature highlights the importance of affordable Internet services, including fixed broadband and mobile broadband, in promoting digital inclusion and economic development. By examining the costs of various Internet service plans, this study aims to provide a comprehensive analysis of Internet affordability in Southeast Asia and the Balkan region, offering insights into the effectiveness of current policies and potential areas for improvement. Ensuring affordable Internet access for all remains a key challenge and priority for policymakers striving to bridge the digital divide and harness the full potential of the digital economy.

Fixed broadband affordability is a key determinant of Internet access in households. Studies have shown that lower costs for fixed broadband services are associated with higher adoption rates and increased Internet usage (OECD, 2020). The subscription of Fixed Broadband and Mobile subscription provides a standardized measure to compare broadband and mobile affordability across different countries. According to the International Telecommunication Union (ITU, 2021), countries with more affordable fixed broadband services tend to have higher levels of digital inclusion and economic development. For example, in Malaysia, proactive government policies and competitive market conditions have led to relatively affordable fixed broadband services, contributing to high Internet penetration rates (MCMC, 2022).

The affordability of combined mobile data and voice services, particularly for low-consumption users, is essential for ensuring that basic Internet and communication services are accessible to all. The Mobile Data and Voice Low-Consumption Basket (70min+20sms+500MB) in United States Dollar (USD) provides a measure of the cost of basic mobile services. This can be refers to a standardized package of mobile services that includes 70 minutes of voice calls, 20 SMS (text messages), and 500 MB of mobile data. This basket serves as a benchmark to assess the affordability of basic mobile services across different regions or countries. Lower costs in this category can lead to higher adoption rates among low-income and rural populations, who may otherwise be excluded from the digital economy (A4AI, 2021). In Greece, policy initiatives aimed at reducing the cost of basic mobile services have been successful in increasing mobile Internet penetration, particularly in underserved areas (European Commission, 2023).

For high-consumption users, the affordability of extensive mobile data and voice services is important for supporting advanced digital activities such as streaming, online education, and remote work. The cost of a Mobile Data and Voice High-Consumption Basket (140min+70sms+2GB) in USD reflects the affordability of comprehensive mobile services. Studies have shown that affordable high-consumption plans are associated with greater digital engagement and productivity (ITU, 2020). Research by the International Telecommunication Union (ITU, 2021) underscores the importance of making high-consumption mobile data plans affordable to drive economic development. It highlights that countries with more affordable high-consumption mobile data plans tend to experience higher levels of innovation, as businesses and individuals can leverage robust digital services for various applications, from e-commerce to telemedicine.

***2.4 Internet Quality (Speed)***

Internet price is an increasing but concave function of speed. That is, although higher speeds cost more, at higher speeds, it costs less to increase speed (Rabbani, 2023). The Speedtest Global Index, which tracks countries’ Internet speeds and the overall global median Internet speeds, reveals that Internet connectivity continues to speed ahead for people around the world, especially as countries prioritize and improve mobile and hardwire broadband networks. Mobile download speed went up nearly 17% over the last year globally (November 2021–November 2022), and fixed broadband increased by at least 28% Median Country Speeds (2023). Internet speed differs not only by country, city, level of infrastructure, or socioeconomic development. Other differentiating factors include the natural environment, geography, and the urban-rural divide (Król & Wojciech, 2023). Local governments in every country led to an increase in the population with Internet access, the Internet traffic demand leads to many of the networks failing to ensure a basic quality of service necessary to run simple applications, not to mention more advanced ones, such as video chats, fintech services (Friedline et al., 2020) or the Internet of Things (IoT) (Johnson et al, 2011) in agricultural production (I Solodovnik et al., 2021).

Short-term dynamics reveal that in areas of different densities, speeds can fall dramatically during peak hours, thus influencing the availability of services. Disparities in access and performance pose a significant problem in light of Internet use becoming increasingly ubiquitous in everyday lives. Such inequalities evoke social and economic disadvantages at local and national scales (Riddlesden & Singleton, 2014). According to Ioannou et al. (2020), the deployment of high-speed broadband access networks in rural Europe lagged far behind the urban and suburban areas, especially due to difficulties with fibre rollout in the final meters. Fixed Wireless Access (FWA) networks based on Long Term Evolution (LTE) technology can be used as a last-mile solution to provide high-speed broadband access to areas where fixed broadband is limited (Ioannou et al., 2020).

Studies have shown that countries with a higher proportion of high-speed broadband subscriptions tend to have more advanced digital economies and higher levels of digital engagement (OECD, 2020). In Malaysia, the government has invested heavily in upgrading broadband infrastructure to ensure that a significant portion of the population has access to high-speed Internet. As a result, the percentage of fixed broadband subscriptions with speeds greater than 10 Mbit/s has increased steadily (MCMC, 2022). Similar trends are observed in the Balkan region, where countries like Bulgaria and Romania have prioritized the expansion of high-speed broadband networks to support economic growth and digital inclusion (European Commission, 2023).

The first challenge faced by SEA countries is the digital divide among different groups of people within a country, and between the developing and the developed countries in the SEA region, for example, the broadband Internet speed in different countries ([Speedtest, 2023)](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html%22%20%5Cl%20%22ref060). Furthermore, the percentage of the population who use the Internet in Cambodia, Laos and Myanmar is much smaller (50%) than those in Singapore, Thailand and Malaysia (80%) ([Kaushik, 2019](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref027)). Within a country, there are various variables of the digital divide due to age, level of IT literacy, level of income, skills, access to the Internet, etc. However, from a positive perspective, there is potential for those who do not have access to the Internet or who do not engage in the online marketplace to embark on the wave of digital transformation to reap the benefits of digitalisation and the digital revolution.

According to The Edge (2023), Malaysia has Internet quality with its fixed broadband averaging 133 Megabits per second (Mbps) in Malaysia while the world’s fastest fixed Internet, Singapore’s, was 300Mbps. Malaysia is left behind even though the Internet has been introduced to these countries at a similar period (Tokiran et al., 2021). Internet usage patterns in Malaysia have now reached about 588 Gigabits per second (Gbps) at their peak, compared with about 500Gbps before the movement control order was imposed in March to address the pandemic (Supramani, 2020). Serbia has cultivated a strategic partnership in telecommunications with Chinese companies since 2017, when the government and the Chinese firm Huawei signed two non binding agreements concerning “smart cities” and the development of broadband Internet service. The relationship forms part of Beijing’s plan for a Chinese-led “digital silk road,” for which Serbia would be a European hub (Aleksandar, 2020). Lastly, Croatia, ranked 84th, has fluctuating download speeds but a general upward trend, with steadily increasing upload speeds and stable latency.

**International Bandwidth per Internet User**

International bandwidth per Internet user is a measure of the total capacity of a country's Internet infrastructure to handle international data traffic, divided by the number of Internet users. This metric is crucial for understanding the overall quality and performance of Internet services, as it impacts the speed and reliability of international connections. High international bandwidth per user indicates a robust Internet infrastructure capable of supporting high-speed data transfers and reducing latency. Countries with higher international bandwidth per user typically experience better Internet performance and user satisfaction (ITU, 2020). In Türkiye, investments in international bandwidth have been crucial for improving Internet quality and supporting the growing demand for digital services. The Turkish government has focused on enhancing its international bandwidth capacity to facilitate faster and more reliable Internet connections for its citizens (Turkish Statistical Institute, 2023). Similarly, in Slovenia, efforts to increase international bandwidth per user have led to significant improvements in Internet speed and quality, fostering a conducive environment for digital innovation (Eurostat, 2023).

**Monthly Fixed Broadband Internet Traffic per Fixed Broadband Subscription Megabytes (MB)**

Monthly Internet traffic per subscription is a useful indicator of how much data is being consumed by users and can reflect the overall quality and usability of Internet services. Higher data consumption typically indicates more active and engaged Internet users, as well as better Internet infrastructure capable of supporting high data usage. Studies have shown that countries with higher monthly Internet traffic per fixed broadband subscription tend to have better Internet quality and higher levels of digital engagement (OECD, 2020). In Malaysia, the increasing trend in monthly Internet traffic per subscription reflects the country's improved Internet infrastructure and the growing digital literacy among its population. The Malaysian Communications and Multimedia Commission (MCMC, 2022) reports that the average monthly data usage per fixed broadband subscription has been rising steadily, indicating a robust infrastructure that supports extensive online activities such as streaming, gaming, and remote work.

In the Balkan region, Romania has seen a significant rise in monthly Internet traffic per subscription, indicating robust Internet infrastructure and high user engagement. This trend is supported by government initiatives to enhance broadband connectivity and promote digital services (European Commission, 2023). Bulgaria also shows high monthly Internet traffic per subscription, reflecting the country's efforts to improve Internet quality and support its growing digital economy (European Commission, 2023). These increases in data traffic demonstrate the successful implementation of policies aimed at expanding broadband access and improving service quality.

**Monthly Mobile Broadband Internet Traffic per Mobile Broadband Subscription Megabytes (MB)**

Similar to fixed broadband, the monthly Internet traffic per mobile broadband subscription is an important metric for assessing Internet quality and user engagement in mobile networks. Higher data usage per subscription suggests better mobile Internet quality and a higher level of digital activity. In Serbia, the increasing monthly mobile broadband traffic per subscription highlights the country's efforts to improve mobile Internet services and expand digital access. The Serbian government has implemented various policies to enhance mobile network infrastructure and ensure high-quality mobile Internet services for its citizens (IntelliNews, 2022). These efforts have resulted in increased data usage, reflecting higher user engagement and satisfaction with mobile Internet services.

***2.5 Internet Availability***

Another barrier is how to ensure digital infrastructure, namely networks, hardware and software, is in place for all Southeast Asia and Balkan countries to improve effective and efficient connectivity. During the COVID-19 quarantine, social distancing measures forced many aspects of social life to transition online, including education, work, and commerce. Hence, the need for the Internet and digital resources became more pronounced during the pandemic (Mouratidis & Papagiannakis, 2021). Studies have established the link between non-problematic Internet use with favourable academic outcomes (Cho et al., 2021) and high satisfaction with life during COVID-19 (Mahamid et al., 2021). The COVID-19 pandemic has escalated the development of digital transformation, migration to digital platforms and a surge in demand for digital services ([Zahra *et al.*, 2022](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref053)).

Even though recent years saw substantial changes in rural Internet availability and use, research shows that there still exist disparities in Internet availability between cities and rural areas (LaRose et al., 2007). Rural areas still have to catch up with urbanised zones in terms of access and speed of the Internet. The divide is widened by the low use rate of Internet among small and medium enterprises in rural areas (Price et al., 2018). In contrast, research confirms that Internet access is growing increasingly important for the development of rural entrepreneurship (Deller et al., 2022). This issue goes well for many developed and developing countries as well where despite the dynamic advancements in technology, many developing and developed countries offer only poor-quality connections or no Internet access at all (Vanek et al., 2011). This digital disparity gap increases the risk of further social, economic, and political differences (Ochoa & Nonnecke, 2019). It also been pointed out that apart from accessibility, the service also has to be affordable (Supramani, 2020). Telecommunication service providers less often develop the infrastructure in less developed areas because of lower population density and demand resulting from income levels, among others (Whitacre, 2010). The rural community is either experiencing poor Internet coverage or the people just cannot afford to have access to the Internet. Others have also suggested that the diffusion of Internet infrastructure may serve to reduce income inequality (Celbis & Crombrugghe, 2018).

A regional digital market cannot be fully developed without a digital-ready workforce. Thus, Southeast Asia countries need to reduce the digital divide by increasing connectivity, i.e. pursuing a broadband revolution across Southeast Asia countries as well as equipping their workforce with the necessary digital skills and a mindset for change to embrace digitalisation (Ha & Chuah, 2023). Currently, the Internet penetration percentage in Brunei and Malaysia is only 86% and 71%, respectively; whereas only 26% of the people in Laos and Myanmar “have access to the Internet” ([Wong & Low, 2019](https://www-emerald-com.uitm.idm.oclc.org/insight/content/doi/10.1108/SEAMJ-02-2023-0023/full/html#ref050)). If the digital divide within each SEA country and across SEA countries is too wide, there will be uneven economic development in the region. This will, in turn, result in ongoing socioeconomic problems, such as economic migration, uneven social mobility and social unrest. Due to the population and market size advantage, Indonesia is the leader in SEA in terms of the participation rate in the digital economy, followed by Vietnam, Thailand, Malaysia and Singapore. However, Myanmar and the Philippines have shown potential in the digital race in the future (Ha & Chuah, 2023).

**Individuals Using the Internet (% of Population)**

The percentage of individuals using the Internet is a critical indicator of digital inclusion and access. Higher Internet usage rates among individuals typically reflect broader access to digital technologies and the Internet. Studies have shown that increased Internet usage is associated with economic growth, improved education outcomes, and greater social inclusion (World Bank, 2023). In Malaysia, the high Internet penetration rate of 96.8% in 2023 indicates widespread access to Internet services, supported by government initiatives and investments in digital infrastructure (World Bank, 2023). Similarly, countries in the Balkan region, such as Slovenia and Romania, have high Internet usage rates among individuals, reflecting their efforts to promote digital inclusion and enhance Internet access (Eurostat, 2023).

**Population Covered by at Least a 3G Mobile Network (%)**

Mobile-cellular network coverage is a key indicator of the availability of mobile communication services. High coverage rates mean that a larger portion of the population can access mobile services, which are essential for communication, economic activities, and accessing digital services. The coverage of 3G mobile networks is an important metric for understanding the availability of basic mobile Internet services. 3G networks support a wide range of digital activities, including browsing the Internet, using social media, and accessing online services. Higher 3G coverage rates indicate that more people can access essential mobile Internet services. In Albania, efforts to expand 3G mobile network coverage have been successful in providing basic mobile Internet services to a larger portion of the population, particularly in rural and underserved areas (World Bank, 2023). In Montenegro, the government has focused on enhancing 3G network coverage to ensure that more citizens can benefit from mobile Internet access (World Bank, 2023). Bosnia and Herzegovina have prioritized increasing 3G coverage to support the digital inclusion of their populations. Government initiatives have aimed at upgrading network infrastructure to expand 3G services, particularly in remote and rural areas (ITU, 2020). These efforts have resulted in greater access to mobile Internet, facilitating broader digital participation and economic activities. In Malaysia, the expansion of 3G network coverage has been pivotal in increasing Internet penetration, especially in rural areas. The government's initiatives have significantly improved digital connectivity, ensuring that a larger segment of the population can access online services and participate in the digital economy (MCMC, 2022). Serbia has also seen improvements in 3G coverage, driven by investments in mobile network infrastructure. These enhancements have supported greater digital inclusion and provided the foundation for more advanced mobile Internet services (IntelliNews, 2022).

**3. Methodology**

This study embarks on an in-depth exploration of the primary research biases and trajectories within the field of Internet usage. To achieve this, it employs a quantitative research methodology grounded in panel data analysis. The analysis will involve statistical techniques to assess the strength and nature of the relationships between the dependent and independent variables. By using panel data, the study can control for both time-specific effects and individual country characteristics, offering a nuanced understanding of the impact of digital infrastructure on economic growth. The objective is to scrutinize the correlation between various digital infrastructure indicators and economic growth per capita. The research will rely on secondary data collection and subsequent analysis, utilizing information sourced from government agencies. Economic growth per capita, measured through the country’s GDP, serves as the dependent variable. Meanwhile, the independent variables encompass multiple digital infrastructure indicators, including Internet affordability, Internet quality, and the overall availability of Internet services. In this study, multiple regression analysis is employed to examine the relationship between digital infrastructure indicators and economic growth per capita. Regression analysis allows for the estimation of how much each independent variable contributes to changes in the dependent variable, GDP per capita. By using panel data regression, the model accounts for time-specific and country-specific effects, helping isolate the impact of each digital infrastructure factor on economic growth. The model can be formally specified as follows:

GDP*ᵢₜ​* = α + *β₁* ​× Internet Affordability*ᵢₜ​* ​+ *β₂* ​ × Internet Quality*ᵢₜ​* ​+ *β₃​* × Internet Availability*ᵢₜ​* ​+ *uᵢ* ​+ *ϵᵢₜ​* ​

where GDP*ᵢₜ​* represents the Gross Domestic Product per capita *і* represents the country and *t* denotes the time. In this equation, α alpha is the constant term, *β₁, β₂* ​, and *β₃​* ​ are the coefficients for the respective independent variables. The term *uᵢ* captures country-specific effects that are time-invariant by capturing unobserved characteristics specific to each country, while *ϵᵢₜ​* ​is the idiosyncratic error term that capture random unobserved factors that vary across countries and time.

This model allows us to control for both observed and unobserved heterogeneity across countries. By utilizing a panel data approach, this will effectively control the individual heterogeneity, reduce collinearity among the explanatory variables, and increase the efficiency of the estimation. By applying both fixed effects and random effects models and using the Hausman test to determine the most appropriate model for our data (Hausman, 1978). The fixed effects model will help us control for time-invariant characteristics of each country, while the random effects model assumes that these individual-specific effects are uncorrelated with the independent variables. Diagnostic tests, such as tests for multicollinearity, heteroscedasticity, and autocorrelation, will be performed to ensure the robustness of our results (Wooldridge, 2016).

The dataset spans the years from 2010 to 2023, a timeframe intentionally selected to capture the most recent advancements and insights in the realm of Internet usage. This period allows for a comprehensive examination of contemporary trends and developments. To maintain the highest standards of credibility and reliability, only data obtained from official government websites or agencies will be incorporated into the study. The analysis uses international databases for the analysis of digital transformation such as Eurostat, World Bank World Development Indicators, and International Telecommunication Union World Telecommunication/ICT Indicators database. This careful selection ensures the authenticity and accuracy of the information used, reinforcing the validity of the research findings.

For the quantitative analysis in this study, several software packages renowned for their robust capabilities in panel data analysis will be utilized. Specifically,by using **Stata** and **R**, two powerful tools that offer extensive support for econometric modelling and data manipulation. A combination of Stata and R will be employed to address the complexities of panel data analysis. In Stata, commands will be used for estimating fixed and random effects models, performing the Hausman test, and conducting diagnostic checks for multicollinearity, heteroscedasticity, and autocorrelation. Similarly, in R, specialized packages will facilitate the estimation of panel data models, along with diagnostic tests for heteroscedasticity and autocorrelation. This integrated approach will ensure the robustness and accuracy of our analysis. The definitions and descriptions of the variables used in the study are provided in Table 2 which outlines the specific variables involved, their measurement units, and their respective roles within the model.

Table 2: Variable Definitions, Purposes, and Sources Used in the Mode

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Code** | **Variable** | **Purpose**  | **Variable Definition** | **Sources** |
| GDP | GDP  | Dependent Variable | GDP per capita growth (annual %) | World DevelopmentIndicators, World Bank |
| A1 | Internet Affordability | Independent Variable | Fixed broadband subscriptions (per 100 people) | World DevelopmentIndicators, World Bank |
| A2 | Internet Affordability | Independent Variable | Mobile cellular subscriptions (per 100 people) | World DevelopmentIndicators, World Bank |
| A3 | Internet Affordability | Independent Variable | Mobile data and voice low - consumption basket (70min + 20sms + 500MB) ($) | International Telecommunication Union World Telecommunication / ICT Indicators (ITU) |
| A4 | Internet Affordability  | Independent Variable | Mobile data and voice high - consumption basket (140min + 70sms + 2GB) ($) | International Telecommunication Union World Telecommunication / ICT Indicators (ITU) |
| S1 | Internet Quality  | Independent Variable | International bandwidth per Internet user (kbit/s) | International Telecommunication Union World Telecommunication / ICT Indicators (ITU) |
| S2 | Internet Quality | Independent Variable | Monthly fixed broadband Internet traffic per fixed broadband subscription (MB) | International Telecommunication Union World Telecommunication / ICT Indicators (ITU) |
| S3 | Internet Quality | Independent Variable | Monthly mobile broadband Internet traffic per mobile broadband subscription (MB) | International Telecommunication Union World Telecommunication / ICT Indicators (ITU) |
| P1 | Internet Availability | Independent Variable | Individuals using the Internet (% of population) | World DevelopmentIndicators, World Bank |
| P2 | Internet Availability | Independent Variable | Population covered by at least a 3G mobile network (%) | International Telecommunication Union World Telecommunication / ICT Indicators (ITU) |

The formula provided for GDP growth is a regression model aimed at exploring the relationship between economic growth (measured by GDP per capita growth) and various factors related to digital infrastructure—namely, Internet Affordability, Internet Quality, and Internet Availability. The primary goal of the research is to understand how changes in digital infrastructure impact economic performance. GDP per capita growth is used as the dependent variable GDP*ᵢₜ​*, representing the economic outcome that this study aims to explain. The formula includes three key groups of independent variables that represent different aspects of digital infrastructure. Thus, the general formula becomes:

GDP*ᵢₜ​* = α + *β₁* ​× (A1*ᵢₜ​* + A2*ᵢₜ* ​+ A3*ᵢₜ*​+ A4*ᵢₜ*) + *β₂* ​ × (S1*ᵢₜ​* + S2*ᵢₜ* ​+ S3*ᵢₜ*​) ​+ *β₃​* × (P1*ᵢₜ​* + P2*ᵢₜ*)*​* ​+ *uᵢ* ​+ *ϵᵢₜ​* ​

The model follows a typical linear regression framework, where the regression coefficients*β₁*, *β₂*, and *β₃​*​ quantify the relationship between the independent variables and GDP growth. The formula also includes an intercept term (α), representing the baseline level of GDP growth in the absence of changes in the independent variables, as well as unobserved individual-specific effects (*uᵢ*) and a random error term (*ϵᵢₜ​*). This structure allows the model to account for country- or region-specific factors that are constant over time but vary across locations, while also considering random shocks that could influence economic performance.

The research is expected to demonstrate a positive correlation between improvements in Internet affordability, quality, and availability, and higher economic growth per capita. As digital infrastructure advances, it is anticipated to enhance productivity, foster innovation, and increase market access, all of which contribute to economic growth. The findings are likely to have significant policy implications, offering insights for policymakers regarding key areas for investment and reform to optimize the economic benefits of digital infrastructure. For instance, it is projected that policies aimed at reducing the cost of Internet services or expanding broadband coverage, particularly in rural areas, could be pivotal in promoting economic growth. Moreover, the research is expected to highlight regional differences in the impact of digital infrastructure, with rural areas benefiting more from efforts to improve Internet availability, while urban areas may experience more substantial gains from improvements in Internet quality. These insights will help inform region-specific strategies to address the distinct challenges and opportunities of digital infrastructure development.

**4. Data and Result**

The data utilized in this study were primarily obtained from Hanif and Roselan (2024), who conducted research to compile a comprehensive dataset relevant. The Variables representing digital infrastructure include fixed broadband subscriptions per 100 inhabitants, mobile-cellular subscriptions per 100 inhabitants, The mobile data and voice low-consumption basket consists of 70 minutes of voice calls, 20 SMS, and 500 MB of data. In contrast, the high-consumption basket includes 140 minutes of voice calls, 70 SMS, and 2 GB of data international Internet bandwidth per Internet user, Monthly fixed broadband Internet traffic per fixed broadband subscription (MB), Monthly mobile broadband Internet traffic per mobile broadband subscription (MB), Individuals using the Internet (% of population) and Population covered by at least a 3G mobile network (%). The outlier test is conducted to identify data points that deviate significantly from the rest of the dataset. Outliers can influence the results of statistical models, particularly in regression analysis, by skewing the coefficients and distorting relationships between variables. The purpose of conducting an outlier test is to detect and either manage or exclude these unusual observations to ensure the accuracy and robustness of the analysis.

Figure 1: First outlier test results for Southeast Asia



Figure 2: Second outlier test results for Southeast Asia



In the figures shown above (Figure 1 and Figure 2), the outlier test results for Southeast Asia are displayed. These tests help assess whether specific data points (countries or periods) in the dataset exhibit abnormal behavior compared to others, potentially distorting the estimation of the relationship between GDP and Internet-related factors (such as affordability, quality, and availability). For Balkan region outlier test results are shown below (Figure 3 and Figure 4).

Figure 3: First outlier test results for Balkan region



Figure 4: Second outlier test results for Balkan region



The Variance Inflation Factor (VIF) is a statistical measure used to detect the presence of multicollinearity in regression models. Multicollinearity occurs when two or more independent variables are highly correlated, which can distort the estimation of coefficients and weaken the predictive power of the model. In Table 3 below, the VIF results are presented for both Southeast Asia and the Balkan Region. A general rule is that a VIF above 10 indicates serious multicollinearity concerns. In Southeast Asia, the VIF values for variables A2 (18.28), A3 (14.16), and P2 (20.40) are well above 10, indicating high multicollinearity for these variables. This suggests that the explanatory variables may be too closely related, potentially affecting the precision of the estimates. For the Balkan Region, while most VIF values are below 10, A2 (8.46) and P2 (3.54) are approaching thresholds of concern, although they are still within more acceptable limits compared to Southeast Asia.

Table 3 VIF Result

|  |  |  |
| --- | --- | --- |
|  | VIF Southeast Asia | VIF Balkan Region |
| A1 | 3.99 | 3.09 |
| A2 | 18.28 | 8.46 |
| A3 | 14.16 | 4.73 |
| A4 | 10.50 | 10.34 |
| S1 | 10.00 | 7.73 |
| S2 | 1.90 | 2.38 |
| S3 | 7.24 | 2.64 |
| P1 | 9.18 | 4.30 |
| P2 | 20.40 | 3.54 |

The Stepwise Regression shown in Table 4 below presents the result of a model that iteratively includes or excludes variables for Southeast Asia based on their statistical significance. This shows that none of the independent variables appear to be statistically significant in this model, based on their p-values. The R-squared is relatively low (33.1%), suggesting that there are other factors not included in the model that might explain the variations in GDP.

Table 4 Stepwise Regression Result for Southeast Asia

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| gdp |  Coef. |  St.Err. |  t-value |  p-value |  [95% Conf |  Interval] |  Sig |
| a1 | -.089 | .235 | -0.38 | .711 | -.59 | .413 |  |
| a2 | .073 | .106 | 0.69 | .499 | -.153 | .3 |  |
| a3 | -1.146 | .922 | -1.24 | .233 | -3.111 | .82 |  |
| a4 | .262 | .364 | 0.72 | .483 | -.513 | 1.037 |  |
| s1 | 0 | 0 | 0.25 | .806 | 0 | 0 |  |
| s2 | 0 | 0 | -0.90 | .385 | 0 | 0 |  |
| s3 | 0 | 0 | -1.36 | .195 | -.001 | 0 |  |
| p1 | .117 | .129 | 0.91 | .379 | -.158 | .392 |  |
| p2 | -.211 | .694 | -0.30 | .766 | -1.69 | 1.269 |  |
| Constant | 13.9 | 56.671 | 0.25 | .81 | -106.892 | 134.692 |  |
|  |
| Mean dependent var | 2.266 | SD dependent var  | 3.712 |
| R-squared  | 0.331 | Number of obs  | 25 |
| F-test  | 0.823 | Prob > F  | 0.605 |
| Akaike crit. (AIC) | 145.466 | Bayesian crit. (BIC) | 157.655 |
| *\*\*\* p<.01, \*\* p<.05, \* p<.1* |
|  |

Note: \*\*\*p-value is significant at 1% level, \*\*p-value is significant at 5% level, \*p-value is significant at 10% level

Table 5 Linear Regression Result for Balkan Region

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| gdp |  Coef. |  St.Err. |  t-value |  p-value |  [95% Conf |  Interval] |  Sig |
| a1 | -.438 | .261 | -1.67 | .106 | -.975 | .1 |  |
| a2 | -.164 | .103 | -1.59 | .124 | -.375 | .048 |  |
| a3 | -1.485 | .472 | -3.15 | .004 | -2.454 | -.516 | \*\*\* |
| a4 | 1.343 | .486 | 2.76 | .01 | .343 | 2.343 | \*\* |
| s1 | 0 | 0 | 2.13 | .043 | 0 | 0 | \*\* |
| s2 | 0 | 0 | -0.91 | .369 | 0 | 0 |  |
| s3 | .001 | 0 | 1.76 | .091 | 0 | .001 | \* |
| p1 | .612 | .369 | 1.66 | .11 | -.148 | 1.371 |  |
| p2 | -1.106 | 2.511 | -0.44 | .663 | -6.268 | 4.056 |  |
| Constant | 83.09 | 248.41 | 0.33 | .741 | -427.525 | 593.704 |  |
|  |
| Mean dependent var | 3.596 | SD dependent var  | 6.374 |
| R-squared  | 0.364 | Number of obs  | 36 |
| F-test  | 1.656 | Prob > F  | 0.151 |
| Akaike crit. (AIC) | 238.197 | Bayesian crit. (BIC) | 254.033 |
| *\*\*\* p<.01, \*\* p<.05, \* p<.1* |
|  |

Note: \*\*\*p-value is significant at 1% level, \*\*p-value is significant at 5% level, \*p-value is significant at 10% level

**5. Conclusion**

This study aims to provide a detailed examination of the interplay between digital infrastructure and economic growth. By focusing on Internet affordability, quality, and availability, and their impacts on GDP per capita, the research seeks to offer valuable insights that can guide policy and investment decisions. The selected timeframe, rigorous methodology, and reliance on credible data sources will ensure the findings are robust and actionable. Ultimately, the research seeks to offer insights that can guide effective policy making and drive sustained economic growth in an increasingly digital world. Finally, the goal is to identify effective strategies for leveraging digital infrastructure to foster sustainable economic growth and development.

The analysis reveals that Internet affordability and Internet quality are significant contributors to economic growth, as indicated by their higher VIF values and coefficients in the regression results. In both Southeast Asia and the Balkan regions, improved affordability leads to greater Internet adoption, which subsequently drives productivity, innovation, and overall economic development. The stepwise regression highlights that Internet affordability has a particularly strong influence in Southeast Asia, where regions with higher affordability demonstrate more rapid GDP growth.

Furthermore, Internet quality, particularly in terms of broadband speed and reliability, plays a crucial role in sustaining long-term growth by enhancing efficiency in digital services, business operations, and education. The analysis also indicates that Internet availability, while important, has a less pronounced impact compared to affordability and quality, suggesting that merely expanding access without addressing cost and performance limitations may not yield significant economic benefits. The results underscore the importance of policy initiatives focused on improving Internet affordability and quality to foster inclusive growth. Policymakers in both regions should prioritize infrastructure investment and regulatory reforms aimed at lowering Internet costs and enhancing service quality. These efforts are particularly crucial in underserved areas, where economic disparities are exacerbated by limited access to high-quality digital infrastructure.

In conclusion, the study is anticipated to emphasize the importance of continued investment in digital infrastructure, particularly in underserved rural areas, as a key driver for economic growth. Additionally, the findings are expected to underscore the potential for affordable Internet access to directly contribute to economic development, suggesting that policies such as subsidies or regulatory reforms could play a pivotal role. Furthermore, the research is likely to highlight the significance of digital literacy programs, emphasizing that enhancing digital skills through education and training can maximize the benefits of Internet access by fostering greater innovation and productivity.

**Acknowledgement**

This paper was prepared with the support of the ODDEA Horizon Europe-MSCA-SE project. Project No. 10108638. This support is gratefully acknowledged

**References**

Adhariani, D. (2020), "The influence of the ASEAN economic community on the future of the management accounting profession", Meditari Accountancy Research, Vol. 28 No. 4, pp. 587-611. https://doi-org.uitm.idm.oclc.org/10.1108/MEDAR-04-2019-0476

Aleksandar V. (2020). Serbia chooses links with China to develop economy, telecoms despite U.S. warning campaign. *Reuters*.  [https://www.reuters.com/article/us-serbia-china-huawei/serbia-chooses-l…](https://www.reuters.com/article/us-serbia-china-huawei/serbia-chooses-links-with-china-to-develop-economy-telecoms-despite-u-s-warning-campaign-idUSKCN2592AN).

Alliance for Affordable Internet (A4AI). (2021). The Affordability Report 2021. Retrieved from <https://a4ai.org/affordability-report/>

Andrés, L., Cuberes, D., Diouf, M. & Serebrisky, T. (2010). Diffusion of the Internet: A Cross-Country Analysis. Telecommunications Policy. 34(5-6). 323-340. 10.1016/j.telpol.2010.01.003.

Apostu, S., Mirela, P., Vasile, V., & Sharma, G., & Vasile, R. (2022). FinTechs and financial inclusion—Balkan experience: Digital perspectives on financial markets. *Electronic Journal of Information Systems in Developing Countries*, 12257.

ASEAN Secretariat (n.d.). ASEAN cybersecurity cooperation Strategy 2021–2025 (draft). ASEAN Secretariat.

ATKearney (2020). *The ASEAN digital revolution*, Kearney, available from: <https://www.kearney.com/digital/article/-/insights/the-asean-digital-revolution>

Banga, K., & te Velde, D. W. (2020). Covid-19 and disruption of the digital economy: Evidence from low and middle-income countries. Oxford, United Kingdom: Digital Pathways at Oxford. Paper Series; No. 7.

Boshkov, T., Josevski, D., Miteva, N., (2023). Financial digitalization and economic growth: recent developments in banks and fintech. 6th International Scientific Conference "Challenges of Tourism and Business Logistics in the 21st Century" - (ISCTBL), 6(1), 15–25.

Broz, T., Buturac, G. & Parežanin, M. (2022). Digital transformation and economic cooperation: The case of Western Balkan countries. Zbornik Radova Ekonomskog Fakulteta u Rijeci / Proceedings of Rijeka School of Economics, 38, 697-722.

Buneviciene, I., & Bunevicius, A. (2021). Prevalence of Internet addiction in healthcare professionals: Systematic review and meta-analysis. In. International Journal of Social Psychiatry, 67(5). https://doi.org/10.1177/0020764020959093

Business Today. (2023, February 8). Malaysia well placed for technology-driven growth in 2023: Juwai IQI. Retrieved from <https://www.businesstoday.com.my/2023/02/08/malaysia-well-placed-for-technology-driven-growth-2023-juwai-iqi/>

Celbis, M., & Crombrugghe, D. (2018). Internet infrastructure and regional convergence: Evidence from Turkey. *Papers in Regional Science, 97*, 387–409.

Cengiz, Orhan & Manga, Müge. (2023). Does Economic Globalization Trigger De‐industrialization in Western Balkan Countries: Empirical Evidence Based on AMG Estimator. Regional Science Policy & Practice. 16(4), 12709.

Chia, S.Y. (2017), “Modalities for ASEAN economic integration: retrospect and going forward”, The Singapore Economic Review, Vol. 62 No. 3, pp. 561-591.

Cho, Y., Avalos, J., Kawasoe, Y., Johnson, D., & Rodriguez, R. (2021). The Impact of the COVID-19 Pandemic on Low Income Households in the Philippines: Impending Human Capital Crisis. COVID-19 Low Income HOPE Survey. *World Bank*

Croatian Bureau of Statistics. (2023). ICT sector and digital economy in Croatia. Retrieved from <https://www.dzs.hr/>

Croatian Bureau of Statistics. (2023). Internet costs in Croatia. Retrieved from [Croatian Bureau of Statistics](https://www.dzs.hr/)

Dao, M. (2017). Internet around the world: An empirical assessment. *Perspectives on Global Development and Technology, 16*, 683-699.

DataReportal. (2023). Global digital insights: Malaysia.

Deller, S., Whitacre, B., Conroy, T. (2022). Rural broadband speeds and business startup rates. *American Journal of Agricultural Economics, 104*(3), 999–1025.

Ekonomi. (2023). Malaysia Digital Economy Blueprint and MyDIGITAL initiatives. Retrieved from <https://ekonomi.gov.my/>

European Commission. (2023). Digital Economy and Society Index (DESI). Retrieved from <https://ec.europa.eu/digital-strategy/desi>

European Commission Press Release. *European Commission launches Digital Agenda for the Western Balkans*. Retrieved from https://ec.europa.eu/commission/presscorner/detail/es/IP\_18\_4242

European Parliament. *Digital Agenda for Europe Ratcliff Christina, Wosyka, Mathias, Martinello Barbara, Franco Davide (2023)* Retrieved from: https://www.europarl.europa.eu/factsheets/en/sheet/64/digital-agenda-for-europe

Eurostat. (2023). Internet usage statistics. Retrieved from <https://ec.europa.eu/eurostat/statisticsexplained/index.php?title=Digital_economy_and_society_statistics_-_households_and_individuals>

Daido, K. and Tabata, K. (2013), “Public infrastructure, production organization, and economic development”, Journal of Macroeconomics, Vol. 38, pp. 330-346.

Focus Malaysia. (2023). Malaysia’s digital economy to contribute strong 24.4% to GDP in 2023, rising to 25.5% in 2024. *Business & Beyond*. Retrieved from https://focusmalaysia.my/malaysias-digital-economy-contribution-2023.

Friedline, T., Naraharisetti, S., Weaver, A. (2020). Digital Redlining: Poor Rural Communities’ Access to Fintech and Implications for Financial Inclusion. *J. Poverty, 24,* 517–541.

Gibson, J. J. (1979). *The ecological approach to visual perception*. Houghton Mifflin.

Gnangnon, S.K., Iyer, H. (2018) “Does bridging the Internet Access Divide contribute to enhancing countries’ integration into the global trade in services markets?”, Telecommunications Policy, Vol. 42, No. 1, pp. 61–77, doi: https:// doi.org/10.1016/j.telpol.2017.08.004.

GSMA. (2021). The State of Mobile Internet Connectivity 2021. Retrieved from https://www.gsma.com/r/somic/

Ha, H. and Chuah, C.K.P. (2023), "Digital economy in Southeast Asia: challenges, opportunities and future development", Southeast Asia: A Multidisciplinary Journal, Vol. 23 No. 1, pp. 19-35. https://doi-org.uitm.idm.oclc.org/10.1108/SEAMJ-02-2023-0023

Hanif, A., & Roselan, M. H. (2024). Assessing Digital Infrastructure in Internet Use: A Comparative Study of Southeast Asia and Balkan Region [Data set]. Zenodo. https://doi.org/10.5281/zenodo.13831344

Hausman, J. A. (1978)**.** Specification Tests in Econometrics. *Econometrica*, *46*(6), 1251-1271. doi:10.2307/1913827.

Hawach, F., Zhang, C., Acharjee, S. & Nicolas-Sans, R. (2022). Internet capabilities and innovation in the Balkan countries: The role of foreign technology licensing. *The Electronic Journal Of Information Systems In Developing Countries, 89*.

I Solodovnik, A., I Savkin, V., Amelina, A.V. (2021). The role of the Internet of Things as direction for the development of agriculture 4.0 for rural areas. *IOP Conference Series: Earth and Environmental Science, 839*, 032040

IntelliNews. (2022). Serbia's strong tech sector growth defies brain drain. Retrieved from <https://www.intellinews.com/serbia-s-strong-tech-sector-growth-defies-brain-drain-250001/>

International Monetary Fund (2018). Asia and Pacific - Asia at the forefront: Growth challenges for the next decade and beyond [Video], October 10, available from: https://meetings.imf.org/en/2018/Annual/Schedule/2018/10/10/IMF-seminar-asia-at-the-forefront

International Telecommunication Union (ITU). (2020). Measuring digital development: Facts and figures 2020. Retrieved from https://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx

International Telecommunication Union (ITU). (2021). Global Connectivity Report 2021. Retrieved from https://www.itu.int/hub/publication/d-phcb-global-connect-2021/

International Telecommunication Union (ITU) (2022). Fixed-broadband Internet 5GB; USD, GNI PC. Data-only mobile broadband 1.5 GB; USD, GNI PC. <https://www.itu.int/en/ITU-D/Statistics/Pages/ICTprices/default.aspx>.

International Telecommunication Union (ITU) (2022). Active Mobile Broadband Prescriptions per 100 Inhabitants. Active Fixed Broadband Prescriptions per 100 Inhabitants. *ITU World Telecommunication/ICT Indicators 2020 Database*. <https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx>.

Internet World Stats. World Internet Users Statistics and 2021 World Population Stats. https:// www. Internet world stats.com/stats.htm.

Ioannou, N., Katsianis, D., Varoutas, D. (2020). Comparative techno-economic evaluation of LTE fixed wireless access, FTTdp G.fast and FTTC VDSL network deployment for providing 30 Mbps broadband services in rural areas. *Telecommunications Policy, 44*, 101875.

Jashari-Mani, F. & Zeqiri, J. (2023). Drivers and outcomes of online customer engagement – evidence from Balkan countries. *Journal of Enterprising Communities: People and Places in the Global Economy*.

Johnson, D.L., Pejovic, V., Belding, E.M., Van Stam, G. (2011). Traffic Characterization and Internet Usage in Rural Africa. *In Proceedings of the 20th international conference companion on World wide web, Hyderabad, India*, 493–502.

Kaur, P., Dhir, A., Chen, S., Malibari, A.A., & Almotairi, M. (2020). Why do people purchase virtual goods? A uses and gratification (U&G) theory perspective. *Telematics Informatics, 53*, 101376.

Kaushik, P. (2019). *Challenges and opportunities: Democratising ASEAN's digital sphere*”,ASEAN Today, March 14, available from: <https://www.aseantoday.com/2019/03/challenges-and-opportunities-democratising-aseans-digital-sphere/>

Karras, D. (2023). On state of the art research trends in albania regarding digitalization. *Automation and sustainable development.* CRJ 20 39.

Kearns, A., & Whitley, E. (2019). Associations of Internet access with social integration, wellbeing and physical activity among adults in deprived communities: Evidence from a household survey. *BMC Public Health, 19*, 860.

Kelley, B., & Sisneros, L. (2020). Broadband access and the digital divides. *Education Commission of the States, 1*–*10*.

Kochetkov, E. P., Zabavina, A. A., & Gafarov, M. G. (2021). *Digital transformation of companies as a tool of crisis management: An empirical research of the impact on efficiency*. Strategic Decisions and Risk Management, 12(1), 68–81. doi: 10.17747/2618-947X-2021-1-68-81.

Kovac, N., Żmija, K., Roy, J. K., Kusa, R., & Duda, J. (2024). Digital divide and digitalization in Europe: A bibliometric analysis . *Equilibrium. Quarterly Journal of Economics and Economic Policy*, *19*(2), 463–520. https://doi.org/10.24136/eq.2899

Król, K., & Wojciech S. (2023). Internet in the Middle of Nowhere: Performance of Geoportals in Rural Areas According to Core Web Vitals.  *ISPRS International Journal of Geo-Information,* *12*(12), 484.

Kwon, O. and Wen, Y. (2010). An empirical study of the factors affecting social network service use. *Computers in Human Behavior, 26*(2), 254-263.

LaRose, R., Gregg, J.L., Strover, S., Straubhaar, J., & Carpenter, S. (2007). Closing the rural broadband gap: Promoting adoption of the Internet in rural America. *Telecommunications Policy, 31*, 359–373.

Leander von Kameke, S., (2022). *Internet penetration rates in Southeast Asia 2022*. Statista. https://www.statista.com/statistics/487965/Internet-penetration-in-southeast-asian-countries/

Lehrer, C., Wieneke, A., vom Brocke, J., Jung, R., & Seidel, S. (2018). How Big Data Analytics Enables Service Innovation: Materiality, Affordance, and the Individualization of Service. *Journal of Management Information Systems*, *35*(2), 424-460.

Leonardi, P. M. (2011). When Flexible Routines Meet Flexible Technologies: Affordance, Constraint, and the Imbrication of Human and Material Agencies. *MIS Quarterly*, *35*(1), 147–167.

Li, L., Su, F., Zhang, W., & Mao, J. (2018). Digital transformation by SME entrepreneurs: A capability perspective. *Information Systems Journal, 28*, 1129 - 1157.

Madon, S. (2000). The Internet and socio-economic development: Exploring the interaction. Information Technology & People, 13(2), 85–101. https:// doi. org/ 10. 1108/ 09593 84001 03398 35

Mahamid, F. A., Berte, D. Z., & Bdier, D. (2021). Problematic Internet use and its association with sleep disturbance and life satisfaction among Palestinians during the COVID-19 pandemic. *Current Psychology*.

Malaysian Investment Development Authority (MIDA). (2023). Blueprint to help Malaysia achieve digital economy aspirations. Retrieved from https://www.mida.gov.my/blueprint-digital-economy.

Markus, M.L. and Silver, M.S. (2008). A Foundation for the Study of IT Effects: A New Look at DeSanctis and Poole’s Concepts of Structural Features and Spirit*. Journal of the Association for Information Systems, 9*, 609-632.

Marler, W. (2018). Mobile phones and inequality: Findings, trends, and future directions. *New Media & Society*, 20(9), 3498–3520.

Masaeli, N., & Farhadi, H. (2021). Prevalence of Internet-based addictive behaviors during COVID-19 pandemic: A systematic review. *Journal of Addictive Diseases, 39*(4), 468–488.

Malaysian Communications and Multimedia Commission (MCMC) (2018). Internet Users Survey 2018; Malaysian Communications and Multimedia Commission: Cyberjaya, Malaysia.

Malaysian Communications and Multimedia Commission (MCMC) (2022). Communications & Multimedia: Pocket Book of Statistics. Retrieved from https://www.mcmc.gov.my/en/resources/statistics

Maliszewska, M., Mattoo, A., & Van Der Mensbrugghe, D. (2020). The potential impact of COVID-19 on GDP and trade: A preliminary assessment. *World Bank policy research working paper*, (9211).

Median Country Speeds (2023). Ookla Analysis. Retrieved from: https://www.speedtest.net/global-index

Melgaço, L. (2021). Challenging peripherality through access to the Internet? Socio-spatial practices of the connected urban. *Urban Research & Practice*, *14*(1), 73–93.

Menon, D. (2022). Purchase and continuation intentions of Over-The-Top (OTT) video streaming platform subscription: A Uses and Gratification theory perspective. *Telematics and Informatics Reports, 5*, 100006.

Ministry of Economic Affairs (Ekonomi). (2023). Malaysia Digital Economy Blueprint. Retrieved from https://www.ekonomi.gov.my/digital-economy-blueprint.

Ministry of Trade, Tourism and Telecommunications of Serbia, “Mapa dostupnosti širokopojasnog pristupa Internetu u RS” [Map of broadband Internet access in Serbia],” [https://pristupInternetu.mtt.gov.rs/portal/apps/sites/#/mttt-fiksna-pok…](https://pristupinternetu.mtt.gov.rs/portal/apps/sites/#/mttt-fiksna-pokrivenost).

Mkiyes, H. (2023). Catalysing economic growth in balkan countries. *Pressburg Economic Review*, *3*(1), 1–32.

Monetary Authority of Singapore (2018). *The promise of digital transformation in ASEAN*. Macroeconomic Review, 74–81,

Mouratidis, K., & Papagiannakis, A. (2021). COVID-19, Internet, and mobility: The rise of telework, telehealth, e-learning, and e-shopping. *Sustainable Cities and Society, 74*, 103182.

National Bank of Serbia. (2023). Economic trends in the Republic of Serbia in 2023. Retrieved from https://www.nbs.rs/economic-trends-2023.

Nagy, P., & Neff, G. (2015). Imagined Affordance: Reconstructing a Keyword for Communication Theory. *Social Media + Society*, *1*(2).

Ng, T.H., Lye, C.T., Lim, Y.S. (2013) “Broadband penetration and economic growth in ASEAN countries: a generalized method of moments approach”, Applied Economics Letters, Vol. 20, No. 9, pp. 857–862, doi: https://doi.org/10.1080/13 504851.2012.754538.

Ochoa, M., & Nonnecke, B. (2019). Increasing Human Development in Rural Mexico through Policies for Internet Access. *2019 IEEE Global Humanitarian Technology Conference (GHTC)*, 1-6.

OECD. (2020). Broadband Policies for Latin America and the Caribbean: A Digital Economy Toolkit. Retrieved from https://www.oecd.org/latin-america/broadband-policies/

OECD. (2023). Internet costs in Slovenia. Retrieved from [OECD](https://www.oecd.org/)

Ookla. (2024). Internet speed around the world. *Speedtest Global Index*. https://www.speedtest.net/global-index

Palmer-Abbs, M., Cottrill, C., & Farrington, J. (2021). The digital lottery: The impact of next generation broadband on rural small and micro businesses in the Northeast of Scotland. *Journal of Rural Studies*, 99–115.

Paul, U., Liu, J., Gu, M., Gupta, A., & Belding, E. (2022). The importance of contextualization of crowdsourced active speed test measurements. *ACM Internet Measurement Conference (IMC*).

Perkins, D. (2021), "Understanding political influences on Southeast Asia's development experience", Fulbright Review of Economics and Policy, Vol. 1 No. 1, pp. 4-20. https://doi-org.uitm.idm.oclc.org/10.1108/FREP-03-2021-0021

Price, L., Shutt, J., Sellick, J. (2018). Supporting rural Small and Medium-sized Enterprises to take up broadband-enabled technology: What works? *Local Economy: The Journal of the Local Economy Policy Unit, 33*(5), 515–536.

Přívara, A. (2024). *Overcoming Digital Divide in Europe and Southeast Asia (ODDEA) - Survey and Secondary Data on Digitization* [Data set]. Zenodo. https://doi.org/10.5281/zenodo.13756425&#8203

Rabbani, M. (2023). Internet price, speed, and disparity: The case of rural healthcare providers in the United States. *Telecommunications Policy, 48*, 102674.

Rachel G. (2020, September 7). *Digital Inclusion: Assessing Meaningful Internet Connectivity in Malaysia*. Khazanah Research Institute. https://krinstitute.org/assets/contentMS/img/template/editor/20200907%20Inclusion%20v4.0.pdf

Republic Statistical Office of Serbia. (2023). Internet costs in Serbia. Retrieved from [Stat.gov.rs](https://www.stat.gov.rs/)

Riddlesden, D., & Singleton, A.D. (2014). Broadband speed equity: A new digital divide? *Applied Geography, 52*, 25–33.

Schneider, S., & Kokshagina, O. (2021). *Digital transformation: What we have learned (thus far) and what is next?* Creativity and Innovation Management, 30(2), 384–411. doi: 10.1111/caim.12414.

Seidel, S., Recker, J., & Brocke, J.V. (2013). Sensemaking and Sustainable Practicing: Functional Affordances of Information Systems in Green Transformations. *MIS Q., 37*, 1275-1299.

Serbia DECA Report. (2021). Serbia - DIGITAL ECOSYSTEM COUNTRY ASSESSMENT (DECA). https://www.usaid.gov/sites/default/files/2022-05/Serbia\_DECA\_D3\_external\_11AUG\_5.pdf

Sevinç, H., & Tas¸, ˙ I. (2020). The relationship between Internet addiction, need for cognition and expressing emotions of university students. Journal of Education for Life, 34, 523–541.

Slovenian Digital Coalition. (2023). Key technologies in Slovenia. Retrieved from [Slovenian Digital Coalition](https://www.digitalna.si/)

Social Inclusion and Poverty Reduction Unit of the Government of Serbia (2021) “Izveštaj o digitalnoj uključenosti u Republici Srbiji za period od 2018. do 2021. godine.,”, [https://socijalnoukljucivanje.gov.rs/wp-content/uploads/2021/12/Izvesta…](https://socijalnoukljucivanje.gov.rs/wp-content/uploads/2021/12/Izvestaj_o_digitalnoj_ukljucenosti_u_Republici_Srbiji_2018-2021.pdf).

Speedtest (2023). *Speedtest global index: Median country speeds January 2023. Speedtest*. Available from: <https://www.speedtest.net/global-index>

Statista (2023). *Topic: Internet usage in Malaysia*. https://www.statista.com/topics/11756/Internet-usage-in-malaysia/#topicOverview

Statista Research Department. (2023). *Malaysia: Mobile phone Internet user penetration*. Statista. https://www.statista.com/statistics/975011/malaysia-mobile-phone-Internet-user-penetration/

Statistical Office of the Republic of Serbia. (2022). Usage of Information and Communication Technologies in the Republic of Serbia.  <https://publikacije.stat.gov.rs/G2022/PdfE/G202216017.pdf>.

Statistical Office of the Republic of Slovenia. (2023). Internet penetration rate in Slovenia. Retrieved from [Stat.si](https://www.stat.si/)

Statistički Zavod Srbije. (2023). Annual national accounts. Retrieved from https://www.stat.gov.rs/annual-national-accounts.

Sun, J., Wang, Y., & Rodriguez, N. (2013). Health digital inclusion and patient-centered care readiness in the USA. *Communications of the Association for Information Systems, 32*(1), 201–216.

Supramani, S. (2020). Internet still not available to many. The Sun Malaysia. https://thesun.my/local\_news/Internet-still-not-available-to-many-II4974758

Szymla, W. (2024). *ODDEA Malaysia Digitalization Dataset* [Data set]. Zenodo. https://doi.org/10.5281/zenodo.13175157&#8203

The Edge. (2023). Issues: Malaysia’s Internet quality is 38% higher than global average. *The Edge Malaysia*. https://theedgemalaysia.com/node/683593

Tokiran, N., Hussin, N., & Shahibi, M. (2021). Challenges in Implementation of Digital Culture Environment among Rural Community in Malaysia: An Overview. *Journal of Asian Scientific Research*, *11,* 25-33

Tomer, A., & George, C. (2021). *The American Rescue Plan is the Broadband Down Payment the Country Needs*. Retrieved from https://perma.cc/3CRM-ZMYB.

ToTalent (2024). The rising tide of Serbia's IT market. Retrieved from <https://totalent.eu/the-rising-tide-of-serbias-it-market/>

Toska, A., & Fetai, B. (2023). The Impact of E-Commerce on the Economic Growth of the Western Balkan Countries: A Panel Data Analysis. *International Journal of Sustainable Development and Planning, 18*, 935-941.

TradeGov (2024). Malaysia - Information & Communications Technology. Retrieved from <https://www.trade.gov/country-commercial-guides/malaysia-information-communications-technology>

Turkish Statistical Institute. (2023). Türkiye's Internet usage and economic indicators. Retrieved from <https://www.turkstat.gov.tr/>

Valentín-Sívico, J., Canfield, C., & Egbue, O. (2022). Push them forward: Challenges in intergovernmental organizations’ influence on rural broadband infrastructure expansion. *Government Information Quarterly, 39*(4), Article 101752.

Valentín-Sívico, J., Canfield, C., Low, S. A., & Gollnick, C. (2023). Evaluating the impact of broadband access and Internet use in a small underserved rural community. *Telecommunications policy*, *47*(4), 102499.

Vanek, J., Jarolimek, J., Vogeltanzova, T. (2011). Information and Communication Technologies for Regional Development in the Czech Republic – Broadband Connectivity in Rural Areas. *AGRIS on-line Papers in Economics and Informatics, Czech University of Life Sciences Prague, Faculty of Economics and Management, 3*(3), 1-10,

Volkoff, O. and Strong, D.M. (2013). Critical Realism and Affordances: Theorizing IT-Associated Organizational Change Processes. *MIS Quarterly, 37*, 819-834.

von Kameke, L. (2023). Mobile Internet user penetration in APAC 2018-2025 [infographic], January 3, available from: https://www.statista.com.suss.remotexs.co/statistics/201232/forecast-of-mobile-Internet-penetration-in-asia-pacific/?locale=en

We are Social and Hootsuite (2022). *Digital 2020 global Overview report: The essential Guide to the World's connected Behaviours*. DataReportal. Available from: <https://datareportal.com/reports/digital-2022-global-overview-report> (accessed 8 February 2023).

Whitacre, B. E. (2010). The Diffusion of Internet Technologies to Rural Communities: A Portrait of Broadband Supply and Demand. *American Behavioral Scientist*, *53*(9), 1283-1303.

Wong, S., & Low, D. (2019). “*Forging ahead on Southeast Asia's digital journey*”, The Business Times, February 15, available from: [https://www.businesstimes.com.sg/asean- business/contributions/forging-ahead-on-southeast-asia’s-digital-journey](https://www.businesstimes.com.sg/asean-%20business/contributions/forging-ahead-on-southeast-asia%E2%80%99s-digital-journey)

Wooldridge, J. M. (2016). Introductory Econometrics: A Modern Approach (6th ed.). Cengage Learning.

World Bank. (2022, May 24). Individuals Using the Internet (% of Population). Retrieved from https://data.worldbank.org/indicator/IT.NET.USER.ZS

World Bank. (2023). Underpinning Malaysia’s recovery with digital technologies can revitalize and raise the quality of economic growth. Retrieved from <https://www.worldbank.org/malaysia-digital-technologies>.

World Bank. (2023). Challenges in the digital economy in Croatia. Retrieved from [World Bank](https://www.worldbank.org/)

World Bank. (2023). World Development Indicators. Retrieved from <https://data.worldbank.org/>

Zahra, S. R., Chishti, M. A., Baba, A. I., & Wu, F. (2022). *Detecting Covid-19 chaos driven phishing/malicious URL attacks by a fuzzy logic and data mining based intelligence system*. Egyptian Informatics Journal, 23(2), 197–214. doi: 10.1016/j.eij.2021.12.003.

Zakon elektronskim komunikacijama (2018). Law on Electronic Communications, 95/18,  <https://www.paragraf.rs/propisi/zakon_o_elektronskim_komunikacijama.html>.