Paving the Way for Digital Transformation: Investigate Customer Experiences of Using Mobile Apps

Shu-Chun Ho[1,*], Yen-Ping Hsu[2]

[1]National Kaohsiung Normal University, Taiwan, sch@nknu.edu.tw
[2]National Kaohsiung Normal University, Taiwan, sh066656@gmail.com

Abstract

Background: *Mobile apps have become a critical channel for retailers to interact with their customers and digitalize shopping behaviors in the customer journeys. In the transition of digital transformation, convenience stores have launched mobile apps to interact with and particularly collecting data from their customers. It is critical to investigate customer experiences in using mobile apps because it paves the way for successful digital transformation. This paper aims to investigate the customer experiences of convenience stores' mobile apps from the online reviews.*

Method: *This study proposed a mobile apps quality model as the theoretical framework to empirically test the online reviews of mobile apps. Large volumes of online reviews generated by customers provide important strategic values for business and service design for mobile apps. This paper collected 40,521 online reviews of two leading convenience stores in Taiwan and analyzed with text analysis and qualitative analysis.*

Results: *Applying text analysis and qualitative analysis, this paper identified the critical quality attributes of mobile apps in the convenience stores that need to be improved. In addition, software quality is the major concern that 7-11 Open Point needs to improve, followed by service quality and information quality respectively. Software quality is also the major concern that FamilyMart app needs to improve the customer experiences, followed by service quality and information quality. Moreover, customer dissatisfaction primarily resulted from problems in software quality and information quality. Instead, convenience, ease of use, and practicability of mobile apps lead to customer satisfaction.*

Conclusion: *The results demonstrate that software quality, information quality, and service quality are critical dimensions in affecting customer experiences in using mobile apps. Although different mobile apps may have different priorities of quality attributes that are needed to be improved, these improvements of mobile apps help to enhance customer experiences and accelerate digital transformation of the convenience stores.*

Keywords: Customer Experience, Digital Transformation, Online Review, Mobile Apps Quality Model, Text Analysis.

Introduction

Convenience stores are considered as essential facilities to support an individual's daily life. Opened with easily accessible location and extended hours, convenience stores provide fast purchasing and limited product assortment with typically higher prices than others (Goic et al., 2021). Because convenience stores usually respond to both customers' present and troubleshooting needs, customers are often visit convenience stores several times a week (Gahinet & Cliquet, 2018). In addition, the services provided in convenience stores have been an extension of e-commerce. Through the in-store, online shopping, or mobile apps experience, customer can perceive the integration efforts provided by retailers in online as well as offline environments (Fang et al., 2021). The products and services offered by the retailers serve as their core value proposition (Grewal et al., 2021). However, there were 12,200 U.S. retail stores closed in 2020 because of the impact of e-commerce and COVID-19 pandemic (Fortune, 2021). The ongoing COVID-19 pandemic as well as the changing business environment have created great challenges for the brick-and-mortar retail stores and forced companies to advance themselves with digital transformation (Kleisiari et al., 2021).

Retailers have begun to take the advantage of the digital technologies for digital transformation. Inevitably, mobile app serves as the first step of digital transformation for retailers. Mobile app plays a critical role in digital transformation because it is a direct channel to interact with customers, digitalize customer shopping journeys, and analyze customer shopping behaviors. The importance of mobile app in the transition of digital transformation motivates us to investigate the customer experiences of using mobile apps in the convenience stores. To respond to the fast-changing environment, convenience store chains have gone through the processes of digital transformation. It also challenges the convenience stores in Taiwan which ranked top two around the world in terms of the density of convenience store (Chang & Meyerhoefer, 2019). The geographic space with dense population contributes to the fast development of convenience stores in Taiwan (Kuo et al., 2018). In the face of limited physical store space, convenience stores in Taiwan not only sell the commodities of food, beverages, and stationery, but also provide a variety of services such as copying, printing, banking, ticketing, posting mail, and delivering online shopping products.

Offering ubiquitous services and products on the go, mobile apps have become a powerful channel for retailers (Mclean et al., 2018). When customers are unable to complete their tasks on their apps in a timely manner, it leads to dissatisfied and disappointed customer experiences (Pantano, 2014; Mclean et al., 2018). Prior mobile apps related studies focus on a relatively small group of lead customers in a specific set of perspectives such as location-based services (Ho, et al., 2015), mobile advertising (Tsang et al., 2004), privacy concern of mobile apps (Balapour et al., 2020), customer experience of mobile apps (Mclean et al., 2018), mobile apps adoption and loyalty (Kumar et al. 2018), and continued use intention (Liang et al., 2013; Wu et al., 2020). Compared to the small group of lead customer survey, the increasing amount of customer reviews provide different facet to explore customer experience in the consumption journey. Big data and analytics create strategic value for enterprises (Grover et al., 2018). Large volumes of online reviews generated by customers provide important strategic values for business strategies and service design for mobile apps. In addition, prior online reviews related studies primary focus on how reviews affect customers shopping decisions. However, little is known about how corporates can proactively respond to these reviews by incorporating features requests into mobile app design and business strategies (Zhou et al., 2018; Chen et al., 2019). Since online reviews reflect the feedback from customers, it is critical to understanding customers' experience from the text data to further predict the acceptance of products or services (Chang et al., 2021). To alleviate the research gap, this study investigates customer experiences of using convenience stores' mobile apps from the online reviews.

Specifically, the objective of this paper is to investigate customer experiences of using mobile apps from the mobile apps quality model by analyzing the online reviews of two leading convenience stores. From the customer feedbacks from a large number of the online reviews, convenience stores can proactively incorporate with these feedbacks into the mobile apps improvement and design. This study collected a massive amount of online customer reviews of mobile apps in the top two convenience stores in Taiwan and conducted textual analysis to empirically test the mobile apps quality model. Specifically, there are two research questions in this paper.

1. What are the quality attributes in convenience stores' mobile apps that can be identified from the online reviews?
2. What are the quality attributes that contribute to the satisfaction and dissatisfaction of the convenience stores' mobile apps?

This rest of this paper is structured as follows. In section 2, we review the studies of digital transformation in convenience stores, customer experience from the online reviews, and mobile apps quality model. Section 3 shows the research method, textual analysis, data collection and text pre-processing. Section 4 discusses the data analysis with descriptive statistics, term frequency analysis, and co-occurrence network analysis. These different approaches compose the findings in the online reviews of mobile apps in the top two convenience stores in Taiwan. Section 5 concludes the discussions of our findings, managerial and theoretical implications, limitation, and future research.

Literature Review

Digital Transformation in Convenience Stores

Taking advantage of new digital technologies to enable major business improvements, digital transformation has gained increasingly attention over the past two decades (Cha et al., 2015; Matarazzo et al., 2021). Companies have realized that technological changes will significantly influence their business decisions over the coming years. The investments on technologies to support digital transformation were predicted to reach $1.3 trillion US dollars in 2018 (Guinan et al., 2019). Digital transformation refers to the capability of an enterprise to adapt, respond and position itself for success regardless of the rapid technology evolution (Legner et al., 2017; Hadjielias et al., 2021). Although accessibility is a major differentiating factor for brick-and-mortar retailers, the traditional retailing has gone through irreversible systemic changes in recently years (Gauri et al., 2021). These systemic changes urge retailers to take advantage of digital technologies which play a critical role in retailing revolution (Grewal et al., 2020; Willems et al., 2017). The advance of digital technologies prompt retailing to evolve operation, redefine business model, and shift into new paradigm such as self-served devices, in-store kiosks, mobile apps, and unmanned stores. These new paradigms have radically transformed not only human behaviors but also companies' management strategies (Sestino et al., 2020). To better satisfy customers' need and enhance customer experience, the development of greater assortment and functions creates new opportunities and advantages for convenience stores (Nakayama & Yan, 2019). However, mobile apps have been considered the first step and fundamental application before the widely acceptance of self-scanning on the counter and just walking experience in the convenience stores.

Customer Experience from the Online Reviews

Retailers have provided and integrated different channels such as the in-store, online shopping, or mobile apps, to assist customers in the consumption journey (Fang et al., 2021). No matter what channels to deliver services, customers always have an experience. When

customers purchase a product or encounters services from a retailer, they may have good, bad or indifferent experiences (Lemon & Verhoef, 2016). Customer experience is proved to have great impact on business performance and in particular marketing outcomes, such as customer satisfaction, customer loyalty, and word-of-mouth (Gupta, 2016; Kuehnl et al., 2019). It is a significant issue for enterprises to understand customer experiences to pave the way for customer satisfaction (Liang et al., 2006) and digital transformation (Scherer et al., 2015; Chen et al., 2021). Customer experience is defined as the customer's internal and subjective response to the holistic direct and indirect interactions with the organization (Kim & Choi, 2016; Lemon & Verhoef, 2016). These interactions include communication interaction, service interaction and consumption interaction (Kim & Choi, 2016). The acknowledgement of customer emotions with experience distinguishes customer experience from service quality (Mclean et al., 2018).

Online reviews reveal customers' positive or negative experiences about a product, service, or even a company (Zhang et al., 2021a). Online reviews serve as a critical source of information for interested consumers to infer the quality and experience of using a product (He et al., 2020; Racherla & Friske, 2012; Evans et al., 2021; Yang et al. 2010). On the other hand, online reviews help companies to improve their products, services, or innovations that satisfy consumers' demands (Zhang et al., 2021b). Online reviews can be defined as the positive or negative statement made by potential, actual, or former consumers about a product, service, or company that is available to anyone on the Internet (Filieri et al., 2018). Everyone can obtain insights from a plethora of reviews contributed by others in the online community, except the marketing information about products and services from the firms (Banerjee & Chua, 2021).

Online reviews play an important role to understand customers' needs, voices and experience. However, it is almost impossible for an individual to read a voluminous number of reviews (Jung & Suh, 2019). Research in this stream is generally based on the online data or texts crawled from the Internet. Most of the online reviews are not only true and objective, but also low-cost of acquisition and large in volume (Hong et al., 2020). Since online reviews reflect the feedback from customers, understanding customers' experiences from the text helps to predict the sales of products or services (Chang et al., 2021). Although the content of positive and negative reviews differ, negative reviews are more factual, diagnostic, objective, and rational (Hong et al., 2020). Positive or negative customer experiences result in positive or negative online reviews, respectively. Consequently, positive or negative online reviews contribute to increase and decrease purchase intention, respectively (Jimenez & Mendoza, 2013).

Mobile Apps Quality Model

Quality is considered as a multi-dimensional concept perceived differently in different domains (Ashrafi, 2003). Quality is defined as the ability of a set of intrinsic characteristics to satisfy requirements (Khosravi et al., 2018). IS success model is comprised with three components: system quality, information quality, and service quality (DeLone & McLean, 2003). However, different research contexts call for the necessity to validate the DeLone and McLean IS success model (Wang, 2008; Green et al., 2014). To measure the quality attributes of mobile apps, we develop a mobile app quality model based on the IS success model (DeLone & McLean, 2003) (Figure 1). The mobile apps quality model is comprised with three dimensions: software quality, information quality, and service quality. System quality is a measure of the information processing system itself (Negash et al., 2003). We use software quality to replace system quality since mobile app is one kind of mobile software applications and services. When evaluating the quality of an application, users usually draw on different system indicators – related to a system's objective, behaviors, accessibility, and aesthetics – that create the perception of the application's overall quality (Hoehle & Venkatesh, 2015). Thus, we argue that software quality is more appropriate for measuring mobile apps' quality. Software quality is defined as the degree to which a software can be used by specific users to

meet their needs to achieve specific goals with effectiveness, efficiency, freedom from risk and satisfaction in specific context of use (Atoum, 2020). Information quality is a function of the value of the output produced by a system as perceived by the user (Negash et al., 2003). Information quality refers to the measures of information system output, i.e., the quality of information the system produces (Hsu et al., 2008). In the context of IT-enabled service, service quality reflects an individual's evaluation of the quality of interactions with IT artifacts, including the extent to which specific service needs are fulfilled (Kang et al., 2020). Service quality is defined as the gap between perceptions and expectations of customers (Parasuraman et al., 1985). At the business level, strategic attributes are a necessary consideration for mobile apps (Green et al., 2014). In the proposed model, service quality reflects the strategic attributes of the services provided from a mobile app.
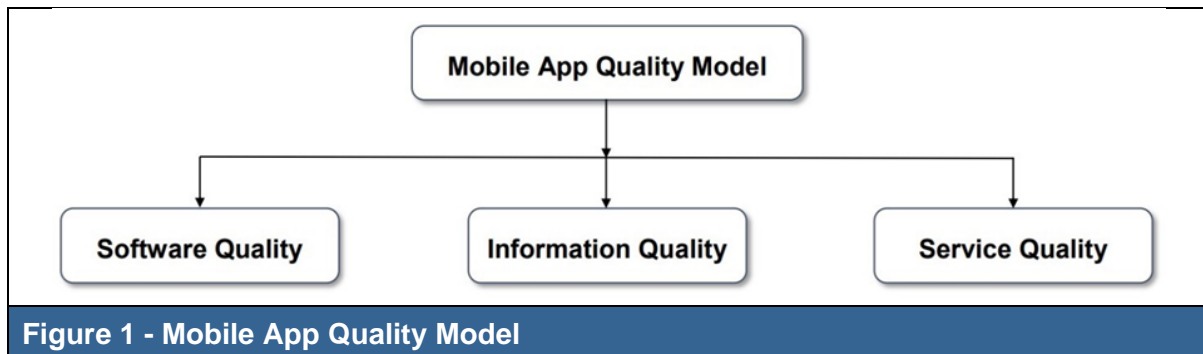

Figure 1 - Mobile App Quality Model

Research Method

This section discusses the processes of textual analysis, data collection and text pre-processing. Data collection and text pre-processing processes addressed where data were collected and pre-processed before the textual analysis.

Textual Analysis

Textual analysis of user generated contents and consumer reviews has attracted great attention in literature (Buschken & Allenby, 2016). Textual analysis refers to the process of extract valuable information from the text that is also known as text mining or content analysis (Guo et al., 2016; Loughran & McDonald, 2016). It is a widely used method that systematically analyze textual data to improve the understanding of a phenomenon (Hernández-Chea et al., 2021). Textual analysis is a commonly used quantitative method of content analysis. Textual analysis is an interpretative method that allows the researcher to explore all aspects of content (Tandoc & Ferrucci, 2014). It is an appropriate method when the phenomenon to be observed is communication rather than behavior or a physical object (Nasir, 2005). To understand customer experiences about products or services, prior studies have used textual analysis in analyzing online reviews (Xu et al., 2017; Yang et al., 2019).

Figure 2 - Research Process
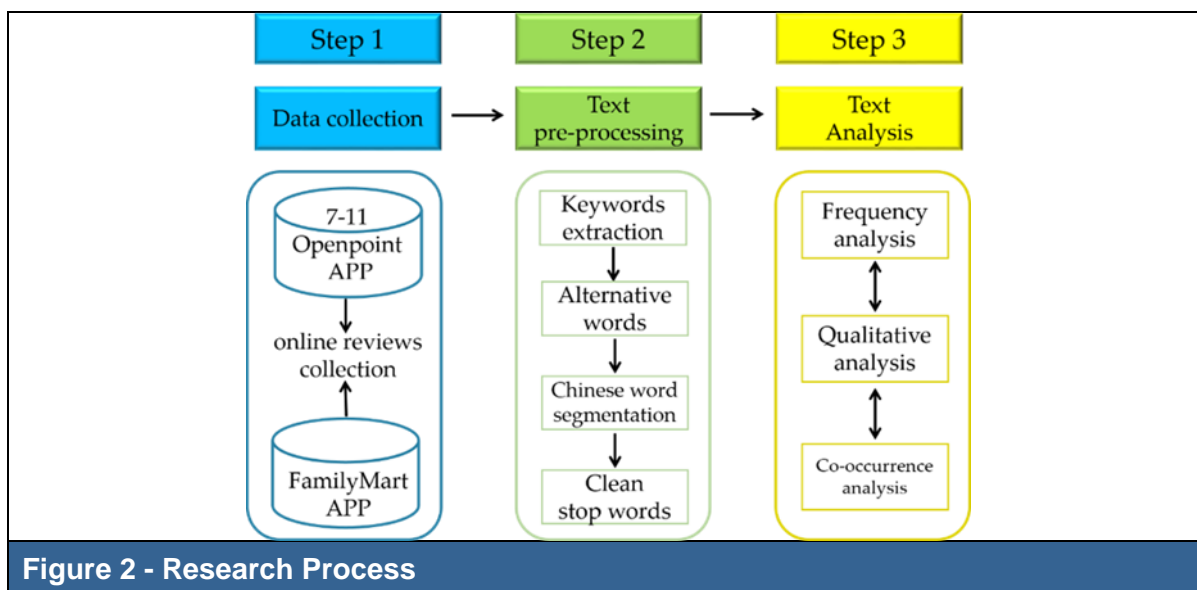
This study applies textual analysis to discover critical opinions from the online review of mobile apps in the top two convenience stores, 7-11 OpenPoint and FamilyMart, in Taiwan. There are four major convenience store chains in Taiwan, 7-11, FamilyMart, Hi-Life, and OK-Mart, which account for 98% of convenience store outlets (Chang & Meyerhoefer, 2019). This study intends to observe the customer experiences of using the convenience stores' mobile apps. Thus, textual analysis is an appropriate method for our research objectives. There are three steps in the process of textual analysis: harvest text, clean and parse text, and analyze text (See Figure 2) (Guo et al., 2016). In step 1, we collected the online reviews of the mobile app in the top two convenience stores. In step 2, the data were pre-processed by extracting keywords, finding alternative words, segmenting words in Chinese, and cleaning stop words. In the step 3, we conducted the textual analysis with frequency analysis and co-occurrence network analysis. We further interpreted the results by qualitative analysis

Data Collection and Text Pre-Processing

To collect the online reviews, first, we retrieved online reviews of the top two convenience stores' mobile apps in Google Play, 7-11 Open Point[1] and FamilyMart[2] app. Initially, there were 21,255 and 21,304 online reviews of 7-11 Open Point and FamilyMart apps, respectively (See Table 1). The overall 42,559 online reviews are collected in August 2021. Second, these online reviews are ranked with three features: high correlation, all devices, and all ranking. These online reviews are retrieved by Java programing in the HTML code.

After crawling the online reviews, we followed by data pre-processing process. In the second step, data pre-processing step (Figure 2), first, we removed the HTML formatting and any other non-textual information, such as embedded images or spreadsheets that may be present in the text (Katsafados et al., 2021). The text was split into sentences and all punctuations were removed. The advertising messages or meaningless punctuation marks in the online reviews were deleted. We also excluded the online reviews which were written before 2016. Overall, there are 40,521 valid online reviews after deleting 2,023 meaningless ones. Our dataset includes the valid 20,551 online reviews of 7-11 Open Point app and 19,970 online reviews of FamilyMart app, respectively (See Table 1).

Second, the online reviews are segmented into meaningful terms which are the basic unit of analysis. Segment corpuses use bigram that particular terms are usually appear together

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[1] https://play.google.com/store/apps/details?id=tw.net.pic.m.openpoint
[2] https://play.google.com/store/apps/details?id=grasea.familife

throughout the data such as "delicious food" and "log in" (Chen et al., 2021). Third, we calculated the frequency of each term with the term frequency-inverse document frequency (TF-IDF) function. Saved in the CSV format, these terms are segmented by keeping numbers and English terms. Forth, based on the Chinese term dictionary, key terms are selected and identified. Last, to evaluate the performance of selected terms, we can preview the results by adjusting the weights of term and changing parameters in TF-IDF setting.

Table 1 - Data Collection and Pre-processing				
	Collected reviews	Cleaned reviews	Word counts	Terms
7-11 Open Point	21,255	20,551	554,552	12,230
FamilyMart	21,304	19,970	380,588	10,104
Total	42,559	40,521		

Data Analysis

Descriptive Statistics

The cleaned dataset obtained 20,551 and 19,970 valid online reviews of Open Point app and FamilyMart app, respectively. The corpora of 7-11 Open Point app and FamilyMart app online reviews consist of 12,230 and 10,104 unique terms. The convenience store apps' online reviews contain an overall evaluation of the customer experience on a five-point scale, where a higher rating shows a better customer experience. 7-11 Open Point app received an average rating of 2.19 (See Table 2). It implies customer experiences in using 7-11 Open Point app are at the bottom level of the rating scale. From customer experience perspective, it still leaves an ample room for the improvement. In addition, the standard deviation of the rating of 1.65 indicates that many customers rated their experience of using 7-11 Open Point app at the bottom level of the scale (0.54~3.84 with the probability of 68.27%). On the contrary, compared to the rating of 7-11 Open Point app, FamilyMart app received a higher average rating of 3.06 and 1.79 as the standard deviation of the rating. It implies the average customer experiences of FamilyMart app are rather upset nor very satisfying, but in the middle. Customer experience with FamilyMart app has been moved from the bottom level toward to the middle level. However, it still leaves room for improvement as well.

To better understand the structure of the online reviews, we further look into the numerical statistics of the preprocessed data set based on word and sentence counts. When the online reviews contain less data per reviews (by word and sentence count), it would be challenging to extract managerially relevant insights (Buschken & Allenby, 2016). Table 2 reveals that 7-11 Open point reviews contain 2.83 sentences with 26.5 words per sentence. The standard deviation of the number of sentences per review is 2.77, indicating heterogeneity of structure among reviews. On the contrary, FamilyMart reviews contains an average of 2.24 sentences with 19.28 words per sentence. The standard deviation of the number of sentences per reviews is 2.21, showing heterogeneity among customer reviews.

Table 2 - Descriptive Statistics of Online Reviews					
	Apps	Mean	Median	Standard deviation	Range
Rating	7-11 Open Point	2.19	1	1.65	4
	FamilyMart	3.06	3	1.79	4
FamilyMart	7-11 Open Point	2.83	2	2.77	59
	FamilyMart	2.24	1	2.21	62
Number of sentences per review	7-11 Open Point	26.50	16	32.18	337
	FamilyMart	19.28	10	26.36	329

Term Frequency Analysis

The text of the online reviews is useful to identify critical issues best avoided and more informative about positive drivers of customer experiences (Buschken & Allenby, 2016). Term frequency analysis helps to reveal the customer experience from the online reviews. First, we identify the top 20 frequently appeared terms in the online reviews of Open Point and the corresponding frequency in FamilyMart app (See Figure 3). Among the 20,551 valid online reviews of 7-11 Open Point app, there are 12,230 terms identified. The most frequently appeared terms are "update" (4,740 times), "app" (3,598 times), "log in" (2,720 times), "points" (2026 times), "system" (1,465 times), "convenience" (1,381 times), "easy of use" (1,223 times), "password" (1,128 times), and "redeem"(1,111), "mobile phone," (1,074 times), "FamilyMart" (929 times), "membership" (887 times), "problem" (841 times), "account" (816 times), "error" (807 times), "programming" (797 times), "barcode" (766 times), "download" (755 times), "renew" (755 times), "register" (739 times), (See Figure 3). The occurrence frequency of words positively correlates with the significance of the term (Lim & Kim, 2020). The most frequently appeared terms are customers' primary concerns in using Open Point app.

These top 20 frequently appeared terms of Open Point and FamilyMart app can be classified into three dimensions of mobile apps quality model. Some terms can be easily categorized into one of the three dimensions but some are not. Some terms need to read the text of the online reviews before categorization. Software quality attributes include update, app, log in, system, easy of use, mobile phone, account, programing, barcode, download and register. Information quality attributes include update, points, password, redeem, membership, account, and error. Service quality attributes include convenience, redeem and FamilyMart. Software quality is the major area that Open Point app needs to improve its customer experiences, followed by information quality and service quality respectively.

Figure 3 - Term Frequency in Online Reviews of 7-11 Open Point vs FamilyMart app
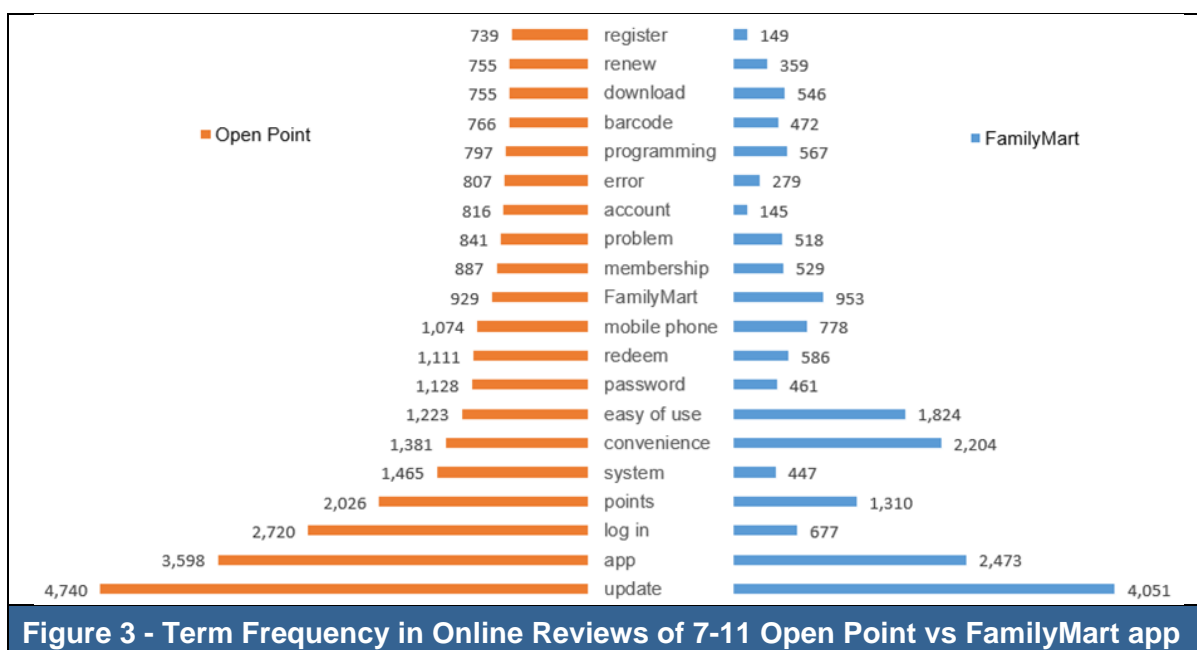
On the contrary, among the 19,970 valid online reviews of Family Mart app, there are 10,104 terms identified. We identified the top 20 frequently appeared terms in the online reviews of FamilyMart app and the corresponding frequency in Open Point app (See Figure 4). The most frequently appeared terms are "update" (4,051 times), "app" (2,473 times), "convenience" (2,204 times), "easy of use" (1,824 times), "points" (1,310 times), "inform" (1,034 times), "Family Mart" (953 times), "products" (846 times), "mobile phone" (778 times), "coffee" (697 times), "log in" (677 times), "function" (637 times), "promotion" (602 times), "redeem" (586 times), "programming" (567 times), "coffee voucher" (553 times), "push notification" (547

times), "advertising" (546 times), "download" (546 times), "membership" (529 times) (Figure 4). These most frequently appeared terms are the customers' primary concern of FamilyMart app. These top 20 frequently appeared terms of Family Mart app can be classified into three dimensions of mobile apps quality model.
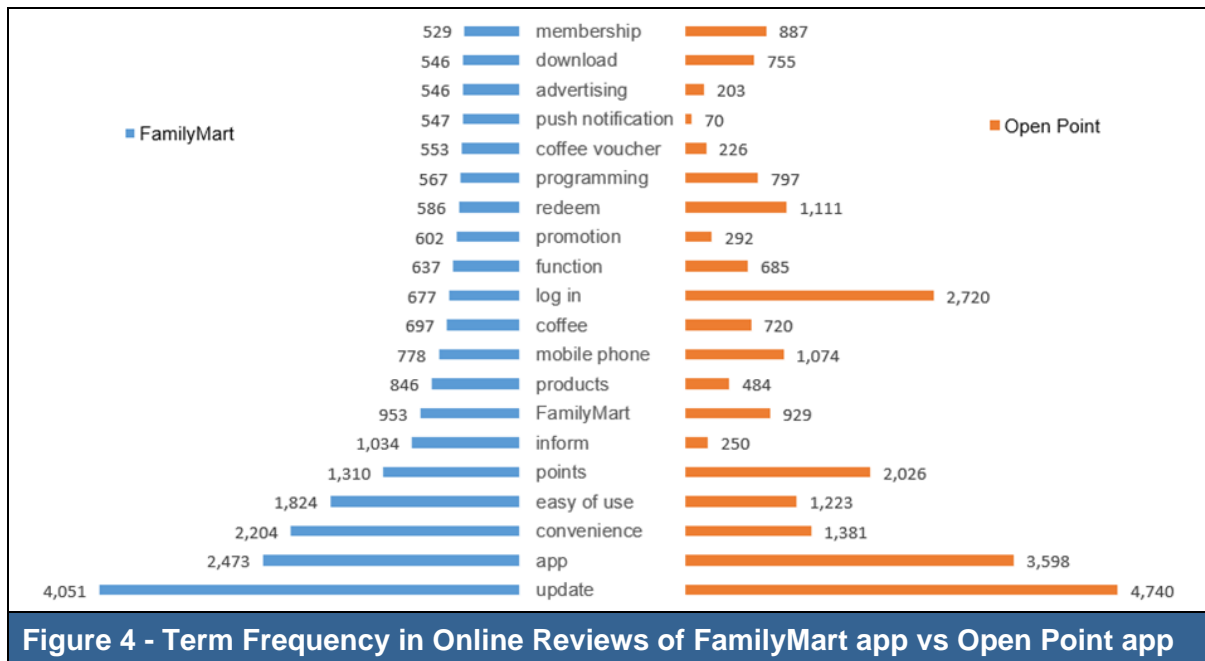

Figure 4 - Term Frequency in Online Reviews of FamilyMart app vs Open Point app

The frequently appeared terms related to software quality include update, app, easy of use, inform, mobile phone, log in, function, programming, and download. The frequently appeared terms related to information quality attributes include update, points, push notification, and membership. Service quality attributes include convenience, promotion, activities, redeem, advertising, and coffee voucher. Software quality is the major concern that Family Mart app needs to improve the customer experiences, followed by service quality and information quality respectively.

We further analyze the text by listing a summary of terms appearing by rating for the Open Point and FamilyMart app online reviews. A rating of 1 or 2 implies dissatisfaction with convenience store apps, where as a rating of 4 or 5 on overall satisfaction indicates satisfaction with the experience of using these apps. Table 3 shows a list of the top 20 words occurring in good and bad overall evaluations for the convenience stores' apps. The top five terms for bad evaluations in Open Point app are update, log in, points, system, and password which are related to software and information quality. On the contrary, the top 5 terms for good evaluations in Open Point reviews are convenience, ease of use, update, points, and *practicability* which are primary related to information quality and service quality. On the other hand, the top five terms for bad evaluations in the online reviews of FamilyMart app are update, app, points, inform, and log in. On the other hand, the top five terms for good evaluations in the online reviews of FamilyMart app are convenience, ease of use, FamilyMart, and service. Update, app, points, and log in are in the bad evaluations for both Open Point and FamilyMart apps. Convenience, ease of use, and *practicability* are the frequently appeared terms appeared in the good evaluations of both apps. It implies that convenience, ease of use, and *practicability* are three attributes that lead to customer satisfaction in the mobile apps of convenience stores. In general, customers value the quality attributes of convenience, ease of use, and *practicability* of mobile apps which lead to positive customer experiences.

Table 3 - Mostly Frequently Used Words by Rating in Reviews				
	7-11 Open Point		FamilyMart	
Rank	Rating 1or 2	Rating 4 or 5	Rating 1or 2	Rating 4 or 5
1	update	convenience	update	convenience
2	app	easy of use	app	easy of use
3	log in	update	points	app
4	points	points	inform	FamilyMart
5	system	app	log in	service
6	password	practicability	mobile phone	update
7	redeem	promotion	products	practicability
8	mobile phone	function	FamilyMart	function
9	FamilyMart	barcode	push	points
10	account	service	coffee	products
11	error	membership	advertising	promotion
12	problem	invoice	download	coffee
13	membership	programming	redeem	coffee voucher
14	download	log in	programming	barcode
15	register	mobile phone	password	mobile phone
16	programming	redeem	problem	use
17	renew	products	system	credits
18	coffee	coffee	turn off	activities
19	activities	account balance	coffee voucher	membership
20	enter	improvement	membership	inform

The analysis of term frequency has the limitation of marginal analysis of predefined groups. The analysis of word counts or frequencies by rating offer limited information of these individual classification variables. However, it does not identify the combinations of classified variables that contribute to unique themes or topics for analysis (Buschken & Allenby, 2016). To compromise the limitation of frequency analysis, we further conduct co-occurrence analysis and qualitative analysis to reveal the combination of classification variables.

The Analysis of Co-occurrence Networks of Words

Co-occurrence networks of words analysis measures the frequency of co-occurrence of two keywords in the same text which is also called network text analysis (Bullinaria & Levy, 2007). It is a method that codes the links between words in a text and builds the networks of linked words (Diesner & Carley, 2004). Co-occurrence relation is based on three assumptions: co-occurrence within a consecutive arrangement of words, within syntactic relations, and within a limited context (Dagan et al., 1995). In the co-occurrence analysis, first, we set up 10% as the threshold in identifying keywords. When a word is mentioned by different customers in the collected online reviews more than 10% of the total extracted words, it will display in the co-occurrence relation network (Figure 5). The frequency of its occurrence as a keyword determines the size of a node (Muritala et al., 2020). The higher frequency of words appeared in the online reviews results in bigger node.

Second, to further explore the relationships between terms, the co-occurrence map shows the links between highly correlated terms. The co-occurrence is not a permanent relationship and co-word patterns change over time (Muritala et al., 2020). When different terms appear in the same online review, they are considered correlated with each other. The line between two different nodes represents a relation between terms, that is, how frequently they co-occurred as keywords (See Figure 5). The proximity of two terms and the thickness of the lines connecting them show how frequently they co-occurred as keywords (Muritala et al., 2020). The high probability terms allow for a richer interpretation of the data (Buschken & Allenby, 2016). We set up 35% as the threshold in linking the correlations between keywords. When

the relation between two different nodes are higher than 20%, there will a link between two different nodes. We pick up 20% because it reaches 1/5 of the co-occurrence. The flexibility of threshold varies in different dataset and context. With this threshold eliminating many lines from the network, it is easier to visualize the relations between nodes. The thicker the linked lines, the higher the correlation between different words.
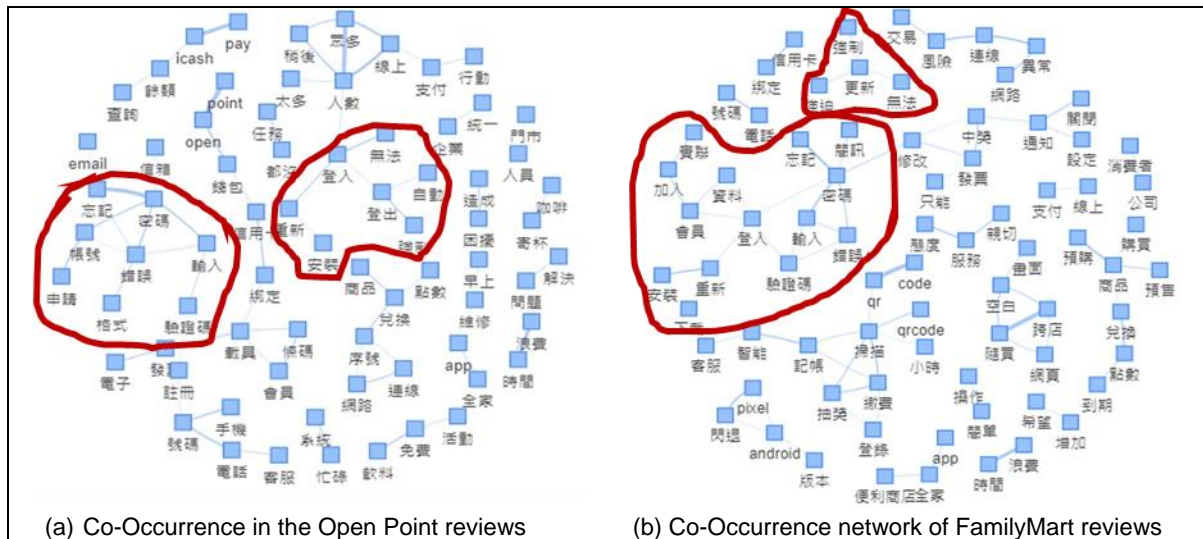

(a) Co-Occurrence in the Open Point reviews   (b) Co-Occurrence network of FamilyMart reviews

Figure 5 - Co-Occurrence Network Analysis[3]

In the co-occurrence network analysis of Open Point reviews, there is a network among the terms of "can not", "log in", "renew", "log out", "force", "install", and "automatic". In addition, there is a network among the terms of "forget", "password", "enter", "error", "verification code", "format", "apply", and "account" (Figure 5(a)). On the other hand, the terms of "can't", "force", "urge" are all related to "update" in the co-occurrence network analysis of FamilyMart app. In addition, there is a network among the terms of "forget", "password", "message", "error", "verification code", "log in", "data", "membership", and "install" (Figure 5(b)). From the co-occurrence network analysis, it helps to link the terms together to better understand relationship between terms. Co-occurrence analysis is a semantic representation that utilizes the idea that words with similar meanings tend to appear in alike contexts (Celardo & Everett, 2020). The advantage of word co-occurrence relations is their unambiguity that they are defined and extracted from the language data in a theory-neutral manner (Liu & Cong, 2013). When sets of keywords are frequently used together by different authors in a similar context, it implies that these keywords have a significant relationship within this circumstance (Whittaker, 1989). Co-occurrence analysis helps to unveil the conceptual structure and primary research themes in that context (Muritala et al., 2020).

Qualitative Analysis After the Analysis of Term Frequency

Data are commonly thought of as representing observations or contents, but they are always the outputs of given processes (Dilevko & Gottlieb, 2009). To spotlight the importance of keywords that are identified with frequency analysis, we further get into the text of the online reviews to interpret context of what the customers intend to express. Qualitative data analysis is related to customer's feelings, experiences, opinions, values, decisions, and behaviors. To better understand the identified terms in the co-occurrence network analysis of, we further conducted the qualitative analysis of the online reviews (See Table 4).

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[3] Figure 5(a, b) display the outputs of the co-occurrence network analysis from the Big Data Business Analytics Platform at National Sun Yat-sen University, Taiwan.

Table 4 – Qualitative Analysis of the Online Reviews		
Theme	**Co-occurrence terms**	**Text**
Software quality, service quality	*Update, coffee voucher, system, function, redeem, coffee*	*"The design is so complex. A lot of stuff squeeze in the app. I have to check out respectively if I buy other stuffs and also use a coffee voucher. It usually updates the system in the rush hours in the morning which leads to unavailability and can't check out. 6/15 is the first working day, the function of coffee voucher is under maintaining. Why you maintain the function in the working day? Customers can not redeem coffee normally."* – Open Point #20069
Software quality, service quality	*Update, can't, force*	*"It forces to update the app. But I can't open and use it when I updated."* – Open Point #20069
Software quality, information service quality	*Barcode, redeem, points, update, coffee, coffee voucher*	*"There is no barcode when I try to redeem the points. It requires update in a couple of days. I can't use this app if I don't update it. I can't redeem my coffee. If you don't improve it, I will refund all my coffee voucher."* – FamilyMart #2951
Software quality, information quality, service quality	*Push notification, advertising, function, FamilyMart, convenience*	*"Could you please don't pop up the push notification for advertising? There is no function to turn off the push notification. The pop-up notifications are very annoying. This app breaks my impression of FamilyMart. App should bring convenience instead of irritation."* - FamilyMart #3016

The online reviews of the co-occurred terms were identified and followed by extracting the key terms from the online reviews. After interpreting the texts of the online reviews, we specified the terms with a theme which is based on the mobile app quality model. These terms are the most comparing issues in using mobile apps that compared by the customers of convenience stores. Customers of 7-11 Open Point app complained about the frequency of updating the app wich creates the problems in using coffee voucher. On the other hand, the online reviews of FamilyMart app show that customers had negative experiences when they tried to redeem points on the app. Family Mart's customers also complained about they were forced to update the app and irration of push notification with advertising. These negative customer experiences are related to the quality attributes of Family Mart's app that need to be improved. These extracted themes can be respectively inferred to software quality, information quality, and service quality of these apps

The Empirical Work of Mobile App Quality Model

From the interpretation of qualitative analysis, we can find that some terms be classified into different quality attributes. For example, "update" in the text of online reviews sometimes is used for app update and sometimes is used for data update. The qualitative analysis of the online reviews better helps to classified the terms in different categories of mobile app quality model. Based on the term frequency, co-occurrence network analysis, and qualitative analysis, we classify the terms into the mobile app quality model (See Figure 6). The top 20 frequently appeared terms are classified into software quality, information quality, and service quality. Software quality includes terms of update, app, log in, system, easy of use, mobile phone, account, programming, barcode, download, register, function, and inform. Information quality includes terms of update, point, password, redeem, membership, account, error, advertising, and push notification. Service quality includes the terms of convenience, redeem, FamilyMart, activities, products, coffee, and promotion. Overall, the issues of software quality are the most needed to be improved in the convenience stores' app, followed by information quality, and service quality.
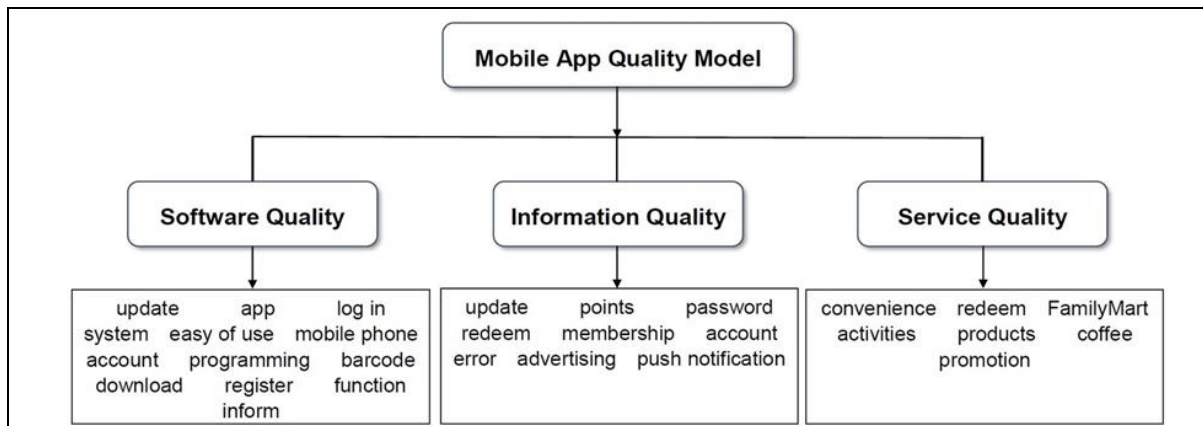
Figure 6 - Mobile Apps Quality Model

Conclusion

The fast changing and dynamic business environment force enterprises to conduct digital transformation (Rueckel et al., 2020). Moreover, the ongoing COVID-19 pandemic accelerated the need for retailers to embrace new alternatives and enhance themselves with digital transformation. Mobile apps have become a critical channel for enterprises in the transition of digital transformation. To better satisfy customers' need and enhance customer experience in their consumption journeys, it is important for enterprises to understand customer experiences in using their mobile apps. Therefore, this paper aims to investigate customer experiences in using mobile apps in the leading two convenience stores in Taiwan. We propose a mobile app quality model to serve as a theoretical foundation and to further empirically test the online reviews. We collected 20,551 online reviews of 7-11 Open Point app and 19,970 online reviews of Family Mart app in Taiwan. Text analysis is applied to pre-process and analyze the online reviews of two apps. Qualitative analysis is further applied to better interpret the findings from the text analysis.

Discussions

The first objective of this paper is to identify the quality attributes in convenience stores' mobile apps from the online reviews. To answer the first research question, we conducted frequency analysis and found that the most frequently appeared terms from the online reviews of two leading convenience stores are "update", "app", "log in", "points", "convenience", "system", "easy of use", "points", "password", and etc. Based on the mobile app quality model, these terms can be classified into three dimensions related to software quality, information quality, and service quality. However, some terms cannot be easily categorized into specific dimension. Thus, we further conducted co-occurrence analysis and qualitative analysis. Overall, this study identified the top 20 frequently appeared terms and classified them into software quality, information quality, and service quality. Software quality includes terms of update, app, log in, system, easy of use, mobile phone, account, programming, barcode, download, register, function, and inform. Information quality includes terms of update, point, password, redeem, membership, account, error, advertising, and push notification. Service quality includes the terms of convenience, redeem, FamilyMart, activities, products, coffee, and promotion. The overall rating of Open Point and FamilyMart apps were 2.17 and 3.06. The lower level of rating indicates the negative customer experiences of using these tow convenience stores' apps. These imply that the issues of software quality are the most needed to be improved in the convenience stores' app, followed by information quality, and service quality.

Specifically, customers of 7-11 Open Point app have more negative experiences in the software quality followed by information quality and service quality respectively. On the other hand, customers of FamilyMart app have more negative experiences in the software quality followed by service quality and information quality. In addition, the primary complaints in the online reviews are related to software quality such as these apps require to update frequently. The frequent request of updating app leads to negative customer experiences in using mobile apps. Easy of use of the apps is also a critical software quality of the mobile apps of convenience stores. It is no doubt that convenience is a critical service quality for mobile apps for convenience stores.

To answer the second research question, we further compared the most frequently appeared terms by rating. The second aim of this study is to investigate the quality attributes that contribute to satisfaction and dissatisfaction of the convenience stores' mobile apps. A rating of lower level such as 1 or 2 implies dissatisfaction with convenience store apps, where as a rating of higher level such as 4 or 5 on overall satisfaction indicates satisfaction with the experience of using these apps. We found that the top five terms for bad evaluations in Open Point app are update, log in, points, system, and password which are related to software and information quality. On the other hand, the top five terms for bad evaluations in the online reviews of FamilyMart app are update, app, points, inform, and log in. Quality attributes such as update, points, and log in are in the bad evaluations for both Open Point and FamilyMart apps. It is interesting to find that quality attributes in software quality and information quality are highly related to the customer dissatisfaction. In others words, quality attributes in software quality and information quality are the basic requirement for the development and design mobile apps in convenience stores. Problems with the quality attributes in software quality and information quality are urgent to be improved, otherwise, they will lead to negative customer experience. On the contrary, the top 5 terms for good evaluations in Open Point reviews are convenience, ease of use, update, points, and practicability which are primary related to information quality and service quality. On the other hand, the top five terms for good evaluations in the online reviews of FamilyMart app are convenience, ease of use, service, update, and practicability which are related to service quality and software quality. Convenience, ease of use, and practicability are the frequently appeared terms appeared in the good evaluations of both apps. It shows that convenience, ease of use, and practicability are three critical attributes that lead to customer satisfaction in the mobile apps of convenience stores. In general, customers value the quality attributes of convenience, ease of use, and practicability of mobile apps which lead to positive customer experiences.

Theoretical Implications

This study tries to fulfill the research gap by investigating the convenience stores' customer experiences of mobile apps from the online reviews. This study offers several theoretical contributions. First, this study proposes a theoretical model to investigate customer experiences in using mobile apps in the convenience stores. The proposed mobile app quality model serves as the theoretical foundation to analyze the collected dataset. Mobile app quality model is comprised of software quality, information quality, and service quality. The most frequently appeared terms in the online review of two mobile apps can classified into three dimensions of the mobile app quality model. In addition to the textual analysis, we further conducted qualitative analysis to deepen our understanding of customer experiences in using these two competing mobile apps. The qualitative interpretations of the online reviews compromise the limitations of text analysis. Second, we analyzed a large amount of unstructured data to identify the critical terms in online reviews of mobile apps. Prior studies in mobile apps focus on a relatively specific group of lead customers (Balapour et al., 2020). However, the large amount of unstructured online reviews from customers is a critical data resource that enables value co-creation between corporates and customers (Zhou et al., 2018). The key in the unstructured data analysis is to impose some type of structure on the analysis (Buschken & Allenby, 2016). Third, we applied a mixed-methods, text analysis and qualitative

analysis, to compromise the limitation of text analysis since linguistic content frequently contains noise and imprecision. Behavioral research has shown that text analysis can only approximate the authors' subjective opinions. The mixed-methods approach helps to better interpret customers experiences in three quality attributes dimension of using mobile apps. Forth, prior online reviews related studies primary focus on how reviews affect customers shopping decisions. However, little is known about how corporates can proactively respond to these reviews by incorporating features requests and mobile app quality attributes into new versions of mobile apps releases. This study contributes to the stream of customer-driven innovation literature with a large dataset. Our findings contribute to alleviate the research gap in the mobile apps sector and the development of digital transformation.

Managerial Implications

The managerial contributions can be concluded as follows. First, the findings of this paper provide practical insights for convenience stores in improving apps design, digital transformation and business sustainability. Specifically, this study demonstrates how advanced analytics could provide strategic business value. It aids convenience stores in strengthening their service design in mobile apps and digital transformation by competing with the help of analytics. This echoes the works of Prollochs & Feuerrieg (2020) that mining user data could create practical business value. Second, our findings identify the critical factors that lead to negative customer experiences in using mobile apps of convenience stores. The improvement of mobile apps helps to accelerate the development and implementation of digital transformation and business sustainability in convenience stores. Third, this paper follows a practice-based view on strategy which the goal is to help managers by focusing on practical techniques for developing strategies (Prollochs & Feuerriegel, 2020). These findings are based on a large amount of objective and factual data, online reviews. The findings from large volume online reviews contribute to the less-biased and valuable feedbacks for the improvement of mobile apps in convenience stores.

Limitations and Future Research

Although this paper overcomes some challenges, it remains limitations for future research. First, our findings primarily focus on the mobile apps of two leading convenience stores in Taiwan. Convenience stores in different countries may vary in the progress of digital transformation and customer experiences. Country difference and cultural differences leave the space for future research. Second, the customer online reviews change in different contexts and over time. Our findings provide some specific improvements for the mobile apps design of two competing convenience stores. However, they are time-sensitive and proprietary for the apps in the convenience stores. Future research can compare the apps of different convenience stores in different period of time to see the variation of time-series dataset. Third, our approach can only sense the apps performance as encoded in the narrative materials. Limitations may arise from the chosen sources of online reviews such as Apple app store or Google play. Future research can compare the difference from diverse sources or combine different data sources to circumvent any limitation.

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Appendix: More Text Cases for the Qualitative Analysis of the Online Reviews

Theme	Co-occurrence terms	Text
Software quality	*Convenient, update, system*	*"It is not convenient. It requires to update the system frequently."* – Open Point #20335
Information quality, service quality	*Update, balance, FamilyMart*	*"This app is awful. It often updated my balance three days later after my consumption, sometimes it even one week later. FamilyMart is much better then 7-11."* – Open Point #20348
Software quality, information quality	*Query, electronic receipt, update*	*"Excuse me. Can I query electronic receipt on the app? Please don't force to update my app."* – Open Point # 20361
Service quality, software quality	*Practical, easy of use*	*"It is practical and easy of use."* – Open Point #20438
Software quality	*Log in, update, Internet abnormal, function, Internet connection*	*"Log in after I updated the app. It showed the message of Internet abnormal but other functions worked well with the Internet connection."* – Open Point # 186
Software quality, information quality, service quality	*Query, points, balance, convenient*	*"It only allows to query points but not balance. It is not convenient."* – Open Point # 485
Software quality, information quality, service quality	*Redeem coffee, Internet connection, pre-paid coffee*	*"When I wanted to redeem coffee today, it showed Internet connection timed out. I can not get my pre-paid coffee and had to pay for it instead."* – FamilyMart #3026
Software quality, information quality, service quality	*Register, member, coffee*	*"Why don't you allow to register as a member?" I want to buy a cup of coffee."* – FamilyMart #3104
Software quality, information quality, service quality	*Exchange, point, product, return, flexibility, quality control*	*"It encourages to exchange points with the half-priced cookies. But the cashier charged my points with wrong product and he didn't return my points. He did not remind me to get the half-priced cookies either. Please add these flexibility and quality control in your app."* FamilyMart #3149
Service quality	*Practical, convenient*	*"It is very practical and convenient."* FamilyMart #3246
Service quality	*Open Point, advertising*	*"This app is much better than Open Point. The only disadvantage is the advertising."* – FamilyMart #3396
Software quality, service quality	*Notification, irritating, turn off, not easy to use, bad experience*	*"The notification is so irritating. It can not turn off the notification and not easy to use. I had very bad experience."* -FamilyMart #4641
Software quality, service quality	*Version, mobile phone, update, operation system, customer services, point*	*"Could you please don't limit the version of mobile phones? If I don't want to update the operation system in my mobile phone, I can't use my app. It is not reasonable. There is no response from the customer services after my calling. I can't use my points either."* FamilyMart.# 3425

About the Authors

Dr. Shu-Chun Ho is an associate professor in the Department of Software Engineering and Management at National Kaohsiung Normal University, Taiwan. She received her Ph.D. in Department of Information Management at National Sun Yat-sen University, Taiwan. Her papers have appeared in International Journal of Electronic Commerce, Electronic Commerce Research and Applications, Information Technology and Management, Pacific Asia Journal of the Association for Information Systems, Journal of Educational Technology and Society, and Journal of Mathematics, Science and Technology. Her current research interests include user experiences, service design, learning motivation, and gamification.

Dr. Yen-Ping Hsu received his master degree from the Department of Software Engineering and Management at National Kaohsiung Normal University, Taiwan. He is currently in the mandatory military service.