Analysis of Inequality in Household Internet Utilization and Policy Implications

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Cover Page Footnote

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Abstract

This research investigates the pervasive inequality in household internet access and use that contributes to the digital divide. As the internet becomes an integral part of daily life, variations in access and use carry significant implications for social and economic opportunities. A quantitative approach is applied, analyzing data from The National Statistical Office of Thailand to capture a comprehensive understanding of inequality in household internet access and use, as measured by the Gini coefficient. Five aspects of internet access and use are considered as the determinants of inequality, including internet connectivity, internet affordability, internet quality, device availability, and flexibility and convenience in connecting to the internet. The analysis further breaks down the data by residential area, socio-economic class, and income. The research found that households living outside the municipality face greater inequality in accessing and using the internet than those within the municipality. Households in the northern and northeastern regions face higher levels of inequality in internet access and use compared to other regions. Economically inactive households encounter extreme inequality. Regarding the inequality based on income, the finding can be concluded that households with lower average monthly incomes face an increase in inequality in internet utilization. A policy for relieving inequality is suggested.

Keywords: Inequality, Household internet, Digital divide, Gini coefficient, Policy implications

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Introduction

In the contemporary digital economy landscape, the Internet, along with various digital innovations, plays a pivotal role in facilitating communication, disseminating information, and fostering social connections. Moreover, it serves as a critical gateway to a myriad of services and opportunities offered by both government and private sectors. These include, but are not limited to, public health services, educational avenues, and career prospects. The advent of the Internet has fundamentally transformed traditional paradigms of communication, work, and learning (Kraiwanit et al., 2023; Lacarcel & Huete, 2023; Limna et al., 2023). However, not every person or household has equal internet access, leading to the digital divide and causing economic and social inequality, especially for those with limited resources, such as internet connection budgets, technology knowledge, and skills, and those residing in distant areas. All these factors limit the opportunity for household members to access and use the internet (Chiou & Tucker, 2020; Sanders & Scanlon, 2021; Fang et al., 2022).

According to the survey conducted by the National Statistical Office (2022) on the use of information and communication technology in households between 2017 and 2022, it was found that internet connections in households have been continuously increasing each year. Most recently, in 2022, 89.3 percent of households connected to the internet, up from 87.7 percent in 2021. When considering household internet connections by region in 2022, it was observed that households in Bangkok had the highest internet connectivity at 96.3%, followed by the Central region at 92.5%, the Southern region at 90.7%, the Northeastern region at 85.4%, and the Northern region at 82.3%.

Figure 1: The percentage of households with internet connections from 2017 to 2022

Source: National Statistical Office, 2022

Figure 2: The percentage of households with internet connections from 2020 to 2022, categorized by region
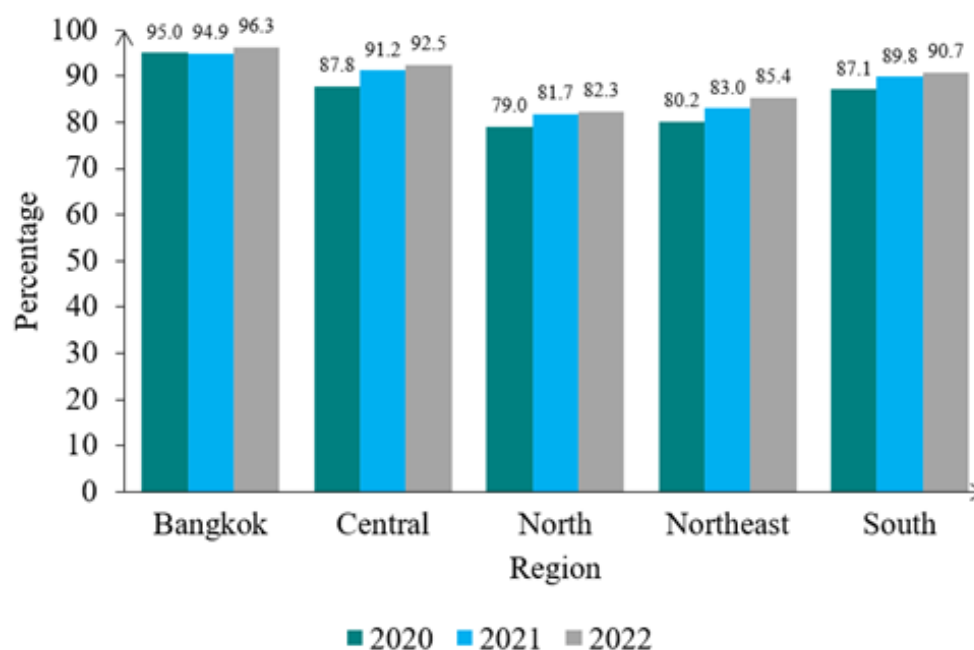
Source: National Statistical Office, 2022

Inequality in internet access and use contributes to a digital divide, primarily driven by economic and social factors. Moreover, the insufficient development of digital infrastructure in remote or rural areas, particularly in developing countries like Thailand, presents a significant barrier to people's access to and utilization of the internet. The International Monetary Fund (2020) reports that a large world population still lacks access to home or mobile internet connections, especially among disadvantaged groups and those residing in rural areas facing limited internet access. This digital inequality has resulted in increased income and opportunity inequality, even in developed countries.

Although existing literature acknowledges the existence of digital inequality in Thailand, there is still a gap in the study of inequalities within specific areas of digital technology, which would be useful in reducing the digital divide and advancing equitable access to and use of digital technology. Thus, this research aims to investigate inequality in internet access and use among households in Thailand by assessing the index of internet access and use in five aspects, including (1) Internet Connectivity, (2) Internet Affordability, (3) Internet Quality, (4) Device Availability, and (5) Flexibility and Convenience.

The paper consists of six main sections. The first section is the introduction. The second section provides a literature review. The third section outlines the research methodology, while the fourth section presents the study's results. The fifth section discusses the study's findings, and the last section includes conclusions, limitations, and recommendations.

Literature Review

Inequality refers to an unfair difference among groups of people in society, where some groups possess more wealth, status, or opportunities than others. Inequality can arise in various areas (Koh, 2020; Nijman & Wei, 2020; Tanjitpiyanond et al., 2022). The United Nations (2015) defines it as a state of disparity, especially concerning rights and opportunities. Inequality is a key concept in social justice theory. Economists often focus on the financial dimension when studying inequality, which is determined by the income and consumption of individuals and households. That is just one perspective, as inequality can take many forms, such as inequality in skills, education, opportunities, happiness, health, life expectancy, welfare, assets, and social status. (Heshmati, 2004)

*Digital Inequality***:** DiMaggio and Hargittai (2001) study on the digital divide and inequality states that differences in five dimensions are the primary cause of digital inequality. First, Technical Means involve the availability of equipment and connection methods, including computers with sufficient speed and appropriate software installed. Differences in these aspects can lead to limitations in accessing and using the internet. Second, Autonomy involves the convenience of accessing and using the Internet, such as accessing it from various places including home, work, school, or various community centers. Third, Skills involve technical knowledge and other skills that affect the ability to access and use the internet. Fourth, Social Support involves advice on using technology from friends, family members, teachers, and co-workers. This support can increase motivation to use technology and develop digital capabilities. Finally, Purpose involves income, education, and other factors that influence the reasons for using the internet. Inequality in these five aspects can impact the experiences of internet users, influencing both the use and satisfaction, as well as the returns from using the internet in various forms, including skills, human capital, social capital, income, and political outcomes.

The affordability gap is the part of the digital inequality. Affordability is important for using telecom services as it relates to the price of telecom/ICT services and consumer income. The monthly cost of internet plans expressed as a percentage of per-capita GNI serves as an affordability indicator. According to an evaluation by the International Telecommunication Union (ITU), the United Nations specialized agency for information and communication technology, internet affordability has improved across all economic levels and regions. However, access to the internet remains limited by costs, especially in low-income countries. The task of expanding internet access in these areas may become more challenging due to the current state of the global economy, characterized by high inflation, rising interest rates, and significant uncertainty (ITU, 2022).

The internet usage's unequal distribution is driven by social inequalities such as socioeconomic status, gender, age, ethnicity, and geographic location. Cost of use, lack of appropriate content, and lack of technological support are also barriers for underprivileged people to access and use the internet. Inequality in internet access is not solely dependent on individual skills or resources, as evidenced by numerous studies examining gaps in internet access and use. People living in different geographic locations, such as rural, suburban, and urban centers, experience varying levels of internet access. Additionally, internet users tend to have higher financial and educational statuses than non-users. Given the growing importance of the Internet

in searching for information, finding jobs, and participating in civic activities, inequality in access to and use of the Internet contributes to broader social inequities. Thus, this inequality impacts both individuals and society on a larger scale (Chen & Wellman, 2005).

According to Muller and Aguiar (2022), the digital divide refers to the gap between those with internet access and those without. This divide is caused by several factors, including the availability of the internet. The presence of an internet connection in residential areas is a primary factor in accessing the internet, serving as the first requirement. The next factor is affordability, which involves comparing the cost of the internet with the cost of other essential goods and assessing them as a proportion of income. The quality of the internet is determined by the speed of uploading and downloading data, which should be sufficient to meet the needs of the user. In addition, there exist additional factors that contribute to the digital divide, including skills, digital knowledge, technology, interests, comprehension, language, content, device connectivity and security.

A study by Pansri and Chomtohsuwan (2019) on the inequality of digital life in Thailand found that inequality is spread throughout the country, but it is trending in an improving direction due to a steady decrease in inequality. The population is increasingly using the internet each year, particularly connecting through smartphones for various purposes such as online purchases. There is less digital inequality among people in urban areas than in the countryside. People living in the Northeastern region experience the greatest inequality, while Bangkok has less digital inequality than other regions.

The framework depicted in Figure 3 is a conceptual model outlining the factors that contribute to inequalities in household internet access and use. The study's framework suggests that inequality in internet access and use is a multifaceted issue that is influenced by a range of factors, including the quality and cost of internet service, availability of devices, and the ease with which these services can be used. It is a model that can be used to assess and address the digital divide by identifying which factors need improvement in different communities.

Figure 3: Conceptual framework
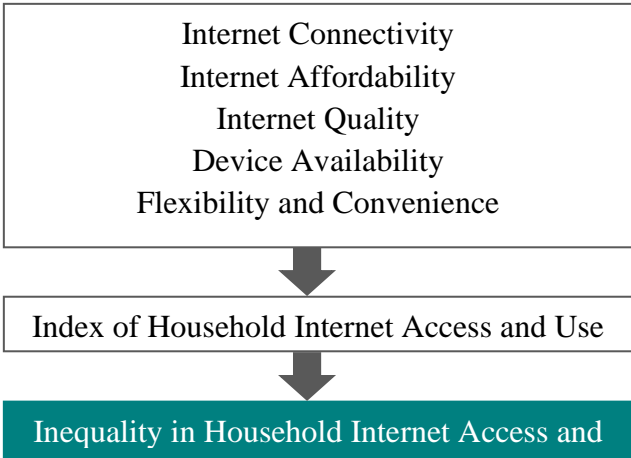
Source: Authors

Inequality Measurement: Inequality can be assessed applying the Lorenz curve and indices such as the Gini Index and Atkinson Index. When deciding which sort of inequality measurement to utilize, it is important to weigh the advantages and disadvantages of each option as well as how best to combine them to comprehensively measure inequality (United Nations, 2015; Sitthiyot & Holasut, 2023). Measuring inequality applying the Lorenz curve involves analyzing the distribution of income and wealth by considering cumulative income relative to cumulative population. Several inequality indices can be obtained from the Lorenz curve; the most widely used is the Gini Coefficient (Heshmati, 2004; Orsuwan et al., 2023).

The Gini coefficient or Gini index was developed by an Italian statistician named Corrado Gini and is commonly used to measure income inequality. However, other forms of inequality, such wealth and life expectancy, can also be measured by applying an adaptation of the Gini coefficient. The Gini coefficient ranges from 0 to 1, with higher values indicating greater inequality. It can also be expressed as a percentage, known as the Gini index, ranging from 0 to 100. The Gini coefficient is calculated by examining the area under the Lorenz curve, which illustrates the relationship between the cumulative percentage of income and the cumulative percentage of the population. The formula for the Gini coefficient, Gini = A/(A+B) (Hasell, 2023), quantifies the deviation of the Lorenz curve from the 45-degree line, a symbol of equal income distribution, by comparing areas A and B (Figure 3).

Figure 4: Gini coefficient of inequality
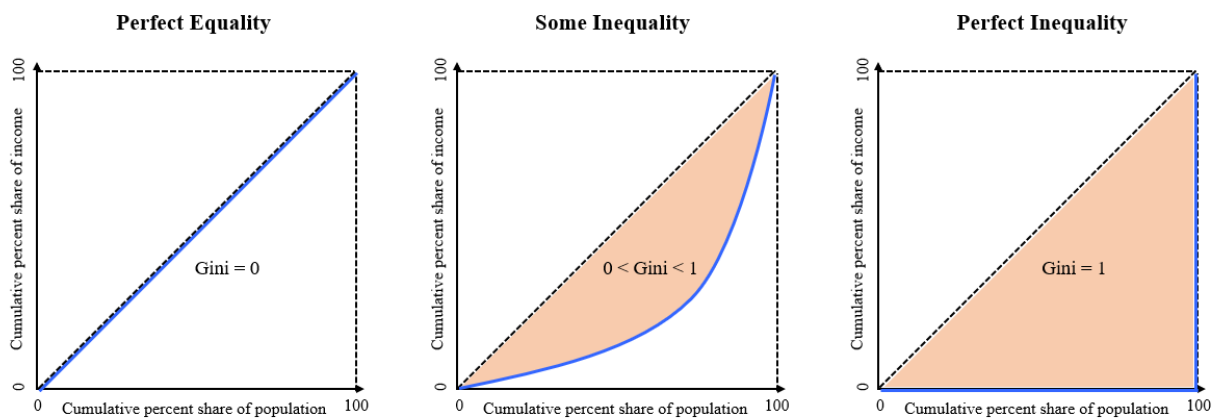
Source: International Monetary Fund**,** 2023

Methodology

Data collection: This research utilizes secondary data, specifically Microdata from The Household Socio-Economic Survey Whole Kingdom conducted by the National Statistical Office of Thailand, which is surveyed and collected annually. The research is based on data from 2021, during which household income and expenditure data were collected simultaneously. The data provided this year is the latest collection of household income and internet spending, categorized by home and mobile internet use, which is also the key factor in calculating internet affordability. However, in 2021, people faced the Covid-19 pandemic, leading to many households subscribing to and increasing their home internet use for members working from home. In the report 'How the COVID-19 pandemic is changing business: A Literature Review' by the International Labour Organization, it is stated that the Covid -19 pandemic has shaped labor patterns, and these changes have persisted far longer than first thought. Some of these changes may be permanently implemented by numerous businesses and governments. The report references studies by Lund et al. (2021), Oxford Martin School, and Citi (2020), which mention that the COVID-19 pandemic and the ensuing pandemic countermeasures severely disrupted the workforce. The widespread use of remote work and the quick development of digital solutions like document-sharing software, videoconferencing, and the growth of cloud-based capabilities are some effects of this.

In this research, the data analysis comprises two parts: the index of internet access and use, and inequality in internet access and use among Thai households.

Analysis of internet access and use index: For the analysis of the index of internet access and use, it is divided into five aspects, as follows:

1. Internet Connectivity is taken into account the presence of household members using the internet, as well as internet expenses, whether in cash or in-kind.

2. Internet affordability is determined by the percentage of income spent on both home and mobile internet.

3. Internet Quality is determined by the cost of internet use, with internet packages offering higher data volume and speed being more expensive.

4. Device availability is considered the existence of equipments or gadgets, both laptops and smartphones, that are prepared to connect to and utilize the internet.

5. Flexibility and convenience are considered based on whether a household has home internet, mobile internet, or both, and their use.

In analyzing the index, researchers assigned scores to the availability of five aspects. Each aspect carries equal weight and is scored on a scale of 0 to 100 points. These scores are then aggregated to create the index of internet access and use. This method is adopted from the indexing scoring approach derived from the research methodology of the study on Digital Life Inequality in Thailand by Pansri and Chomtohsuwan in 2019. The indexation equation is provided below.

The Index of Internet Access and Use

$$I = \left(\beta_A A + \beta_F F + \beta_Q Q + \beta_D D + \beta_C C \right)$$

(1) Internet Connectivity Index

$$A = \sum_{i=1}^{n} (\alpha_i A_i) \times 100$$

(2) Internet Affordability Index

$$F = \sum_{i=1}^{n} (\partial_i F_i) \times 100$$

(3) Internet Quality Index

$$Q = \sum_{i=1}^{n} (\mu_i Q_i) \times 100$$

(4) Device Availability Index

$$D = \sum_{i=1}^{n} (\theta_i D_i) \times 100$$

(5) Flexibility and Convenience Index

$$C = \sum_{i=1}^{n} (\Upsilon_i C_i) \times 100$$

Where as

I	is the index of internet access and use
β	is the weight value is assigned to the household's Internet Connectivity (A), Internet Affordability (F), Internet Quality (Q), Device Availability (D), and Flexibility and Convenience (C).
A	is the internet connectivity index
A_i	is the internet connectivity value at i
α_i	is the weight value of internet connectivity at i
F	is the internet affordability index
F_i	is the internet affordability value at i
∂_i	is the weight value of internet affordability at i
Q	is the internet quality index
Q_i	is the internet quality value at i
μ_i	is the weight value of internet quality at i
D	is the device availability index
D_i	is the device availability value at i
θ_i	is the weight value of device availability at i
C	is the flexibility and convenience index
C_i	is the flexibility and convenience value at i
Υ_i	is the weight value of flexibility and convenience at i
n	is the number of sub-factors for each aspect

Analysis of inequality in internet access and use: For the analysis of inequality in internet access and use by applying the Gini coefficient, the results of the analysis from the analysis of the index of internet access and use will be further examined to calculate the Gini Coefficient, a measure of inequality in internet access and use among Thai households. A low Gini coefficient suggests slight differences in internet access and use among Thai households, indicating low inequality.

The Gini coefficient or Gini index, developed by Italian statistician Corrado Gini, is applied in this study. According to the study on "Inequality Indices" by Heshmati, A. in 2004, where inequality was measured using the Lorenz diagram, this measure is referred to as the Gini coefficient. The equation is as follows.

$$Gini = 1 - \sum_{i=0}^{n-1} (F_{i+1} - F_i)(\Phi_{i+1} + \Phi_i)$$

Where as
F_i is the cumulative percentage of the household
Φ_i is the cumulative percentage of the index of internet access and use

Results

1. Analysis results of the Index of household Internet access and use

As presented in Figure 5, the analysis results of the Index of Household Internet Access and Use, divided into five aspects, found that the average score for the Internet Connectivity Index was 79.54, showing that households have members connected to the internet and pay for internet use. The Internet Affordability Index was 55.90, indicating that more than half of households have internet costs equal to or less than 2 percent of their income. The Internet Quality Index was 5.63, indicating that most households pay for internet use at low data and speed levels. The Device Availability Index was 53.06, indicating that most households are well-equipped with devices to connect to the internet, including laptops and smartphones. Finally, the Flexibility and Convenience Index was 45.37, indicating that most households are only connected to and using either home or mobile internet. This lack of flexibility results in inconvenience when trying to connect and use the internet anywhere, anytime.

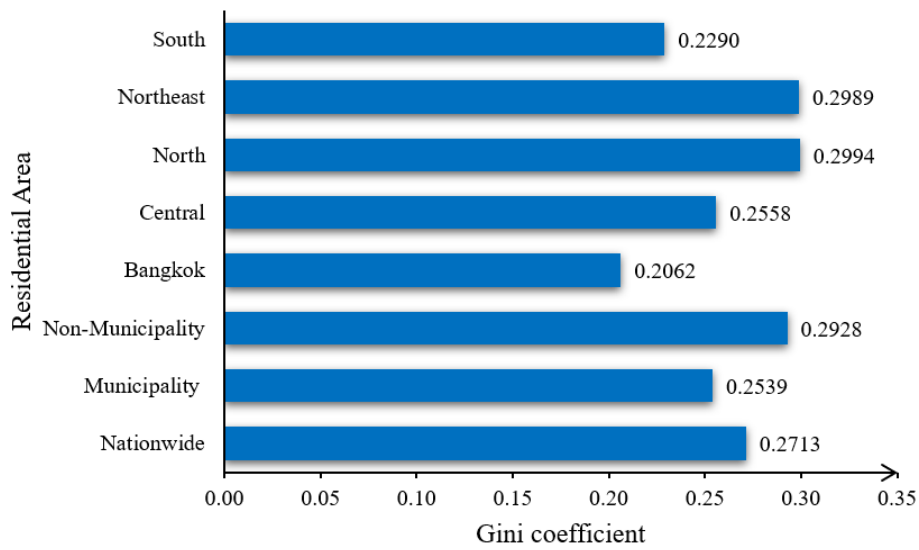**Figure 5:** The Index of household internet access and use
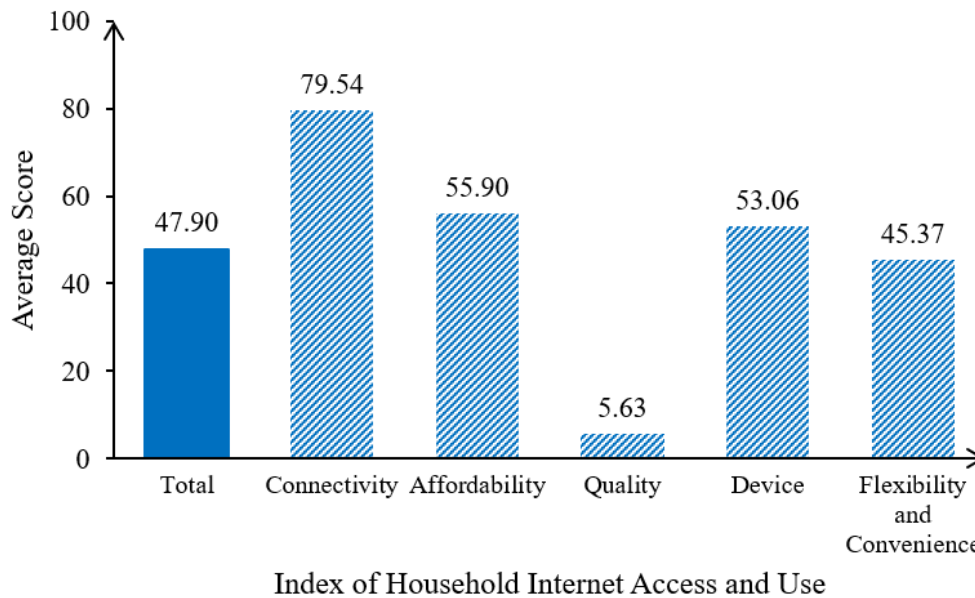
Source: Authors

From researching five aspects—internet quality, including speed and data transfer volume; flexibility and convenience of use; availability of devices (computers and smartphones); affordability; and connectivity—that affect inequality to differing degrees, ranging from most to least significant.

2. Analysis results of inequality in household internet access and use

2.1. Analysis results of inequality in household internet access and use categorized by residential area

As shown in Figure 6, the analysis results of the inequality in household internet access and use, categorized by residential area and measured by applying the Gini coefficient, found that inequality still exists, with a nationwide Gini coefficient of 0.2713. Households outside the municipality face greater inequality in internet access and use than households inside the municipality, with Gini coefficients of 0.2928 and 0.2539, respectively. This explains the more unequal distribution of internet access and use outside the municipality compared to unequal distribution in municipal areas. According to measures of inequality categorized by region, households in the North show the highest levels of inequality in internet access and use, with Gini coefficients of 0.2994, followed by the Northeastern, Central, and Southern, with the Gini coefficients of 0.2989, 0.2558, and 0.2290, respectively. Households in Bangkok experience the least inequality, with a Gini coefficient of 0.2062. This explains the highest unequal distribution of internet access and use shown in the North compared to unequal distribution in other regions, while in Bangkok, the distribution of internet access and use shows less inequality than in other regions.

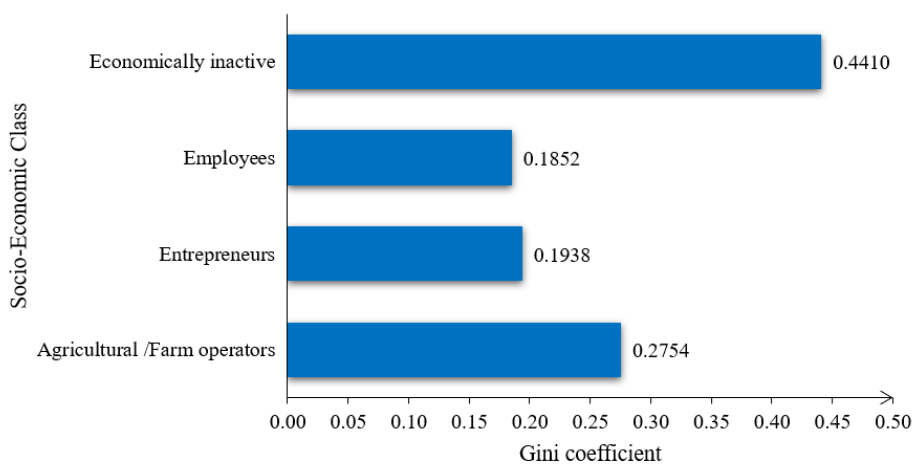**Figure 6:** The Gini coefficient of household internet access and use categorized by residential area

Source: Authors

2.2 Analysis results of inequality in household internet access and use categorized by socio-economic class

Figure 7 shows the analysis results of the inequality in household internet access and use, categorized by socio-economic class and measured using the Gini coefficient. Households with economically inactive members face the highest inequality in internet access and use, with Gini coefficients of 0.4410. This is followed by agricultural / farm operators and entrepreneurs for non-agricultural business with Gini coefficients of 0.2754 and 0.1938, respectively. Households containing members of the employee class experience the least inequality with a Gini coefficient of 0.1852.

Figure 7: The Gini coefficient of household internet access and use categorized by socio-economic class
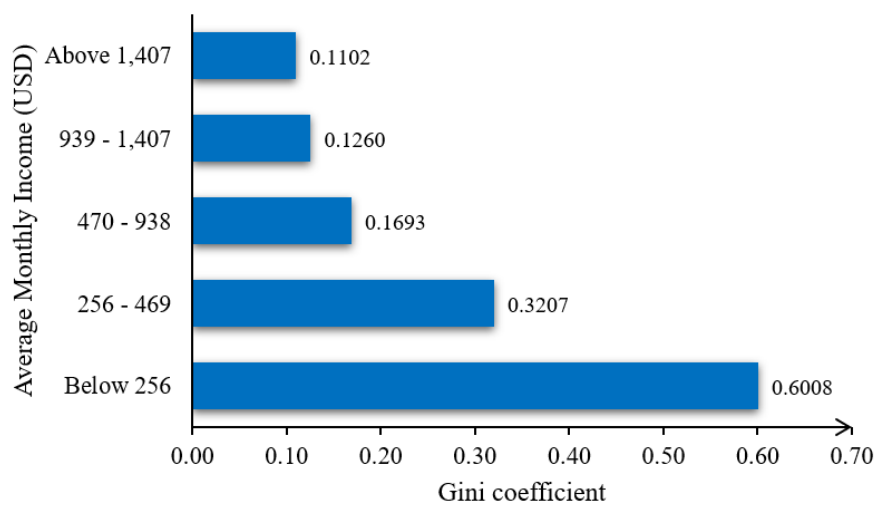

Source: Authors

2.3 Analysis results of inequality in household internet access and use categorized by income

As shown in Figure 8, the analysis results of the inequality in household internet access and use, categorized by income and measured applying the Gini coefficient, found that households with an average monthly income of less than $256 face the highest inequality in internet access and use, with a Gini coefficient of 0.6008. This is followed by households with average monthly incomes of $256-$469, $470-$938, and $939-$1,407, with Gini coefficients of 0.3207, 0.1693, and 0.1260, respectively. Households with average monthly incomes of more than $1,407 experience the lowest inequality in internet access and use with a Gini coefficient of 0.1102.

Figure 8: The Gini coefficient of household internet access and use categorized by income

Source: Authors

Discussion

Inequality in internet access and use exists throughout the entire country, especially for households living outside the municipality, as shown by the research results. The most pronounced instances of this inequality are observed in households located in the northern and northeastern regions of Thailand; both regions' Gini coefficients are higher than the nationwide values. The findings support previous research by Pansri and Chomtohsuwan (2019), which examined digital life inequality and concluded that people living in Bangkok have the highest average digital life, while those in the Northeast and the North have the least average digital life, respectively. This may be attributed to the fact that these two regions still have more underdeveloped areas compared to other regions. Moreover, there is a trend of working-age individuals migrating to cities for employment, while those remaining in the region often lack the knowledge, ability, and financial resources to access digital life.

Economically inactive households, such as those receiving income from gratuity, pension, or subsidies, were found as the group experiencing the greatest inequality in internet access and use when compared to other socioeconomic classes including employees, entrepreneurs for non-agricultural business, and agricultural / farm operators. Meanwhile, households with the lowest

incomes, below the poverty line, were found to face the most significant inequality in internet access and use when compared by income. These results indicate a greater difference in accessing and using the internet in the group of households where members are not employed, retired, and/or working for a low income. The income and occupation of household members can impact the availability of connecting equipment, the ability to pay, the quality of internet used, and technology skills. Consequently, these factors can limit some households' access to the internet, contributing to the digital technology divide.

Essentially, income inequality can affect access to digital technology. Simultaneously, inequality in the access to and use of digital technology, such as the internet, can impact various opportunities for people, including employment and income generation.

Policy Implications

Infrastructure Development: Expanding investment in internet infrastructure will help promote internet access and use throughout the country. Good infrastructure resulting from innovative investments also enhances network quality, reliability, flexibility, and convenience, allowing people to access it anytime and anywhere.

It is vital to include government policies focused on developing digital infrastructure, such as a comprehensive internet network and low-cost or free internet. The expansion of high-speed internet network infrastructure must cover the entire country, with special attention to rural areas in the north and northeast of Thailand, where there is a high Gini coefficient. This ensures that people across the nation have equal opportunities to access and utilize the internet.

The Organisation for Economic Co-operation and Development (OECD) recommends extending broadband connectivity in Thailand, aligning with the point that Thailand should develop its broadband/internet infrastructure. To increase broadband and internet access in Thailand, the OECD suggests implementing comprehensive policies that prioritize investment, competition, and innovation in broadband development. These proposals focus on strengthening resilience, stability, security, and capacity, with a special emphasis on the vital role that broadband networks play in closing the digital divide and improving network quality. The goal of the proposed rules is to make Thailand's broadband market more inventive and competitive so that the country can fully utilize digital connectivity for social and economic advancement.

Nowadays, Thailand has initiated the 20-Year National Digital Economy and Society Development Plan and Policy 2018 - 2037 (Ministry of Digital Economy and Society, 2016), which includes important strategies such as developing countrywide high-efficiency digital infrastructure and building an equitable and inclusive society through digital technology. The goal is to establish a high-speed internet network that reaches every village in the country, ensuring accessibility for all groups of people, especially farmers, those living in remote areas, the elderly, the underprivileged, and the disabled. Mobile internet services should be accessible and available to the public, covering all villages, communities, and tourism sites. In the long term, high-speed internet infrastructure will be a basic utility like roads, electricity, and water, connecting everyone and everything. **However, it is imperative that the plan be carried out seriously and that the work be evaluated on a regular basis.**

Affordability: This is a crucial aspect that fosters connectivity, quality, flexibility, and convenience in accessing and using the internet.

Some of the research results are consistent with those found in "Factors Motivating Broadband Adoption in Thailand" by Tiamnara et al. (2015), indicating that the affordability of high-speed internet or broadband, along with access to computers, significantly influences broadband adoption. **Therefore, governance policies should aim to ensure that broadband prices align with the average income of users, motivating people to subscribe to broadband services.** While the internet contributes to economic growth and GDP by facilitating the emergence of new services and businesses, a significant obstacle to widespread internet use in Thailand is the low-income levels of a substantial portion of the population.

The "price" or "cost" of telecom/ICT services is often cited as a barrier to their adoption, but what matters most is the "affordability" or ease of purchasing a service relative to consumer income. (ITU, 2021) One of the goals in the Thai national digital infrastructure development plan is to ensure that **the cost of high-speed internet services does not exceed 2 percent of the gross national income (GNI) per capita by the year 2021.** This goal is specified in the National Digital Economy and Society Development Plan and Policy for the period of 2018-2037. It aligns with the target set by the ITU/UNESCO Broadband Commission for Sustainable Development, which aims to make entry-level broadband services affordable in developing countries by 2025, costing less than 2% of monthly Gross National Income (GNI) per capita.

Table 1: The Internet Affordability in Thailand, Malaysia, Singapore, Japan, Korea (Rep. of), Asia & Pacific, and Worldwide in 2021

Economies	Affordability			
	Fixed-broadband Internet1[4]	Data-only mobile broadband[5]	Mobile data and voice low-consumption[6]	Mobile data and voice high-consumption[7]
World	2.98	1.25	2.02	2.86
Asia & Pacific	3.08	1.18	1.93	2.97
Thailand	3.52	1.40	2.02	2.98
Malaysia	2.34	0.98	1.06	1.27
Singapore	0.78	0.22	0.30	0.30
Japan	1.09	1.25	1.18	1.53
Korea (Rep. of)	1.11	0.53	0.71	0.85

Source: International Telecommunication Union, 2021

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[4] This is composed of the cheapest plan providing at least 5GB of monthly high-speed data (256Kbit/s or higher) from the operator with the largest market share in each economy.

[5] This refers of the cheapest mobile broadband plan providing at least 2 GB of monthly data using at least 3G technology.

[6] This is based on a monthly usage of a minimum of 70 voice minutes, 20 SMSs and 500 MB of data using at least 3G technology.

[7] This is based on a monthly usage of a minimum of 140 voice minutes, 70 SMSs and 2 GB of data using at least 3G technology.

Based on the affordability data in Table 1, when comparing Thailand to Malaysia and other countries with advanced digital technology like Singapore, Japan, and Korea, it's evident that Thai internet costs, measured as a percentage of GNI per capita, exceed those of other nations. **The OECD report indicates that Thailand and Malaysia exhibit similarities in their demographic makeup, with comparable proportions of urban and rural populations.** Malaysia has a higher concentration of people in urban areas compared to Thailand. Both countries are classified as having "very high" human development by the United Nations Development Programme (UNDP). Additionally, Thailand and Malaysia share similarities in geographical and economic conditions that affect broadband deployment. (OECD, 2023) **Nevertheless, it is evident that Malaysia has better internet or broadband affordability than Thailand across all use categories.**

The key factors influencing affordability development are price and income. According to The Office of The National Broadcasting and Telecommunications Commission's (NBTC) Annual Retail Price Report 2021, the average price of mobile internet services continuously decreased. This trend was attributed to promotions offered by all five mobile network providers: AWN, DTN, TUC, NT (My by NT network), and NT (NT Mobile network), which granted unlimited internet use to meet the increased demand during the COVID-19 pandemic. In 2021, the average price of mobile internet service stood at 0.1 baht/MB. Meanwhile, the average price for fixed broadband internet services in 2021 was 4.82 baht/Mbps, up from 4.11 baht/Mbps in the previous year. The main five providers in 2021 were NT (CAT and TOT network), True Internet, 3BB, and AIS. Notably, the average price of fixed broadband internet services increased for NT (CAT network), NT (TOT network), and AIS. (NBTC, 2021). The average price increase is a factor that limits Thai households' ability to access home internet.

Policy recommendations for making the internet affordable include encouraging healthy competition among internet service providers (ISPs) to prevent monopolies or oligopolies, ensuring transparency in pricing and service offerings, strengthening regulatory oversight to monitor and regulate internet prices, investing in improving and expanding internet infrastructure, and implementing subsidies or support programs for low-income households. These strategies aim to reduce internet costs for consumers and bridge the digital divide, requiring collaboration between government agencies, regulatory bodies, industry stakeholders, and consumer advocacy groups to be effective. This is aligned with the OECD's recommendations for strengthening Thailand's communication sector through increased transparency in the appointment of top-level NBTC officials, a review of merger regulations, close observation of recent mergers of True and Dtac in the mobile market, promotion of wholesale networks in underserved areas, relaxation of restrictions on foreign investment, and streamlining of permit procedures. These recommendations all contribute to better oversight of internet service prices to ensure they are fair and affordable.

On the other side, increasing the income of the country's population will help improve their ability to access digital technology. Governments can implement multifaceted policies, including fostering job creation through support for businesses, encouraging entrepreneurship with financial incentives, promoting infrastructure development to create employment opportunities, enacting tax policies that stimulate economic growth, regularly reviewing minimum wage levels, supporting remote work opportunities, and facilitating access to financial services. A comprehensive and optimized approach is crucial for the success of these policies in promoting

widespread income generation and economic well-being. In addition, promoting digital education is crucial for enhancing the ability to access and use the internet, as well as increasing job opportunities. For instance, government agencies can provide funding or organize educational programs to train individuals in digital skills. Furthermore, the development of technology-related industries creates new job and business opportunities for people and contributes to the growth of the national economy.

Conclusion

The purpose of this research is to investigate inequality in household internet access and use by assessing indices related to five aspects: internet connectivity, internet affordability, internet quality, device availability, and flexibility and convenience. After analyzing these indices, the Gini coefficient is employed to measure inequality in household internet access and use. The analysis is conducted based on the following factors: residential area, socio-economic class, and average monthly household income.

According to the findings of the index analysis, the Internet Connectivity Index has the highest average score, concluding that most households can connect to the internet, whether there is a service charge or not. The next highest scores belong to the Internet Affordability Index and the Device Availability Index, which include computers and smartphones. Both indexes have an average score of more than 50 percent, concluding that households have a good ability to pay and are well-equipped with devices for accessing and using the internet. The Internet Quality Index and the Flexibility and Convenience Index have an average score of less than 50 percent, concluding that most households connect to either home or mobile internet, not both types of use, causing a reduction in the convenience of accessing and using the internet. Additionally, they use the internet with limited speeds and data transmission. These low scores in both indices are significant contributors to the widening gap in internet use.

From the finding of the inequality analysis, households in Northeastern and Northern regions face significant differences in internet access and use, as indicated by higher Gini coefficients than the nationwide average. Households in Bangkok are found to have the least inequality, as indicated by the lowest Gini coefficient. In the group of economically inactive households with no income from work, such as those receiving income from pensions or grants, the highest Gini coefficient is observed. This result indicates that they face higher inequality in internet access and use compared to inequality in other socio-economic classes. Additionally, households with average monthly incomes less than the poverty line, which is $256, face the greatest inequality. In conclusion, households with a higher average monthly income experience a decrease in inequality in internet access and use.

The recommendations for government agencies, regulatory bodies, and industry stakeholders to reduce inequality in household internet access and use start with developing infrastructure that covers the entire country, allowing people in remote rural and suburban areas to access and use the internet equally. In addition to geographical coverage, promoting investment and fair competition will bring about high-quality innovative networks, providing opportunities for high-speed internet access and use for everyone. Price regulation is crucial for creating affordability. Endorsing initiatives aimed at reducing the costs of internet access and use, such as discount programs for low-income households or supporting free or low-cost internet projects for

citizens, is essential. This will enable people to access and use the internet seamlessly, both on mobile devices and at home, with data quality and quantity meeting their needs. Furthermore, it is important to support efforts to increase household income, which is crucial for enhancing affordability, as research has found that there are still inequalities, especially in households with low incomes. Equitable access to and use of the internet by households is key to affecting social equality and the economic development of a country.

This research focuses on investigating the presence of inequality in household internet access and use, but there has been no in-depth specific study on the factors that significantly influence the outcomes. Therefore, further studies should be conducted to comprehend the factors that contribute to inequality in internet access and use, including geographic and socio-economic factors. Clarifying the factors influencing inequality will lead to an effective resolution of the problem and ensure equal access to and use of digital technology by all.

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