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MOFTI: Mobile Self-Service Framework to Uplift Customer Experience for the Telecommunications Industry in Malaysia

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ABSTRACT

The new era of digital technologies has caused customers to require more efficient, easier access and immediate services. The first concern in the telecommunications industry is unpleasant conventional interactions (live agents) and interactive voice responses. The second area of concern is the operational change due to the MCO, which has impacted customer experience at physical counters. MCO imposes physical distancing at physical counters, with customers required to be at least one metre apart. Some businesses have imposed long queues to avoid congestion within a limited space, forcing customers to queue outside business spaces: perhaps along the road, in front of other premises, and under uncertain weather conditions. The shortened working hours during the MCO have amplified the number of unresolved issues among customers and long queues. This research aims to formulate a proposed framework for uplifting customer experience while managing the restrictions people face due to the MCO. The proposed solution is based on a literature review, reviewing existing mobile apps, and analysing data collected in 2020 through surveys and interviews. The evaluation results show that the proposed solution can be a guide for telecommunications service providers to enhance the customer's experience of their self-service platforms while managing the restrictions people face due to the MCO. The novelty of this research is aligned with the Industrial Revolution 4.0 to reduce the workforce through the automation of business processes to meet the demands of the future economy.

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INTRODUCTION

According to the Industry Performance Report (IPR) produced by the Malaysian Communications and Multimedia Commission (MCMC), broadband subscriptions in Malaysia almost doubled over a recent five-year period to reach 39.4 million in 2018. With the 4G and 5G network expansions in December 2018, the demand for continuous connectivity and mobile technology is growing among Malaysians. Statistics show that mobile broadband subscriptions grew by 4.3% from 2016 to 2017. In those years, network coverage improvements and attractive pricing plans from service providers were growth factors. Since then, mobile devices have continuously made consumers' lifestyles more convenient through e-commerce applications, navigation applications, entertainment applications, and many more. Furthermore, with the implementation of the Internet of Things (IoT), big data, and artificial intelligence (AI), digital services are evolving and impacting everyone.

Moreover, digital advertising expenditure (ADEX), which provides widespread advertising coverage through thousands of digital publishers, is becoming more well-known because of its cost-effectiveness, global reach, increased audience size, and multi-platform use (IPR, 2018). IPR (2018) also mentioned that the smartphone market share is growing due to strong customer demand, aggressive marketing by vendors, and a wide selection of devices available at various prices worldwide. The annual MCMC survey in 2018 indicates that smartphones remain the most common device with which to access the internet (93.1%), compared to laptops (44.2%), desktops 28.1%, and tablets (20.4%).

Irfan (2016) mentioned that mobile phone services in the telecommunications industry are growing, with more than 1.7 billion subscribers worldwide and about 80% of the global population as potential targets. It shows that users are more attached to the phone than other devices. Telecommunications services continue to be the main revenue makers, while digital platforms are becoming new sources of revenue for the telecommunications industry. Telecommunications service providers in Malaysia, such as TM, TIME, Celcom, Maxis, and Digi, are focusing on retaining and making additional revenue from existing subscribers to meet the demands of the future economy. Additional revenue can be made by moving beyond their traditional business through the automation of their business processes. One way to automate business processes is to find ways for customers, especially digital natives, to help themselves through online self-service technology (SST). Online SST can take the form of web-based or mobile applications. Since the mobile SST is the focus of this research, this paper showcases the mobile devices and online SST provided by telecommunications service providers in Malaysia.

Currently, service providers in Malaysia have equipped mobile devices and online SST with various customer features, such as the capability to sign-up, check account status, check for updates, obtain technical assistance, perform billing-related transactions, and

receive the latest promotions on a single platform. According to Salomann et al. (2006), self-service can be clustered into two central themes, customers and technology. Lu et al. (2015) pointed out that with the development of customer capability in technology and mobile self-service, customers have personalized service experience based on their specific knowledge and skills.

Zhou et al. (2010) suggested using Platform-as-a-Service (PaaS), whereby services are more targeted, focused, and personalized to maintain customer loyalty and increase an organization's revenue. On the other hand, Riahi and Ristock (2014) proposed conventional interaction, whereby a contact centre provides a centralized customer service handled by live agents who, for example, answer telephone calls, respond to emails, and conduct live chats, and make outbound calls.

Interactive voice response (IVR) technology is another type of conventional interaction that can facilitate the tasks of live agents. IVR can also assist customer service agents by providing customer solutions, repeating announcements, and routing to the main menu selection if the customer selects the wrong option. In addition, IVR shortens the time taken for customers to obtain solutions by reducing the burden on the customer service agent. For example, IVR obtains customer information such as the account number before control is handed to a live agent. Although these advantages show that IVR can assist live agents, it has also been indicated that IVR is not a sufficient contact centre solution for most customer concerns.

Flaws also exist with live agents and IVR in that customers and live agents have to endure several. For example, they must (1) undergo repetitive processes; (2) spend time calling and waiting; and (3) face inadequate, incorrect, and/or inconsistent information. In addition, al-Mashraie et al. (2020) mentioned other drawbacks, such as call disconnection and the frequency with which customers have to obtain solutions, which can impact the customer's experience of the customer services.

According to Fang et al. (2020), implementing a lockdown policy effectively reduces the spread of the COVID-19 virus due to population flows. At the early stage of the MCO implementation, all Malaysians were ordered to stay at home, except for essential workers in the health services and those employed by water, electricity, telecommunications, and food supply companies. The government also shortened business hours, imposed physical distancing, and promoted workplace hygiene. Telecommunications service providers have complied with these orders in different ways. For instance, Maxis has limited the number of customers allowed to enter its premises at one time and practises strict social distancing.

Meanwhile, TM has reduced its work schedule to operate only three days a week, with a maximum of three staff and five customers at a time. Furthermore, TM only performs installation and restoration for appointments made before the MCO, except in the Enhanced Movement Control Order (EMCO) areas. This situation impacts the customer's

experience as it leads to frustration and dissatisfaction with the inefficiency of the service since connectivity is critical during the MCO. Furthermore, the situation has worsened because several services can only be performed at service centres. These include service subscriptions (in addition to the online subscriptions channel at www.unifi.com.my), account terminations, collections, and replacements of SIM cards for Unifi Mobile, and device collections for Unifi Air and CPE replacement.

The first concern in the telecommunications industry is the unpleasant conventional interactions with live agents and IVR. According to Rawson et al. (2013), organizations must identify the appropriate metrics and develop software that emphasizes customer experience. The second concern is the operational changes due to the MCO, which has increased the time to resolve customer complaints like network issues and call disconnections. Digitization in today's world has shaped customer services from face-to-face or voice interaction into digital interaction (Bhale & Bedi, 2021). Digital interaction has been crucial since 2020 because the COVID-19 pandemic has increased people's reliance on internet services due to the MCO. People are forced to work, study, and even shop through online platforms from home (MCMC, 2020). Realizing these areas of concern, the first objective of this research is to analyse customer preference and experience when using the mobile self-service features provided by telecommunications service providers in Malaysia while managing the restrictions people face due to the MCO. The second objective of this research is to propose a framework for overcoming the unpleasant conventional methods since there are flaws and limitations with conventional interaction (live agents) and IVR as well as with the operational changes due to the MCO, which has impacted customer experience at physical counters. The third research objective is to evaluate Malaysia's proposed self-service framework providers. Subsequently, the proposed framework can be used as a guideline for the software developers to enhance or develop a new self-service mobile app for telecommunication industries in Malaysia.

RELATED WORK

People rely on technology as a driving force for advancing economic systems and their quality of life. The COVID-19 pandemic has enhanced the demand for mobile app services due to their ease of use, privacy, security, usefulness, previous experience, technology competency, lifestyle, trust, and credibility (Salam et al., 2021). In this study, a literature review is carried out to review the existing research on mobile self-service and customer experience. Second, this research reviews existing mobile applications, specifically those used by the telecommunications industry in Malaysia. Current researchers on mobile self-service and customer experience have highlighted four main issues: customer preference, service quality, perspectives of self-service, and the impact on operational change due to the MCO.

Customer Preference

According to Al-Mashraie et al. (2020), telecommunications service providers secure customer loyalty and attract new customers by increasing their market share, offering a variety of plans, bundling services to meet customer demands, and providing discounts. To stay competitive in the market, service providers must understand their customer's behaviours and preferences before they can subsequently provide a tailored service for each customer. Xu et al. (2015) mentioned that the growth of smartphones and mobile applications had captured the attention of businesses. However, businesses must understand user behaviours regarding their initial acceptance and continued use of mobile applications. Wang et al. (2019) described the adoption of inertia in marketing. Inertia is a physical term that describes the tendency of a physical object to resist change. In marketing, consumer inertia is some customers' tendency to continue using the same product when superior options exist. According to the Forbes website, marketing inertia can be driven by customer habits, brand loyalty, switching cost and many more. One of the reasons why a consumer continues using the same service can be the inertia strategy taken by the company in setting prices after analysing their competitors. Thus, service providers can increase levels of inertia to sustain long-term positive relationships with consumers.

Service Quality

Al-Mashraie et al. (2020) stated that service quality is one of the most influential factors affecting customers. The quality of a mobile service can influence customers to continue using a particular service. Hence, customers usually evaluate the service quality to decide if it is worth continuing after the trial (Wang et al., 2019) to continuously improves its mobile app service quality to sustain market growth. Improving the store service quality is also important in making it comparable with the quality of the other major applications' stores to convince the customers. Businesses need to emphasize the benefits, quality, aesthetic appeal, and enjoyment these mobile applications can deliver to encourage customers to use them during their marketing campaigns (Xu et al., 2020).

However, according to Riahi and Ristock (2014), conventional interaction through live agents or IVR is not a sufficient contact centre solution for most customer concerns. Both types of interaction have inherent limitations, such as repetition in the call handling process and time spent (calling and waiting). At the same time, the information provided is often inadequate, incorrect, and/or inconsistent. IVR also takes a long time to reach a live agent, and the process is longer if the customer selects the wrong option. Al-Mashraie et al. (2020) mentioned that conventional interaction has issues such as call disconnections and the length of time spent over the phone, which impact customer experience. In addition, it may mean customers tend to change to a different telecommunications service provider.

Perspectives of Self-Service

Beatson et al. (2006) suggested the key attributes for SST that need to align with a personal service. Identifying service attributes, such as the ease of using SST facilities, saving time, low risk, and customization, allows service managers to focus on service performance drivers to provide the best customer service. Hence, customer service staff can train customers to use the available SST. By providing this training, customers will consider the customer service staff agent's burden and simultaneously improve the customer's satisfaction and commitment to solving the issues independently.

Salomann et al. (2006) stated that self-service is important for customer relationships. The acceptance factors related to SST are ease of use, usefulness, risk, and the need for interaction with personnel. These factors increase customer satisfaction, word of mouth, and repeat purchase intentions towards the services while avoiding complaints. However, a lack of human interaction may become a challenge for companies that require high levels of attention and integration with persona design (i.e., fictional characters). When designing an SST, the listed characteristics include a name, age, gender, job title, accent, and sense of humour to create an imaginary person.

Barua et al. (2018) interpreted the perceived reliability of SST as having significant effects on perceived risk, technology trust, and customer satisfaction. The two important predictors under perceived reliability are perceived security and perceived control. When designing and implementing SST, these must be considered to moderate the risk, satisfy existing users, and attract new customers. Meanwhile, Yang et al. (2014) reviewed perceived usefulness (PU) and perceived ease of use (PEU) in developing SST for mobile devices. The study concluded that PEU is more important than PU in driving the adoption of new SST. However, PU is more important than PEU when mobile services are those of a new brand.

Impact on Operational Change

The COVID-19 outbreak has caused changes in the operating hours of businesses in Malaysia. However, according to Fang et al. (2020), the imposition of an extensive lockdown policy effectively reduces the spread of the virus due to population flows. In addition, restrictions on human mobility and the enhancement of social distancing policies have significantly reduced the infection rate.

In previous research, Aziz et al. (2020) mentioned that at the early stage of the MCO implementation, all Malaysians were instructed primarily to stay at home and prohibited from attending large gatherings. All facilities were closed except primary and essential services such as health, water, electricity, telecommunications, and food supply companies. In phase 4 of the MCO, the government allowed certain businesses to open and the movement of people if mandatory standard operating procedures were followed, including movement restrictions and social distancing, while no mass gatherings were allowed.

Table 1 describes the focus of this research, mobile self-service and customer experience while highlighting four main issues: customer preference, service quality, perspectives of self-service, and the impact on operational change due to the MCO.

Table 1

The focus of research on mobile self-service and customer experience

The focus of the research	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14
Service quality	/		/	/					/					
Customer experience	/	/	/		/	/	/	/		/	/	/		
Self-service perspective						/	/			/	/	/		
Impact on operation change due to MCO													/	/

Note:
R1 refers to the article by Xu et al. (2015)
R2 refers to the article by Al-Mashraie et al. (2020)
R3 refers to the article by Wang et al. (2019)
R4 refers to the article by Wang et al. (2016)
R5 refers to the article by Riahi and Ristock (2014)
R6 refers to the article by De Leon et al. (2020)
R7 refers to article by Salomann et al. (2006)
R8 refers to the article by Rawson et al. (2013)
R9 refers to the article by Basole and Karla (2012)
R10 refers to the article by Beatson et al. (2006)
R11 refers to the article by Barua et al. (2018)
R12 refers to the article by Yang et al. (2014)
R13 refers to an article by Aziz et al. (2020)
R14 refers to the article by Fang et al. (2020)

Table 1 describes how, in recent years, most researchers have focused on enhancing app services, improving customer experience, and enabling SST for mobile apps. However, with the commencement of the COVID-19 pandemic, researchers drastically shifted their focus onto enabling mobile apps to accommodate human restrictions due to the MCO.

Physical distancing, whereby customers need to be 1 metre apart, has become an issue, as the current physical business spaces are insufficient in size. Some businesses have limited their number of daily customers, leading to unresolved issues among customers. Meanwhile, some businesses have imposed low queues, whereby customers must queue outside the business spaces: perhaps along the road or in front of other premises, and uncertain weather. The MCO has also meant limits on working hours, amplified the number of unresolved issues and long queues.

Aziz et al. (2020) and Fang et al. (2020) focused merely on human restrictions due to COVID-19. However, as seen in the research trends since 2012, researchers have focused

on enhancing app services or enabling SST. They have mostly incorporated customer experience into their research. It is to ensure the uplifting of the user experience. Thus, this research aims to focus on how mobile apps have been enabled to accommodate human restrictions due to the MCO while uplifting the user experience. Table 2 compares Live Agent, IVR, Physical Counter and SST.

Table 2

The comparison between live agent, IVR, physical counter and SST

Platform	Strength	Weakness
Conventional interactions (live agents)	1) Offer flexibility and perform human interaction	1) Undergo repetitive processes 2) Spend time calling and waiting 3) Face inadequate, incorrect, and/or conflicting 4) Call disconnected
IVR	1) Facilitate the tasks of live agents, for instance, providing solutions to customers, repeating announcements, and routing to the main menu selection if the customer selects the wrong option. 2) IVR shortens the time taken for customers to obtain solutions by reducing the burden on the customer service agent. For example, IVR obtains customer information such as the account number before control is handed to a live agent.	1) Undergo repetitive processes 2) Spend time calling and waiting 3) Face inadequate, incorrect, and/or conflicting information. 4) Call disconnected
Physical counters (e.g., branches, outlets or kiosks)	1) Offer flexibility and perform human interaction	1) MCO rules imposed physical distancing at physical counters, such as long queues, shortened working hours and promoted workplace hygiene 2) Transactions are limited. Self-service kiosks are pre-programmed to execute commands only to a certain extent. Complicated transactions are usually not supported

Table 2 *(Continue)*

Platform	Strength	Weakness
SST (e.g., Apps or Portal)	1) Made consumers' lifestyles more convenient through e-commerce applications, navigation applications, entertainment applications, and many more. 2) Provides widespread advertising coverage through thousands of digital publishers, cost-effectiveness, global reach, increased audience size, and multi-platform use. 3) Users are more attached to the phone than to other devices. 4) Additional revenue can be made by moving beyond their traditional business through the automation of their business processes. 5) Equipped mobile devices and online SST with various features for customers, such as the capability to sign-up, check account status, check for updates, obtain technical assistance, perform billing-related transactions, and receive the latest promotions on a single platform 6) With the development of customer capability in terms of technology and mobile self-service, a customer has more opportunities to receive a personalized service experiences based on their specific knowledge and skills 7) Services are more targeted, focused, and personalized to maintain customer loyalty and increase an organization's revenue. 8) Ease of using SST facilities, saving time, low risk, and customization, allows service managers to focus on service performance drivers to provide the best customer service. 9) SST can reduce the live agent's burden and, at the same time, improve the customer's satisfaction and their commitment to solving the issues on their own. 10) Reduce the workforce through the automation of business processes to meet the demands of the future economy	1) Lack of human interaction 2) Equipment malfunctions 3) High up-front costs

Existing Deployment of Mobile Apps in Malaysia

This section reviews four mobile apps used in the telecommunications industry in Malaysia. The selection was based on the app ratings given by customers. The four apps chosen were the Celcom Life App, MyUnifi App, Maxis App, and TIME App.

The Celcom Life App, by Celcom, was created exclusively to help customers to check and manage Postpaid and Celcom Xpax accounts. If using other Internet connections, customers can request a One Time PIN (OTP) for their mobile device. In addition, customers can download the latest app from the Google Play Store (Android), the Apple App Store (iOS) and the Huawei App Gallery. Celcom Life is free to download and use without incurring any internet charges, and it was specially designed for Celcom customers.

The MyUnifi app is an app for Unifi customers that was created to consolidate all the Unifi services. Customers can subscribe to Unifi services and manage their accounts in one app. In addition, the MyUnifi app is free for everyone and available for download via the Google Play Store and the Apple App Store. Customers can register to enjoy the features via a protected profile with personal information, giving a hassle-free experience and peace of mind. The app also allows customers to identify and link with current Unifi accounts. However, through the guest mode, existing or prospective customers can still browse TM's latest Unifi offerings.

The Maxis app is a secured self-help app for Maxis subscribers. The Maxis app is accessible with a Maxis ID. Customers can download the app on the Apple App Store or Google Play and sign up for a Maxis ID. However, if a customer uses Google maps retrieval from the rewards module or redirects to other websites or apps from the Maxis app, they will incur standard data charges.

The TIME Internet app allows the customer to manage a TIME account with the tap of a finger. In addition to viewing accounts, customers can pay bills and simplify their life with the TIME app. Table 3 summarises the key features of the existing mobile apps.

Table 3

Summary of the key features of the existing mobile apps, according to the top two highest ratings and bottom two lowest ratings

App Name	Features	Rating	Total Downloads	Total Reviewer
Celcom Life App	1. Usage overview 2. Check statements & pay bills 3. Instant reload 4. Buy internet & add-ons 5. Roaming internet add-ons 6. Self-register Celcom Xpax	4.4	1M+	176,720

Table 3 *(Continue)*

App Name	Features	Rating	Total Downloads	Total Reviewer
MyUnifi App	1. Subscription of Unifi services 2. Account overview & activity 3. Product offering & subscription 4. Bill payment 5. Support (Unifi community, Live Chat, self-troubleshooting) 6. Rewards	4.1	500K+	36,415
Maxis App	1. Account overview & latest offers 2. Track data usage & purchase passes 3. Bill payment, download bill 4. Subscribe to e-Bill & manage direct debit 5. Maxis TV/ Maxis home fibre WiFi 6. Rewards	3.5	1M+	36,542
TIME App	1. Account summary & info 2. View and update billing information 3. View, download and pay bills 4. Register auto debit 5. Connection status 6. Self-care	3.4	50K+	466

METHODOLOGY

This research implemented the Design Science Research Methodology (DSRM) to demonstrate the principles, practices, and procedures for a successful artefact (Peffers et al., 2007). The DSRM process consists of six steps, whereby each activity is carried out to answer the research questions. In Table 4, the research questions are mapped, along with the corresponding research objectives and the methodology applied to achieve the objectives.

Table 4

Research questions and methodology

Research Objective	Research Question	Methodology
i. To analyse customer preference and experience when using SST compared to the conventional method (traditional platform).	1.1 What current platforms were served to telecommunication customers in Malaysia?	i. Survey ii. Interview iii. Review the website of a service provider in Malaysia iv. Review the annual report of a service provider in Malaysia
	1.2 Does the mobile SST able to support customer needs and requirements?	i. Survey ii. Interview
	1.3 What are the customer preferences when contacting the service providers?	i. Survey ii. Interview

Table 4 *(Continue)*

Research Objective	Research Question	Methodology
ii. To formulate a mobile self-service framework based on existing processes and features.	2.1 What are the services that currently cannot be done online?	i. Survey ii. Interview iii. Review the website of a service provider in Malaysia iv. Review the annual report of a service provider in Malaysia
	2.2 How the other domains can support online registration and termination?	i. Literature review
	2.3 What are the customer preferences in digitizing these offline processes?	i. Survey ii. Interview
iii. To formulate a framework and through a mobile self-service solution based on existing features: 1. The interface 2. Billing 3. Account status 4. Ad-on to purchase 5. Rewards 6. Support received 7. Others features	3.1 What are the features that should have inside a self-service mobile application?	i. Survey ii. Interview iii. Review existing mobile applications of service providers in Malaysia iv. Review the website of a service provider in Malaysia
	3.2 What are the available self-service mobile applications in telecommunication industries?	i. Survey ii. Interview iii. Review existing mobile applications of service providers in Malaysia iv. Review the website of a service provider in Malaysia
	3.3 What are the available self-service web-based applications in telecommunication industries? Can these self-service practices be converted to mobile applications?	i. Survey ii. Interview iii. Review existing mobile applications of service providers iv. Review the website of a service provider in Malaysia
	3.4 What are the solutions for all available mobile SST in telecommunication?	i. Survey ii. Interview iii. Literature review iv. Review existing mobile applications of service providers in Malaysia v. Review the website of a service provider in Malaysia
	3.5 Are there are any researchers that focusing on compiling all available self-services along with the existing practices in the telecommunication industry? How about in other industries such as health and education?	i. Survey ii. Interview iii. Literature review
iv. To evaluate the formulated framework and process model based on existing features	4.1 How to evaluate the formulated framework?	i. Survey ii. Interview

This research reviewed journals and articles published within the period 2006 to 2020. The keywords are mobile applications, customer experience, human mobility restriction, digital contact centre, and customer loyalty. Through an in-depth study of existing research, this research identified many existing self-service mobile frameworks but found that most researchers have only focused on general factors and certain service areas. In many countries, telecommunications providers used to be state-owned monopolies that controlled the market and ensured that telecommunications were available to the public. Thus, the concepts and software depend on company strategies and market demand. Besides, few research studies focus on mobile self-services that drive companies to develop their customer service systems based only on user requirements studies. This research also reviewed the existing mobile apps and their features developed by telecommunications service providers in Malaysia. The reviews and selection were based on customer app ratings, which were the top two highest and the bottom two lowest. Thus, the apps reviewed were the Celcom Life App, MyUnifi App, Maxis App and TIME App. Based on their existing features, the apps were redesigned to deliver seamless and effortless user experiences with a refined look. As a result, a new framework for mobile self-service provision is proposed as guidelines for the telecommunications industry. Both customers and companies will benefit from the new framework, which helps to improve customer experience through the features provided. In addition, it should increase the number and loyalty of customers to service providers.

In this research, data was collected through primary and secondary sources. The primary data was collected using a survey and interviews. The secondary data was collected through a review of the journals, articles, web portals, existing mobile apps, and annual reports to gain the related information.

The survey questionnaire used Google Forms to gauge the information about the respondents' demographics, customer experience and recommendations for mobile app services. In addition, the questionnaire was distributed via email and social media such as Facebook and WhatsApp. Meanwhile, interview sessions with service providers were conducted through phone calls because of the implementation of social distancing due to the COVID-19 pandemic in Malaysia. Therefore, the opinions from selected service providers, including TM, Maxis, Celcom, and TIME, were needed to support the analysis for this research.

For the secondary data, information was collected from the respective service providers, e, so the sample size had to be greater than 75. Therefore, this research set 75 as the minimum sample size.

The design phase of the mobile app framework was based on the existing mobile applications developed by the service providers and the feedback from the survey results.

The design phase of the mobile application graphic user interface was based on the formulated framework. These graphic user interfaces (GUI) were displayed to customers and service providers during the evaluation.

The proposed mobile application framework and the GUI were evaluated based on the survey questions to get respondents' opinions and feedback. The questionnaire results were analysed using a Likert Scale to determine if the new requirements met the objective of this research. The existing evaluation frameworks designed by other researchers could be used as guidelines to formulate the new framework.

ANALYSIS AND RESULTS

According to Wang et al. (2019), five core features should be included while designing a mobile self-service. Based on a comparison of mobile apps in the literature review section: Celcom Life App, MyUnifi App, Maxis App, and TIME App, not all service providers include an Exclusive Deals and Rewards feature, while only the Celcom Life App has an Account Security (2FA) feature to verify the app account. Furthermore, Celcom Life App won the Best Use of Mobile award at the Customer Experience Asia Summit in 2018. Thus, the Exclusive Deals and Rewards and Account Security (2FA) features were included in the proposed framework. This section elicited customers' requirements as part of the initiative to resolve research problems which aim to provide comprehensive SST in telecommunication industries in Malaysia while adopting the existing mobile applications.

The newly proposed framework contains processes to enhance the services or features of mobile apps to improve customer experience. This research elicited customers' preferred transaction methods to integrate the processes.

According to Figure 1, 62% of customers chose transactions through Mobile Apps as the most desired. Meanwhile, 26% chose the web portal, and 7% chose walk-in (over the counter) as the least desired. Based on the survey, 92 customers gave the following reasons to contact their service provider's support team:

- Technical assistance (65 feedback items)
- Account info and bill-related (26 feedback items)
- Inquiry (22 feedback items)
- Product offering and Promotions (11 feedback items)
- Never (2 feedback items)

Operational Changes Due to the MCO Outlets/Kiosks

The newly proposed framework contains processes to accommodate the operational changes due to the MCO, which have impacted customer experience at physical counters. In addition, this research elicited the requirements of customers facing difficulties in performing transactions to formulate a mobile self-service framework.

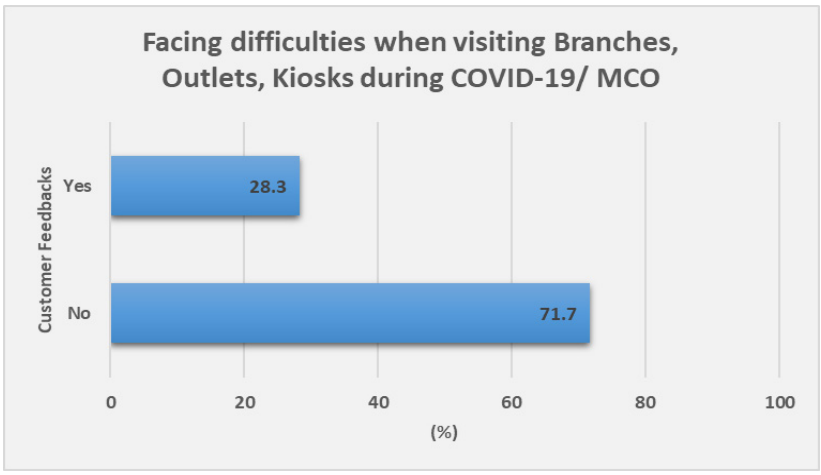

Figure 1. Analysis of customer preference when performing transactions

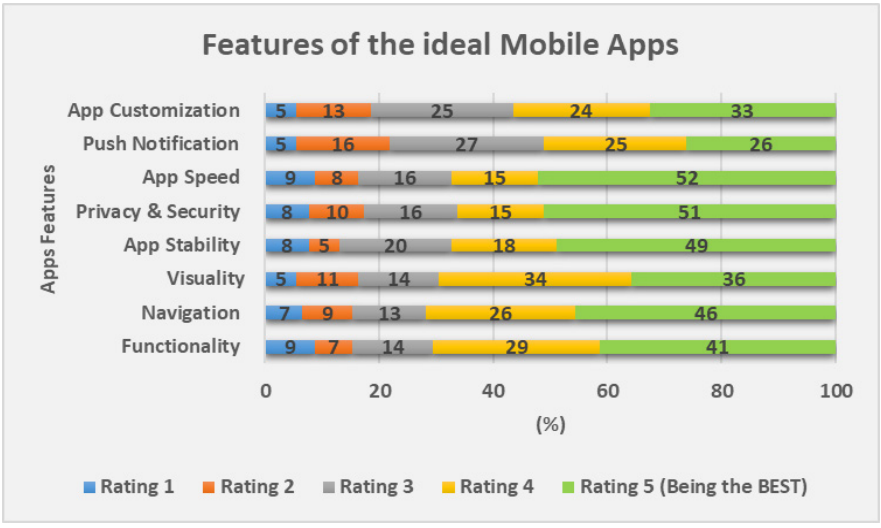

Figure 2. Analysis of operational changes due to the MCO

According to Figure 2, 28.3% of customers faced difficulties while performing a transaction at a physical counter during the MCO. Meanwhile, 71.7% of customers faced no difficulties. Twenty-four customers gave feedback on their difficulties during the MCO, which are:

- Long queues waiting time and do not exist in the form of SST, such as a request for account termination and transfer ownership (Feedback by 10 customers)
- Operating hours—closed and open at specific hours (Feedback by six customers)
- Following the Standard Operating Procedure (SOP) (Feedback by five customers)
- Others (feedback on services, people) (Feedback by three customers)

In addition, the newly proposed framework contains processes to analyse and formulate the framework through a mobile self-service solution based on existing features. This research elicited the ideal mobile app service practices to integrate the processes.

According to Figure 3, more than 41% of customers rated five for app speed, privacy & security, app stability, navigation, and functionality, which were regarded as the best practices. Meanwhile, 36% gave a rating of five for app visuality, 33% gave a rating of five for app customization, and 26% gave a rating of five for push notification. A mobile app's most important function or feature is to provide utility or value to customers. Thus, the prioritization and each requirement have been mapped out with the problem statement and previous study to provide a clear picture of critical features versus highly desired or nice to have features. Based on the survey, 11 customers gave the following suggestions for functionality or features:

- Outage or maintenance information (suggested by one customer)
- Connect with personnel support or agent (suggested by three customers)
- Log a technical report (suggested by one customer)
- Privacy & personalization (suggested by one customer)
- Security (suggested by two customers)
- Simple guidelines or manual for using the app (suggested by two customers)
- Bill reminder (suggested by one customer)

Summary of Analysis

Overall, the existing mobile applications supported the service providers' and helped customers perform the related transactions. The weaknesses to be resolved are listed below.

i. None of the mobile apps consists of all services; thus, the SST in the telecommunication industry in Malaysia can be further improvised by expanding the technology for a customer to perform self-service.
ii. There are too many reasons for contacting their service provider's support team resulting in congestion in the telephone line. Examples of reasons are requesting technical assistance or asking about account information and billing related.
iii. Long waiting times and tedious processes are involved in getting an answer, update or solution at the physical branches, especially during MCO, where the working hour is shortened, and fewer customers can be attended to. The main features and services can be enhanced to benefit the customers. The existing services in the mobile apps can be enhanced by providing more guidelines and frequently asked questions (FAQ) to help customers use the application and the available features. These are customer requirements for improving mobile applications, which served as the basis for formulating the self-service framework.

THE FORMULATION OF A MOBILE SELF-SERVICE FRAMEWORK

It is important to enhance customers' engagement and experience through the quality of interactions and make the technical features of offline and online interactions easier to use to retain customer loyalty (Dhasan & Kowathanakul, 2021). Thus, this research aimed to formulate a Mobile Self-Service Framework for the Telecommunications Industry (MOFTI). The following section describes the proposed framework.

First, customers must verify their security using a two-factor authentication after logging in to their account successfully. Next, the customer can see the guidelines and FAQs under the dashboard application. The processes highlighted in orange are the five processes adopted from the existing mobile SST:

Process 1	:	Login
Process 2	:	Enter dashboard application
Process 3	:	Select the menu or features
Process 4	:	Perform the transaction or run content
Process 5	:	Received the transaction ID
		The processes highlighted in brown are the new processes formulated by this research. In order to improve the customer experience by using a digital platform instead of the conventional method, this research formulates new processes:
Process 6	:	Display Guideline & FAQ
		In order to improve the customer experience at the physical counter (Branches/ Outlets/Kiosks during MCO (research objective 2), this research formulates two new processes:
e	:	Transfer Ownership
Process 8	:	Termination
		In order to provide the mobile SST best practices for service providers, this research formulates two new processes:
Process 9	:	Display the list of actions that service providers can take. These actions are based on the requirements elicited.
e	:	Service providers to enhance the features and services to improve customer experience based on literature review and survey results.

The other new features are described below:

There are three sub-processes under non-technical services: Transfer Ownership, Outages, and Termination. Transfer Ownership means the customer requests the transfer of an account or ownership to another person (a new owner), as shown in the sub-process below:

1. The owner applies to transfer ownership by filling in details such as their name and the new owner's Malaysian Identity Card (MyKad) number and then uploading a soft copy of the MyKad.

2. The new owner must upload a soft copy of their MyKad and accept the transfer process.

3. An agent from the telecommunications company requests more supporting documents and approves.

The term outages mean a process of handling downtime, whereby the system enables customers to view the planned maintenance or downtime in a specific area. The sub-process for outages includes the following points:

1. The customer selects the area code or service number.

2. The system displays the planned maintenance or downtime status.

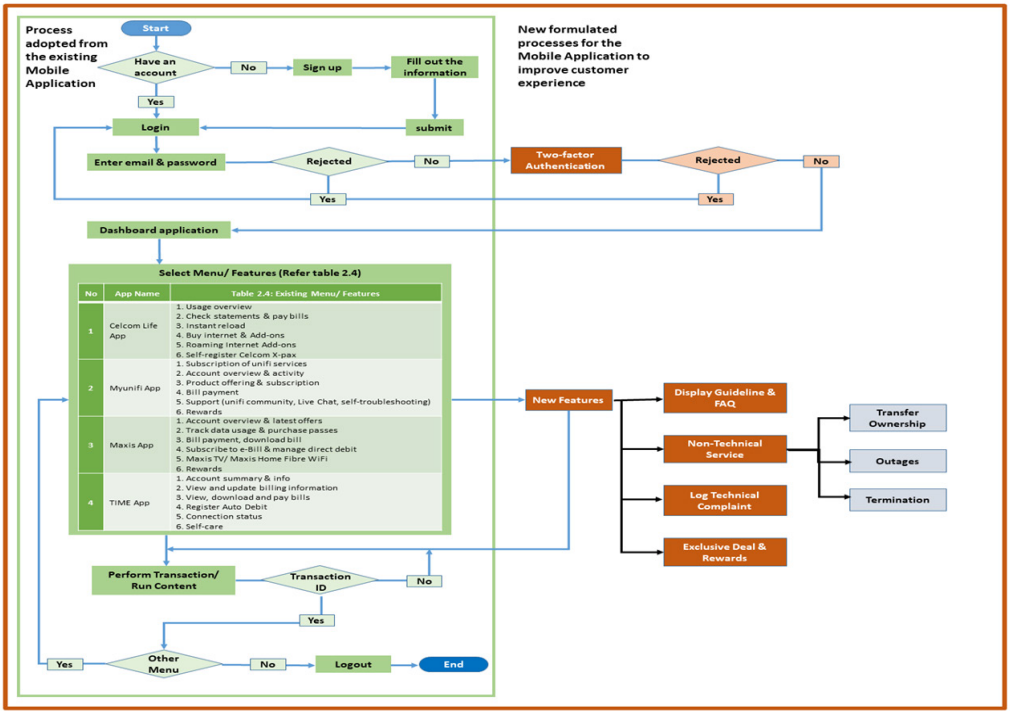

Figure 4. The proposed Mobile Self-Service Framework for the Telecommunications Industry (MOFTI)

The termination feature enables customers to terminate their accounts. The sub-processes for termination include:

1. The customer requests termination.

2. The system executes persuasive features to persuade customers not to terminate the account. For example, the system offers exclusive deals and reward features.

3. If the customer complies with the terms and conditions, the termination request will be approved.

3.1 A feature allows customers to request to switch their account to another service provider.

3.2 A notification is received from the new service provider.

3.3 The account is terminated.

4. If customers do not comply with the terms and conditions:

4.1 A penalty is calculated.

4.2 The customer pays the penalty.

4.3 The process is escalated to step 3.

The exclusive deals and rewards feature aims to provide customers with special offers and points that they can use for any campaign, promotion, merchandise, or rewards redemption, to make new purchases using a combination of points, or to associate with other vendors for prizes and customer loyalty reward points. The sub-processes of the exclusive deals and rewards feature are:

1. The customer checks for exclusive deals and points.

2. Upon reaching a certain number of points, customers are allowed to redeem exclusive deals and rewards.

3. The agent is notified of the redemption.

4. The agent validates and processes the redemption.

The log technical complaint feature aims to replace chatting with live agents and long repetitive calls:

1. Self-troubleshooting information is displayed.

2. The customer creates a technical complaint.

3. The agent validates the complaint.

3.1 Instructions are sent to the customer to rectify the problem.

3.2 Requests are sent for technical personnel to resolve the issue.

3.3 The technical personnel update the status.

4. If the problem is resolved, the customer closes the complaint.

5. If the complaint is unresolved company sends the customer. The process is escalated back to step 3.

EVALUATION

The evaluation of the analysis, survey results, and interview results aimed to validate that the newly proposed solution could enhance the customer experience through an SST that accommodated restrictions on people due to the MCO. This research developed a series of mobile app GUI based on the formulated framework to ease customers in understanding the framework while evaluating. The evaluation was done by collecting 2020 data from the telecommunications industry and analysing the data referring to the proposed mobile self-service framework, as illustrated in Figure 4, together with the respective GUI. The evaluation results show that more than 78% of customers would be satisfied if the following

features or services were available on their mobile apps. Furthermore, the questionnaire results show that more than 73% of customers agree that Mobile Apps are more convenient than contacting a support team via phone.

The Ideal Mobile Apps for the Proposed Mobile Self-Service Framework

The questionnaire results show that more than 41% of customers rated five (five being the best) for app functionality, followed by app navigation, app stability, app privacy & security and app speed. Meanwhile, less than 36% of customers rated the app visuality, app customization and push notifications based on the ideal Mobile App for the MOFTI.

Customer Preference for the Platform (Method) for the MOFTI

The questionnaire results show that more than 62% of customers choose the Mobile App as the most desired platform for the MOFTI. Tables 5 to 8 and Figures 5 to 7 describe the detailed findings of the MOFTI.

Table 5

Results of customer satisfaction for the MOFTI

Account overview, activity & other services related	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	45	49.0
Agree	40	43.0
Neither agree nor disagree	7	8.0
Disagree	0	0
Strongly disagree	0	0
Bill statement & payment system	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	48	52.0
Agree	38	41.0
Neither agree nor disagree	5	5.0
Disagree	1	1.0
Strongly disagree	0	0.0
Product offering, promotion & subscription	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	30	33.0
Agree	44	48.0
Neither agree nor disagree	16	17.0
Disagree	1	1.0
Strongly disagree	1	1.0

Table 5 *(Continue)*

Support services/ self-care	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	34	37.0
Agree	42	46.0
Neither agree or disagree	15	16.0
Disagree	1	1.0
Strongly disagree	0	0.0
Upgrade/ downgrade/ switching numbers	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	40	43.0
Agree	35	38.0
Neither agree nor disagree	13	14.0
Disagree	4	4.0
Strongly disagree	0	0.0
Termination request/ transfer ownership	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	36	39.0
Agree	36	39.0
Neither agree nor disagree	16	17.0
Disagree	4	4.0
Strongly disagree	0	0.0
Relocation request	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	35	38.0
Agree	38	41.0
Neither agree nor disagree	14	15.0
Disagree	5	5.0
Strongly disagree	0	0.0
Store finder	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	34	37.0
Agree	42	46.0
Neither agree nor disagree	14	15.0
Disagree	2	2.0
Strongly disagree	0	0.0
Rewards point & redemption	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	42	46.0
Agree	40	43.0
Neither agree nor disagree	7	8.0
Disagree	3	3.0
Strongly disagree	0	0.0

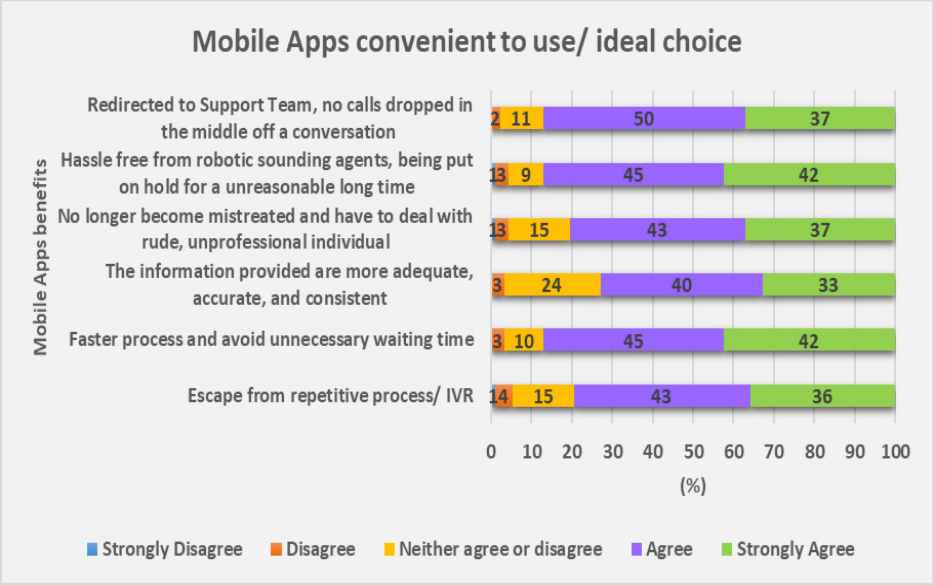

Figure 5. Results showing the mobile App as a convenient platform for the MOFTI

Table 6

Results showing the mobile App as a convenient platform for the MOFTI

Escape from repetitive process / IVR	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	33	35.9
Agree	40	43.5
Neither agree nor disagree	14	15.2
Disagree	4	4.3
Strongly disagree	1	1.1
Faster process and avoid unnecessary waiting time for an answer, update, or solution	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	39	42.4
Agree	41	44.6
Neither agree nor disagree	9	9.8
Disagree	3	3.3
Strongly disagree	0	0.0
The information provided is adequate, accurate, and consistent	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	30	32.6
Agree	37	40.2
Neither agree nor disagree	22	23.9
Disagree	3	3.3
Strongly disagree	0	0.0

Table 6 *(Continue)*

No longer become mistreated and have to deal with rude, unprofessional individual	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	34	37.0
Agree	40	43.5
Neither agree nor disagree	14	15.2
Disagree	3	3.3
Strongly disagree	1	1.1
Hassle-free from robotic-sounding agents, being put on hold for an unreasonable long time	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	39	42.4
Agree	41	44.6
Neither agree nor disagree	8	8.7
Disagree	3	3.3
Strongly disagree	1	1.1
Redirected to support team for further assistance without having to contact the hotline no, facing disconnected or calls dropped in the middle of a conversation	**Total of respondents (N=92)**	**Percentage %**
Strongly agree	34	37.0
Agree	46	50.0
Neither agree nor disagree	10	10.9
Disagree	2	2.2
Strongly disagree	0	0.0

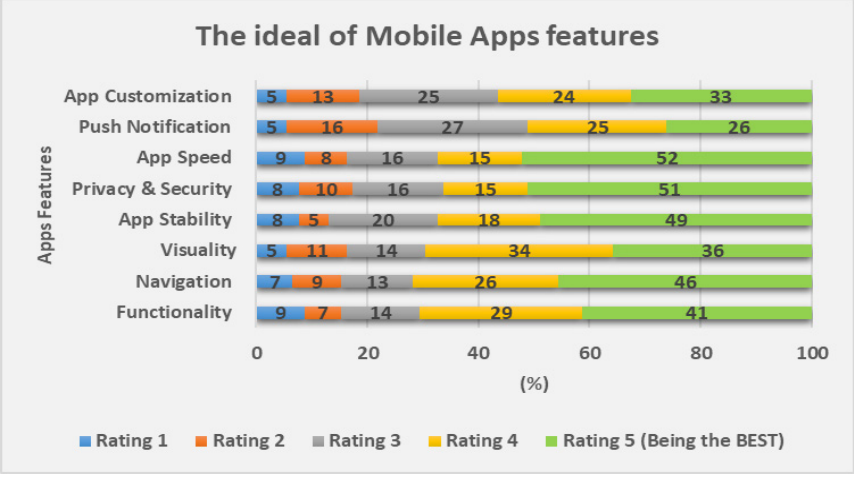

Figure 6. Results of the ideal mobile App for the MOFTI

Table 7

Results of the ideal mobile App for the MOFTI

Functionality (Relevant features, social integration, feedback system)	**Total of respondents (N=92)**	**Percentage %**
Rating 1	8	8.7
Rating 2	6	6.5
Rating 3	13	14.1
Rating 4	27	29.3
Rating 5 (Being the BEST)	38	41.3
Navigation (Able to access the information quickly and easily, simple menu selection)	**Total of respondents (N=92)**	**Percentage %**
Rating 1	6	6.5
Rating 2	8	8.7
Rating 3	12	13.0
Rating 4	24	26.1
Rating 5 (Being the BEST)	42	45.7
Visuality (Look and feel: interactive design, content layout, visually appealing)	**Total of respondents (N=92)**	**Percentage %**
Rating 1	5	5.4
Rating 2	10	10.9
Rating 3	13	14.1
Rating 4	31	33.7
Rating 5 (Being the BEST)	33	35.9
App Stability (App reliable & compatible, seldom crashed)	**Total of respondents (N=92)**	**Percentage %**
Rating 1	7	7.6
Rating 2	5	5.4
Rating 3	18	19.6
Rating 4	17	18.5
Rating 5 (Being the BEST)	45	48.9
Privacy & Security (Provide two-factor authentication: personal question, SMS confirmation code, biometric authentication: fingerprint and retina)	**Total of respondents (N=92)**	**Percentage %**
Rating 1	7	7.6
Rating 2	9	9.8
Rating 3	15	16.3
Rating 4	14	15.2
Rating 5 (Being the BEST)	47	51.1

Table 7 *(Continue)*

App Speed (Fast loading screen, high performance)	**Total of respondents (N=92)**	**Percentage %**
Rating 1	8	8.7
Rating 2	7	7.6
Rating 3	15	16.3
Rating 4	14	15.2
Rating 5 (Being the BEST)	48	52.2
Push Notification (Relevant and personalized push messaging option: manage alerts, secured messaging, receive timely updates, easy tracking of notification)	**Total of respondents (N=92)**	**Percentage %**
Rating 1	5	5.4
Rating 2	15	16.3
Rating 3	25	27.2
Rating 4	23	25.0
Rating 5 (Being the BEST)	24	26.1
App Customization (Personalization option: able to filter, control, sorts out important features, quick access)	**Total of respondents (N=92)**	**Percentage %**
Rating 1	5	5.4
Rating 2	12	13.0
Rating 3	23	25.0
Rating 4	22	23.9
Rating 5 (Being the BEST)	30	32.6

Service Provider Perspectives of the MOFTI

Based on the interviews, most service providers agreed that the MOFTI would benefit and improve the customer experience and services. However, risk factors such as security, fraud, and technology adaptation should be considered. Nevertheless, TIME has proven that customer transactions or services can be done online since they have never had a physical store. Table 9 describes the detailed results of the service providers' perspectives of mobile apps during the interview sessions.

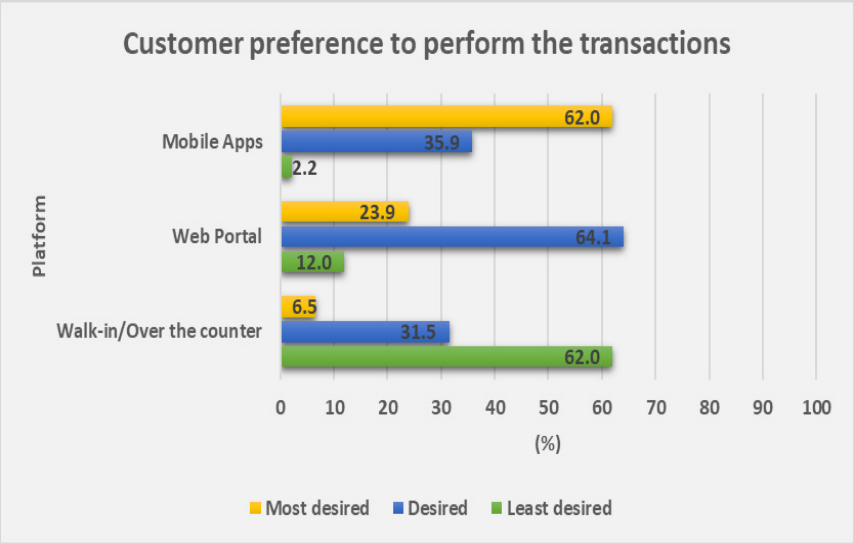

Figure 7. Results showing customer preference for the platform (method) for the MOFTI

Table 8

Results showing the customer preference for the platform (method) for the MOFTI

Mobile Apps	**Total of respondents (N=92)**	**Percentage %**
1-Most desired	57	62.0
2-Desired	33	35.9
3-Least desired	2	2.2
Web Portal	**Total of respondents (N=92)**	**Percentage %**
1-Most desired	22	23.9
2-Desired	59	64.1
3-Least desired	11	12.0
Walk-in/over the counter	**Total of respondents (N=92)**	**Percentage %**
1-Most desired	6	6.5
2-Desired	29	31.5
3-Least desired	57	62.0

Table 9

Results of the service providers' perspectives of the MOFTI

Mobile Apps improve the services/ bring benefit	**Total of respondents (N=8)**	**Percentage %**
Improve customer experience	8	100.0
Improve customer loyalty	8	100.0
Improve efficiency (function & support Services)	8	100.0
Reduce cost & increase revenue	8	100.0
The services that currently cannot be done online	**Total of respondents (N=8)**	**Percentage %**
Change ownership	3	37.5
Termination	6	75.0
Replacement sim card	3	37.5
Downgrade plan	1	12.5
All thru online platform (website/ Email/ call/ social media)	1	12.5

Summary of Evaluation

Table 10 summarises the scores and indicates that the newly proposed mobile self-service framework uplifts customer experience towards telecommunication service providers in Malaysia.

Table 10

Comparison between the existing framework and the MOFTI

No	**Attributes**	**Score**	
		Existing framework (%)	**MOFTI (%)**
	Features/ Services		
1	The average results of the offering features/ services	76.10	78.00
	Customer Satisfaction/ Experience		
2	The average results of customer satisfaction/ experience	44.60	73.00
	Mobile Apps Factor		
3	The average results of the mobile apps factor	54.30	66.00
	Platform/ Method		
4	Customer preference	19.40	62.0

The mean values for the MOFTI are generally higher than those for the existing framework. The customers agreed that the MOFTI would perform transaction-related tasks more satisfactorily than the existing framework. It is mainly because the MOFTI consists of ten newly formulated processes designed to:

i. Enhance the services or features of a mobile app to improve the customer experience since there are flaws and limitations with conventional interaction (live agents) and IVR.
ii. Improve the operational changes by making them digital due to the MCO, which has impacted customer experience at physical counters (e.g., at branches, outlets or kiosks).
iii. Analyse and formulate the framework through a mobile self-service solution based on the existing features since there is a lack of studies on mobile app service practices.

Among the four aspects evaluated, most customers feel satisfied with the features or services offered by the MOFTI (78%), an increase of two percentage points compared to the existing frameworks (76%). The increment shows that the automation of physical counter services has improved customer satisfaction. Based on the customer experience results, there was a tremendous increment of about 28.4%, with customers finding it more convenient to use the MOFTI (73%) than the existing frameworks (44.6%).

CONCLUSION AND FUTURE WORK

The main aim of this research is to overcome the unpleasant conventional methods since there are flaws and limitations with conventional interaction (live agents) and IVR as well as with the operational changes due to the MCO, which has impacted customer experience at physical counters.

In realizing the importance of resolving these problems, this research achieves its first research objective: to analyse customer preference and experience when using the mobile self-service features provided by telecommunications service providers in Malaysia while managing the restrictions people face due to the MCO through analysis of the survey results. Then this research achieves the second research objective by formulating MOFTI to uplift customer experience based on an analysis of the literature review, the survey results, and the frameworks of the existing mobile SST. Next, this research achieves the third research objective by providing evidence that the proposed self-service framework can uplift customer experience towards telecommunication service providers evaluation results prove that the MOFTI could resolve the limitations of conventional interaction and is highly relevant to today's environment. Another strength of completing this research was customers' positive reception of the MOFTI. Therefore, this research recommends that MOFTI be referred by personnel from telecommunication industries in Malaysia to

enhance the improvements that made it possible to complete the primary task involving customer activities.

The novelties for this study are projected to benefit society and telecommunications service providers, considering that mobile apps have the highest potential to contribute to the customer experience through SST.

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