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Measuring user acceptance of satellite broadband in the UAE

Khalid Al Awadhi[a], Bader Obeidat[a,b] and Muhammad Alshurideh[c,d*]

[a]*The British University in Dubai, United Arab Emirates*
[b]*Department of Business Management, School of Business, The University of Jordan, Amman, Jordan*
[c]*Department of Marketing, School of Business, The University of Jordan, Amman, Jordan*
[d]*Department of Management, College of Business Administration, University of Sharjah, Sharjah, United Arab Emirates*

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A B S T R A C T

The Information and Communications Technologies (ICT) sector provides different connectivity solutions in urban areas. Unfortunately, market players make little effort to ensure connectivity to underserved markets. The analysis of the existing ICT market revealed the possibility of a solution to this problem by utilizing the latest advances in satellite communication. It is recognized that connectivity through satellites is generally not a popular option in the United Arab Emirates (UAE), although there are still some underserved markets in the UAE that require better connectivity solutions. In this study, the Technology Acceptance Model (TAM) has been used to assess users' acceptance in the UAE market to introduce NGSO satellite broadband connectivity. We consider the main two independent variables of the model: perceived usefulness (PU) and perceived ease of use (PEU). Additional two variables had been proposed which significantly affect UAE consumers' intention to use satellite broadband which are: innovativeness (INN) and satisfaction with current services (SAT). The study results support that PU, PEU, and INN will positively influence the UAE population's intention to use the service. The hypothesis that PEU will positively affect PU was also supported. The hypothesis that SAT will negatively influence the UAE population's intention to the service was not supported. Additionally, the study also shows that UAE consumers' intention to use satellite broadband is unrelated to gender or age group. A set of recommendations were drawn to support the smooth introduction of NGSO satellite broadband service in the UAE.

1. Introduction

There has been global recognition of ICT's contribution to human progress. ICT is identified as an essential component in all of the 17 Sustainable Development Goals (SDGs) as outlined by the United Nations (UN) (ITU, 2021; Lythreatis et al., 2022). Despite this, almost half of the people around the world do not have Internet access (Henri, 2020, p. 2), leading to the so-called "digital divide". Market research led us to understand that the internet through NGSO satellites would provide connectivity to unconnected areas (Henri, 2020). The UAE enjoys globally recognized excellent internet connectivity, and the UAE's mobile internet is rated the best in the world (Alshurideh et al., 2019a; Al Kurdi et al., 2020a; Ookla, 2021). Nevertheless, there are still some underserved markets in the UAE that require better connectivity solutions (Alshurideh et al., 2019b; Al-Hamad et al., 2021). Looking at the current connectivity options in the UAE, it is recognized that connectivity through satellites is generally not widespread, as connectivity through the current GSO satellites has many disadvantages over standard terrestrial connectivity (Lin et al., 2021; Nuseir et al., 2021). Therefore, the acceptance of satellite connectivity by end-users in the UAE has to be assessed. The UAE currently has two mobile internet service providers: Etisalat and du. In addition, other telecommunication service providers are licensed to provide telecommunication services through Geostationary (GSO)

* Corresponding author.
E-mail address: malshurideh@sharjah.ac.ae (M. Alshurideh)

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satellites, such as Yahsat, Thuraya, and Inmarsat. However, these services cannot be compared to the performance and reliability of the services being provided by the mobile service providers (Al-Dalahmeh et al., 2018; Al-Khayyal et al., 2021; Suleman et al., 2021). Recent developments in satellite telecommunications allow providing broadband connectivity that is similar to services provided by terrestrial networks.

This study aims to assess the acceptance of internet users in the UAE to use services provided by NGSO satellite operators in the UAE market. An extended TAM will be used to achieve this objective. A survey study is conducted to confirm the model's validity within the context of accepting satellite broadband by consumers in the UAE.

2. Literature Review

2.1 Global Connectivity Requirements

Humanity continues to make significant progress in the ICT sector. Faster connectivity speeds and larger bandwidth have spurred technological giants to develop innovative technological solutions (Obeidat et al., 2015; Adedoyin et al., 2020), such as general artificial intelligence, augmented reality applications, autonomous vehicles, and Telemedicine (Gampala et al., 2021; Rodrigues et al., 2021; Shetty et al., 2021). Known collectively as the Fourth Industrial Revolution (4IR), these innovations will yield a paradigm shift in life (Schwab, 2016; Sheikh & Halima, 2020). With the expected rollout of these use cases, the demand for connectivity will increase dramatically (Harfoushi et al., 2013; Akour et al., 2021). In the coming decade, it is expected that two-thirds of the world's population will be connected to the internet, with the number of connected devices reaching threefolds of the world's population (Oughton et al., 2021). Therefore, efficient and reliable connectivity solutions would be an essential component to realize the capabilities of 4IR. Countries with considerable early investments in the ICT sector are expected to be the early adopters of 4IR (Adedoyin et al., 2020).

2.1.1 The Digital Divide

The International Telecommunication Union (ITU), the United Nations specialized agency for ICTs, is considering reducing the digital divide. Recognized as "*the gap between people who have adequate access to information communication technology (ICT) and people who have poor or no access to ICT*" (Lythreatis et al., 2022, p. 1), the digital divide creates a serious issue that poses a significant threat to the development and spread of the 4IR worldwide. This social inequality is considered a primary global concern. The latest COVID-19 pandemic has stressed the importance of addressing the challenge, where connectivity was an essential part of work, study, and social life (Alshurideh et al., 2021a; Lythreatis et al., 2022). For example, the pandemic has urged businesses to shift their activities to the internet. As such, businesses with poor connectivity became less resilient to these emerging requirements (Morris et al., 2022).

The challenge of the digital divide has different levels (Lythreatis et al., 2022). As it could refer to the absence of connectivity, it could also refer to poor Quality of Service (QoS) (Montenegro & Araral, 2020). Therefore, a nation could have its population fully connected to the internet while still suffering from a particular type of digital divide, where a portion of the population has a poor service quality. This type of digital divide is argued to be critical, particularly with the rollout of 4IR use cases, such as the applications indicated earlier. Therefore, ITU member states are seriously considering tackling this problem in collaboration with the ICT industry. As a result, many innovative connectivity solutions have recently been developed to fulfill this connectivity gap (Osoro & Oughton, 2021), including the development of satellite connectivity.

2.2 Satellite Connectivity

One of the best solutions to the global digital divide could be the dependence on advancements in space communications. More than 4,500 satellites are orbiting the Earth (UCS, 2005). Looking at the expected significant role of connectivity in rolling out 4IR use cases, global initiatives started to evolve to provide broadband connectivity through NGSO satellites (Del Portillo et al., 2019). The significant advantage of the NGSO satellites over the GSO satellites is that the former is much closer to the Earth's surface: NGSO is about 2000 kilometers above sea level, while the latter is about 36,000 kilometers above sea level (Osoro & Oughton, 2021). Combining low Earth orbit with satellite advancements allows for faster communications with more reliability and higher capacity. The propagation delay is drastically less than the propagation delay of GSO satellites (Henri, 2020; Lin et al., 2021). GSO satellites offered two-way connectivity only to fixed locations on Earth in the early stages of satellite communications, such as the legacy Intelsat services (Leive, 1988). With the development of satellite communications, GSO satellites enabled connectivity with mobile terminals with very low speeds and data rates (Wright, 1995). Nowadays, we are witnessing significant growth in satellite communications, with capabilities comparable to terrestrial connectivity resulting from sophisticated technological developments (Del Portillo et al., 2019). Along with satellite technology developments that improved connectivity, the cost of building and launching small NGSO satellites has reduced dramatically (Crisp et al., 2015). With these recognized advantages of NGSO satellite connectivity, they are being used to connect rural areas, where rolling out terrestrial infrastructure is found to be infeasible for terrestrial operators (Osoro & Oughton, 2021).

NGSO satellites are becoming increasingly attractive for satellite connectivity. Some constellations have reached advanced stages of planning and development, such as Starlink, OneWeb, TeleSat, and Kuiper (Del Portillo et al., 2019; Osoro & Oughton, 2021). Some of these mega initiatives adopt a model of providing communication services directly to end-users, such as Starlink (Starlink, 2021). However, to implement such a model, satellite operators need to overcome many obstacles. In addition to telecommunications service licensing, many countries worldwide require satellite signal landing rights (Azzarelli, 2020). Satellite operators must contact all regulatory bodies of countries they wish to provide their services within. Moreover, there is a significant probability that they will not be able to obtain a license. Another challenge is complying with various regulatory requirements in every country, which could be challenging for the NGSO satellite operator (Nalda, 2004). It is technically difficult to make different transmissions for adjacent countries based on the regulatory requirements of every country, especially when the national territories are relatively small.

One of the newest satellite connectivity initiatives for NGSOs is Starlink. It is a project launched by SpaceX, a pioneering space company owned by the entrepreneur Elon Musk. With a promise of speeds ranging from 50 Mbps to 150 Mbps, Starlink proposes offering a fast and reliable internet connection (McNally, 2022; Starlink, 2021). As the company plans to launch thousands of satellites to provide connectivity, the speed of the service is expected to increase as the number of satellites increases. Many other initiatives similar to Starlink are on design boards or have recently appeared. Broadband connectivity through NGSO satellites is expected to be a flourishing market in the near future.

2.3 Broadband Connectivity Status in the UAE

Every community considers the ICT sector to be necessary. Also, it is acknowledged that the ICT industry is a very profitable business. Leaving the sector unregulated could degrade service quality (Montenegro & Araral, 2020). Therefore, governments usually create a regulatory body for the ICT sector to facilitate critical ICT services to society. The Telecommunications and Digital Government Regulatory Authority (TDRA) is responsible for this task in the United Arab Emirates. According to UAE's Telecom Law, any entity that wants to provide ICT services in the country must obtain a license from the TDRA. The licensees must adhere to strict license terms and conditions to ensure quality services and serve most of the country's population (Obeidat ret al., 2018; Fatafta et al., 2019). At the same time, the TDRA protects the interests of the licensees in the sector by allowing for balanced competition. In the case of too many service providers for ICT solutions, licensees' market share would be negatively affected, and the quality of their products and services would degrade.

There is no doubt that UAE's internet connectivity is among the best globally (Leo et al., 2021; Aburayya et al., 2020a&b). Until June 2021, the UAE was ranked first globally for mobile internet speed, with an average download speed of 183 Mbps (Ookla, 2021). However, every country has less connected people than others (Henri, 2020). The UAE market is still underserved in some places.

Various reliable connectivity solutions are being provided in urban areas. However, little effort is being made to connect underserved markets (Sheikh & Halima, 2020, p. 1). Profitability is usually the driving force behind companies (Obeidat et al., 2013; Aqqad et al., 2019). If the provision of ICT services had been entirely left to the private sector, many services would have been limited to urban areas: areas with a dense population that guarantee a good Return of Investment (ROI) for the installed ICT infrastructure. In light of this, regulators like the TDRA allow entities to offer ICT services with conditions that ensure good service coverage. However, rules in the UAE, similar to many other countries, do not allow regulators to oblige service providers to provide services all over the country due to investment costs (Lin et al., 2021, p. 1). With the development of the discussed satellite connectivity solutions, it became inevitable to introduce broadband internet connectivity through satellites into the UAE market.

Many researchers studied different aspects of internet connectivity provisioning around the globe (Alalwan et al., 2018; Montenegro & Araral, 2020; Oughton et al., 2021). However, not much research is done on the expected acceptance of internet service provisioning via satellite. History has shown that innovation in a satellite communication solution, such as Iridium, does not guarantee consumer acceptance of the solution (Wang et al., 2008). Therefore, we will look into factors identified in the literature affecting other similar technologies and attempt to extract the main variables identified as the main factors for the acceptance of satellite internet broadband.

2.4 Conceptual Framework

The Technology Acceptance Model (TAM) has been widely used to explain users' acceptance of new technologies (Alshurideh et al., 2019c; Al Kurdi et al., 2020b; Alshurideh et al., 2020; AlHamad et al., 2021). The model is usually used for the ICT sector. In addition, researchers have widely used it as the basis for extended TAM models according to the scenario being studied (Alalwan et al., 2018; Jimenez et al., 2021; Wang et al., 2008). Thus, this model has been chosen to be the theoretical basis of our work.

TAM was introduced by Davis (1985), where he proposed the main two variables to be determinants of computer usage: Perceived Usefulness (PU) and Perceived Ease of Use (PEU). Many researchers have adopted the model and introduced

different extensions to it according to different contexts. It has been proposed that TAM is used to study the impact of external variables on the acceptance of technology (Davis et al., 1989). The model has been used to predict acceptance for many innovations and technology products and services (Wang et al., 2008). Davis et al. (1989) argued that the TAM model could be used in the pre-implementation stage of the technology, where technology acceptance is predicted based on perceptions of usefulness and ease of use. Therefore, using TAM will predict the UAE's population acceptance of satellite broadband, even if it has not been deployed yet in the Country.

In a study to assess network externals that affect TAM for mobile telecommunication innovation, it was found that Number of Users (NOU) and Technology-Specific Valuation (TSV) directly affect PU as external factors in an extended TAM (Wang et al., 2008). People tend to replicate the experiences of other people around them. When many people are using a specific technology, it is presumed that many other people will attempt to have the same experience of using the technology.

Šumak et al. (2011) listed user-specific factors that affect TAM constructs in two or more studies. These factors are computer self-efficacy (CSE), confidentiality (CONF), computer anxiety (CANX), self-efficacy (SEFF), subjective norms (SN), and enjoyment (ENJ). Jimenez et al. (2021) proposed a TAM extension that fits an e-learning tool (FARMER 4.0). They proposed the following individual level external factors that influence both PU and PEU: SCE, CANX, ENJ, innovativeness (INN), and experience (EXP). As can be observed, many factors are repeated in both studies.

In a study to examine the adoption of mobile internet in Saudi Arabia, it was found that INN, ENJ, and trust (TR) influence Saudi customers' intention to adopt mobile internet, in addition to PU and PEU (Alalwan et al., 2018).

These are only a few examples of studies based on TAM. Many other studies exist, but we will not be able to analyze all of them. Based on our literature review, we will consider the following factors and make the indicated hypotheses.

2.4.1 Perceived Usefulness (PU)

Perceived Usefulness (PU) is one of the primary constructs of TAM. Davis (1989, p. 320) defined Perceived Usefulness as *"the degree to which a person believes that using a particular system would enhance his or her job performance"*. In essence, satellite broadband could be perceived as more productive by customers, providing them with the opportunity to save effort and time in accessing the internet, compared to using existing connectivity solutions (Alalwan et al., 2018; Alshurideh et al., 2021b). The main advantage of satellite connectivity is that it is deemed to be accessible from anywhere in the world. Also, it has very high service reliability (Lambrechts & Sinha, 2019). Satellite broadband is therefore perceived as more practical by customers, making them more motivated to use it. Thus, perceived usefulness will have a direct impact on UAE user's intention to adopt satellite broadband. The following hypothesis is proposed:

H_1: *Perceived Usefulness will positively influence the UAE population's intention to use satellite broadband.*

2.4.2 Perceived Ease of Use (PEU)

Davis (1989, p. 320) defined Perceived Ease of Use as *"the degree to which a person believes that using a particular stem would be free of effort"*. Since people are not familiar with satellite broadband's installation and operation details, such as antenna installation and overall system setup, they might have doubts about the ease of use of this new technology. Therefore, Perceived Ease of Use would be a significant element in the intention to use satellite broadband. Also, many studies identify a link between PU and PEU, where PEU will positively affect PU (Jimenez et al., 2021; Šumak et al., 2011; Wang et al., 2008). Therefore, the following hypotheses are proposed:

H_2: *Perceived Ease of Use will positively influence the UAE population's intention to use satellite broadband.*

H_3: *Perceived Ease of Use will positively influence UAE population's Perceived Usefulness of satellite broadband.*

2.4.3 Innovativeness (INN)

Innovativeness, or individual innovativeness (INN), is defined as "*the individual's disposition towards adopting any new technology before others*" (Jimenez et al., 2021, p. 10). Societies generally conceive early adopters of new technologies as being innovative. The space sector has recently encountered significant developments in the UAE. With the establishment of the UAE Space Agency in 2014, the launch of the UAE astronauts program in 2017, and the successful continuation of the UAE Mars Mission, residents of the UAE are naturally attracted to space innovation and technologies. Therefore, it is expected that if satellite broadband becomes available in the UAE, the UAE's population would be eager to adopt it. It is also shown that innovativeness is an essential factor in reducing perceived risks of implementing the new technology (Aldás-Manzano et al., 2009). Therefore, the following hypothesis is proposed:

H_4: *Innovativeness will positively influence the UAE population's intention to use satellite broadband.*

2.4.4 Satisfaction with current services (SAT)

Through the literature review, we could not identify satisfaction with current services (SAT) as an external variable that has been tested with TAM. However, we believe that people's satisfaction with the existing internet service providers in the UAE is a sensitive topic that attracts much attention in the Country (Al Batayneh et al., 2021; Al-Dmour et al., 2021; Hayajneh et al., 2021). Therefore, it is essential to test the impact of UAE consumers' satisfaction with current services on their intention to use satellite broadband services offered by a new service provider. The following hypothesis is proposed:

H_5: *Satisfaction with current services will negatively influence the UAE population's intention to use satellite broadband.*

2.4.5 Behavioral Intention (BI)

Behavioral Intention (BI) is defined as "*the degree to which a person has formulated conscious plans to perform or not perform some specified future behavior*" (Šumak, et al., 2011, p. 92). In many studies, Attitude toward using the technology (ATU) is included as a mediator between PU and PEU from one side and BI from the other. However, in many other studies, BI is considered a direct dependent variable for the two independent variables PU and PEU (Šumak, et al., 2011, p. 92). In this study, we are going to consider the direct relationship between these variables.

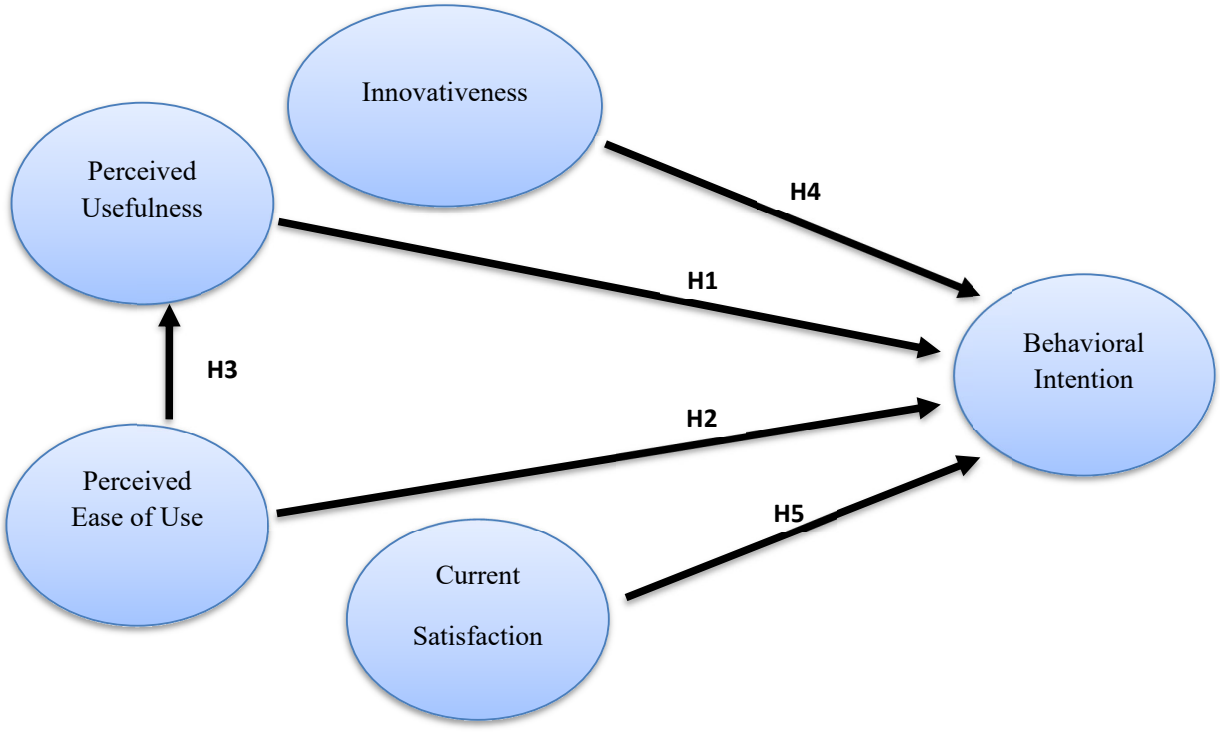

Fig. 1. Conceptual Model

In the original TAM model by Davis (1985), actual system use is being recognized. Our study will only look at factors affecting BI (Davis, et al., 1989) and would not link BI with the actual system use. This will be discussed further in the limitations section. The conceptual model in this study can be seen in Fig.1.

3. Methodology

3.1 Sample and research tool

The population of this research is internet users living in the UAE. According to public resources, around 99% of the UAE's population, estimated to be more than 9.8 Million, uses the internet (Datareportal, 2021; The World Bank, 2021). Therefore, a sampling frame could not be established. The questionnaire was developed using Google Forms and distributed through electronic mail and social media channels, such as WhatsApp and LinkedIn. As the study is based on an online survey, this created a limitation in the sampling process, detailed in the limitations section.

The questionnaire included questions to measure PU, PEU, INN, SAT, and BI of satellite broadband. The questions were translated into Arabic, as Arabic is the official language in the UAE. The translation was shared with legal experts in the Telecommunications and Digital Government Regulatory Authority of the UAE, who confirmed the validity of the translation. The distributed questionnaire was bilingual. Complete responses were received from 146 participants.

3.2 Measures and Variables

The developed questionnaire included 24 questions divided into two main sections. Section 1 had 20 questions for the extended TAM constructs: PU, PEU, INN, SAT, and BI (see the appendix**)**, in addition to a question about the current service provider. Section 2 of the questionnaire included three demographic questions: the respondent's age, gender, and emirate of residence. Since we have 20 items to measure the constructs and our sample size is 146, we have around a 7:1 ratio of observations to variables. Hence, we are above the minimum sample size (Hair et al., 2014, p. 172).

The constructs of the conceptual framework were measured using items extracted from different references. The items to measure PU, PEU and BI were extracted from Šumak et al. (2011). The items to measure INN were extracted from Alalwan et al. (2018). The items to measure SAT were extracted from Ray et al. (2012). All the measurement scales for the questions related to TAM constructs were five-point Likert-type scales, with five representing strongly agree and one representing strongly disagree. The questionnaire items were slightly modified to reflect the context of acceptance of satellite broadband. To ensure the accuracy of the developed survey, it was shared with experts, who conveyed their agreement with the structure of the survey questions.

3.3 Statistical Analysis

Demographic characteristics of participants in this study are presented and analyzed. Cronbach's alpha is used to check the reliability and internal consistency of the constructs in the conceptual model. Confirmatory Factor Analysis is used to check the reliability of the survey items to represent the constructs. To test the appropriateness of the conceptual model to represent people's acceptance of satellite broadband, single and multiple regression were used with the collected data from the survey questionnaire.

4. Data Analysis

4.1 Demographic Characteristics and Analysis

As indicated earlier, 146 respondents completed the survey questionnaire. The profile of the respondents is summarized in Table (1). It is noted that almost half of the respondents were male, and half were female. It was also noted that most respondents currently use Etisalat services (around 82%) compared to du services (about 18%). Also, responses were received from respondents living in all Emirates of the UAE, except Fujairah, with most respondents living in Sharjah (around 59%).

Looking at the demographic characteristics of the respondents, we first tried to analyze if there is any significant difference between the BI of male and female respondents. Hence, we ran an independent t-test using SPSS at a significance level of 5% (α=0.05). The p-value of significance was found to be 0.955, which is larger than α. Since $P > \alpha$, we fail to reject the null. Therefore, we are 95% confident that there is no significant difference in BI between male and female respondents.

Also, we tried to analyze if the age group is a significant factor for BI. Hence, we ran an ANOVA test using SPSS at a significance level of 5% (α=0.05). The p-value of significance was found to be 0.573, which is larger than α. Since $P > \alpha$, we fail to reject the null. Therefore, we are 95% confident that there is no link between the age group of the respondents and their intention to use the new services (BI).

4.2 Reliability and Validity

Before we begin testing the hypotheses, we assessed our questionnaire items for reliability using Cronbach's alpha. Cronbach's alpha analysis was conducted initially for all items of each construct. It was found that all the estimated values of Cronbach's alpha for the TAM constructs exceeded the generally agreed upon lower limit of 0.7 (Hair, et al., 2014, p. 123), which means that the measurement has strong internal consistency.

The items for the model's constructs were collected from different literature sources. To confirm that the sample we collected still fits the developed factor structure of our model, Confirmatory Factor Analysis (CFA) is used. We conducted a Measure of Sampling Adequacy (MSA). Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.889, and Bartlett's Test of Sphericity is significant. From the Anti Image Matrix, it is shown that all values are above 0.5. Then, we conduct the CFA. We used Factor Analysis in SPSS and selected a fixed number of factors to extract (five factors). We chose Varimax Rotation and suppressed coefficients less than 0.6. We observed a deficiency in the PEU factor, where the total extraction sum of squared loading is 0.786, which is less than 1. PEU1 and PEU2 had small loading on the PEU factor (PEU1: 0.245 and PEU2: 0.356).

They loaded much higher on the PU factor (PEU1: 0.801 and PEU2: 0.723). Hence, we removed PEU1 and PEU2 and conducted the CFA again. This time, we got perfect loadings on the five factors. The new Cronbach's alpha for the PEU construct was also above 0.7. Cronbach's alpha readings, as well as item loadings, are shown in Table 1. The new Kaiser-Meyer-Olkin Measure of Sampling Adequacy is 0.873, and Bartlett's Test of Sphericity is significant. Again, the Anti Image Matrix showed that all values are above 0.5. After conducting reliability and validity tests and modifying the model accordingly, the final structural model is shown in Fig. 3.

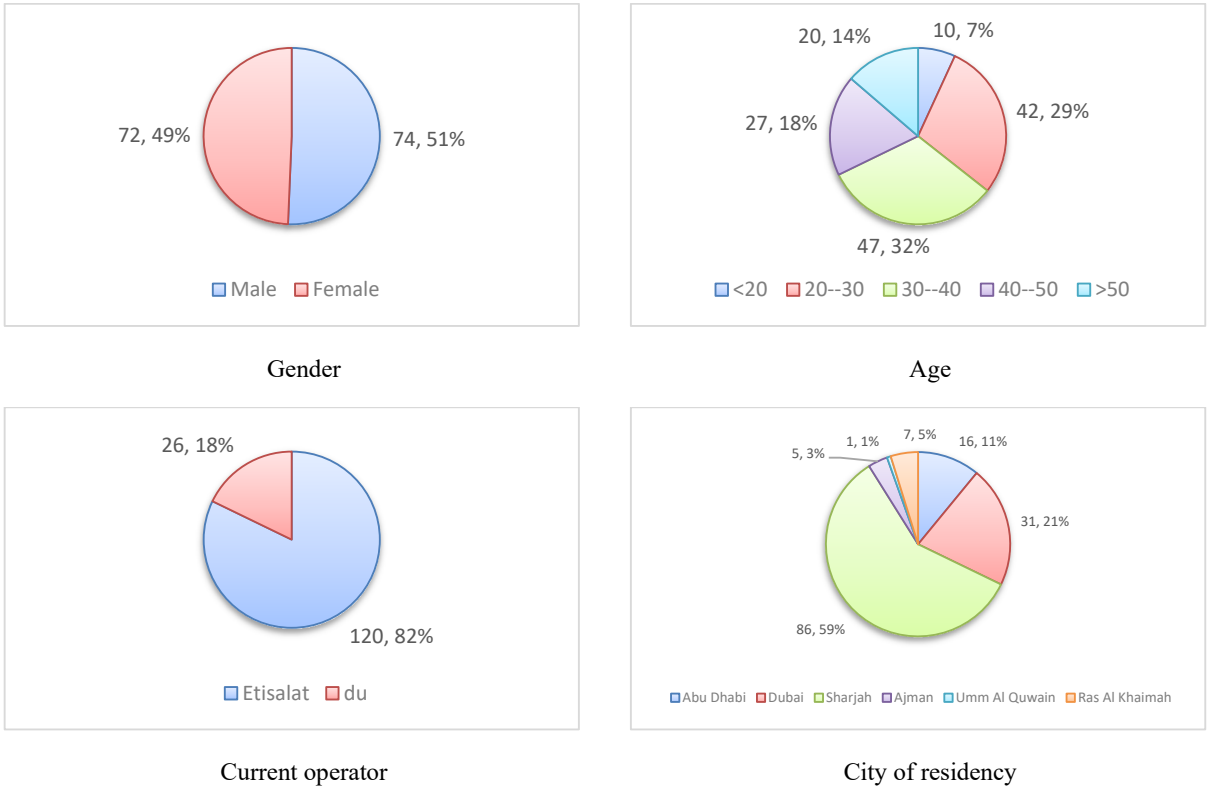

Fig. 2. Personal characteristics of the participants

Table 1
Instrument Reliability and Validity

Construct	*Item*	*Cronbach α*	*Factor Loading*
Perceived Usefulness	PU1	0.910	0.830
	PU2		0.831
	PU3		0.719
	PU4		0.770
Perceived Ease of Use	PEU3	0.838	0.696
	PEU4		0.705
Innovativeness	INN1	0.909	0.704
	INN2		0.861
	INN3		0.752
	INN4		0.635
	INN5		0.813
	INN6		0.599
Current Satisfaction	SAT1	0.923	0.931
	SAT2		0.940
	SAT3		0.917
Behavioral Intention	BI1	0.904	0.712
	BI2		0.731
	BI3		0.843

4.3 Model Test

To conduct our analysis on the model and test our hypotheses, we used summated scales. We created new scales to represent the model's constructs in SPSS, using the following:

PUs = PU1+PU2+PU3+PU4

PEUs = PEU3+PEU4

INNs = INN1+INN2+INN3+INN4+INN5+INN6

SATs = SAT1+SAT2+SAT3

BIs = BI1+BI2+BI3

To test our hypotheses, we conduct regression analysis in SPSS on the summated scales. To test **H3**, a simple regression analysis is performed. To test **H1**, **H2**, **H4**, and **H5,** multiple regression analysis is conducted.

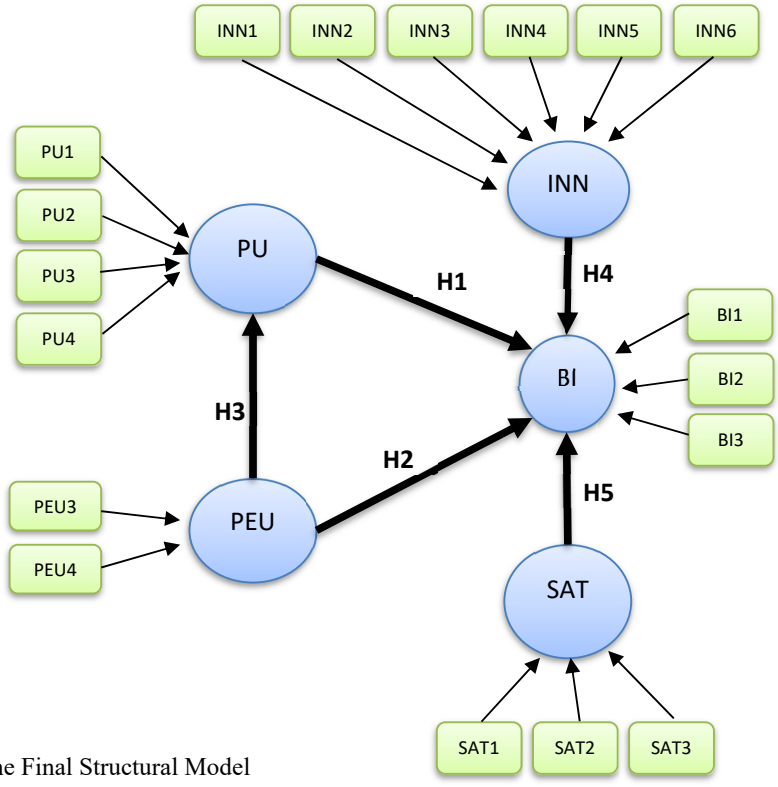

Fig. 3. The Final Structural Model

5. Findings and Discussion

5.1 Test Results Discussion

A simple regression analysis was conducted for our hypothesis that Perceived Ease of Use will positively influence the UAE population's Perceived Usefulness of satellite broadband **(H3)**. The model is found to be acceptable since ANOVA is significant (< 0.001). The PEU coefficient is found to be significant for a 95% confidence interval. Therefore, we reject the null hypothesis. We conclude that PEU has a statistically significant impact on PU. Thus, **H3** is supported. The model explains around 44% of the variations (R^2 = 0.438). To test hypotheses **H1**, **H2**, **H4**, and **H5**, multiple regression analysis was conducted. The model is found to be acceptable since ANOVA is significant (0.000). Also, PU, PEU, and INN coefficients are found to be significant for a 95% confidence level. Therefore, we reject the null hypotheses. We conclude that PU, PEU, and INN factors have a statistically significant impact on BI. **H1**, **H2,** and **H4** are supported. The model explains around 60% of the variations (R^2 = 0.594). SAT coefficient is found to be insignificant. Therefore, we fail to reject the null hypothesis. **H5** is not supported. The test results, including the β value for each supported hypothesis, are found in Table 2.

Table 2
Model Test Results

Hypothesis	*Effects*	*Standardized Coefficients β*	*Coefficient Significance*	*Hypothesis Result*
H1	PU → BI	0.223	0.005	Supported
H2	PEU → BI	0.276	<0.001	Supported
H3	PEU → PU	0.665	<0.001	Supported
H4	INN → BI	0.394	<0.001	Supported
H5	SAT → BI	-	0.730	Not Supported

5.2 Limitations

First, as we are using TAM as the basis for the theoretical framework of this study, we should consider all of its constructs. However, the actual system use, which is the dependent variable in the original model made by Davis (1985), was not considered because satellite broadband (the recent NGSO technology) is not yet implemented in the UAE. Instead, Behavioral Intention (BI) was regarded as the dependent variable, where studies showed that BI would positively influence people's adoption of the new technology (Alalwan, et al., 2018). Assessing the relation between BI and actual adoption will require a longitudinal study (Wang, et al., 2008), while the current study is cross-sectional. Another limitation is that the population for the study is 99% of the UAE's population, which is estimated to be more than 9.7 million. As a result, we were unable to establish a sampling frame for the study. Finally, we recognize the limitation in the distribution of the study tool, which is the survey. In this study, we used an online survey and distributed it through e-mail and social media platforms, which created a sampling challenge of online research (Bougie & Sekaran, 2019, p. 249). The survey was distributed starting from the researcher's closest online connections, which created a bias in respondents and the risk of non-probability samples.

6. Conclusions and Recommendations

This study aims at assessing the acceptance of consumers in the UAE of satellite broadband. Since the advancement in satellite technologies has brought satellite services much closer to the usual services provided by terrestrial service providers, it became inevitable that satellite broadband is to be considered to provide appropriate communication services in underserved markets in the UAE. This step is expected to be essential for the rollover of 4IR use cases in the Country. To conduct our assessment, we used the Technology Acceptance Model (TAM) as the theoretical basis of our work. We considered the effect of the primary two independent variables in the model, PU and PEU. In addition, we included INN based on the literature review and SAT based on existing knowledge about the UAE market. Hypotheses were established regarding the effect of the four factors on consumer behavior (BI) towards using satellite broadband. Also, a hypothesis was established regarding the effect of PEU on PU. Accordingly, we constructed the model and tested it using the appropriate tools. All the hypotheses were supported by the conducted test, except the effect of SAT on BI. It was found that the model is acceptable for the assessment of UAE consumer's acceptance of satellite broadband. From the analysis of survey results and model tests, we could draw recommendations on how to support a smooth introduction of NGSO satellite broadband into the UAE market.

It is recommended that before introducing the services into the UAE market, tailored advertising campaigns should be conducted. In order to demonstrate the usefulness, the campaigns could, for example, focus on how the NGSO broadband services can be used wherever the user is in the UAE, even in remote and rural areas. They could also demonstrate the sufficient connectivity speed and reliability of the service. Also, to demonstrate the ease of use, the campaigns could, for example, focus on how easy it is to set up and install the required user terminals to establish the service. Finally, to demonstrate innovativeness, the campaigns could, as an example, shed more light on the space sector and its importance to the UAE. A good strategy could be to link the NGSO satellite broadband service to the major achievements made in the UAE in the space sector. Also, the campaigns could show the fact that NGSO satellite broadband is considered the latest technological advancement in satellite connectivity. An attempt was also made to analyze the difference in BI for different genders and age groups. The result of such analysis would assist in identifying the target audience of any advertising campaigns for the new services. The results showed that gender and age group do not significantly affect people's intention to use the new services. Therefore, it is recommended that any advertising campaign should be general to the UAE population and should not target a specific gender or age group. It is recognized that the current services and performance of existing service providers in the UAE have been previously criticized (Salama, 2020). However, this study showed that our hypothesis for the relation between satisfaction with current services and the UAE population's intention to use satellite broadband is not supported. Therefore, it is expected that attempts to improve satisfaction with existing services will not affect introducing the new services.

Finally, it is recommended that future research expands the acceptance model by looking at other variables that could affect people's intention to use the service. Also, future research could be done after introducing the service into the UAE market to introduce the actual system use into the model and conduct a chronological study to link it with the existing model.

References

Aburayya, A., Alshurideh, M., Al Marzouqi, A., Al Diabat, O., Alfarsi, A., Suson, R., ... & Salloum, S. A. (2020a). An empirical examination of the effect of TQM practices on hospital service quality: an assessment study in UAE hospitals. *Systematic Reviews in Pharmacy, 11*(9), 347-362.

Aburayya, A., Alshurideh, M., Al Marzouqi, A., Al Diabat, O., Alfarsi, A., Suson, R., ... & Alzarouni, A. (2020b). Critical success factors affecting the implementation of tqm in public hospitals: A case study in UAE Hospitals *Systematic Reviews in Pharmacy*, *11*(10), 230-242.

Adedoyin, F. F., Bekun, F. V., Driha, O. M., & Balsalobre-Lorente, D. (2020). The effects of air transportation, energy, ICT and FDI on economic growth in the industry 4.0 era: Evidence from the United States. *Technological Forecasting and Social Change, 160*, 1–10. https://doi.org/10.1016/j.techfore.2020.120297

Aqqad, N., Obeidat, B., Tarhini, A., & Masa'deh, R. E. (2019). The relationship among emotional intelligence, conflict

management styles, and job performance in Jordanian banks. *International Journal of Human Resources Development and Management, 19*(3), 225-265.

Akour, I., Alshurideh, M., Al Kurdi, B., Al Ali, A., & Salloum, S. (2021). Using machine learning algorithms to predict people's intention to use mobile learning platforms during the COVID-19 pandemic: machine learning approach. *JMIR Medical Education, 7*(1), e24032.

Alalwan, A. A., Baabdullah, A. M., Rana, N. P., Tamilmani, K., & Dwivedi, Y. K. (2018). Examining adoption of mobile internet in Saudi Arabia: Extending TAM with perceived enjoyment, innovativeness and trust. *Technology in Society, 55*, 100–110. https://doi.org/10.1016/j.techsoc.2018.06.007

Al Batayneh, R. M., Taleb, N., Said, R. A., Alshurideh, M. T., Ghazal, T. M., & Alzoubi, H. M. (2021, June). IT Governance Framework and Smart Services Integration for Future Development of Dubai Infrastructure Utilizing AI and Big Data, Its Reflection on the Citizens Standard of Living. *In The International Conference on Artificial Intelligence and Computer Vision (pp. 235-247). Springer*, Cham.

Al-Dalahmeh, M., Al-Shamaileh, O., Aloudat, A., & Obeidat, B. (2018). The Viability of Mobile Services (SMS and Cell Broadcast) in Emergency Management Solutions: An Exploratory Study. *International Journal of Interactive Mobile Technologies, 12*(1), 95-115.

Aldás-Manzano, J., Lassala-Navarré, C., Ruiz-Mafé, C., & Sanz-Blas, S. (2009). The role of consumer innovativeness and perceived risk in online banking usage. *International Journal of Bank Marketing, 27*(1), 53–75. https://doi.org/10.1108/02652320910928245

Al-Dmour, R., AlShaar, F., Al-Dmour, H., Masa'deh, R., & Alshurideh, M. T. (2021). The Effect of Service Recovery Justices Strategies on Online Customer Engagement Via the Role of "Customer Satisfaction" During the Covid-19 Pandemic: An Empirical Study. *The Effect of Coronavirus Disease (COVID-19) on Business Intelligence, 334*, 325346.

Al-Hamad, M., Mbaidin, H., AlHamad, A., Alshurideh, M., Kurdi, B., & Al-Hamad, N. (2021). Investigating students' behavioral intention to use mobile learning in higher education in UAE during Coronavirus-19 pandemic. *International Journal of Data and Network Science, 5*(3), 321-330.

AlHamad, M., Akour, I., Alshurideh, M., Al-Hamad, A., Kurdi, B., & Alzoubi, H. (2021). Predicting the intention to use google glass: A comparative approach using machine learning models and PLS-SEM. *International Journal of Data and Network Science, 5*(3), 311-320.

Al-Khayyal, A., Alshurideh, M., Al Kurdi, B., & Salloum, S. A. (2021). Factors influencing electronic service quality on electronic loyalty in online shopping context: data analysis approach. In Enabling AI Applications in Data Science (pp. 367-378). Springer, Cham.

Al Kurdi, B., Alshurideh, M., Salloum, S., Obeidat, Z., & Al-dweeri, R. (2020a). An empirical investigation into examination of factors influencing university students' behavior towards elearning acceptance using SEM approach. *International Journal of Interactive Mobile Technologies, 14*(2), 19-41.

Al Kurdi, B., Alshurideh, M., & Salloum, S. A. (2020b). Investigating a theoretical framework for e-learning technology acceptance. *International Journal of Electrical and Computer Engineering (IJECE), 10*(6), 6484-6496.

Alshurideh, M., Salloum, S. A., Al Kurdi, B., Monem, A. A., & Shaalan, K. (2019a). Understanding the quality determinants that influence the intention to use the mobile learning platforms: A practical study. *International Journal of Interactive Mobile Technologies, 13*(11), 183-157.

Alshurideh, M., Al Kurdi, B., & Salloum, S. A. (2019b). Examining the main mobile learning system drivers' effects: A mix empirical examination of both the Expectation-Confirmation Model (ECM) and the Technology Acceptance Model (TAM). *In International Conference on Advanced Intelligent Systems and Informatics (pp. 406-417)*. Springer, Cham.

Alshurideh, M., Salloum, S. A., Al Kurdi, B., & Al-Emran, M. (2019c). Factors affecting the social networks acceptance: an empirical study using PLS-SEM approach. *In Proceedings of the 2019 8th International Conference on Software and Computer Applications* (pp. 414-418).

Alshurideh, M., Al Kurdi, B., Salloum, S. A., Arpaci, I., & Al-Emran, M. (2020). Predicting the actual use of m-learning systems: a comparative approach using PLS-SEM and machine learning algorithms. *Interactive Learning Environments*, 1-15.

Alshurideh, M. T., Kurdi, B. A., AlHamad, A. Q., Salloum, S. A., Alkurdi, S., Dehghan, A., ... & Masa'deh, R. E. (2021a). Factors affecting the use of smart mobile examination platforms by universities' postgraduate students during the COVID 19 pandemic: an empirical study. *In Informatics (Vol. 8, No. 2, p. 32). Multidisciplinary Digital Publishing Institute*.

Alshurideh, M. T., Al Kurdi, B., & Salloum, S. A. (2021b). The moderation effect of gender on accepting electronic payment technology: a study on United Arab Emirates consumers. *Review of International Business and Strategy. Review of International Business and Strategy, 31* (3), 375-396.

Azzarelli, T. (2020). Obtaining Landing Licenses and Permission to Operate LEO Constellations on a Global Basis. In Handbook of Small Satellites (pp. 1287–1313). Springer Nature Switzerland AG 2020. https://doi.org/10.1007/978-3-030-36308-6_72

Bougie, R., & Sekaran, U. (2019). *Research methods for business: A skill building approach* (8th ed.). John Wiley & Sons.

Crisp, N. H., Smith, K. L., & Hollingsworth, P. M. (2015). Launch and deployment of distributed small satellite systems. *Acta Astronautica, 114*, 65–78. https://doi.org/http://dx.doi.org/10.1016/j.actaastro.2015.04.015

Datareportal. (2021). DIGITAL 2021: THE UNITED ARAB EMIRATES. https://datareportal.com/reports/digital-2021-united-arab-emirates

Davis, F. D. (1985). A technology acceptance model for empirically testing new end-user information systems: Theory and

results [Massachusetts Institute of Technology]. https://doi.org/10.1126/science.146.3652.1648
Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly, 13*(3), 319–340. https://doi.org/https://doi.org/10.2307/249008
Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. *Management Science, 35*(8), 982–1003. https://doi.org/10.1287/mnsc.35.8.982
Del Portillo, I., Cameron, B. G., & Crawley, E. F. (2019). A technical comparison of three low earth orbit satellite constellation systems to provide global broadband. *Acta Astronautica, 159*, 123–135. https://doi.org/https://doi.org/10.1016/j.actaastro.2019.03.040
Fatafta, L. W., Obeidat, B., Mohammed, A. B., & Kanaan, R. K. (2019). The effect of information technology on organizational performance: the mediating role of quality management capabilities. *Journal of Social Sciences (COES&RJ-JSS), 8*(3), 456-480.
Gampala, V., Aurelia, S., Krishna Kishore, S., & Mydhili, S. K. (2021). Nautical communication relying on mobile Ad-hoc network via augmented reality devices. Materials Today: Proceedings. https://doi.org/10.1016/j.matpr.2020.11.822
Hair Jr., J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2014). Multivariate Data Analysis. In Pharmaceutical Quality by Design: A Practical Approach (7th ed.). Pearson Education Limited.
Harfoushi, O., Alfawwaz, B., Obeidat, B., Obiedat, R., & Faris, H. (2013). Impact of internet advertisement and its features on e-commerce retail sales: Evidence from Europe. *Journal of Software Engineering and Applications, 6*(11), 564-570.
Hayajneh, N., Suifan, T., Obeidat, B., Abuhashesh, M., Alshurideh, M., & Masa'deh, R. (2021). The relationship between organizational changes and job satisfaction through the mediating role of job stress in the Jordanian telecommunication sector. *Management Science Letters, 11*(1), 315-326.
Henri, Y. (2020). The OneWeb Satellite System. In Handbook of Small Satellites (pp. 1091–1100). Springer Nature Switzerland AG 2020. https://doi.org/https://doi.org/10.1007/978-3-030-20707-6_67-1
ITU. (2021). ICTs for a Sustainable World #ICT4SDG. https://www.itu.int/en/sustainable-world/Pages/default.aspx
Jimenez, I. A. C., García, L. C. C., Violante, M. G., Marcolin, F., & Vezzetti, E. (2021). Commonly used external tam variables in e-learning, agriculture and virtual reality applications. *Future Internet, 13*(1), 1–21. https://doi.org/10.3390/fi13010007
Lambrechts, W., & Sinha, S. (2019). *Last Mile Internet Access for Emerging Economies. In Lecture Notes in Networks and Systems* (Vol. 77). Springer International Publishing.
Leive, D. M. (1988). The role of intelsat in the use of the geostationary orbit. *Acta Astronautica, 17*(6), 615–619. https://doi.org/10.1016/0094-5765(88)90206-8
Leo, S., Alsharari, N. M., Abbas, J., & Alshurideh, M. T. (2021). From Offline to Online Learning: A Qualitative Study of Challenges and Opportunities as a Response to the COVID-19 Pandemic in the UAE Higher Education Context. *The Effect of Coronavirus Disease (COVID-19) on Business Intelligence, 334,* 203-217.
Lin, X., Hofström, B., Wang, Y.-P. E., Masini, G., Maattanen, H.-L., Rydén, H., Sedin, J., Stattin, M., Liberg, O., Euler, S., Muruganathan, S., Löwenmark, S. E., & Khan, T. (2021). *5G New Radio Evolution Meets Satellite Communications: Opportunities, Challenges, and Solutions. In 5G and Beyond (pp. 517–531).* Springer. https://doi.org/https://doi.org/10.1007/978-3-030-58197-8_18
Lythreatis, S., El-Kassar, A. N., & Singh, S. K. (2022). The digital divide: A review and future research agenda. *Technological Forecasting and Social Change, 175*, 1–11. https://doi.org/https://doi.org/10.1016/j.techfore.2021.121359
McNally, C. (2022). SpaceX Starlink Satellite Internet Review 2022. https://www.reviews.org/internet-service/spacex-starlink-satellite-internet-review/
Montenegro, L. O., & Araral, E. (2020). Can competition-enhancing regulation bridge the quality divide in Internet provision? *Telecommunications Policy, 44*(1), 1–15. https://doi.org/10.1016/j.telpol.2019.101836
Morris, J., Morris, W., & Bowen, R. (2022). Implications of the digital divide on rural SME resilience. *Journal of Rural Studies, 89*, 369–377. https://doi.org/https://doi.org/10.1016/j.jrurstud.2022.01.005
Nalda, C. (2004). Domestic and International Satellite Regulatory Procedures: Paths to Progress or Insurmountable Obstacles? *Astropolitics, 2*(2), 227–235. https://doi.org/10.1080/14777620490493593
Nuseir, M. T., Aljumah, A., & Alshurideh, M. T. (2021). How the Business Intelligence in the New Startup Performance in UAE During COVID-19: The Mediating Role of Innovativeness. *The Effect of Coronavirus Disease (COVID-19) on Business Intelligence, 334*, 63-73.
Obeidat, B., Al-dalahmeh, M., & Masa'deh, R. (2015). The role of knowledge management infrastructure in enhancing innovation at mobile telecommunication companies in Jordan. *European Journal of Social Sciences, 50*(3), 313-330.
Obeidat, B., El-Rimawi, S., Maqableh, M., & Al-Jarrah, I. (2013). Evaluating the profitability of the Islamic banks in Jordan. *European Journal of Economics, Finance and Administrative Sciences, 56*, 27-36.
Obeidat, D., Yousef, B., Hashem, L., & Masa'deh, R. E. (2018). The influence of knowledge management uses on total quality management practices in commercial banks of Jordan. *Modern Applied Science, 12*(11), 1-16.
Ookla. (2021). Speedtest Global Index. https://www.speedtest.net/global-index
Osoro, O. B., & Oughton, E. J. (2021). A Techno-Economic Framework for Satellite Networks Applied to Low Earth Orbit Constellations: Assessing Starlink, OneWeb and Kuiper. *IEEE Access, 9*, 141611–141625. https://doi.org/10.1109/ACCESS.2021.3119634
Oughton, E. J., Lehr, W., Katsaros, K., Selinis, I., Bubley, D., & Kusuma, J. (2021). Revisiting Wireless Internet Connectivity: 5G vs Wi-Fi 6. *Telecommunications Policy, 45*(5), 1–15. https://doi.org/10.1016/j.telpol.2021.102127

Ray, S., Kim, S. S., & Morris, J. G. (2012). Online users' switching costs: Their nature and formation. *Information Systems Research, 23*(1), 197–213. https://doi.org/10.1287/isre.1100.0340

Rodrigues, A., Li, G., Zhang, M., Jin, M. C., & Hayden-Gephart, M. (2021). High-quality neurosurgeon communication and visualization during telemedicine encounters improves patient satisfaction. *Journal of Clinical Neuroscience, 94*, 18–23. https://doi.org/10.1016/j.jocn.2021.09.013

Salama, S. (2020, June 10). UAE telecom companies criticised for costly but poor services. Gulf News. https://gulfnews.com/uae/government/uae-telecom-companies-criticised-for-costly-but-poor-services-1.71975763

Schwab, K. (2016). The Fourth Industrial Revolution: what it means, how to respond. https://www.wefo-rum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/

Sheikh, S. M., & Halima, N. Ben. (2020). Building Backhaul Networks for Rural Area Connectivity towards the Fourth Industrial Revolution. 2020 *3rd International Conference on Computer Applications & Information Security (ICCAIS),* 1–4.

Shetty, A., Yu, M., Kurzhanskiy, A., Grembek, O., Tavafoghi, H., & Varaiya, P. (2021). Safety challenges for autonomous vehicles in the absence of connectivity. *Transportation Research Part C: Emerging Technologies, 128*, 1–20. https://doi.org/https://doi.org/10.1016/j.trc.2021.103133

Starlink. (2021). High-speed low latency broadband internet. https://www.starlink.com/

Suleman, M., Soomro, T. R., Ghazal, T. M., & Alshurideh, M. (2021, June). Combating Against Potentially Harmful Mobile Apps. In The International Conference on Artificial Intelligence and Computer Vision (pp. 154-173). Springer, Cham.

Šumak, B., Heričko, M., Pušnik, M., & Polančič, G. (2011). Factors affecting acceptance and use of Moodle: An empirical study based on TAM. *Informatica, 35*(1), 91–100.

The World Bank. (2021). Individuals using the Internet (% of population) - United Arab Emirates.

UCS. (2005). UCS Satellite Database. https://www.ucsusa.org/resources/satellite-database

Wang, C.-C., Lo, S.-K., & Fang, W. (2008). Extending the technology acceptance model to mobile telecommunication inno-vation: The existence of network externalities. *Journal of Consumer Behaviour, 7*(2), 101–110. https://doi.org/10.1002/cb.240

Wright, D. (1995). Reaching out to remote and rural areas: Mobile satellite services and the role of Inmarsat. *Telecommuni-cations Policy, 19*(2), 105–116. https://doi.org/10.1016/0308-5961(94)00023-L

Appendix

The items used to measure the model's constructs

Construct	*Item*		*Sources*
perceived Usefulness (PU)	PU1	I expect finding satellite broadband to be useful for internet access	(Šumak, et al., 2011)
	PU2	I expect that using satellite broadband will enables me to accomplish tasks more quickly	
	PU3	I expect that using satellite broadband for internet access will increases my productivity	
	PU4	I expect that If I use satellite broadband, I will increase my chances of getting good internet access	
Perceived Ease Of Use (PEU)	PEU1	I expect that my use of satellite broadband would be clear and understandable	(Šumak, et al., 2011)
	PEU2	It would be easy for me to become skillful at using satellite broadband system	
	PEU3	I would find satellite broadband easy to use	
	PEU4	Learning to operate satellite broadband is easy for me	
Innovativeness (INN)	INN1	If I heard about satellite broadband, I would look for ways to experiment with it.	(Alalwan, et al., 2018)
	INN2	Among my peers, I am usually the first to explore new technologies, such as satellite broadband	
	INN3	I like to experiment with new technologies, such as satellite broadband	
	INN4	In general, I am not hesitant to try out new information technologies, such as satellite broadband	
	INN5	Compared to my friends, I seek out a lot of information about satellite broadband	
	INN6	I would try new satellite broadband service even if in my circle of friends nobody has trailed it before	
satisfaction (SAT)	SAT1	In general, I am satisfied with the services of the Internet Service Provider I currently use.	(Ray, et al., 2012)
	SAT2	Overall, the service of this current Internet Service Provider comes up to my expectation.	
	SAT3	Overall, I am very satisfied with my relationship with this Internet Service Provider.	
Behavioral intention (BI)	BI1	I intend to use satellite broadband if it becomes available in the UAE in the next 6 months.	(Šumak, et al., 2011)
	BI2	I predict I would use satellite broadband in the next 6 months.	
	BI3	I plan to use satellite broadband when it became available	