



e-ISSN: 2550-1569

Available online at
<https://myjms.mohe.gov.my/index.php/IJSMS>

International Journal of Service Management and Sustainability
9(1) 2024, 139 – 160.

**International
Journal of Service
Management and
Sustainability
(IJSMSust)**

Digital economy and income inequality in China: Challenges and way forward

Youqin Liang¹, Siew King Ting^{2*} and Abdul Aziz Lai Mohd Fikri Lai³

^{1,2}*Faculty of Business and Management, Universiti Teknologi MARA, Cawangan Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia*

³*Faculty of Business and Management, Universiti Teknologi MARA, Cawangan Sabah, 88997 Kota Kinabalu, Sabah, Malaysia*

ARTICLE INFO

Article history:

Received 10 January 2024
Revised 22 February 2024
Accepted 5 March 2024
Online first
Published 30 March 2024

Keywords:

Digital economy
Income inequality
Digital divide
ICT development
China
Urban-rural economy

DOI: [10.24191/ijms.v9i1.24202](https://doi.org/10.24191/ijms.v9i1.24202)

ABSTRACT

Digital economy plays an important role in reducing urban-rural income inequality and promoting common prosperity. In 2022, China's digital economy accounted for more than 41.5% of the gross domestic product (GDP). In China, there is a huge gap between urban and rural income resulting from the digital economy amidst rapid economic development. This paper aims to examine the impacts of the digital economy on the urban-rural income gap in China from different aspects such as characteristics, comparisons, policies, and challenges. Using academic databases, a narrative literature review approach was conducted on the impacts of the digital economy on urban-rural income inequality in China and international countries from 2014 to 2023. These empirical findings reveal that the development of the digital economy could narrow the urban-rural income inequality worldwide. However, these conclusions are mixed and inconsistent. The digital economy development on urban-rural income in China has encountered various challenges, such as the urban-rural gap in digital infrastructure, uneven regional digital economic development, and lack of digital talents. This study advances several recommendations to reduce urban-rural income inequality. These include, among others, improvement of enterprise informatisation and new generation information technologies, development of digital infrastructure, expansion of rural human capital, digital integration of rural industries, and enforcement of digital security.

1.0 INTRODUCTION

The economy of China has progressed over the decades, and it is currently the second-largest world economy after the United States. China has experienced rapid economic development and substantial improvements in people's livelihoods. Although China's per capita disposable income increased from

^{1*} Corresponding author. *E-mail address:* tings036@uitm.edu.my

¥384.7 in 1978 to ¥71,489 in 2020, the urban-rural income inequality has widened. The urban-rural ratio was recorded at 1.92:1 in 1978 and 2.56:1 in 2021 (Wang et al., 2024). Scholars argue that the digital economy development has further enlarged the urban-rural income inequality in China (Jiang et al., 2022; Jiang & Jin, 2024).

The digital economy is defined as the ‘part of economic output derived primarily from information communication technology (ICT) within an economy’ (Bukht & Heeks, 2017). The digital economy covers three main scopes namely: (a) the ICT sector that produces foundational digital goods and services, (b) the digital sector plus emerging digital and platform services, and (c) the use of ICTs in all economic fields (Bukht & Heeks, 2017). The digital economy includes big data analytics, artificial intelligence, the Internet of Things, platform economy, digital trade, fintech innovation, and resource sustainability (Dong et al., 2024). Meanwhile, urban-rural income inequality refers to the disparities of the income of urban residents and rural residents within a certain period (Zhu et al., 2020). It is used to express the gap between high- and low-income levels or the proportion of the gap between high and low-income levels in total income (Yang et al., 2022).

The government has taken various initiatives and strategies to narrow the urban-rural income gap over the decades. In particular, the government has invested in the digital economy to facilitate business processes, improve value-added employment, promote green energy, technology upgrade, and increase labour market performance (Liang & Tan, 2024; Zheng & Wong, 2024). In 2022, the ratio of per capita disposable income of urban and rural residents was recorded at 2.45. As a result, it restricts quality of life, prosperity, and long-term sustainable economic development in China (Chen & Ma, 2022).

Although the rapid development of the digital economy has brought new drivers to economic growth and national well-being, it also widens the urban-rural income gap. Subsequently, various economic and social challenges occur in urban-rural settings. These include, among others, unbalanced allocation of resources, concentrated development of labour, capital, and technology in urban areas, the limited income of low-skilled workers, different degrees of industries integration, new job creations in urban areas, and rural labour migration (Long et al., 2016; Su et al., 2015). In addition, the digital divide causes various issues in rural areas such as under-development of rural areas, a decline in productivity, and higher unemployment, and restricts rural residents from wealth creation and human capital development (Ye & Yang, 2020). In the long term, it limits the improvement of labour quality and affects the high-quality development of China's economy.

On the other hand, the net results of the impact of the digital economy on income inequality are mixed at the international level. The digital economy brings various benefits to the nations such as improvement in income, climate resilience, and environmental quality (Shobande et al., 2024; Tchamyou et al., 2019). Nonetheless, the digital economy causes negative impacts such as income inequality, widened gender pay gap, and pollution (Aksoy et al., 2021; Ndoya & Asongu, 2024; Rahman & Ferdaous, 2024). Thus, the impact of the digital economy on income inequality in China is worth investigating.

The study of the digital economy on urban-rural income inequality is essential and timely. China is chosen as the focus due to its main role in ICT at the international level, huge investment in the digital economy, vast geographical areas, and large population size. This study is important to narrow the urban-rural income inequality, promote common prosperity, and achieve social stability in China. This study is also in line with the sustainable development goals (SDGs) of (a) decent work and economic growth, and (b) reduced inequalities (United Nations, 2022).

Using the narrative literature review approach, the study aims to analyse (a) the characteristics of international empirical studies of the digital economy on urban-rural income inequality, (b) a comparison

of the digital economy and urban-income inequality in China and international countries, (c) worldwide comparative digital economy policies, and (d) challenges and issues of the digital economy on urban-rural income gap in China.

The paper consists of six parts. Section 2 provides a summary of the literature review of the digital economy on urban-rural income inequality. The institutional background of China's digital economy is detailed in Section 3. Section 4 outlines the methodology, while Section 5 discusses the findings and policy recommendations. Section 6 sums up the study.

2.0 LITERATURE REVIEW: THE THEORY OF DIGITAL DIVIDE

The digital divide theory refers to the gap between individuals, households, communities, or regions that have access to ICTs and those that do not. Moreover, this theory explores how digital access and skills disparities can lead to economic and social inequalities (Van Dijk, 2006).

The digital divide theory contends that the gap between the accessibility of information, the level of information utilisation awareness, income, and information infrastructure are the main reasons for the formation of the urban-rural “digital divide” and income gap (Jamil, 2021). The digital divide consists of three levels, namely (a) digital access divide, (b) digital capability divide, and (c) digital achievement divide (Scheerder et al., 2017). The digital capability divide is caused by the digital access divide, and the digital achievement divide arises due to the digital capability divide. Education, income, gender, age, and infrastructure are important factors that determine the formation of the digital divide (Buchi et al., 2016; Song et al., 2021).

The development of the digital economy brings significant improvement at the worldwide level such as economic growth, increase in productivity, renewable energy development, improvement of trade, and climate resilience (Shobande et al., 2024; Zheng & Wong, 2024). However, the disparities in digital access and skills also lead to various economic and social issues. These include, among others, income inequality, wage and salary rigidity at the lower market entry, automation, cyberbullying and security concerns, resources constraints for small and medium-sized businesses, skill gaps, pollution, widened human capital development between rich and poor countries, and gender gaps (Ndoya & Asongu, 2024; Rahman & Ferdaous, 2024; Wang & Chen, 2024).

In recent years, the impacts of the digital economy on the economy and society have been mixed. For example, ICT causes negative environmental impact in the Middle East and North Africa (MENA), and Organization for Economic Cooperation and Development (OECD) nations (Rahman & Ferdaous, 2024). In Europe, robot-driven productivity improvements benefit male more than female employees and widen the gender pay gap (Aksoy et al., 2021). In addition, Information Technological Infrastructure (ITI) promotes climate resilience and environmental quality in OECD countries (Shobande et al., 2024).

In China, urban areas tend to have better digital infrastructure such as high-speed internet connections and advanced telecommunications networks. Unlike cities, rural areas have lower internet penetration and insufficient access to information (Nie & Wan, 2023). Rural residents have a lower level of education, a lack of opportunities to systematically learn information tools, and limited network skills. These have hindered the rural residents' ability to fully participate in the digital economy and affect their income potential (Jiang et al., 2022).

The relationship between the digital economy and urban-rural income inequality is mixed, based on international empirical studies. These results include, among others, (a) positive relationship (Njangang et al., 2022; Odhiambo, 2022), (b) negative relationship (Tchamyoun et al., 2019; Zheng et al., 2022), (c) U-

shape relationship (Jiang et al., 2022; Peng & Dan, 2023) and (d) inverted U-shape relationship (Wu et al., 2024). These empirical studies were conducted in different countries and regions. In addition, different research conclusions were generated by scholars using different methodologies, data sets, and variables.

In China, the dual structure of the urban-rural economy system causes major challenges to the development of the digital economy. Although the Gini coefficient index decreased from 0.437 (2010) to 0.371(2020), the income inequality in China remains higher compared to European countries (The World Bank, 2024). China's government has implemented various short-term and long-term policies to develop and modernise the digital economy over the decades. Thus, the impacts of the digital economy on urban-rural income in China warrant an investigation.

3.0 INSTITUTIONAL BACKGROUND OF THE DIGITAL ECONOMY IN CHINA

In China, the digital economy plays an important part in the national development strategy. China has adopted a series of policies to guide the development of the digital economy to narrow the gap between the urban-rural economy (Zhang et al., 2021). The urban-rural settings of the digital economy in China are demonstrated in Table 1. There are significant differences in digital economy development between urban and rural areas in various aspects such as socio-economic background, digital facilities, and internet penetration.

Table 1. Urban-rural digital economy settings in China, 2022

No	Items	Urban areas	Rural areas
1	Number of populations	920.71million	491.04 million
2	Employment	459.31 million	274.20 million
3	Per capita disposable income	¥49,283	¥20,133
4	Digital facilities (Broadband access user)	413.33 million households	176.32 million households
5	Internet penetration	83.1%	61.9%

In 2022, China's population was recorded at 1,411.75 million, including 920.71 million urban permanent residents and 459.31 million employed people. The permanent rural population was 491.04 million, and the number of employed people was 274.2 million. The per capita disposable income of urban residents was ¥49,283, the per capita disposable income of rural residents was ¥20,133 and the ratio of per capita disposable income of urban and rural residents was 2.45 (He et al., 2024).

Digital equipment is represented by the number of internet broadband access users. There were 413.33 million urban broadband access users and 176.32 million rural broadband access users in China. The internet penetration rate in urban areas was 83.1%, while the internet penetration rate in rural areas was 61.9% (Meng et al., 2023). The difference in internet penetration rates between urban and rural areas has narrowed by 2.5% when compared to 2021.

The development of China's digital economy is divided into three stages, as demonstrated in Table 2. These stages include: (a) the embryonic stage, (b) the development stage, and (c) the prosperity stage.

Table 2. Development stage of China's digital economy: 1994-present

No	Digital economy stages	Years	Core themes
1	Embryonic stage	1994-2002	Information infrastructure; digital policies
2	Development stage	2003-2015	E-commerce; internet+; social media
3	Prosperity stage	2016- present	Industrial digitalisation; big data; financial digital transformation; 5G

3.1 Embryonic stage (1994-2002)

In 1994, China was officially connected to the internet, which was the starting point for the development of China's digital economy. In 1998, the Ministry of Information Industry was established to promote the informatisation of the national economy and social services (Shen, 2016). After that, China vigorously promoted the construction of information infrastructure. The main goal of this stage was to build a facility system.

Major policies have been implemented over the years. The most notable policy is "Several Opinions on Accelerating the Development of the Mobile Communications Industry". In 2000, the China Electronic Commerce Association (CECA) was established, which was a milestone in the e-commerce industry and marked the official recognition of e-commerce as a specific industry (You, 2020). These measures have laid a solid foundation for the subsequent application of internet communication technology and the development of new industries.

3.2 Development stage (2003-2015)

China's industrialisation development has entered a new stage in the 21st century. At the policy level, the main emphasis was to promote industrialisation through informatisation and promoting informatisation through industrialisation (Zhang et al., 2022). In January 2005, the State Council issued "Several Opinions on Accelerating the Development of E-Commerce", which was China's first policy document in the field of e-commerce.

In 2007, China released the "Eleventh Five-Year Plan for E-Commerce Development" and identified the e-commerce service industry as an important emerging industry in the country. In 2015, China issued the "Guiding Opinions on Actively Promoting the "Internet +" action. The rapid development of e-commerce, internet finance, and social media were notable features of this stage. The scale and advantages of the internet were fully utilised. The in-depth expansion and integration of the internet with various economic and social fields led to economic and social innovation, and development (Chen et al., 2014).

3.3 Prosperity stage (2016-present)

The current policy content is mainly focused on industrial planning and guidance, and a relatively clear industrial development direction and development goals have been formed. China has also entered a new stage of integrated development of emerging digital industrialisation and the digitalisation of traditional industries (Shi et al., 2022). The State Council has successively issued a series of policies such as the "13th Five-Year Plan for National Informatisation", the "Action Outline for Promoting the Development of Big Data", and the "14th Five-Year Plan for Digital Economy Development". These policies focused on industrial digitalisation and digital economic structures (Xu & Xu, 2023).

In 2022, China's digital economy accounted for more than 41.5% of GDP. A total of 2.312 million 5G base stations were built and opened in China, and 5G users reached 561 million, accounting for more than 60% of the world's digital economy (Nie et al., 2023). The above digital policies serve as an important tool for the government to promote the development of the digital economy and the innovation of manufacturing enterprises. It stimulates research and development (R&D), innovation, and productivity, realises digital clusters, and promotes industry digitisation and digital industrialisation (Xu & Xu, 2023).

4.0 METHODOLOGY

In this study, we focus specifically on the impact of the digital economy on urban-rural income inequality by using China and international empirical studies. We employed the narrative literature review method to achieve the objectives of the study. This method is more suitable because it accommodates

various sub-topics, is comprehensive, and covers policies and challenges issues. Other methods such as PRISMA and Bibliometrics analysis are not suitable as these approaches mainly focus on empirical studies.

We conducted a thorough search using keywords such as ‘digital economy’, ‘internet’, ‘ICT’, ‘broadband’, and ‘mobile phone’ in different online academic databases to proxy ‘digital economy’. The nine main databases include Google Scholar, Science Direct, Web of Knowledge, Scopus, Emerald, Elsevier, PubMed, ProQuest, and official governmental websites. These databases were chosen because they contained a wide range of choices with the latest, and trustable empirical studies, and official reports. In this study, we limited our analysis to empirical articles and official government reports. The official government reports are important for the discussion of digital economy policies and challenges, due to the rapid changes of the ICT sector. The processes of article selection are detailed in Table 3 and Table 4.

Table 3. Main stages of the article selection process

No	Stages	Remarks	Selected articles (n)
1	Identification	<ul style="list-style-type: none"> • Ran the searches in the nine main databases • Removed duplicates of articles and official government reports 	604
2	Screening	<ul style="list-style-type: none"> • Read title and abstract • Excluded books, book chapters, review papers, letters, non-English and non-Chinese papers • Excluded nonempirical articles and reports before 2014 and after 2023 	350
3	Eligibility	<ul style="list-style-type: none"> • Read the full text of articles and official government reports • Made further include/exclude decision • Excluded articles and reports that did not include words like urban-rural income inequality, income gap, digital economy • Excluded studies that did not assess the impact of the digital economy on income inequality 	105
4	Inclusion	<ul style="list-style-type: none"> • Selected articles and official reports that fulfilled the objectives of this study • Characteristics, comparison, policies, and challenges of digital economy on urban-rural income inequality 	85

Table 4. Inclusion and exclusion criteria of article selection

No	Elements	Inclusion	Exclusion
1	Type of Literature	Journal research articles and official government reports	Review articles, book chapters, conference papers, letters and replies, editorials, books and manuals
2	Language	English or Chinese	Other languages
3	Years	2014-2023	Before 2014 and after 2023
4	Research method	Empirical research methods and official government reports	Nonempirical research methods and official government reports
5	Title and Abstract Screening	Digital economy on income inequality	Non income inequality
6	Full-text screening	<ul style="list-style-type: none"> • Digital economy on specific dimension namely urban-rural income inequality • Characteristics, comparison, policies, and challenges of digital economy on urban-rural income inequality 	Not meeting the objectives

Based on the above criteria, our literature search yielded a total of 105 eligible published articles, of which only 85 were relevant to this study. The selected studies were published from 2014 to 2023. Thus, the explanation of the following sections is based on China and international empirical studies.

Although the development of the digital economy in each country is different due to the variation in the endowment of resources, we seek to discover (a) the characteristics of international empirical studies of digital economy on urban-rural income inequality, (b) a comparison of digital economy and urban-income inequality in China and international countries, (c) worldwide comparative digital economy policies, (d) challenges and issues of digital economy on urban-rural income gap in China, based on the above 85 studies.

5.0 RESULT AND DISCUSSION

In general, our review revealed three major findings from the narrative literature review: (a) the characteristics of international empirical studies of the digital economy on income inequality, (b) a comparison of the digital economy and urban-rural income inequality in China and international countries, (c) worldwide comparative digital economy policies, (d) challenges and issues of the digital economy on urban-rural income gap in China. The details of these three trends are discussed below.

5.1 Characteristics of empirical studies

We discovered four key aspects of these empirical models, as summarised in Table 5. These four aspects include (a) theories, (b) choices of dependent variables, (c) choices of independent variables, and (d) analysis methods. These empirical models were conducted in both developed and developing countries. The explanation of these characteristics is detailed in Table 5.

Table 5. Key aspects of empirical models

No	Items	Remarks	Sources
1	Theories	Dual economic structure theory, income distribution theory, information asymmetry theory, digital divide theory and human capital theory	Helsper (2010), and Vollrath (2009)
2	Dependent variables	Urban-rural income ratio, Theil index and Gini coefficient	Altunbas & Thornton (2020), and Odhiambo (2022)
3	Independent variables	Digital infrastructure, digital industrialisation and industrial digitisation	Canh et al., (2020), and Zhang et al., (2021)
4	Methods	Static panel models: ordinary least squares (OLS), fixed effect (FE), random effect (RE), dynamic panel models: difference generalized methods of moment (DGMM) and system generalized methods of moment (SGMM)	Asongu (2015), Odhiambo (2022), and Tchamyou et al., (2019)

First, scholars use various theories to explain the impact of the digital economy on the urban-rural income gap. Among others, these theories include (a) dual economic structure theory, (b) income distribution theory, (c) information asymmetry theory, (d) digital divide theory, and (e) human capital theory. Vollrath (2009) reveals that a dual economy is the coexistence of a modern commercial sector alongside a traditional subsistence sector. The traditional sector grows slowly, while the modern sector expands rapidly. The contrast exacerbates the gap between the two sectors, thereby becoming one of the main factors that restricts economic development in developing countries (Gao, 2021).

Income distribution theory contends that the distribution of production factors among different individuals is naturally uneven, and the difference in remuneration of different factors affects the income distribution of factor holders (Turnovsky, 2008). Information asymmetry theory refers to the impact of the asymmetric distribution of relevant information between transaction parties on market trading behaviour in an incomplete information market, and the resulting market operating efficiency (Bergh et al., 2019).

The digital divide refers to the economic and social inequality regarding the access, use, or impact of information and communications technologies. Education, income, gender, age, and infrastructure are important factors influencing the formation of the digital divide (Helsper, 2010; Sylvia & Szydlik, 2005). Human capital theory argues that the production factors that determine economic growth include the sum of knowledge, skills, physical strength, and human capital (Marginson, 2019). Differences in human capital investment cause income gaps and income inequality mainly comes from education premiums (Lee & Lee, 2018).

Second, scholars use different variables to proxy the urban-rural income inequality as dependent variables. Among others, these dependent variables are the urban-rural income ratio, the Theil index, and the Gini coefficient. Based on the availability of data, researchers use one or more of these variables to conduct empirical studies (Yuan et al., 2020).

Third, the indicators of independent variables mainly include three categories: (a) digital infrastructure, (b) digital industrialisation, and (c) industrial digitisation. The measures of digital infrastructure consist of the length of optical cables, internet penetration rate, mobile phone penetration rate, and fixed broadband subscription (Canh et al., 2020). Indicators of digital industrialisation include software business revenue, total telecommunications business volume, and the proportion of software industry employees. Lastly, indicators of industrial digitalisation include the digital financial inclusion index, e-commerce sales, and the number of corporate websites (Zhang et al., 2021).

Fourthly, scholars use various empirical analysis methods, such as (a) static panel models: ordinary least squares (OLS), fixed effect (FE) and random effect (RE), (b) dynamic panel models: difference generalized methods of the moment (DGMM) and system generalized methods of the moment (SGMM). The method most used by scholars is GMM. This method considers individual differences between samples and reduces bias caused by endogeneity (Arellano & Bover, 1995).

Lastly, the impacts of the digital economy on urban and rural income inequality are mixed. Among others, digital economy (a) widens the urban and rural income inequality (Njangang et al., 2022; Odhiambo, 2022), and (b) reduces urban-rural income inequality (Tchamyou et al., 2019; Zheng et al., 2022), (c) is U-shape (Jiang et al., 2022; Peng & Dan, 2023) and (d) is inverted U-shape (Wu et al., 2024). These empirical studies were conducted in different countries and regions. In addition, different research conclusions were drawn by scholars using different methodologies, data sets, and variables.

5.2 Comparison of the digital economy and urban-income inequality in China and international countries

We focus on the five aspects of comparison between China and international experiences on the impacts of the digital economy on urban-rural income inequality. These aspects include research focus, measurement of variables, digital economy development stage, and policy interventions, as summarised in Table 6.

International researchers pay more attention to the impact of digital technology and financial inclusion on income gap or wealth inequality (Altunbas & Thornton, 2020; Tchamyou et al., 2019). International studies focus on various indicators such as relative poverty, inequality of opportunity, and social welfare to proxy income inequality. These include, among others, the Gini coefficient, the Atkinson index, and the Palma ratio (Odhiambo, 2022). On the other hand, in China, the urban-rural resident income ratio data is more intuitive in an economic sense and often used as a common indicator of income inequality (Deng et al., 2023).

Table 6. Comparison of the digital economy and urban-rural income inequality in China and international countries

No	Items	International countries	China
1	Research focus	Income inequality (Altunbas & Thornton; 2020; Tchamyou et al., 2019)	Urban-rural income inequality (Jiang et al., 2022; Nie & Wan, 2023)
2	Measurement of variables	Dependent variables: Gini coefficient, the Atkinson index, and the Palma ratio Independent variables: ICTs (Odhiambo, 2022; Tchamyou et al., 2019)	Dependent variables: Theil index, income ratio of urban and rural residents Independent variables: Digital economy index (Deng et al., 2023; Jiang et al., 2022)
3	Digital economy development stage	Developed countries: advanced digital economy system Developing countries: weak digital economy system (Oloyede et al., 2023)	China's digital economy started late but developed rapidly (Zhang et al., 2021)
4	Policy intervention	Market mechanism, intellectual property protection (Manzini & Lazzarotti, 2016)	Innovation and entrepreneurship & strengthening supervision (Zhang et al., 2021)

International studies generally use information and communication technology (ICT) as explanatory variables, such as internet penetration, mobile phone penetration, and fixed broadband (Njangang et al., 2022; Odhiambo, 2022). In recent years, some studies in China have estimated the digital economy development index as an explanatory variable by constructing an indicator system (Jiang et al., 2022).

There is a unique development level of the digital economy between China and foreign countries. China's digital economy started late compared to advanced countries but has developed rapidly over the decades (Zhang et al., 2021). North America, Asia-Pacific, and Western Europe are the three regions with higher levels of digital economy development, while Africa is the least developed. The United States, Singapore, and Japan are the top three countries in the digital economy index ranking (Putri et al., 2023).

5.3 Policies of the worldwide digital economy

In 2022, the global 5G network covered 33.1% of the population, and the total number of global 5G base station deployments exceeded 3.64 million. China had a total of 2.312 million 5G base stations, accounting for 63.5% of the world's total. The total number of 5G connection users worldwide exceeded 1.01 billion, and the 5G penetration rate reached 12%. The number of 5G connections in China reached 560 million, accounting for more than half, and ranked first in the world (Liu, Tian et al., 2024).

The policies of the worldwide digital economy worldwide are summarised in Table 7. We categorise the countries into three types, namely: (a) high-income nations, (b) upper-middle-income nations, and (c) lower-middle and low-income nations.

The digital economic policies of developed high-income countries focus on digital innovation, technology research and development, and promote digital transformation (Mansour, 2022). Besides, the developed countries advance key scientific and technological research areas such as chips, artificial intelligence, quantum computing, and semiconductors (Ugurluay & Kirikkaleli, 2022). In addition, high-income countries also emphasise international cooperation and exchanges to promote the development of the global digital economy.

Table 7. Government policies on the digital economy

No	Types of countries	Countries	Major government policies & countries	Focus on the digital economy
1	High-income nation	United States, Germany, South Korea, and United Kingdom	<ul style="list-style-type: none"> Federal Communications and Commission (FCC), USA (Ezeigweneme et al., 2024) Germany digital innovation (Hervas-Oliver, 2021) South Korea e-government initiatives (Im & Seo, 2005) UK intellectual property initiatives (Kumar et al., 2024) 	Research & application of artificial intelligence, digital technology & intelligent manufacturing, Artificial Intelligence & talent training system
2	Upper middle-income nation	China, Malaysia, Indonesia, and Thailand	<ul style="list-style-type: none"> "14th Five-Year Plan" Digital Economy Development Plan in China (Wang & Zhong, 2023) Malaysia Digital Economy Blueprint (Edrak et al., 2022) Indonesia Digital Roadmap 2021-2024 (Alfiani, 2024) Thailand "National 20-Year Development Strategic Plan" (2018-2037) (Wongwuttivat & Lawanna, 2018) 	Industrial digitalisation, integration of digital industrialisation, digital transformation of public services & digital infrastructure
3	Lower-middle & low-income nation	India, Vietnam, Philippines, and Myanmar	<ul style="list-style-type: none"> Indian Maritime Vision 2030 (China Academy of Information and Communications Technology [CAICT], 2022) National digital transformation plan to 2025 and development direction to 2030 in Vietnam (China Academy of Information and Communications Technology [CAICT], 2022) Philippine Development Plan 2023-2028 (Guillermo, 2023) Cambodia Digital Economy and Society Policy Framework (DESPF 2021–35) (Savuth & Sothea, 2023) 	Digital tourism, digital trade, digital finance, digital government, digital economy & digital society

On the other hand, digital economic policies in upper-middle-income countries mainly concentrate on core digital technology innovation and promote the integrated development of digital economy and industry (Pham, 2023). For example, China encourages the digital transformation of enterprises at the policy level, promotes the application of information technology, strengthens infrastructure construction, and improves education and skill levels, and strengthens integration between the development of industrial digitisation and digital industrialisation. Nonetheless, various ongoing policies are implemented to support the regulations and governance levels to improve the development of the digital economy in China (Yang, 2023).

Digital economic policies in lower-middle-income and low-income countries concentrate on the application of the digital economy to improve the informational level and people's living standards (Elmassah & Mohieldin, 2020). These countries have implemented a series of measures to support the development of the digital economy, such as building internet infrastructure, providing basic digital services, and promoting mobile payments.

5.4 Problems of the digital economy in China

The digital economy poses many challenges in China, as listed in Table 8. These challenges include problems in digital infrastructure, regional differentiation, human resources, industrial digitalisation, and digital security.

Table 8. Problems of the digital economy in China

No	Items	Problems/Challenges
1	Digital infrastructure	<ul style="list-style-type: none"> • Dual urban-rural economy system (Peng & Dan, 2023; Vollrath, 2009) • Rural digital infrastructure construction is weak & internet penetration is lower than in cities (Deng et al., 2023) • First-level digital divide (Zhang et al., 2021)
2	Regional digital economy	<ul style="list-style-type: none"> • Severe digital divide among regions (Han et al., 2024) • Urban-rural income gap in provinces with high digital economic agglomeration is significantly smaller than in low-aggregation provinces (Xiao et al., 2023)
3	Human resources	<ul style="list-style-type: none"> • Rural residents have relatively low education levels and lack technical skills, insufficient business management, limited online education, and restricted internet financial management (Deng et al., 2023; Liu, Xue et al., 2023) • Second-level digital divide (Peng & Dan, 2023)
4	Industrial digitalisation	<ul style="list-style-type: none"> • Integration of rural industries and digital technology is qualitatively and quantitatively different from urban industries, slow development of rural secondary and tertiary industries, a small amount of industrial digitalisation, and low degree of industrial integration (Luo et al., 2023)
5	Digital security	<ul style="list-style-type: none"> • Cyber-attacks, fraud, malware, ransomware, distributed denial of service (DDoS) attacks, and cloud vulnerabilities (Perez-Moron, 2022)

Note: The first level of the digital divide refers to gaps in technology access due to differences in infrastructure and services, while the second level of the digital divide refers to the gap in usage due to differences in capabilities and skills (Scheerder et al., 2017).

There are large differences in digital infrastructure, digital literacy, and skills between urban and rural areas and between regions in China and the "digital divide" phenomenon still exists (Zhang et al., 2021). Although the construction of digital infrastructure in rural areas has accelerated and network conditions have improved, there is still a large gap compared to cities (Deng et al., 2023). The development of the digital economy in the Western region is relatively slow and the degree of digitalisation is low, as compared to the developed Eastern region (Han et al., 2024). The comprehensive index of digital economic development in Guangdong, Beijing, and Jiangsu ranks among the top three in the country, while Hainan, Jilin, Ningxia, Qinghai, and Tibet have relatively low development levels (Xiao et al., 2023).

Under China's urban-rural dual structure, China's rural residents have relatively low education, a lack of skills, and limited human capital (Deng et al., 2023). Compared to urban residents, rural residents do not have sufficient ability to use ICTs for resource acquisition, business management, online education, telemedicine, and internet financial management, especially those in remote and backward counties and townships in the central and western regions (Liu, Xue et al., 2023). The integration of rural industries and digital technology is qualitatively and quantitatively different from urban industries. The development of rural secondary and tertiary industries is slow, the amount of industrial digitalisation is small, and the degree of industrial integration is low (Luo et al., 2023).

5.4 Way forward for the digital economy in China

Based on the existing problems and challenges of the digital economy on the urban-rural income inequalities, several recommendations are proposed for the future development and direction of China's digital economy, as summarised in Table 9. The suggested durations of implementations are short-term,

medium-term and long-term, depending on the level of government support and cooperation from the stakeholders.

Table 9. Way forward for digital economy on urban-rural income inequality in China

No	Areas	Policy recommendations	Ministries/ Authorities in-charge	Duration of implementation
1	Enterprise informatisation	Improve enterprise informatisation and new generation information technologies: (a) 5G information technology and artificial intelligence (b) Digitalisation of the industry chain (c) Digital transformation of enterprises	Local government	Medium-term (6 months)
2	Digital infrastructure	Improve the construction and maintenance of digital infrastructure: (a) Develop rural network infrastructure. (b) Develop information terminals suitable for rural areas. (c) Increase infrastructure logistics. (d) Rapid urbanisation	Local government	Medium-term (6 months)
3	Human capital development	Improve rural human capital: (a) Use online education for training. (b) Guide skilled talents to return to their hometowns to start businesses. (c) Establish a special fund for information talents.	Local government	Long term (more than one year)
4	Digital integration of rural industries	Accelerate the digital integration of rural industries: (a) Accelerate the development of digital agriculture. (b) In-depth integration of characteristic agriculture. (c) Promote rural tourism industry.	State Council	Long term (more than one year)
5	Digital security	Digital economy regulation: (a) Data governance (b) Data security (c) Raise anti-fraud awareness	State Council	Short-term (3 months)

We suggest five major policies for the future development of the digital economy. Firstly, the government shall promote and improve enterprise informatisation and new-generation information technologies such as 5G information technology and artificial intelligence. By vigorously promoting the construction of internet platforms, enterprises embrace the digitalisation of the entire industry chain. In addition, the government shall increase financial support, cultivate information technology talents, and implement taxation policies to support the digital transformation of enterprises.

Secondly, according to the current regional and urban-rural imbalance of China's digital economy development, a differentiated digital economy development strategy should be implemented under the urbanisation initiatives (Qian et al., 2021). The government shall promote the development experience and models of leading areas in the digital economy to propel the backward areas to share "digital dividends". In addition, the government shall further improve the construction of rural digital information infrastructure according to local conditions. Among others, these include the construction of 4G base stations in rural areas, the promotion of 5G networks, and the improvement of rural network infrastructure. The government shall encourage the development of information terminals and mobile internet application software suitable

for rural areas. In addition, the government shall increase the construction of logistics infrastructure based on local characteristics and e-commerce development characteristics.

Thirdly, the government shall improve the development level of rural human capital. The stakeholders shall pay attention to the knowledge training and digital skill improvement of rural residents (Roberts et al., 2017). The government and relevant agricultural departments shall arrange vocational skills training for farmers and make good use of online education. The stakeholders shall guide e-commerce practitioners with practical experience to return to their hometowns to start businesses. In addition, a special fund for the training of agricultural and rural informatisation talents shall be established to support the role of rural talents in teaching and guiding the agricultural and rural informatisation talent teams.

Fourthly, the government shall promote enterprise reform and innovation in response to the digital differences between urban and rural industrial digitalisation. In particular, the government should integrate the development of the digital technology industry, service industry, and agriculture (Leng & Tong, 2022). The government shall upgrade the industrial foundation and modernisation of the industrial chains such as production, processing, circulation, sales, and consumption. The stakeholders shall promote the deep integration of the internet among industries, and develop new business formats such as creative agriculture. In addition, the Ministry shall promote the development of new industries such as rural tourism, and accelerate the coordinated development of primary, secondary, and tertiary industries in rural areas.

Finally, the government shall strengthen the digital security in the country. The government shall establish a sound legal supervision system, and absorb the experience of advanced countries. In addition, the government shall strengthen the promulgation of laws and regulations on data governance, data security, and anti-monopoly issues, protect the legitimate rights and interests of enterprises, and enhance residents' awareness of fraud.

6.0 CONCLUSION

In this paper, we focus specifically on the impact of the digital economy on the urban-rural income gap in China and other international countries. We conducted a quantitative study by using the narrative literature review method. We used keywords such as 'digital economy', 'internet', 'ICT', 'broadband', and 'mobile phone' to proxy the 'digital economy' in different online academic databases to obtain relevant journal articles.

There are four major contributions of this study to the empirical digital divide literature. Firstly, we offer a methodological approach by using the narrative literature review method to identify the characteristics of the empirical studies of the digital economy on urban-rural income inequality. We listed the steps on how to search for the relevant articles. We focus on four aspects of these empirical studies, namely (a) theories, (b) choices of dependent variables, (c) selection of independent variables, and (d) analysis methods. Future researchers could use a similar approach to examine the digital economy features in both developed and developing countries.

Secondly, we compare the status of the digital economy and income inequality between China and other countries across five aspects, namely research focus, measurement of variables, digital economy development, and policy interventions. Although the digital economy in China was developed much later compared to more advanced countries, it is now developing rapidly. These aspects could serve as a guide for the policymakers in China to further evaluate, promote, and improve the digital economy.

Thirdly, we present the latest digital economy policies at a worldwide level. We focus on the digital economy policies in three categories of countries, namely: (a) high-income nations, (b) upper-middle-

income nations, and (c) lower middle-and low-income nations. China's government could compare and draw some important lessons from these policies to further improve the digital economy development in China.

Fourthly, we discover unique challenges and issues of the digital economy on the urban-rural income gap in China, given its vast geographical and population size. These challenges and issues are more profound in rural areas, and these include (a) inadequate digital infrastructure, (b) a divided regional digital economy, (c) limited human resources, (d) deprived industrial digitalisation, and (e) frail digital security. Other developing countries could learn and further improve their digital economies to avoid the 'digital urban-urban income inequality trap'.

Various public policy implications could be derived from these results. We put forward five main policy recommendations to improve the digital urban-rural income gap. These five main recommendations are (a) promotion and improvement of enterprise informatisation and new generation information technologies, (b) development of digital infrastructure, (c) development of rural human capital, (d) digital integration of rural industries, and (e) enforcement of digital security. These measures could serve as a guide for China to further develop the digital economy and formulate relevant policies to narrow the urban-rural income inequalities.

Our study has several limitations, such as a limited number of countries and aspects of digital economy development. In the future, researchers could include more countries in the study to provide additional insights into the impacts of the digital economy on urban-rural income inequality. In addition, future researchers could focus on the impacts of the digital economy on other aspects such as education, quality of life, financial development, economic growth, and international trade. Subsequent studies could enrich the findings of the impacts of the digital economy on urban-rural income inequality in different countries by using both qualitative and quantitative methods.

Overall, our findings show that the digital economy causes economic and social challenges in rural areas in China, especially in terms of urban-rural income inequality. The government could draw some lessons from international digital economy policies to further improve the digital economy in China.

7.0 ACKNOWLEDGMENT

The authors would like to acknowledge the support of the Faculty of Business and Management, Universiti Teknologi MARA (UiTM), Cawangan Sarawak for providing the facilities and technical support for this research. The authors are grateful for the suggestions and comments contributed by the anonymous referees.

8.0 FUNDING

This work received no specific grant from any funding agency.

9.0 CONFLICT OF INTEREST STATEMENT

All authors declare that they have no conflicts of interest.

10.0 CONTRIBUTION OF AUTHORS

The authors confirm the equal contribution in each part of this work. All authors reviewed and approved the final version of this work.

11.0 REFERENCES

- Aksoy, C., Ozcan, B., & Philipp, J. (2021). Robots and the gender pay gap in Europe. *European Economic Review*, 134, 103693. <https://doi.org/10.1016/j.euroecorev.2021.103693>
- Alfiani, F. (2024). Regulation and literacy must strengthen digital transformation. *Asian Journal of Engineering, Social and Health*, 3(1), 94–108. <https://doi.org/10.46799/ajesh.v3i1.213>
- Altunbas, Y., & Thornton, J. (2020). Finance and income inequality revisited. *Finance Research Letters*, 37, 101355. <https://doi.org/10.1016/j.frl.2019.101355>
- Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1), 29–51. [https://doi.org/10.1016/0304-4076\(94\)01642-D](https://doi.org/10.1016/0304-4076(94)01642-D)
- Asongu, S. (2015). The impact of mobile phone penetration on African inequality. *International Journal of Social Economics*, 42(8), 706–716. <https://doi.org/10.1108/IJSE-11-2012-0228>
- Bergh, D. D., Ketchen Jr, D. J., Orlandi, I., Heugens, P. P., & Boyd, B. K. (2019). Information asymmetry in management research: Past accomplishments and future opportunities. *Journal of Management*, 45(1), 122–158. <https://doi.org/10.1177/0149206318798026>
- Buchi, M., Just, N., & Latzer, M. (2016). Modeling the second-level digital divide: A five-country study of social differences in Internet use. *New Media & Society*, 18(11), 2703–2722. <https://doi.org/10.1177/1461444815604154>
- Bukht, R., & Heeks, R. (2017). Defining, conceptualising and measuring the digital economy. *Development Informatics working paper*, (68). <http://dx.doi.org/10.2139/ssrn.3431732>
- Canh, N. P., Schinckus, C., Thanh, S. D., & Hui Ling, F. C. (2020). Effects of the internet, mobile, and land phones on income inequality and the Kuznets curve: Cross country analysis. *Telecommunications Policy*, 44(10), 102041. <https://doi.org/10.1016/j.telpol.2020.102041>
- Chen, D., & Ma, Y. (2022). Effect of industrial structure on urban–rural income inequality in China. *China Agricultural Economic Review*, 14(3), 547–566. <https://doi.org/10.1108/CAER-05-2021-0096>
- Chen, S., Xu, H., Liu, D., Hu, B., & Wang, H. (2014). A vision of IoT: Applications, challenges, and opportunities with China perspective. *IEEE Internet of Things Journal*, 1(4), 349–359. <https://doi.org/10.1109/JIOT.2014.2337336>
- China Academy of Information and Communications Technology (CAICT). (2022). *White paper on global digital economy* (2022). http://www.caict.ac.cn/english/research/whitepapers/202303/t20230316_416850.html
- Deng, X., Guo, M., & Liu, Y. (2023). Digital economy development and the urban-rural income gap: Evidence from Chinese cities. *Plos One*, 18(2), e0280225. <https://doi.org/10.1371/journal.pone.0280225>
- Dong, K., Liu, Y., Wang, J., & Dong, X. (2024). Is the digital economy an effective tool for decreasing energy vulnerability? A global case. *Ecological Economics*, 216, 108028. <https://doi.org/10.1016/j.ecolecon.2023.108028>
- Edrak, B., Nor, Z. M., & Shaik, A. R. (2022). The readiness of Malaysia digital economy: A study of three government policies from 1991 to 2020. *International Journal of Economics and Finance*, 14(12),

- 1–84. <https://doi.org/10.5539/ijef.v14n12p84>
- Elmassah, S., & Mohieldin, M. (2020). Digital transformation and localizing the sustainable development goals (SDGs). *Ecological Economics*, 169, 106490. <https://doi.org/10.1016/j.ecolecon.2019.106490>
- Ezeigweneme, C., Umoh, A., Ilojiyanya, V., & Adegbite, A. (2024). Review of telecommunication regulation and policy: comparative analysis USA and Africa. *Computer Science & IT Research Journal*, 5(1), 81–99. <https://doi.org/10.51594/csitrj.v5i1.703>
- Gao, F. (2021). China's poverty alleviation “miracle” from the perspective of the structural transformation of the urban–rural dual economy. *China Political Economy*, 4(1), 86–109. <https://doi.org/10.1108/CPE-06-2021-0008>
- Guillermo, M (2023). Perceptions on the implementation of the Philippine development plan in ensuring efficient governance. *Open Journal of Leadership*, 12(4), 375–399. <https://doi.org/10.4236/ojl.2023.124018>
- Han, J., Song, Y., & Chen, J. (2024). Reducing the “digital divide” to reap the “digital dividend”: spatial differences and convergence of the digital economy in cities of China. *Frontiers in Sustainable Cities*, 6, 1283604. <https://doi.org/10.3389/frsc.2024.1283604>
- Helsper, E. A. (2010). Digital natives: Where is the evidence? *British Educational Research Journal*, 36, 503–520. <https://doi.org/10.1080/01411920902989227>
- He, S., Zhong, Y., & He, W. (2024). The impact of city size on income inclusive growth: A human capital perspective and evidence from China. *Plos One*, 19(2), e0288294. <https://doi.org/10.1371/journal.pone.0288294>
- Hervas-Oliver, J. L., Gonzalez-Alcaide, G., Rojas-Alvarado, R., & Monto-Mompo, S. (2021). Emerging regional innovation policies for industry 4.0: analyzing the digital innovation hub program in European regions. *Competitiveness Review: An International Business Journal*, 31(1), 106–129. <https://doi.org/10.1108/CR-12-2019-0159>
- Im, J. J., & Seo, J. W. (2005). E-government in South Korea: planning and implementation. *Electronic Government, an International Journal*, 2(2), 188–204. <https://doi.org/10.1504/EG.2005.007094>
- Jamil, S. (2021). From digital divide to digital inclusion: Challenges for wide-ranging digitalization in Pakistan. *Telecommunications Policy*, 45(8), 102206. <https://doi.org/10.1016/j.telpol.2021.102206>
- Jiang, C., & Jin, B. (2024). Does the development of digital economy infrastructure reduce the urban-rural income gap? Theoretical experience and empirical data from China. *Kybernetes*, 53(2), 600–619. <https://doi.org/10.1108/K-12-2022-1744>
- Jiang, Q., Li, Y., & Si, H. (2022). Digital economy development and the urban–rural income gap: Intensifying or reducing. *Land*, 11(11), 1980. <https://doi.org/10.3390/land11111980>
- Kumar, N., Gour, R., & Sharma, N. (2024). Intellectual property rights and economical development: A brief overview. *Journal of Scientific Research and Reports*, 30(5), 145–162. <https://doi.org/10.9734/jsrr/2024/v30i51930>
- Lee, J. W., & Lee, H. (2018). Human capital and income inequality. *Journal of the Asia Pacific Economy*, 23(4), 554–583. <https://doi.org/10.1080/13547860.2018.1515002>

- Leng, X., & Tong, G. (2022). The digital economy empowers the sustainable development of China's agriculture-related industries. *Sustainability*, 14(17), 10967. <https://doi.org/10.3390/su141710967>
- Liang, S., & Tan, Q. (2024). Can the digital economy accelerates China's export technology upgrading? Based on the perspective of export technology complexity. *Technological Forecasting and Social Change*, 199, 123052. <https://doi.org/10.1016/j.techfore.2023.123052>
- Liu, T., Xue, D., Fang, Y., & Zhang, K. (2023). The impact of differentiated development of the digital economy on employment quality—An empirical analysis based on provincial data from China. *Sustainability*, 15(19), 14176. <https://doi.org/10.3390/su151914176>
- Liu, Y., Tian, L., Li, C., & Wu, Y. (2024). Analyzing the competitiveness and strategies of Chinese mobile network operators in the 5G era. *Telecommunications Policy*, 48(2), 102652. <https://doi.org/10.1016/j.telpol.2023.102652>
- Long, H., Tu, S., Ge, D., Li, T., & Liu, Y. (2016). The allocation and management of critical resources in rural China under restructuring: Problems and prospects. *Journal of Rural Studies*, 47, 392–412. <https://doi.org/10.1016/j.jrurstud.2016.03.011>
- Luo, G., Yang, Y., & Wang, L. (2023). Driving rural industry revitalization in the digital economy era: Exploring strategies and pathways in China. *Plos One*, 18(9), e0292241. <https://doi.org/10.1371/journal.pone.0292241>
- Mansour, H. (2022). How successful countries are in promoting digital transactions during COVID-19. *Journal of Economic Studies*, 49(3), 435–452. <https://doi.org/10.1108/JES-10-2020-0489>
- Manzini, R., & Lazzarotti, V. (2016). Intellectual property protection mechanisms in collaborative new product development. *R&D Management*, 46(S2), 579–595. <https://doi.org/10.1111/radm.12126>
- Marginson, S. (2019). Limitations of human capital theory. *Studies in higher education*, 44(2), 287–301. <https://doi.org/10.1080/03075079.2017.1359823>
- Meng, Y., Lu, Y., & Liang, X. (2023). Does Internet use alleviate the relative poverty of Chinese rural residents? A case from China. *Environment, Development and Sustainability*, 1–30. <https://doi.org/10.1007/s10668-023-03531-3>
- Ndoya, H., & Asongu, S. A. (2024). Digital divide, globalization and income inequality in sub-Saharan African countries: Analysing cross-country heterogeneity. *Social Responsibility Journal*, 20(1), 1–19. <https://doi.org/10.1108/SRJ-07-2022-0277>
- Nie, C., & Wan, J. (2023). How does internet infrastructure construction affect the urban–rural income gap? Evidence from a quasi-natural experiment in China. *Progress in Development Studies*, 23(3), 317–337. <https://doi.org/10.1177/14649934231173819>
- Nie, C., Zhong, Z., & Feng, Y. (2023). Can digital infrastructure induce urban green innovation? New insights from China. *Clean Technologies and Environmental Policy*, 25(10), 3419–3436. <https://doi.org/10.1007/s10098-023-02605-0>
- Njangang, H., Beleck, A., Tadadjeu, S., & Kamguia, B. (2022). Do ICTs drive wealth inequality? Evidence from a dynamic panel analysis. *Telecommunications Policy*, 46(2), 102246. <https://doi.org/10.1016/j.telpol.2021.102246>

- Odhiambo, N. M. (2022). Information technology, income inequality and economic growth in sub-Saharan African countries. *Telecommunications Policy*, 46(6), 102309. <https://doi.org/10.1016/j.telpol.2022.102309>
- Oloyede, A. A., Fark, N., Noma, N., Tebep, E., & Nwaulune, A. K. (2023). Measuring the impact of the digital economy in developing countries: A systematic review and meta-analysis. *Heliyon*, 9, e17654. <https://doi.org/10.1016/j.heliyon.2023.e17654>
- Peng, Z., & Dan, T. (2023). Digital dividend or digital divide? Digital economy and urban-rural income inequality in China. *Telecommunications Policy*, 47(9), 102616. <https://doi.org/10.1016/j.telpol.2023.102616>
- Perez-Moron, J. (2022). Eleven years of cyberattacks on Chinese supply chains in an era of cyber warfare, a review and future research agenda. *Journal of Asia Business Studies*, 16(2), 371–395. <https://doi.org/10.1108/JABS-11-2020-0444>
- Pham, K. T. (2023). Technology revolution 4.0 is a social-economic development solution for developing countries. *Revista de Investigaciones Universidad del Quindío*, 35(1), 148–156. <https://doi.org/10.33975/riuq.vol35n1.1008>
- Putri, S. O., Yahya, A. S., Attahira, A., Nabilasari, L. S., & Tamaela, V. (2023). Digital economy growth in Singapore and Thailand following the post-COVID-19 pandemic. *Journal of Eastern European and Central Asian Research (JEECAR)*, 10(4), 557–568. <https://doi.org/10.15549/jeecar.v10i4.1366>
- Qian, Y., Liu, J., Cheng, Z., & Forrest, J. Y. L. (2021). Does the smart city policy promote the green growth of the urban economy? Evidence from China. *Environmental Science and Pollution Research*, 28, 66709–66723. <https://doi.org/10.1007/s11356-021-15120-w>
- Rahman, M. N., & Ferdaous, J. (2024). Linkages between ICT diffusion, renewable energy consumption, and carbon emissions: A comparative analysis of SAARC, MENA, and OECD countries. *Environmental Science and Pollution Research*, 31(9), 13471–13488. <https://doi.org/10.1007/s11356-024-32068-9>
- Roberts, E., Anderson, B. A., Skerratt, S., & Farrington, J. (2017). A review of the rural-digital policy agenda from a community resilience perspective. *Journal of Rural Studies*, 54, 372–385. <https://doi.org/10.1016/j.jrurstud.2016.03.001>
- Savuth, C., & Sothea, O. (2023). Digital transformation in Cambodia. *Journal of Southeast Asian Economies*, 40(1), 145–172. <https://www.jstor.org/stable/27211228>
- Scheerder, A., Van Deursen, A., & Van Dijk, J. (2017). Determinants of internet skills, uses and outcomes. A systematic review of the second-and third-level digital divide. *Telematics and informatics*, 34(8), 1607–1624. <https://doi.org/10.1016/j.tele.2017.07.007>
- Shen, H. (2016). China and global internet governance: toward an alternative analytical framework. *Chinese Journal of Communication*, 9(3), 304–324. <https://doi.org/10.1080/17544750.2016.1206028>
- Shi, Y., Gao, Y., Luo, Y., & Hu, J. (2022). Fusions of industrialisation and digitalisation (FID) in the digital economy: Industrial system digitalisation, digital technology industrialisation, and beyond. *Journal of Digital Economy*, 1(1), 73–88. <https://doi.org/10.1016/j.jdec.2022.08.005>

- Shobande, O. A., Ogbeifun, L., & Tiwari, A. K. (2024). Unlocking information technology infrastructure for promoting climate resilience and environmental quality. *Technological Forecasting and Social Change*, 198, 122949. <https://doi.org/10.1016/j.techfore.2023.122949>
- Song, Y., Qian, C., & Pickard, S. (2021). Age-related digital divide during the COVID-19 pandemic in China. *International Journal of Environmental Research and Public Health*, 18(21), 11285. <https://doi.org/10.3390/ijerph182111285>
- Su, C., Liu, T., Chang, H., & Jiang, X. (2015). Is urbanization narrowing the urban-rural income gap? A cross-regional study of China. *Habitat International*, 48, 79–86. <https://doi.org/10.1016/j.habitatint.2015.03.002>
- Sylvia, E. K., & Szydlik, M. (2005). Causes and trends of the digital divide. *European Sociological Review*, 21(4), 409–422. <https://doi.org/10.1093/esr/jci030>
- Tchamyou, V. S., Erreygers, G., & Cassimon, D. (2019). Inequality, ICT and financial access in Africa. *Technological Forecasting and Social Change*, 139, 169–184. <https://doi.org/10.1016/j.techfore.2018.11.004>
- The World Bank. (2024). *Gini Index-China*. <https://data.worldbank.org/indicator/SI.POV.GINI?locations=CN>
- Turnovsky, S. J. (2008). The role of factor substitution in the theory of economic growth and income distribution: Two examples. *Journal of Macroeconomics*, 30(2), 604–629. <https://doi.org/10.1016/j.jmacro.2007.06.003>
- Ugurluay, K., & Kirikkaleli, D. (2022). Sustainable technology in high-income economies: The role of innovation. *Sustainability*, 14(6), 3320. <https://doi.org/10.3390/su14063320>
- United Nations. (2022). *The sustainable development goals report (2022)*. <https://unstats.un.org/sdgs/report/2022/The-Sustainable-Development-Goals-Report-2022.pdf>
- Van Dijk, J. A. (2006). Digital divide research, achievements and shortcomings. *Poetics*, 34(4-5), 221–235. <https://doi.org/10.1016/j.poetic.2006.05.004>
- Vollrath, D. (2009). The dual economy in long-run development. *Journal of Economic Growth*, 14(4), 287–312. <https://doi.org/10.1007/s10887-009-9045-y>
- Wang, L., & Chen, L. (2024). Resource dependence and air pollution in China: Do the digital economy, income inequality, and industrial upgrading matter? *Environment, Development and Sustainability*, 26(1), 2069–2109. <https://doi.org/10.1007/s10668-022-02802-10>
- Wang, X., & Zhong, M. (2023). Can digital economy reduce carbon emission intensity? Empirical evidence from China's smart city pilot policies. *Environmental Science and Pollution Research*, 30(18), 51749–51769. <https://doi.org/10.1007/s11356-023-26038-w>
- Wang, Z., Zheng, X., Wang, Y., & Bi, G. (2024). A multidimensional investigation on spatiotemporal characteristics and influencing factors of China's urban-rural income gap (URIG) since the 21st century. *Cities*, 148, 104920. <https://doi.org/10.1016/j.cities.2024.104920>
- Wongwuttawat, J., & Lawanna, A. (2018). The digital Thailand strategy and the ASEAN community. *The Electronic Journal of Information Systems in Developing Countries*, 84(3), e12024. <https://doi.org/10.1002/isd2.12024>

- Wu, M., Ma, Y., Gao, Y., & Ji, Z. (2024). The impact of digital economy on income inequality from the perspective of technological progress-biased transformation: evidence from China. *Empirical Economics*, 1–41. <https://doi.org/10.1007/s00181-024-02563-6>
- Xiao, Q., Gao, M., Chen, L., & Jiang, J. (2023). Dynamic multi-attribute evaluation of digital economy development in China: A perspective from interaction effect. *Technological and Economic Development of Economy*, 29(6), 1728–1752. <https://doi.org/10.3846/tede.2023.20258>
- Xu, Y., & Xu, L. (2023). The convergence between digital industrialization and industrial digitalization and export technology complexity: Evidence from China. *Sustainability*, 15(11), 9081. <https://doi.org/10.3390/su15119081>
- Yang, G., Deng, F., Wang, Y., & Xiang, X. (2022). Digital paradox: Platform economy and high-quality economic development—New evidence from provincial panel data in China. *Sustainability*, 14(4), 2225. <https://doi.org/10.3390/su14042225>
- Yang, H. (2023). Construction of the new development dynamic and development of digital economy: Internal logic and policy focus. *China Political Economy*, 6(2), 92–113. <https://doi.org/10.1108/CPE-12-2023-0>
- Ye, L., & Yang, H. (2020). From digital divide to social inclusion: A tale of mobile platform empowerment in rural areas. *Sustainability*, 12(6), 2424. <https://doi.org/10.3390/su12062424>
- You, C. (2020). Law and policy of platform economy in China. *Computer Law & Security Review*, 39, 105493. <https://doi.org/10.1016/j.clsr.2020.105493>
- Yuan, Y., Wang, M., Zhu, Y., Huang, X., & Xiong, X. (2020). Urbanization's effects on the urban-rural income gap in China: A meta-regression analysis. *Land Use Policy*, 99, 104995. <https://doi.org/10.1016/j.landusepol.2020.104995>
- Zhang, Q., Yang, M., & Lv, S. (2022). Corporate digital transformation and green innovation: A quasi-natural experiment from integration of informatization and industrialization in China. *International Journal of Environmental Research and Public Health*, 19(20), 13606. <https://doi.org/10.3390/ijerph192013606>
- Zhang, W., Zhao, S., Wan, X., & Yao, Y. (2021). Study on the effect of digital economy on high-quality economic development in China. *PloS One*, 16(9), e0257365. <https://doi.org/10.1371/journal.pone.0257365>
- Zheng, M., & Wong, C. Y. (2024). The impact of digital economy on renewable energy development in China. *Innovation and Green Development*, 3(1), 100094. <https://doi.org/10.1016/j.igd.2023.100094>
- Zheng, Y., Zhu, T., & Jia, W. (2022). Does Internet use promote the adoption of agricultural technology? Evidence from 1 449 farm households in 14 Chinese provinces. *Journal of Integrative Agriculture*, 21(1), 282–292. [https://doi.org/10.1016/S2095-3119\(21\)63750-4](https://doi.org/10.1016/S2095-3119(21)63750-4)
- Zhu, S., Yu, C., & He, C. (2020). Export structures, income inequality and urban-rural divide in China. *Applied Geography*, 115, 102150. <https://doi.org/10.1016/j.apgeog.2020.102150>

About the Authors

Youqin Liang is an associate professor in the Department of Management at the Taizhou Vocational & Technical College, China. Currently, she is studying for a PhD in economics at the Faculty of Business and Management, Universiti Teknologi MARA, Cawangan Sarawak, Malaysia. Her main research areas are public economics and financial accounting. She has published extensively on these subjects in various publications such as the *Times Finance*, *Economic Research Tribune*, and *Automation Technology and Applications*. She can be reached through her email at 2277481937@qq.com.

Siew King Ting, PhD is an associate professor of economics at the Universiti Teknologi MARA, Cawangan Sarawak, Malaysia. She received her PhD in economics from the University of New England, Australia. She publishes her research works on productivity and efficiency, innovations in teaching and learning, applied economics, and labour economics in both international and national journals. She provides consultancy services in human resource economics to the government and industry players. She supervises undergraduate and postgraduate students in economics. She is the Corresponding Author and can be reached through her email at tings036@uitm.edu.my.

Abdul Aziz Lai bin Mohd Fikri Lai, PhD is a senior lecturer at the Faculty of Business and Management, Universiti Teknologi MARA, Cawangan Sabah, Malaysia. He graduated with a Bachelor's Degree in Business Administration (Honors) in Business Economics and post-graduate studies by research in Finance and International Trade. He obtained his PhD entitled "A Segregation Analysis of Malaysia's International Trade Pattern". He publishes his research works in both international and national journals. Currently, he is the Head of the Unit for the Industrial Linkages, Community and Alumni of the university. He can be reached through his email at abdulazizlai@uitm.edu.my.



© 2024 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<http://creativecommons.org/licenses/by/4.0/>).

