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Article

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Research in Globalization

Provided in Cooperation with:

Elsevier

Suggested Citation: Shaengchart, Yarnaphat; Tanpat Kraiwanit (2023) : Starlink satellite project impact on the internet provider service in emerging economies, Research in Globalization, ISSN 2590-051X, Elsevier, Amsterdam, Vol. 6, pp. 1-7, <https://doi.org/10.1016/j.resglo.2023.100132>

This Version is available at:

<https://hdl.handle.net/10419/331058>

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Starlink satellite project impact on the Internet provider service in emerging economies

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ARTICLE INFO

Keywords:

Starlink SATELLITE project
Internet Provider
Service
Emerging economy

ABSTRACT

Starlink primarily focuses on delivering high-speed, low-latency broadband Internet in remote and rural locations globally. This study aims to investigate the Starlink satellite project's impact on the Internet provider service in emerging economies. A quantitative approach was used, and an online questionnaire was conducted to collect data from a convenience sample of 617 participants in Thailand. Demographic variables (i.e., gender, age, education, status, and income), user behaviour variables (i.e., computer, laptop, smartphone, tablet, wearable device, time, Internet duration, home Internet, and mobile Internet), and social media variables (i.e., Facebook, Instagram, Twitter, TikTok, and Youtube) were the independent variables. Binary regression analysis was performed to analyse the data. The findings revealed that the Starlink satellite project's impact on the Internet provider service in this emerging economy could be described by gender, education, tablet, wearable device, Internet time, Internet duration, Facebook, and Twitter. It is recommended to inform people of the effects of the Starlink satellite project on Internet service providers in developing economies. Satellite Internet access has transformed the expansion of professional development opportunities for those who live in remote, rural, and underserved areas. Due to the lack of terrestrial Internet infrastructure, users of satellite Internet can now access specialised resources that were previously inaccessible. Satellite Internet has also made it possible for people living in remote areas to benefit from opportunities for career advancement and more.

Introduction

Emerging markets are important drivers of global economic growth and development, and play a key role in shaping the future of the global economy (Khan et al., 2020; Mhlanga, 2021). According to the *Investopedia Team (2022)*, emerging markets refer to economies of countries that are in the process of rapid growth and development, often characterised by factors such as high economic growth rates, rising levels of industrialization, and increasing integration with the global economy. These markets are generally considered to be in the early stages of development, and are often seen as having high growth potential, albeit with higher risk and volatility compared to more established economies. Since their introduction in the early 2000s, emerging markets have played a critical role, and have remained a popular investment area. A number of new funds and tools for investing in emerging markets have been introduced since then. In addition, emerging markets are a one-of-a-kind investment opportunity because they provide an equal mix of risk and reward. Emerging markets are economies that are somewhere between developing and developed. The emerging-market phase is when

economies experience the most rapid growth as well as the most volatility. Investors and economists look for countries with little political or social unrest and consistent economic growth when identifying emerging markets (Beattie, Mansa, & Beer, 2022; Mesly, 2022). Moreover, emerging markets will benefit from a growing middle class, rising consumption, Internet penetration, payment digitisation, and widespread smartphone adoption. These developments are fuelling the expansion of certain services and industries (Bajpai, 2020).

Globalisation has ushered in a qualitatively new stage of development as a result of the expansion of information and communication technologies (ICTs), the Internet, and mobile communications. The main technological features of the current stages of globalisation are the computer and newly developed ICTs, which connect the entire world into a single communication system and create an integrated financial and information space (Limna, Kraiwanit, & Siripipatthanakul, 2022). The Internet is now an integral part of our daily lives. The Internet is the technological advance that has spread and been embraced the fastest in human history. In only decades, Internet use has completely re-invented the ways in which we search for information, consume media and

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<https://doi.org/10.1016/j.resglo.2023.100132>

Received 6 March 2023; Received in revised form 30 April 2023; Accepted 1 May 2023

Available online 4 May 2023

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entertainment, and manage our social networks and relationships (Firth et al., 2019). Starlink is a satellite Internet service provided by SpaceX, a company founded by Elon Musk in 2002. SpaceX designs, manufactures, and launches rockets and spacecraft. SpaceX began launching Starlink satellites in 2019 and has launched over 3,000 satellites into low Earth orbit (LEO) as of September 2022. Starlink's primary focus is on providing high-speed, low-latency broadband Internet in remote and rural areas around the world. As of September 2022, monthly service begins at \$110, with a one-time hardware cost of \$599. Moreover, Starlink's service has expanded significantly thanks to its large constellation of satellites. The company currently has more than 3,000 satellites in orbit and continues to expand this with near-weekly launches. On September 18, 2022, SpaceX launched another 54 satellites into space (Condon, 2022).

According to Marlink (2022) and OceanWeb (2023), broadband satellite services have been available for many decades through geostationary Earth orbit (GEO) satellites, as well as through mobile satellites in LEO. However, the recent development of new LEO and medium Earth orbit (MEO) satellite systems, such as Starlink, OneWeb, Empower, Kuiper, and others, promises to revolutionise the satellite broadband industry by offering low latency, high-bandwidth connectivity to remote and underserved areas around the world. Compared to existing satellite systems, these new LEO and MEO satellite networks have many advantages, including lower latency, higher bandwidth, and lower costs. This is achieved by deploying large constellations of small satellites in low Earth orbit, which allows for faster transmission speeds and reduced signal delay. Additionally, these new systems often use advanced technologies such as optical inter-satellite links to further reduce latency and increase reliability (Daehnick, Klinghoffer, Maritz, & Wiseman, 2020; Lin et al., 2021). As reported by BIS Team (2023), the interconnection of these satellite systems with terrestrial Wi-Fi and other systems will further increase the ease and widespread usage of satellite broadband services. This will allow for seamless connectivity between satellite and terrestrial networks, enabling users to access high-speed internet and other services from anywhere in the world. Overall, the development of these new LEO and MEO satellite systems represents a major step forward in the satellite broadband industry and has the potential to greatly expand connectivity to remote and underserved areas of the world. While the technical performance of these systems may vary based on altitude, bandwidth, and other factors, their overall impact is likely to be significant and long-lasting (Ahmed et al., 2022; Tirmizi et al., 2022). The most advanced of these systems in terms of current deployment is the SpaceX Starlink satellite system and thus was chosen to examine in terms of rural and remote usage in Thailand. This study aims to investigate the Starlink satellite project's impact on the Internet provider service in an emerging economy. The quantitative approach of binary logistic regression analysis was performed to examine factors influencing the Starlink satellite project's impact on the Internet provider service in an emerging economy. The best predictive model showed that the Starlink satellite project's impact on the Internet provider service in an emerging economy could be described by gender, education, tablet, wearable device, Internet time, Internet duration, Facebook, and Twitter. The paper is divided into six sections. After the introduction, the second section is a literature review. The third section describes research methodologies. The fourth presents the study's findings. The fifth and sixth present the study's findings, with discussion and conclusions, respectively.

Literature review

Space Internet is known for its sluggish performance. Satellite-based Internet will undergo a significant upgrade in 2023. Governments and private businesses are taking their plans for a space Internet seriously. SpaceX has several planned launches this year that will place satellites in orbit to support its Starlink network, such as the one with 51 satellites that is set to launch from the Vandenberg Space Force Base in California.

Each new batch adds to the thousands of satellites already in orbit that SpaceX has launched, including those of OneWeb, a competitor of Starlink. While this is going on, Amazon expects to launch its prototype satellites early this year and has plans to use more than 3,000 satellites in its Project Kuiper constellation for satellite Internet. The European Union has said its proposed satellite network, Iriss, could include up to 170 satellites, which are scheduled to enter low Earth orbit between 2025 and 2027. Inspired by the use of Starlink terminals in the war on Ukraine, Taiwan is now reportedly looking for investors to fund its own domestic satellite network (Bishop, 2022; Heilweil, 2023). Furthermore, one of the most advanced broadband Internet systems in the world, Starlink Internet broadband, transmits data through space, where it travels much faster than fibre optic cables and can reach a much larger number of people and locations in a much shorter amount of time. When compared to geostationary satellites, the round-trip data time—also known as latency—between the user and the satellites is much lower for Starlink satellites because they are in low orbit. Users can expect download speeds of 100 Mb/s to 200 Mb/s and latency as low as 20 ms in the majority of locations around the world. Due to this, Starlink is able to offer top-notch services—like online gaming—that are ordinarily unavailable on other satellite broadband systems (Yadav et al., 2022).

According to Voelsen (2021), to provide access to the Internet from any location on Earth, several United States (US) and Chinese businesses intend to create networks with a few thousand satellites each. The location of these satellites will be in low Earth orbit. If these plans are carried out, a completely new dimension will be added to the global Internet infrastructure. This would have significant ramifications for Internet access, the safety and dependability of Internet infrastructure, and power dynamics in international Internet governance. The biggest potential for political influence would be in the home nations of the top corporations, which are most likely to be the US and China. At the level of the global infrastructure for the Internet, they would be able to manage the information flows all over the world. The study presents two hypothetical situations to show the range of potential developments and the corresponding potential responses. One scenario focuses on the emergence of global oligopolies, while the other considers a form of globally regulated competition. In order to create a future Internet infrastructure that is secure and dependable, German and European political decision-makers should use regulations and public funding. The underlying technology's diversity and redundancy serve as the foundation for this. The new satellite constellations can thus play a significant role in a balanced technology mix. For Europe to create its own constellation would be both politically and economically desirable.

Deutschmann, Hielscher, and German (2022) stated that the importance of having quick, dependable broadband Internet access was highlighted during the global COVID-19 pandemic. However, many places lack access to terrestrial broadband Internet. High data rates and extensive coverage are provided by satellite communication. Numerous geostationary satellites cover Europe, and the new Starlink mega constellation in low Earth orbit has recently become operational. Moreover, quick and dependable Internet access is made possible by satellite communication. Virtual private networks and interactive applications are particularly hampered by the high latency of geostationary satellite links. The low Earth orbit mega constellation Starlink can deliver performance comparable to terrestrial Internet access methods.

Methodology

This study used a quantitative approach as a research strategy. Closed-ended questionnaires were employed to collect the data. The questionnaire items were developed based on reliable and valid research data, and the questionnaire was pre-tested on 30 respondents to obtain a dedicated questionnaire, as recommended by Sitthipon et al. (2022) and Limna, Kraiwani, and Siripipattanakul (2023). In addition, the measurement instruments' validity was assessed, as well as their

dependability and accuracy. The researchers explained the study’s goal to the respondents and solicited their participation before distributing online questionnaires. The online survey data were collected between November 2022 and January 2023. According to [Obilor \(2023\)](#), convenience sampling is a technique in which a sample is drawn from the population that is close at hand, easily accessible, or convenient. Convenience sampling is a non-probability sampling technique used by researchers, in which data is collected from a readily available and easily accessible pool of respondents. The respondents were Thai people over 18 years of age, who lived in Thailand. The sample in this study included 617 participants identified through convenience sampling, as recommended by [Kraiwanit \(2021\)](#) and [Siripipatthanakul, Limna, Kraiwanit, and Siripipattanakul \(2022\)](#). Demographic variables (i.e., gender, age, education, status, and income), user behaviour variables (i.e., computer, laptop, smartphone, tablet, wearable device, time, Internet duration, home Internet, and mobile Internet), and social media variables (i.e., Facebook, Instagram, Twitter, TikTok, and Youtube) were the independent variables. According to [Boateng and Abaye \(2019\)](#) and [Gomila \(2021\)](#), in statistics, and more specifically regression analysis, a binary regression calculates the relationship between one or more explanatory variables and a single binary output variable. Therefore, binary regression was employed to analyse the data.

Results

Demographic factors

[Table 1](#) shows that the chi-square is 81.852, with df equal to 5. Thus, a dependent variable can be explained by all the independent variables at the significance level of 0.05.

According to [Table 2](#), the model explained approximately 16.8% of the variation in the result with a significance value of 0.05.

The classification in [Table 3](#) indicates that the model with all the independent variables (demographic variables) was able to predict the Starlink satellite project’s impact on the Internet provider service in the emerging economy of Thailand with an accuracy rate of 61.9% of cases when there was a cut-off value of 0.500 or 50%.

The significance level of each independent variable is presented in [Table 4](#). It shows that the dependent variable (the Starlink satellite project’s impact on the Internet provider service in the emerging economy) could be described by gender and education. Conversely, age, status, and income were not significant. The Starlink satellite project’s impact on the Internet provider service in the emerging economy was significant for males. This change reduced the possibility from 1 to 0.614 ($1 - 0.614 = 0.386$). When there was an increase of one unit in education, the project’s impact increased by 3.504.

User behaviour variables

[Table 5](#) shows that the chi-square is 138.060, with df equal to 9. Thus, a dependent variable can be explained by all independent variables at the significance level of 0.05.

According to [Table 6](#), the model explained approximately 27.1% of the variation in the result with a significance value of 0.05.

The classification in [Table 7](#) indicates that the model with all the independent variables (user behaviour variables) was able to predict the Starlink satellite project’s impact on the Internet provider service in the emerging economy with an accuracy rate of 74.2% of cases when there

Table 1
Omnibus test of the model’s performance using all the independent variables.

		Chi-square	Degrees of freedom (df)	Sig.
Step 1	Step	81.852	5	0.000
	Block	81.852	5	0.000
	Model	81.852	5	0.000

Table 2
The model summary using all the independent variables.

Step	-2 log likelihood	Cox & Snell R square	Nagelkerke R square
1	747.991 ^a	0.124	0.168

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than 0.001.

Table 3
Classification table for back-testing (including all the independent variables).

	Observed	Predicted			
		Impact		Percentage correct	
		No	Yes		
Step 1	Impact	No	66	180	26.8%
		Yes	55	316	85.2%
Overall percentage					61.9%

Note: The cut-off value is 0.500.

Table 4
Variables in the model using all the independent variables.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Gender	-0.488	0.185	6.983	1	0.008	0.614
	Age	0.007	0.068	0.009	1	0.924	1.007
	Education	1.254	0.190	43.379	1	0.000	3.504
	Status	0.321	0.194	2.746	1	0.098	1.378
	Income	-0.073	0.113	0.412	1	0.521	0.930
	Constant	-1.576	0.515	9.373	1	0.002	0.207

Table 5
Omnibus test of the model’s performance using all the independent variables.

		Chi-square	Degrees of freedom (df)	Sig.
Step 1	Step	138.060	9	0.000
	Block	138.060	9	0.000
	Model	138.060	9	0.000

Table 6
The model summary using all the independent variables.

Step	-2 log likelihood	Cox & Snell R square	Nagelkerke R square
1	691.783 ^a	0.200	0.271

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than 0.001.

Table 7
Classification table for back-testing (including all the independent variables).

	Observed	Predicted			
		Impact		Percentage correct	
		No	Yes		
Step 1	Impact	No	164	82	66.7%
		Yes	77	294	79.2%
Overall percentage					74.2%

Note: The cut-off value is 0.500.

was a cut-off value of 0.500 or 50%.

The significance level of each independent variable is presented in [Table 8](#). It shows that the dependent variable (the Starlink satellite project’s impact on the Internet provider service in the emerging economy) could be described by computer, laptop, smartphone, tablet, wearable device, Internet duration, and home Internet. Conversely, Internet time and mobile Internet were not significant. When using a

Table 8
Variables in the model using all the independent variables.

		B	S.E.	Wald	df	Sig.	Exp (B)
Step 1 ^a	Computer	-0.275	0.129	4.555	1	0.033	0.760
	Laptop	-0.339	0.160	4.508	1	0.034	0.712
	Smartphone	1.005	0.421	5.687	1	0.017	2.731
	Tablet	-0.718	0.157	20.873	1	0.000	0.487
	Wearable device	1.032	0.145	50.433	1	0.000	2.807
	Time	-0.011	0.057	0.039	1	0.843	0.989
	Duration	0.242	0.077	9.930	1	0.002	1.273
	Home Internet	0.267	0.073	13.305	1	0.000	1.306
	Mobile Internet	-0.043	0.069	0.381	1	0.537	0.958
	Constant	-1.679	0.544	9.535	1	0.002	0.187

computer, the Starlink satellite project’s impact decreased from 1 to 0.760 (1–0.760 = 0.240). When using a laptop, the project’s impact decreased from 1 to 0.712 (1–0.712 = 0.288). When using a smartphone, the project’s impact increased by 2.731. When using a tablet, the project’s impact decreased from 1 to 0.487 (1–0.487 = 0.513). When using a wearable device, the project’s impact increased by 2.807. When there was an increase of one unit in Internet duration, the project’s impact increased by 1.273. When there was an increase of one unit in home Internet, the project’s impact increased by 1.306.

Social media variables

Table 9 shows that the chi-square is 90.995, with df equal to 6. Thus, a dependent variable can be explained by all the independent variables at the significance level of 0.05.

According to Table 10, the model explained approximately 18.6% of the variation in the result with a significance value of 0.05.

The classification in Table 11 indicates that the model with all the independent variables (social media variables) was able to predict the Starlink satellite project’s impact on the Internet provider service in the emerging economy with an accuracy rate of 64.3% of cases when there was a cut-off value of 0.500 or 50%.

The significance level of each independent variable is presented in Table 12. It shows that the dependent variable (the Starlink satellite project’s impact on the Internet provider service in the emerging economy) could be described by Facebook, Twitter, and TikTok. Conversely, Instagram and Youtube were not significant. When using Facebook, the project’s impact decreased from 1 to 0.160 (1–0.160 = 0.840). When using Twitter, the project’s impact increased by 3.381. When using TikTok, the project’s impact decreased from 1 to 0.365 (1–0.365 = 0.635).

All of the significant variables

Table 13 shows that the chi-square is 184.884, with df equal to 12. Thus, a dependent variable can be explained by all of the independent variables at a significance level of 0.05.

According to Table 14, the model explained approximately 35.1% of the variation in the result with a significance value of 0.05.

Table 15 indicates that the model with all the significant independent variables was able to predict the Starlink satellite project’s impact on the Internet provider service with an accuracy rate of 73.0% of cases

Table 9
Omnibus test of the model’s performance using all of the independent variables.

		Chi-square	Degrees of freedom (df)	Sig.
Step 1	Step	90.995	6	0.000
	Block	90.995	6	0.000
	Model	90.995	6	0.000

Table 10
Model summary using all the independent variables.

Step	-2 log likelihood	Cox & Snell R square	Nagelkerke R square
1	735.787 ^a	0.138	0.186

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than 0.001.

Table 11
Classification table for back-testing (including all of the independent variables).

	Observed	Predicted		Percentage correct	
		Impact			
		No	Yes		
Step 1	Impact	No	59	187	24.0%
		Yes	32	336	91.3%
Overall percentage					64.3%

Note: The cut-off value is 0.500.

Table 12
Variables in the model using all the independent variables.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Facebook	-1.833	0.415	19.502	1	0.000	0.160
	Instagram	-2.193	1.131	3.759	1	0.053	0.112
	Twitter	1.218	0.228	28.453	1	0.000	3.381
	TikTok	-1.009	0.219	21.162	1	0.000	0.365
	Youtube	2.129	1.159	3.370	1	0.066	8.403
	Constant	2.111	0.507	17.317	1	0.000	8.256

Table 13
Omnibus test of the model’s performance using all of the independent variables.

		Chi-square	Degrees of freedom (df)	Sig.
Step 1	Step	184.884	12	0.000
	Block	184.884	12	0.000
	Model	184.884	12	0.000

Table 14
The model summary using all the independent variables.

Step	-2 log likelihood	Cox & Snell R square	Nagelkerke R square
1	641.898 ^a	0.260	0.351

a. Estimation terminated at iteration number 5 because parameter estimates changed by less than 0.001.

Table 15
Classification table for back-testing (including all the independent variables).

	Observed	Predicted		Percentage correct	
		Perception on Starlink			
		No	Yes		
Step 1	Perception on Starlink	No	163	83	66.3%
		Yes	83	285	77.4%
Overall percentage					73.0%

Note: The cut-off value is 0.500.

when there was a cut-off value of 0.500 or 50%.

The significance level of each independent variable is presented in Table 16. This shows that the dependent variable (the Starlink satellite project’s impact on the Internet provider service in the emerging economy) could be described by gender, education, tablet, wearable device, Internet time, Internet duration, Facebook, and Twitter.

Table 16
Variables in the model using all the independent variables.

		B	S.E.	Wald	df	Sig.	Exp (B)
Step 1 ^a	Gender	-0.662	0.219	9.119	1	0.003	0.516
	Education	0.810	0.197	16.894	1	0.000	2.249
	Computer	-0.284	0.241	1.385	1	0.239	0.753
	Laptop	-0.484	0.320	2.282	1	0.131	0.616
	Smartphone	1.018	0.671	2.307	1	0.129	2.769
	Tablet	-0.986	0.287	11.795	1	0.001	0.373
	Wearable device	0.929	0.251	13.651	1	0.000	2.531
	Time	-0.348	0.109	10.201	1	0.001	0.706
	Duration	0.606	0.147	16.870	1	0.000	1.832
	Facebook	-1.577	0.404	15.277	1	0.000	0.207
	Twitter	0.688	0.247	7.764	1	0.005	1.989
	TikTok	-0.149	0.260	0.330	1	0.566	0.861
	Constant	0.160	1.191	0.018	1	0.893	1.173

Conversely, a computer, a laptop, a smartphone, and TikTok were not significant. The Starlink satellite project's impact on the Internet provider service in the emerging economy was significant for males. This change reduced the possibility from 1 to 0.516 ($1 - 0.516 = 0.484$). When there was an increase of one unit in education, the Starlink satellite project's impact increased by 2.249. When using a tablet, the project's impact decreased from 1 to 0.616 ($1 - 0.616 = 0.384$). When using a wearable device, the project's impact increased by 2.531. When there was an increase of one unit in Internet time, the project's impact decreased from 1 to 0.706 ($1 - 0.706 = 0.294$). When there was an increase of one unit in Internet duration, the project's impact increased by 1.832. When using Facebook, the project's impact decreased from 1 to 0.207 ($1 - 0.207 = 0.793$). When using Twitter, the project's impact increased by 1.989.

Discussions

This study investigated the Starlink satellite project's impact on the Internet provider service in the emerging economy of Thailand. The findings revealed that the project's impact on the Internet provider service in the emerging economy could be described by gender, education, tablet, wearable device, Internet time, Internet duration, Facebook, and Twitter. The study found that gender was a significant predictor of the impact of the Starlink project on internet provider services, with males being more likely to be impacted by the project than females. Education level was also found to be a significant predictor, with individuals with higher levels of education being more likely to be impacted by the project. In addition, the study found that device usage, internet time and duration, and social media use were also significant predictors of the impact of the Starlink project on internet provider services. These findings suggest that the impact of the Starlink project on emerging economies is complex and multifaceted, and that various factors need to be considered when analysing its impact. Gupta (2021) reported that the Starlink satellite project has an impact on Internet service providers. As more satellites are launched to add to the grid, the speed and overall quality of the Internet service will improve. The project's impact on the Internet provider service in Thailand's emerging economy could be described by gender. However, Silver (2019) argued that in most countries, gender plays only a minor role in explaining differences in technological use. Men and women use technology at comparable rates in advanced and emerging economies, including smartphones, the Internet, and social media. In the case of smartphone ownership, for example, the gender gap is usually in the mid-single digits, if one exists at all. In Japan, for example, 69% of men own smartphones versus 63% of women. Men and women have largely acquired smartphones at comparable rates in most countries in recent years, implying that the gender gap in usage has remained constant. The results corresponded to those of Silver (2019), that the Starlink Satellite

project's impact on the Internet provider service in emerging economies could be described by education. In emerging economies, technology use is still much more prevalent among the well-educated. Education plays a sizable role when it comes to explaining differences in technological use in most countries. In every country surveyed, better-educated people are more likely to use the Internet than people with lower levels of education. Additionally, Pressman (2019) stated that Facebook and SpaceX can assist in connecting people in developing countries, providing faster online access to primarily rural users who rely on today's slower and more expensive satellite Internet services, and catering to business customers who want real-time data from their equipment, such as oil rigs and ocean buoys. Furthermore, Silver (2019) argued that, while people can and do use social media from a variety of devices, smartphone owners are far more likely to access social networking sites than people who own a basic phone or none at all in every country surveyed.

According to Abdellatif et al. (2023), the SpaceX network, as well as other LEO satellite networks, offer significant advantages in terms of low latency compared to traditional geostationary satellite systems. This is because LEO satellites are much closer to the Earth's surface, typically orbiting at an altitude of around 500–2000 km, while geostationary satellites orbit at an altitude of around 36,000 km. Moreover, because LEO satellites are much closer to the Earth, they have a shorter transmission path, which reduces the time it takes for signals to travel to and from the satellite. This shorter distance results in a lower latency, or transmission delay, compared to geostationary satellites, which have a latency of around 600–800 ms due to the longer distance that signals have to travel. Low latency is particularly important for broadband networking services, such as video conferencing, online gaming, and other real-time applications, where even a small delay in transmission can cause significant problems. Additionally, with low-latency LEO satellite networks, users can experience high-quality, real-time connectivity, even in remote or underserved areas where traditional broadband infrastructure is unavailable or unreliable. In addition to low latency, LEO satellite networks also offer other advantages, such as high bandwidth, global coverage, and the ability to provide connectivity to areas where traditional broadband infrastructure is not feasible or cost-effective. These advantages make LEO satellite networks an attractive option for broadband networking services, particularly in rural or remote areas, where traditional broadband infrastructure is often lacking (Bhattacharjee, 2021; Cakaj, 2021; Zhou et al., 2023).

Conclusions

The Starlink satellite project has the potential to have a significant impact on the internet provider service in emerging economies, as it focuses on delivering high-speed, low-latency broadband internet in remote and rural locations globally. This can help to bridge the digital divide and improve internet access in areas where traditional terrestrial infrastructure is lacking or insufficient. A study conducted in Thailand using a quantitative approach found that the impact of the Starlink satellite project on internet provider services in emerging economies could be influenced by factors such as gender, education, device usage, internet time and duration, and social media use. Understanding the impact of these factors is crucial in developing effective strategies for promoting sustainable and equitable access to broadband connectivity in emerging economies. It is recommended to educate people, regarding the Starlink satellite project's impact on the Internet provider service in emerging economies. For those residing in remote, rural, and underserved areas, satellite Internet access has revolutionised the expansion of professional development opportunities. Users of satellite Internet can now access expert resources that were previously inaccessible because of a lack of terrestrial Internet infrastructure. Satellite Internet has made it possible for residents of remote areas to take advantage of opportunities for professional advancement. Previously inaccessible webinars and conferences can now be accessed by users thanks to satellite Internet.

Due to this, professionals in remote locations have been able to update their skill set and stay current on industry trends. Satellite Internet has also made it possible for rural businesses to reach online markets that would otherwise be inaccessible because of a lack of dependable Internet connection. With satellite Internet, companies can connect with clients anywhere in the world, boosting their chances of success.

While the Starlink Satellite Project has the potential to improve internet access in emerging economies, several factors can intervene in the equation, including access to reliable electrical power, local capabilities, and equipment. In many emerging economies, access to reliable electricity can be a significant challenge. Without a stable power supply, it can be challenging to maintain and operate the necessary equipment to access the internet, including computers, routers, and other devices. The lack of reliable electricity can also limit the ability of individuals and communities to take advantage of the internet's benefits, such as online education, remote work, and electronic commerce (e-commerce). In addition, local capabilities and equipment can also play a crucial role in the success of the Starlink Satellite Project in emerging economies. For example, many rural areas in developing countries may lack the technical expertise needed to install and maintain satellite dishes and other equipment necessary to access the internet via satellite. Similarly, the availability of reliable internet-compatible devices like smartphones and laptops may be limited, particularly in low-income communities. Therefore, while the Starlink Satellite Project has the potential to improve internet access in emerging economies, the availability of reliable power, technical expertise, and equipment is essential to realising its full potential. Policymakers, business leaders, and other stakeholders must address these intervening factors to ensure that the project's benefits can be fully realised in developing countries.

Satellite internet access has the potential to transform the delivery of broadband connectivity in emerging economies. However, it is essential to consider access to reliable electrical power, local capabilities, and equipment as intervening factors in any analysis of the impact of satellite internet access on these economies. Future research in this area could include investigating the relationship between satellite internet access and access to reliable electrical power, assessing the local capabilities and equipment needed to support satellite internet access, examining the potential for satellite internet access to foster local innovation and entrepreneurship, evaluating the potential environmental impact of off-grid power solutions and satellite constellations, and exploring the potential of satellite internet access to support the development of new industries and economic sectors. By including these factors in future research, we can develop a more comprehensive understanding of the impact of satellite internet access on emerging economies and develop more effective strategies for promoting sustainable and equitable access to broadband connectivity. This, in turn, can help to bridge the digital divide and unlock the full potential of emerging economies in the digital age. Furthermore, the respondents were Thai people over 18 years of age, who lived in Thailand, which was a limitation of the study. The recommendation is to expand further to investigate more areas. The nature of this study was a closed-ended questionnaire. Consequently, qualitative studies, such as interviews or focus group discussions, could provide additional insights for future research.

CRediT authorship contribution statement

Yarnaphat Shaengchart: Conceptualization, Methodology, Investigation, Software, Validation, Supervision. **Tanpat Kraiwanit:** Conceptualization, Methodology, Investigation, Resources, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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