

Household Internet Affordability and Its Affecting Factors in Thailand

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Abstract

Internet accessibility is considered a key factor affecting economic growth in the digital economy. In Thailand, while internet use is on the rise, household internet access is less widespread than in developed countries. This study examines the situation of household internet expenses, affordability, and the factors that affect households' internet affordability from 2012 to 2021. Descriptive statistics and linear regression analysis were used to analyze secondary data from the National Statistical Office of Thailand. According to the study, 73.28 percent of Thai households pay for membership or internet service expenses, and 49.03 percent of these households are required to pay an unreasonably high percentage of their income. Internet usage patterns a household has, as well as the number of computers it owns, are factors that influence the household's internet expenses, income, and affordability. This study also found that socio-economic class and residential location are key factors that affect internet affordability. Household size and residential type are important factors that impact internet expenses, while household size and socio-economic class are key factors that affect the income of households with internet expenses.

Keyword: Households, Internet, Affordability, Affecting Factors, Thailand

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Introduction

The internet is a critical foundational infrastructure for the development of the digital economy, driving changes in economic and social activities that impact both the growth of the economy and the quality of life of individuals.

According to the report by the 2021 International Telecommunication Union (ITU) titled 'The Economic Impact of Broadband and Digitization through the COVID-19 Pandemic: Econometric Modelling, a 0.8 percent increase in GDP per capita is the impact of a 10 percent increase in fixed broadband penetration worldwide, while a 1.6 percent increase in GDP per capita is the impact of a 10 percent increase in mobile broadband penetration worldwide. This information demonstrates the significant impact that the rate of internet penetration has on a country's economic development. However, it is worrying that around 34 percent of the global population remains without access to internet services, according to the ITU's latest report.

According to a survey on The Use of Information and Communication Technology in Thailand in Q4 of 2021, which collected data by the National Statistical Office of Thailand, the number of people aged 6 and above who use the internet is 54.6 million or 85.3 percent, up from 52.9 percent in 2017. Additionally, the percentage of Thai households with internet connectivity has increased to 88.7 percent, up from 64.4 percent in 2017. However, Thailand's rate of home internet access is still lower than many countries that are more advanced in digital technology, such as South Korea and Singapore, where the percentage of households with home internet connection is 99.93 percent and 99.32 percent, respectively.

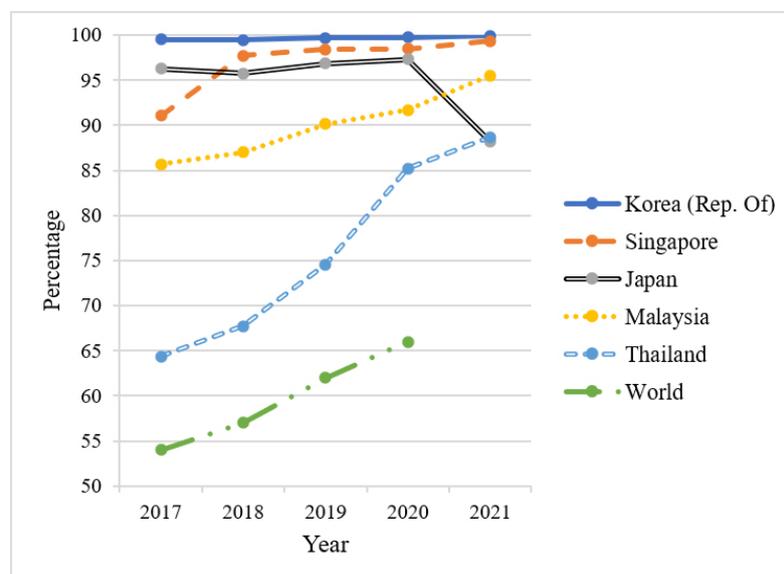


Figure 1: Percentage of households with internet access at home in South Korea, Singapore, Japan, Malaysia, Thailand, and World between 2017 and 2021

Source: Households with Internet access at home (ITU DataHub, 2021)

Affordability is a key factor for household internet access, which is related to the cost of internet service and household income. Despite the consistent decrease in internet service fees in Thailand due to competition among service providers, the average monthly income per capita and household income have shown a downward trend, particularly during the COVID-19 pandemic outbreak in 2019.

One of the reasons why many people around the world do not have access to and use ICT services is the high cost of connectivity compared to income, as reported by the ITU in 2020 on "The affordability of ICT services". Additionally, fixed broadband internet affordability among the population in the Asia-Pacific region has decreased due to the income has decreased proportionally more than the reduction in service fees. This is a result of the economic recession, as reported by the ITU in 2021 on "The economic impact of broadband and digitization through the COVID-19 pandemic".

The above statement has sparked interest among authors to study Thai households' internet affordability and its affecting factors, especially during the COVID-19 pandemic, as people are adjusting to new lifestyles that require increased internet access.

Literature Review

A study on the digital life divide in Thailand (Pansri T. and Chomtohsuwan T., 2019) found that the Thai population is showing a continuous trend towards better digital life. The internet usage index has rapidly increased, and most people use smartphones connected to the internet to carry out daily activities such as financial transactions and online shopping. However, the digital life divide still exists in every area of Thailand. People in urban areas use digital technology more in their daily lives than those in rural areas, and those in the capital have the highest digital life behavior patterns. Developing digital infrastructure, such as increasing internet signals, especially in remote areas, can help reduce the digital life divide.

There are two main obstacles to accessing internet services in Thailand (Tiamnara N. et al., 2015). Firstly, a large portion of the population has low income, and secondly, there are problems with developing internet infrastructure, such as broadband and high-speed internet in rural areas. In addition, industrial factors such as service fees and internet speed can affect the usage rate. Lower service fees can increase the number of internet users, and statistical analysis has shown that high-speed internet service fees and competition among service providers affect the use of the internet.

Affordability

Affordability is a measure of a person's ability to purchase certain goods or to pay for general living expenses on average (Kenton W., 2021). The measurement of affordability is often compared to the price of goods or the cost of living with personal income. The resulting number may be presented as a raw ratio or adjusted to a specified index, which can provide an idea of the standard of living.

The study by Garner and colleagues in 1996 indicated that affordability is an assessment of well-being and happiness in terms of the aspirations of an individual or a family. Affordability is related to the economy, meaning the ability to purchase or achieve certain goals, with budget constraints and beliefs about budget constraints differing from the willingness to pay or purchase. The principle of willingness to pay or purchase is that a person will make a purchase when they want to. If a person thinks they can afford to pay for goods or have enough income to buy them, it is expected that they have better economic well-being than those who cannot afford to buy the products or have insufficient income to make the purchase.

The affordability of ICT services

Yates and colleagues (2010) studied the impact of country policies on the spread and affordability for fixed broadband internet access in over 110 countries. The study also revealed that a country's economic wealth affects the population's ability to pay for broadband services, with countries having higher economic wealth able to provide internet services at lower costs or more affordable services. The economic wealth also affects the readiness and cost relationships of fixed broadband internet services.

Similarly, Weiss and colleagues (2015) also conducted a study on individual abilities based on Sen's capability concept, stating that an individual's capability is determined by the opportunities available to them, such as income and education. In a comparative study of ICT service payment capabilities among countries, it is assumed that countries with higher economic wealth and affluent populations have a higher status in paying for technology-related goods and services.

The report from the ITU on affordability in the context of telecommunications states that the cost of services is often considered a barrier to using telecommunications/ICT services (ITU, 2021). However, "affordability" or ease of decision-making in purchasing services is more important. Affordability depends not only on the cost of the service and income but also on other payment options that can be used as substitutes.

Since the outbreak of COVID-19 in 2020, there has been an increased demand for internet usage to support work, education, and communication. Reddick and colleagues (2020) conducted a study to identify the factors that determine access to and the affordability for home high-speed internet services. They found that the factors affecting the affordability included user-related factors, economic and social factors, as well as provider-related factors such as geographical constraints and industry competition. Overall, the study shows that both user-related and provider-related factors have an impact on the internet affordability.

Affordability Measurement Using the Price-to-Income Ratio Approach

The Price-to-Income Ratio is one of the most used measures of "affordability." It is a method that provides clarity, requires minimal data, and yields a straightforward ratio for calculation and interpretation. This measure is widely used in the media and policy organizations in the real estate market. (Leung C. K. Y., 2021) This concept compares the average cost of goods or services to the average household income. The resulting value shows what proportion of the income is spent on appropriate goods or services. Therefore, the key variables in this method are income and cost of service.

The Price-to-Income Ratio is also applicable to measure affordability for ICT products and services. The cost of ICT services can be presented as a percentage of gross national income per capita, indicating the relationship between the cost of services and the size of the economy of each country, and it also reveals the affordability from a national perspective. However, this ratio alone does not indicate whether ICT services are affordable for low-income households or individuals. In-depth analysis of affordability may require consideration of income distribution or domestic consumption, such as comparing the cost of ICT services to the income of the lowest 40 percent of the population (ITU, 2021).

Methodology

Data collection

This quantitative research uses microdata or raw data from The Household Socio-Economic Survey of the Whole Kingdom between 2012 and 2021. The survey is conducted annually by the National Statistical Office of Thailand, and it collects household expenditure data every year and household income data biennially.

Statistics Used

The statistical analysis is divided into two parts: (1) descriptive statistics that present the frequency, percentage, and mean to examine the proportion of internet expenditure to household income, and (2) regression analysis that identifies the factors affecting households' internet expenditure, income, and internet affordability.

Data Analysis

The researcher proceeded with the data as follows:

- Analyzed the data on the frequency of households using the internet and their internet expenses between 2012 - 2021.
- Analyzed the proportion of internet expenses to household income using the price-to-income ratio approach. The analysis was based on the data of the average monthly internet expenses per person and average monthly income per person of households in 2021. The results of the analysis were compared to the target proportions used by the Thai government and international standards to determine internet affordability. All types of internet usage were analyzed and categorized into three groups according to their patterns: (1) households that use only home internet, (2) households that use only mobile internet, and (3) households that use both home and mobile internet.
- Analyzed the factors related to the socio-economic status and characteristics of households that affect the internet expenses, income, and internet affordability of Thai households. The analysis included factors such as residential location, residential type, household size, number of employed members, socio-economic class, number of computers and smartphones, phone call expenses (Voice services), and the usage patterns of internet services within the household.

Results

Frequency and percentage of households with internet expenses and the average monthly internet expenses between 2012 and 2021.

According to the survey on The Household Socio-Economic Survey of the Whole Kingdom between 2012-2021, the number of households paying for internet service has continuously increased. In 2020, which was the beginning of the COVID-19 pandemic, 15,977,316 households out of a total of 22,301,642 surveyed households (71.64 percent) were paying for

internet service, which was an increase from 59.41 percent in the previous year. In 2021, 16,580,091 households out of a total of 22,624,352 surveyed households (73.28 percent) were paying for internet service.

The analysis of the average monthly internet expenses found that households paid 594.26 baht per month in 2021. This amount increased from 584.73 baht in 2020 and was higher than the average before the COVID-19 outbreak in 2019, which households paid an average of 503.79 baht per month.

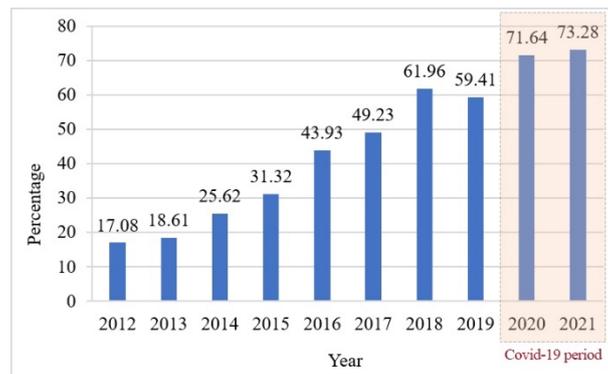


Figure 2: Percentage of Thai households with internet monthly expenses between 2012 and 2021.

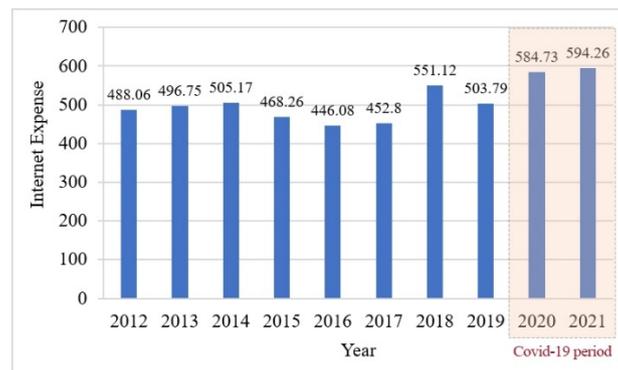


Figure 3: Average monthly internet expenses of Thai households between 2012 and 2021.

The analysis of household internet usage and expenses, classified by usage patterns, shows that in 2021, 69.76 percent of households use only mobile internet, which decreased from 72.33 percent in 2020. This group has the lowest average monthly internet expenses compared to other usage patterns. The percentage of households that only use home internet increased from 8.90 percent in 2020 to 9.69 percent in 2021, and they have internet expenses of 582.48 baht, which decreased from 603.59 baht. However, there is a trend of an increasing number of households using both home and mobile internet simultaneously, while the expenses are decreasing.

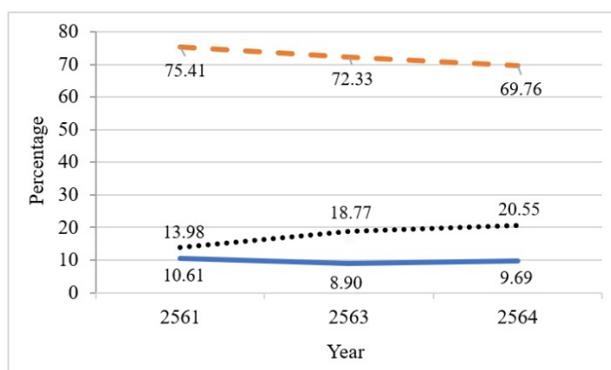


Figure 4: Percentage of households with internet expenses by usage patterns between 2018 and 2021.

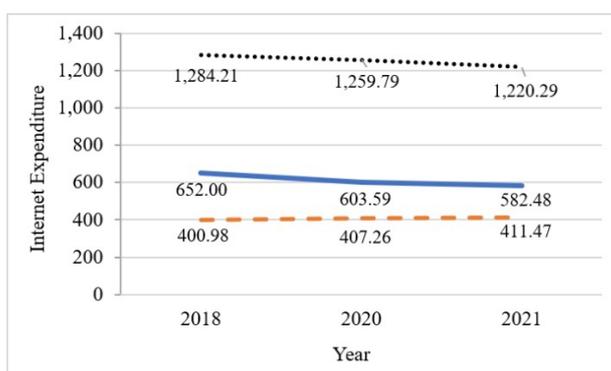


Figure 5: Average monthly internet expenditure of households by usage patterns between 2018 and 2021.

- Using only home internet
- - - Using only mobile internet
- Using both home and mobile home internet

Thai households' internet affordability in 2021, categorized by affordability level and internet usage patterns.

The affordability levels are divided into two groups: (1) The group with internet expenses equal to or less than 2 percent of their income, and (2) the group with internet expenses exceeding 2 percent of their income. These groups are compared to the target level of high-speed internet service affordability in developing nations set by the ITU/UNESCO Broadband Commission for Sustainable Development, which has established a goal for 2025 to make basic broadband services affordable in developing countries (defined as costing less than 2 percent of monthly Gross National Income per capita). This target aligns with the one set in the Thai national digital infrastructure development plan, stating that 'the cost of high-speed internet services shall not exceed 2 percent of the gross national income per capita.' This goal is specified in the National Digital Economy and Society Development Plan and Policy for the period of 2018-2037."

The data of the year 2021 was analyzed using the Price-to-Income Ratio approach. The analysis was divided according to internet usage patterns, including (1) using only home internet, (2) using only mobile internet, and (3) using both home and mobile internet. Additionally, a summary of home and/or mobile internet usage was included. The analysis

was conducted for each member of the household in order to compare the results with the target of promoting internet usage in developing countries.

Table 1: Frequency and percentage of households categorized by their internet affordability and usage patterns.

| Percentage of internet expenses per income | Using only home internet (9.69) | Using only mobile internet (69.76) | Using home and mobile internet (20.55) | Using Home and/or mobile internet (100) |
|--|---------------------------------|------------------------------------|--|---|
| < = 2 | 861,485 (53.62) | 6,680,976 (57.76) | 909,210 (26.68) | 8,451,671 (50.97) |
| > 2 | 745,299 (46.38) | 4,884,916 (42.24) | 2,498,205 (73.32) | 8,128,420 (49.03) |
| Total | 1,606,784 (100.0) | 11,565,892 (100.00) | 3,407,415 (100.00) | 16,580,091 (100) |

According to Table 1, the group that only uses mobile internet is the largest group, with a total of 11,565,892 households or 69.76 percent. Next is the group that uses both home and mobile internet, with a total of 3,407,415 households or 20.55 percent, followed by the group that only uses home internet, with a total of 1,606,784 households or 9.69 percent. Most households that use only home internet and those that use only mobile internet have internet expenses that are less than or equal to 2 percent of their income per capita, with percentages of 53.62 percent and 57.76 percent, respectively. However, for most of the group that uses both home and mobile internet, their internet expenses exceed 2 percent of their income per capita, at 73.32 percent. When considering the overall use of the internet, it is found that most households pay for the internet in proportion to or less than 2 percent of their income per capita, at 50.97 percent. This is close to the number of households that have internet expenses that are more than 2 percent of their income per capita, which is 49.03 percent.

Socio-Economic Characteristics affecting household internet expenses, income, and internet affordability ratio in 2021.

In this section, the analysis results are presented on the socio-economic factors of Thai households that affect average internet expenses and average monthly income, which directly affects the price-to-income ratio used to indicate the level of household internet affordability. The analysis was conducted using a multiple regression analysis and the results are as follows.

Table 2: Regression coefficients for factors affecting internet expenses, income, and internet affordability ratios in Thai households in 2021.

| Socio-Economic Characteristics | B | SE | Beta | t | p |
|---------------------------------------|-----------|-----------|-------------|-----------|----------|
| <i>Internet Expenses</i> | | | | | |
| Constant | 507.290 | 0.235 | | | |
| Residential location | | | | | |
| Bangkok | 35.407 | 0.148 | 0.065 | 238.694 | 0.000 |
| Central | 32.859 | 0.116 | 0.081 | 283.050 | 0.000 |
| North | -11.585 | 0.128 | -0.023 | -90.753 | 0.000 |
| Northeast | 0.406 | 0.121 | 0.001 | 3.358 | 0.000 |
| Municipality | 12.072 | 0.080 | 0.032 | 151.478 | 0.000 |
| Residential type | | | | | |
| Detached house | -26.420 | 0.160 | -0.063 | -164.882 | 0.000 |
| Row house | -36.448 | 0.167 | -0.067 | -217.893 | 0.000 |
| Town house/twin house | -4.228 | 0.187 | -0.006 | -22.655 | 0.000 |
| Household size | -56.952 | 0.036 | -0.471 | -1560.799 | 0.000 |
| Number of employed members | 3.101 | 0.049 | 0.016 | 62.932 | 0.000 |
| Socio-economic class | | | | | |
| Farm operators/culture | -9.800 | 0.136 | -0.017 | -71.980 | 0.000 |
| Entrepreneurs | 12.403 | 0.124 | 0.025 | 99.922 | 0.000 |
| Employees | 16.593 | 0.106 | 0.044 | 156.992 | 0.000 |
| Number of computers | 41.930 | 0.077 | 0.119 | 542.551 | 0.000 |
| Number of smartphones | 10.949 | 0.046 | 0.071 | 237.448 | 0.000 |
| Phone call expenses | 0.031 | 0.000 | 0.071 | 325.086 | 0.000 |
| Internet usage patterns | | | | | |
| Using only home internet | -181.912 | 0.137 | -0.284 | -1329.660 | 0.000 |
| Using only mobile internet | -213.525 | 0.103 | -0.518 | -2063.116 | 0.000 |
| <i>Income</i> | | | | | |
| Constant | 19908.682 | 17.011 | | | |
| Residential location | | | | | |
| Bangkok | 1396.695 | 10.742 | 0.040 | 130.016 | 0.000 |
| Central | 425.517 | 8.407 | 0.017 | 50.613 | 0.000 |
| North | -1473.486 | 9.245 | -0.046 | -159.387 | 0.000 |
| Northeast | -632.582 | 8.750 | -0.022 | -72.292 | 0.000 |
| Municipality | 1116.167 | 5.772 | 0.046 | 193.391 | 0.000 |
| Residential type | | | | | |
| Detached house | -270.374 | 11.604 | -0.010 | -23.300 | 0.000 |
| Row house | -1729.664 | 12.114 | -0.050 | -142.780 | 0.000 |
| Town house/twin house | -332.912 | 13.516 | -0.008 | -24.613 | 0.000 |
| Household size | -3291.714 | 2.643 | -0.429 | -1245.656 | 0.000 |
| Number of employed members | 556.244 | 3.568 | 0.046 | 155.896 | 0.000 |
| Socio-economic class | | | | | |
| Farm operators/culture | 608.197 | 9.860 | 0.017 | 61.684 | 0.000 |
| Entrepreneurs | 164.488 | 8.989 | 0.005 | 18.298 | 0.000 |
| Employees | 1828.648 | 7.655 | 0.076 | 238.898 | 0.000 |
| Number of computers | 4674.880 | 5.597 | 0.209 | 835.264 | 0.000 |
| Number of smartphones | -214.813 | 3.339 | -0.022 | -64.327 | 0.000 |
| Phone call expenses | 5.644 | 0.007 | 0.200 | 806.061 | 0.000 |
| Internet usage patterns | | | | | |

| Socio-Economic Characteristics | B | SE | Beta | t | p |
|---------------------------------------|-----------|-----------|-------------|----------|----------|
| Using only home internet | -2773.939 | 9.908 | -0.068 | -279.973 | 0.000 |
| Using only mobile internet | -3932.406 | 7.495 | -0.150 | -524.655 | 0.000 |
| <i>Internet Affordability Ratio</i> | | | | | |
| Constant | 3.962 | 0.005 | | | |
| Residential location | | | | | |
| Bangkok | 0.045 | 0.003 | 0.006 | 15.669 | 0.000 |
| Central | 0.218 | 0.002 | 0.037 | 97.906 | 0.000 |
| North | 0.322 | 0.002 | 0.044 | 131.623 | 0.000 |
| Northeast | 0.222 | 0.002 | 0.034 | 0.034 | 0.000 |
| Municipality | -0.108 | 0.002 | -0.20 | -70.797 | 0.000 |
| Residential type | | | | | |
| Detached house | -0.215 | 0.003 | -0.036 | -69.986 | 0.000 |
| Row house | -0.101 | 0.003 | -0.013 | -31.593 | 0.000 |
| Town house/twin house | -0.169 | 0.004 | -0.017 | -47.133 | 0.000 |
| Household size | | | | | |
| Number of employed members | -0.107 | 0.001 | -0.039 | -113.149 | 0.000 |
| Socio-economic class | | | | | |
| Farm operators/culture | -0.297 | 0.003 | -0.036 | -113.606 | 0.000 |
| Entrepreneurs | -0.181 | 0.002 | -0.025 | -75.928 | 0.000 |
| Employees | -0.539 | 0.002 | -0.099 | -256.764 | 0.000 |
| Number of computers | | | | | |
| Number of smartphones | -0.367 | 0.001 | -0.072 | -247.170 | 0.000 |
| Phone call expenses | | | | | |
| Phone call expenses | 0.226 | 0.001 | 0.101 | 255.401 | 0.000 |
| Internet usage patterns | | | | | |
| Using only home internet | -0.001 | 0.000 | -0.079 | -273.887 | 0.000 |
| Using only mobile internet | -0.958 | 0.003 | -0.104 | -364.724 | 0.000 |
| | -1.365 | 0.002 | -0.229 | -687.128 | 0.000 |

The socio-economic characteristics of households that influence internet expenses, income, and affordability include residential location, Residential type, household size, number of employed members, socio-economic class, number of computers and smartphones, service and phone call expenses, and internet usage patterns. These variables can collectively explain the variation in household internet expenses, income, and affordability, with R-squared values of 46.5 percent (R Square = 0.465), 30.4 percent (R Square = 0.304), and 5.2 percent (R Square = 0.052), respectively.

According to the analysis results, the most significant factors affecting a household's internet affordability are the usage patterns in the group that uses only mobile internet, followed by the group that uses only home internet, which has a significant negative correlation with the percentage proportion of internet expenses to income. It can be explained that when compared to households that use both home and mobile internet (Reference group), households that use only mobile internet and households that use only home internet have a lower proportion of internet expenses to income, with less than 1.365 and 0.958, respectively. This indicates a higher level of affordability. The next important factor is the socio-economic class of households in the employed group, which has a lower percentage proportion of internet expenses to income than the group of non-economically active (reference group), at 0.539 indicating better affordability. Another factor is the number of computers in the

household, which shows that if the number of computers increases by 1, the percentage proportion of internet expenses to income decreases by 0.367, indicating better affordability.

The most significant factor affecting household internet expenses is the internet usage patterns in the group using only mobile internet, followed by the group using only home internet. These have a negative correlation with household internet expenses. Compared to households that use both home and mobile internet, households that use only mobile internet pay less for internet expenses, at 213.525 baht, while households that only use home internet pay even less, at 181.912 baht. The next most important factors that affect household internet expenses are household size and the number of computers in the household, which have negative and positive correlations, respectively. A household with an additional member pays less for internet expenses, at 56.952 baht, while a household with an additional computer pays more, at 41.930 baht.

The most influential factor on the income of households that pay for internet service is the number of computers in the household, which has a significant positive correlation with household income. This can be explained that for every additional computer in the household, there is an increase in income of 4,674.88 baht. The next most influential factors on household income are the internet usage patterns of the internet in the group of using only mobile internet, and the household size, which have a negative correlation. It can be explained that households that only use mobile internet have lower income compared to households that use both home and mobile internet, with a difference of 3,932.406 baht. Additionally, households that have an increase of one member experience a decrease in average income of 3,291.714 baht.

Conclusion

Based on the research findings, it can be concluded that the number of Thai households spending money on internet services has continuously increased, especially during the COVID-19 pandemic when people have changed their lifestyles to adapt to the new normal. This has led to the incorporation of various technologies to facilitate work and daily life, making the internet an essential component. The data reveals a trend in household internet expenses, with a decrease in the group that only uses home internet and the group that uses both home and mobile internet, but an increasing trend in expenses for mobile internet service. Although the average rate of voice and mobile internet services has decreased from the previous year, and service providers are focusing on marketing to users of smartphones, which have continuously gained popularity in service usage (NBTC, 2021). This indicates that even though service providers reduce the service fee, households tend to pay more for internet usage, possibly because they choose more expensive internet packages for better quality, such as higher speeds. Additionally, service providers often promote the sale of smartphones with service contracts for more expensive packages than regular packages, which may explain why they tend to pay more for internet usage.

Internet affordability of Thai households

Internet affordability of Thai households was examined by studying the percentage proportion of household internet expenses to income. It was found that households that use only home internet and those that use only mobile internet generally pay for the service at or below 2 percent of their income. However, households using both types of internet services mostly paid a service fee higher than 2 percent of their income. In terms of overall internet

usage, the analysis found that approximately 50.97 percent of Thai households paid for the service fee at or less than 2 percent of their income, while 49.03 percent paid more than 2 percent of their income. If compared with the target set by the ITU/UNESCO Broadband Commission for Sustainable Development in 2025, as well as one of the objectives of Thailand's digital infrastructure development plan, there are still almost half of Thai households or people who pay for internet service at a higher proportion than the desired target. This shows that Thailand still needs to develop by increasing household income, while simultaneously supporting access to and use of the internet at a reduced cost, for the internet to be more accessible and easier to use for everyone.

Factors affecting households' internet affordability

The price-to-income ratio, which indicates internet affordability, is affected by various factors including the patterns of internet usage, the socio-economic class of households, and the number of computers in households.

Key socio-economic characteristics that impact internet expenses and household income include the household's internet usage pattern. In Thailand, households use home or mobile internet, or both, to cater to their increasing demand for internet usage, resulting in higher expenses relative to income. The number of computers in a household reflects the technology skills that contribute to the income of household members, along with their internet usage patterns and household size.

Overall, it can be explained that socio-economic characteristics that affect internet expenses and household income will inevitably affect the price-to-income ratio, which indicates households' internet affordability.

Recommendations

Policy recommendations

In order to reduce the expenses of household internet usage and increase the internet affordability, the government, private sector, and stakeholder should support the following measures:

- **Government support:** To reduce the cost of internet services for households, the government can play a significant role by implementing policies that foster competition among internet service providers, investing in infrastructure development, and offering tax incentives to companies that provide affordable internet services. This will lead to lower prices for consumers. The government can achieve this by creating policies that promote competition among internet service providers (ISPs) and funding the expansion of broadband infrastructure to remote and underserved areas. Additionally, the government can finance programs that offer subsidies to low-income households, enabling them to access affordable internet services and/or provide tax relief for low-income households.

The government also supports the research and development of communication technology in Thailand, encouraging the development and utilization of self-invented technology, reducing dependence on foreign technology, reducing service costs, and allowing consumers to access communication technology at a lower cost. To control

and reduce monopolies in the communication industry, especially internet service providers, the government can enact and enforce laws. Additionally, by adjusting the frequency spectrum allocation structure, service costs can be lowered for current providers, and opportunities for new providers with lower potential costs to enter the market can be opened up.

Lastly, promote the idea of family members living together and sharing the cost of household internet services to reduce the burden on individuals and lower the overall cost of internet services for the household.

- Private sector support: Internet service providers can provide affordable packages to households, especially low-income households. They can also work with the government to develop infrastructure in under-served areas. The private sector can also invest in technology that enables households to consume less data while maintaining a high-quality internet experience.
- Stakeholder support: Stakeholders, such as consumer advocacy groups, can work with the government and internet service providers to identify and advocate for policies that support affordable internet access for all households. They can also educate the public about the importance of affordable internet access and how to access it.

Simultaneously, the government and private sector should promote increasing household income to enhance internet affordability by supporting the following measures:

- Encourage and support small and medium-sized enterprises to grow and expand by providing incentives and opportunities to develop their businesses. Additionally, encourage and promote entrepreneurship and innovation by providing incentives, funding, and mentorship programs to individuals who wish to start their own businesses.
- Develop human resources and skills through education and vocational training programs that are relevant to current market demands and can help increase income levels. Provide training and develop skills in computer technology for business operations and work in the digital economy to create new professions as alternatives or supplementary occupations.
- Provide financial support to low-income households or households that have suffered economic hardship, such as those affected by the COVID-19 pandemic, to increase their ability to pay for internet services.
- The government provides financial support to consumers to increase household income. Support access to low-interest loan sources for people to use as capital in their professions. Also, implement policies to reduce income inequality and promote social welfare programs to support households in need.
- Develop infrastructure and promote investment in the digital economy to create more job opportunities and increase income levels. Moreover, encourage and support the growth of the gig economy by creating a favorable legal and regulatory environment and promoting the development of platforms that enable individuals to offer their skills and services online.

Academic recommendations

There are several areas that can be explored to gain a better understanding of the issues related to household internet access. Firstly, expanding the scope of studies to include households that do not pay for internet access can provide valuable insights into the barriers that exist for low-income households, as well as inequality in various aspects related to household internet access. Secondly, the impact of service provider mergers on the ability of households to pay for internet access should be studied, as consolidation in the industry may lead to higher prices for consumers. Thirdly, it is important to examine the impact of the COVID-19 pandemic on internet usage behavior and access, as the pandemic has highlighted the crucial role that internet access plays in daily life. Fourthly, analyzing internet usage and service costs by industry type can help to understand the impact of internet access on business returns. Lastly, exploring the relationship between internet access and education in the digital economy era can help to identify the benefits and challenges of using technology in the classroom.

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