A systematic literature review and analysis on mobile apps in m-commerce: Implications for future research

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A R T I C L E   I N F O

A B S T R A C T

The use of mobile applications (apps) continues to grow. The literature on mobile apps is accumulating along with this growth, but the streams of research are still highly inconsistent and fragmented. A comprehensive and succinct review is needed that would help scholars and practitioners understand (a) the adoption of current mobile apps and (b) consumers' motivations, attitudes and behavior towards mobile apps. This study aims to organize and classify literature on mobile apps in m-commerce and assess the state of the art in order to facilitate future research. Content categorization was conducted on studies of mobile apps published between 2009 and 2018 in the business journals listed in the Journal Citation Reports. They were then analyzed in accordance with a systematic review approach involving interpretation-based assessment of the research methodology and key findings of these studies. Future research directions are also suggested for managerial and academic implications.

1. Introduction

The emergence of smartphones and new mobile technologies has drastically revolutionized people's expectations of their tele-communications devices. Mobile applications (apps) are known as mobile operating systems running on smart devices that offer advanced computing capability and a wide range of functions through application software (Logan, 2016). Mobile apps include small software programs designed to run on mobile devices performing various functions including but not limited to calendar, email, social networking, web browsing and online gaming (Hsiao and Chen, 2016). Mobile apps have not only changed consumer behavior by offering them platforms for entertainment, sharing opinions, obtaining information and making purchasing decisions, they have also transformed the strategies of business, marketing and promotion, building networks with existing customers and attracting potential customers (Cheung and To, 2017).

Even though many studies have been conducted on the subject, this area of mobile app research is still quite young with inconsistent findings from using various research methodologies. Given the significance of mobile apps to business strategies, there is a need to synthesize and summarize the existing literature. This study undertakes a comprehensive review of the mobile apps literature using a succinct classification system to help scholars and practitioners gain a deeper understanding of mobile apps. To the best of our knowledge, there has been no generic review of mobile apps, and thus this paper makes a relevant

and timely contribution to this field of research. This study aims to categorize, highlight, and analyze the key findings of previous studies in the m-commerce apps literature. The major streams of research, together with the types of methodology and key findings, are scrutinized in order to identify the important fields where mobile apps have been applied and studied, and what theoretical and practical implications have been drawn from these studies. This study contributes to the industry by strengthening the knowledge practitioners require in order to either take their initial steps or reinforce their recourse to mobile apps for strategic purposes. Scholars can also identify the research gaps that help them identify the literature gaps and locate the positioning of their research in future studies.

1.1. The concept of mobile apps – Definition

The definition of mobile apps varies in different studies. On one hand, Chang (2015) defines mobile apps as software or applications for performing specific tasks or functions for the user and are suitable to run on different mobile devices including electronic devices, phones and smartphones. On the other hand, Hsu and Lin (2015) define mobile apps as the mobile application software for mobile devices for general productivity and information retrieval purposes including (a) contact management, calendar, email, stock market quotes and weather information searches to (b) other categories of apps such as games, social networking platforms, utilities, ebooks as well as (c) others offering

Google Scholar

↓

Time frame 2009-2018

↓

Keywords: Mobile apps, mobile applications, apps business, apps marketing

Selected ↓

Excluded ↓	*Excluded* ↓	*Excluded* ↓
273 articles in learning/education/social science	322 articles in medical/fitness/ health care	311 articles in engineering/ computer science

453 articles in commerce & marketing

Selected ↓

Excluded ↓	*Excluded* ↓	*Excluded* ↓
99 papers in Non-JCR	81 conference papers	66 books/ business articles

207 papers in JCR journals

Selected ↓

Excluded ↓

84 articles with main theme focusing on apps in commerce and marketing context were selected

Articles mentioning the term "apps" but where the focus of the study is in other areas were excluded.

Exclusion scope 1: Although the term "apps" appeared in the paper, they focused on social media such as Facebook usage rather than the app itself so these studies were excluded.

Exclusion scope 2: Big data/digital marketing (the term "apps" was mentioned in the paper because apps are one of the tools to collect big data/perform digital marketing). Yet the focus of the papers is not on apps so they were excluded.

Exclusion scope 3: mobile usage (some papers discussed mobile phone/smartphone behavior such as privacy concerns using smartphones. The major focus was not on apps usage so they were excluded.
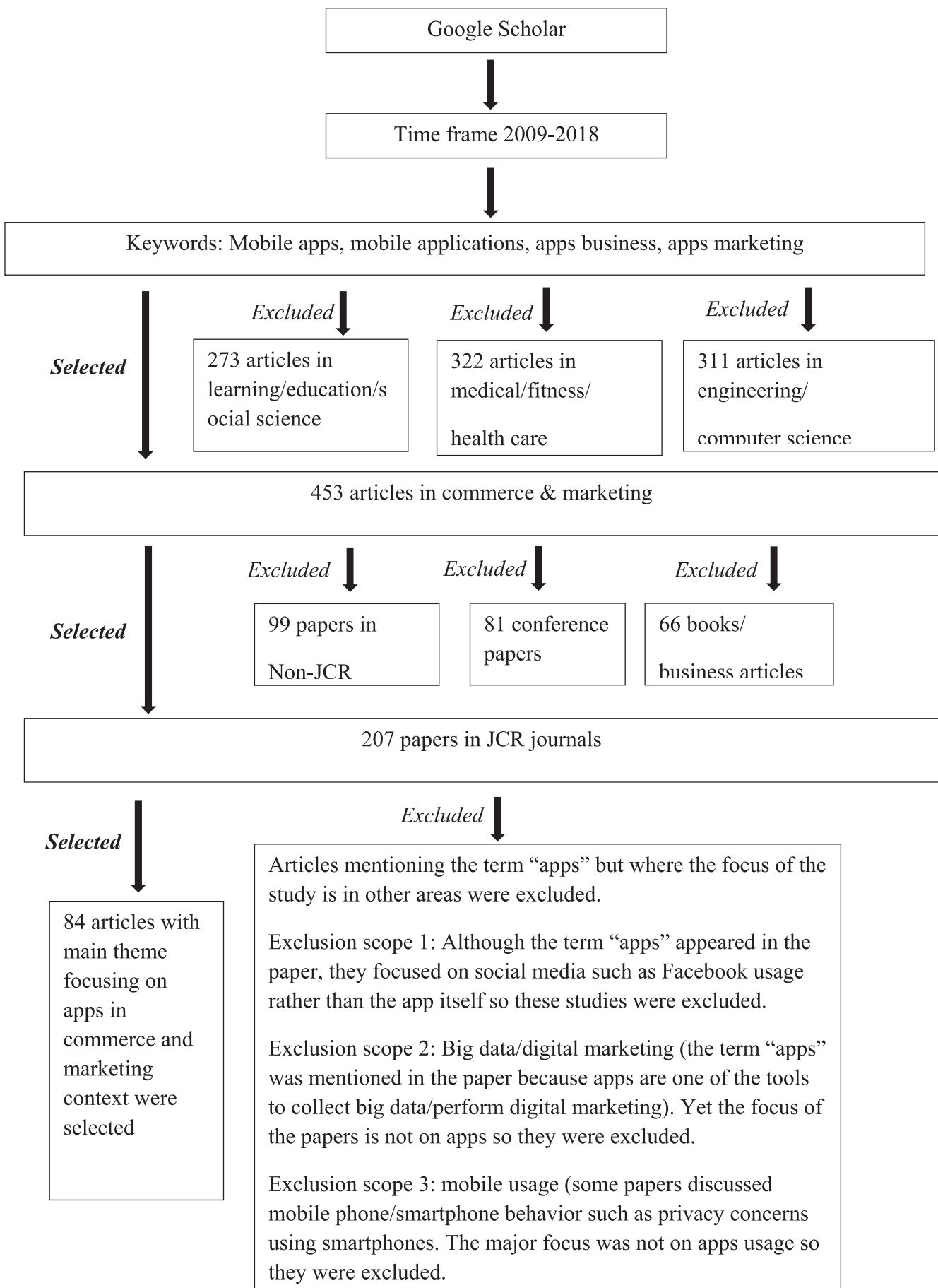
Fig. 1. Selection and exclusion procedures in the methodology.

Table 1
The core theories applied in the app literature.

Core theory applied	Authors	Examination of studies
Technology acceptance model/Extended technology acceptance model	(Rese et al., 2017)	Adoption of Augmented Reality (AR) technologies in retailing
	(Gurtner et al., 2014)	Adoption of mobile apps for different age groups
	(Yang, 2013)	Consumers' acceptance of mobile apps
	(Hur et al., 2017)	Comparison between millennial and mature customers in usage intention in apps
	(Kang, 2014)	Factors influencing intention of mobile app usage
	(Lee et al., 2017)	Factors influencing the behavioral intention to use food delivery apps
	(Leon, 2018)	Millennial's intention to use service mobile apps under the moderating effect of gender
Signaling theory	(Shen, 2015)	Adoption of mobile apps with moderating effect of product type and message framing
Theory of uses and gratifications	(Yang, 2013)	Consumers' acceptance of mobile apps
	(Rauschnabel et al., 2017b)	Mobile app game adoption
	(Wei and Lu, 2014)	Antecedents of playing app games
	(Lu and Wei, 2014)	Antecedents of playing social games apps
	(Logan, 2016)	Attitudes towards in-app advertising:
Theory of Planned Behavior	(Yang, 2013)	Consumers' acceptance of mobile apps
	(Carter and Yeo, 2016)	Mobile apps usage by business undergraduates and postgraduates
Perceived value theory	(Hsiao and Chen, 2016)	In-app purchase intention for mobile games
Flow theory	(Rauschnabel et al., 2017b)	Mobile app game adoption
Expectation confirmation theory	(Lu et al., 2017)	The impact of perceived enjoyment and mobility on user continuance intentions
	(Ding and Chai, 2015)	Emotions and continued usage of apps
	(Hong et al., 2017)	User satisfaction with social apps
	(Hsu et al., 2015)	The effect of unexpectedness and confirmation on app users' delight, satisfaction, customer citizenship behavior and continuance intention
Adaptive expectation theory	(Chen and Fu, 2018)	Effects of perceived value in the mobile moment
Ambivalence theory.	(Wan et al., 2017)	The effectiveness of app-bundling strategy
Motivational theory	(Ozturk et al., 2016)	Continued usage intention of hotel booking app
	(Kang, 2014)	Factors influencing intention of mobile app usage
Self-determination theory	(Ozturk et al., 2016)	Continued usage intention of hotel booking app
Habit theory	(Hsiao et al., 2016)	Factors in continuance usage of social apps
Cognitive dissonance theory	(Merikivi et al., 2017)	Antecedents of enjoyment and its effect on continuance intention
Resistance theory.	(Chen et al., 2018)	The effects of adoption barriers and knowledge of alternatives quality on the resistance behaviors and moderating effects of satisfaction with off-line service.
Big Five Trait Theory	(Xu et al., 2016)	The impact of personality traits on mobile app adoption
Rational addiction theory	(Kwon et al., 2016)	Addictive dependence on mobile social apps
Unified theory of acceptance and use of technology 2 (UTAUT2)	(Hew et al., 2015)	Mobile app usage intention
	(Chopdar et al., 2018)	m-shopping apps adoption and perceived risks
	(Gong et al., 2018)	Factors of continue using mobile social apps
	(Peng et al., 2018)	Moderating effects of app type on the intention of continued use of mobile apps
Identity theory	(Oyedele and Simpson, 2018)	Perceived consumption values and self-identity related to streaming apps
Diffusion of Innovations theory	(Karjaluoto et al., 2019)	Perceived value and the use of mobile financial services apps
	(Kim and Baek, 2018)	The effect of time convenience, interactivity, and compatibility on mobile app engagement which leads to relationship commitment and self-brand connections.
Environmental psychology perspective	(Song et al., 2014)	Satisfaction in app stores
Elaboration likelihood model	(Gu et al., 2017)	Privacy concerns for mobile app download
Dimensional theory of emotion, schema theory	(Chou and Wang, 2016)	Effects of happiness types and happiness congruity on game app advertising
Theory of the niche	(Lee and Shin, 2016)	Selection of potential active users for advertised apps based on users' previous app usage behaviors.
Personalization-privacy theory	(Morosan and DeFranco, 2016)	Intentions to use hotel apps to personalize hotel services
Telepresence theory and social capital theory	(Tang, 2017a)	Success factors of app game

access to information in aspects of business and finance, entertainment and lifestyle. To meet our objective of presenting a comprehensive integrated view of the published business literature on all aspects and facets of mobile apps to facilitate further studies, practice and research, we summarize and define mobile apps in a broader context as "*mobile application software designed to support the functions of performing tasks on smartphones, tablet computers, and other personal mobile devices*".

2. Methodology

A systematic review process was followed to ensure the validity and reliability of our research (see Fig. 1).

First, searching was performed using the Google Scholar search engine using the keywords "mobile apps" or "apps", "apps business", "apps marketing". As the field of research in mobile apps is quite new, the time frame of the publications was from 2009 to 2018. Start year 2009 was picked because Apple's app store was launched on July 10, 2008 and mobile apps have been widely adopted since then (Apple Inc, 2008). Studies in the commerce and marketing literature were selected

while articles in other fields such as learning/education/social science, medical/fitness/health care, and engineering/computer science were excluded so that this study could provide highly relevant insights to business scholars and practitioners. Among the app studies available in the commerce and marketing contexts, journal papers listed in the Journal Citation Reports (JCR) were selected. Conference proceedings, books and articles, and papers which were not published in the JCR list were excluded to assure the findings analyzed in this paper were credible and reliable.

Among the selected JCR journal papers, categorization was conducted to verify whether the literature identified was relevant to mobile apps. Articles that mentioned the term "apps" but their focus of the study was in other areas were excluded.

Exclusion scope 1: Some studies examined social media such as Facebook. Since Facebook has both desktop and app versions, and the study focused on social media usage rather than on the app itself, meant such studies were excluded.

Exclusion scope 2: Big data/digital marketing. The term "apps" was mentioned in the paper because apps were one of the tools to collect big

data/perform digital marketing. The focus of those papers was not on apps, however, so such studies were excluded.

Exclusion scope 3: Mobile/smartphone usage. Some papers discussed mobile phone/smartphone behavior such as privacy concerns using smartphones. The major focus was not on apps usage so they were also excluded.

Eighty-four journal papers were finally selected. An evaluation grid was generated by categorizing the studies of mobile apps in terms of the respective study type, research methodology, theme, and key constructs. Content analysis and summarization were used to identify the key findings.

3. Systematic categorization and analysis

3.1. Research methodology, key variables and core theories applied in the literature

After categorization, 11 qualitative conceptual studies and 73 quantitative empirical studies were identified. Surveys, experiments and secondary data bases were common research approaches among the empirical studies. Studies also used a wide variety of analytical methods such as structural equation modeling (SEM), regression modeling, and ANOVA/MANOVA to test the hypotheses and draw findings from the data. Appendix 1 (see Table A1) shows the types of studies, themes, and key research variables in the quantitative empirical studies. Cross-sectional surveys were the most commonly adopted methodology. Longitudinal studies and experimental studies which reflect actual behavior instead of perceptual answers were relatively few in the literature.

Table 1 shows the core theories that have been adopted in the studies. Among a wide variety of theoretical lens, technology acceptance model/extended technology acceptance model, theory of uses and gratifications, expectation confirmation theory, unified theory of acceptance and use of technology 2 (UTAUT2) were most commonly adopted.

3.2. Streams of studies categorized in mobile apps e-commerce literature

The literature review and analysis (Appendix 1) reveals that mobile apps have been approached across rather diverse fields as reflected in the various topics and themes. Some studies focused on the firms' perspectives, while others investigated the customers' perspectives. This paper identified three main streams in the existing mobile apps literature (Fig. 2). These streams are 1) branded apps as supportive tools, 2) apps as revenue-generating business tools, and 3) consumer attitudes and behaviors in using mobile apps.

3.3. Definition and differences between branded apps and revenue-generating business apps

3.3.1. Definition of branded apps

Various types of mobile apps exist. Some apps are launched by brands such as Adidas, Coca Cola, HSBC to support their business functions such as promotions, on-line purchases, and customer engagement. They are referred to as "branded apps". Bellman et al. (2011) defined branded apps as 'software that is downloadable to a mobile device and prominently display a brand identity, normally through the name of the app and the appearance of a logo or icon of a brand throughout the user experience'.

Among the top 100 Best global brands Ranking in 2018, 96 brands launched apps on Apple iOS app store and 92 brands launched their apps on Google Play (See Table 2). The high penetration rate illustrates apps have become an essential strategic tool in branding.

3.3.2. Definition of revenue-generating business apps

In the market, other than branded apps, some apps are launched as a

business itself that aims to generate revenue (Roma and Ragaglia, 2016; Tang, 2016). There are four common business models in the current mobile apps market; namely (a) paid (b) freemium (c) paidmium and (d) in-app advertising models (Tang, 2016). The top 10 most popular Apple App Store categories as in May 2019, by share of available apps, were games (24.63%), business (9.76%), education (8.52%), lifestyle (8.33%), entertainment (5.99%), utilities (5.18%), travel (3.89%), health & fitness (3.04%), food & drink (2.92%), and book (2.87%) (Statista, 2019). Global consumer spending on apps reached US$101 billion in 2018, while games accounted for 74% of consumer spending in the app stores (App Annie, 2019).

3.3.3. Differences between branded apps and Revenue-generating business apps

Branded apps and revenue-generating business apps are different in nature (Table 3). Branded apps are usually created by existing brands, like retailers, for supporting current business operations such as brand building, promotions and online purchases. Thus, these branded apps normally exhibit different brands or corporate elements such as logos, mascots and brand or corporate colors that have positive persuasive impact for increasing brand interest (Zhao and Balagué, 2015). Revenue-generating business apps, however, are developed by mobile app software houses or individuals for direct profit-making through apps.

3.3.4. Branded apps as business supportive tools

Branded apps can be regarded as the mobile versions of online sites that companies often design and launch when their business expands to the mobile platform (Kim et al., 2017). Branded apps are either pre-installed on handheld devices including smartphones and tablet computers or downloadable from various mobile app stores such as Apple's Store and Google Play (Alnawas and Aburub, 2016). Branded mobile apps can be trialware that contain all the functionality of the apps while its use is limited to a specific period of time - payment is needed beyond that period. They can also be freeware that allow consumers to use the basic functions irrespective of time and can also be upgraded to the full version (Alnawas and Aburub, 2016).

Zhao and Balagué (2015) classified branded apps into five dimensions, namely tool-centric, game-centric, social-centric, m-commerce centric and design-centric apps: tool-centric apps aim at communicating brand values and products so that they enhance brand awareness; game-centric apps are designed by companies to create an immersive environment through the use of various brand elements and to manage customer relationships; social-centric apps are designed to target socializing for fun; m-commerce-centric apps are mainly for product selling while design-centric apps are for communicating brand value. Companies can use apps to create personalized content that promotes brand engagement (Watson et al., 2013).

3.3.5. Values and functions of branded apps

As apps drive most of the media time spent on mobile devices, companies utilize apps to reach and "stay in touch" with mobile consumers (Fulgoni, 2015). The user-friendly nature of the apps, which offer "anytime anywhere" interactive communications, helps deliver better customer experiences and increases customers' enjoyment (Bellman et al., 2011; Chang, 2015; Kim et al., 2015). Branded apps are mainly for supporting the operations of current businesses, including the marketing, brand promotion, communication and customer relationship management functions. Business models such as Airbnb and Uber provide complementary services to their customers using apps (Kannan and Li, 2017). Apps are gaining popularity as effective marketing tools because customers can be highly engaged without perceiving the apps as advertising (Bellman et al., 2011; Gupta, 2013). They are even more attractive if made available to customers at no cost (Stocchi et al., 2017). Trust building is facilitated since the apps are not directly linked to product selling but to entertaining customers and advocating for their needs beyond the corporate revenue of a company
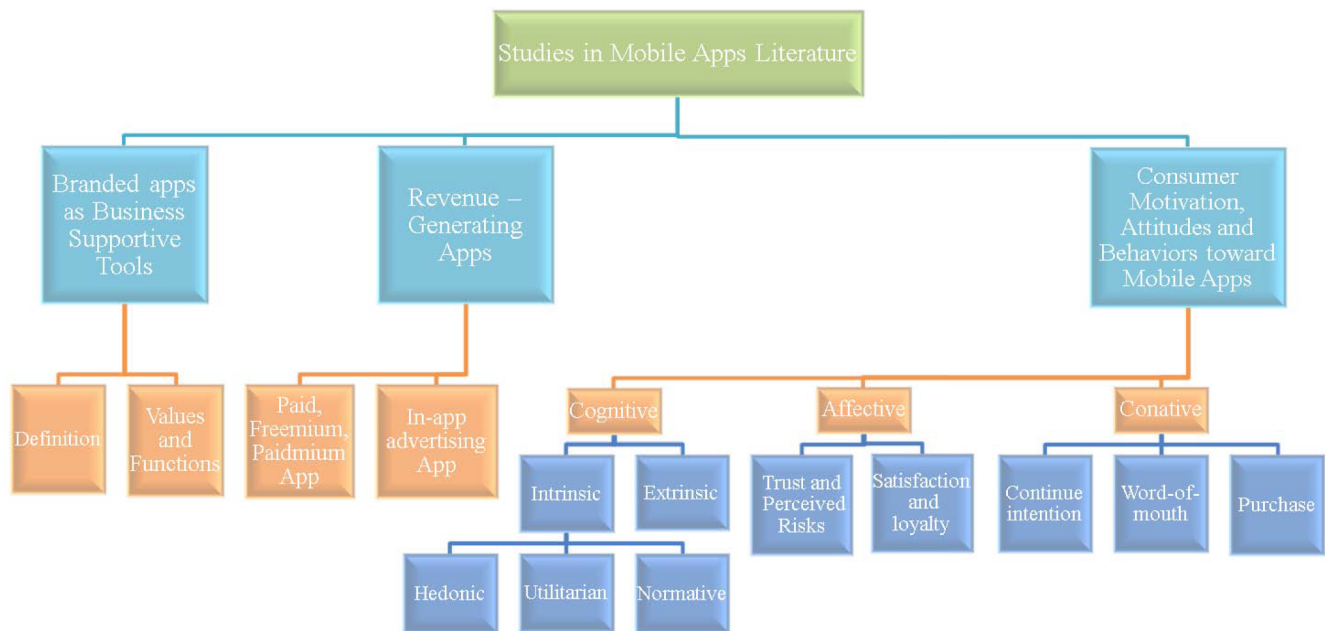
Fig. 2. Classification based on themes in the mobile app literature.

(Urban and Sultan, 2015).

Customer relationship management (CRM) can also be supported by branded apps that help collect user information, generate product recommendations, enhance engagement with loyal customers, and thus help manage the relationships between the brand and the customers (Stocchi et al., 2017; Zhao and Balagué, 2015). Allowing users to share new ideas for products, branded apps can also assist in product innovation and development. Branded apps can also facilitate marketing research by helping a company survey its users in new ways, all the while providing marketers with value-added information to understand consumer behavior better (Zhao and Balagué, 2015). Branded apps can help customers in decision making by suggesting related products based on their purchase history, thereby leading to increased sales and improved profitability (Urban and Sultan, 2015). Empirical findings indicate that continued use of branded app increases future spending and, conversely, their spending levels decrease when they discontinue using the app (Kim et al., 2015).

Branded apps, in short, are regarded as supportive tools for business that help enhance brand image and sales.

3.3.6. Revenue-generating business apps monetization models (paid, freemium and paidmium)

Mobile apps can earn profit directly from customers with three major models: paid, freemium and paidmium models. Paid model apps usually earn from the purchase of the apps on their own through charging users directly for downloading the apps from the app stores—and without any in-app purchase (Tang, 2016). Some apps are made available to consumers at a price as a way to convey a sense of uniqueness, enjoying a price-quality advantage over a large number of free apps in the market (Stocchi et al., 2017).

Freemium model apps are offered for free but have limited or time-expiring features or functionalities. They can also be in a trial form that offers users the chance to experiment with the product before committing to upgrade (upon payment) to a higher value version. Freemium apps earn mainly from in-app purchases that allow users to purchase extended features such as in-game gemstones (virtual game currency) as well as extending play time and eliminating features restrictions (Tang, 2016). Although virtual game items do not exist or carry little value in the real-world, users buy them inside the game app for functional values or aesthetic benefits (Lee and Shin, 2017). Freemium apps account for the highest percentage in the apps stores (Tang, 2016).

Apps within the paidmium model combine both paid downloads and in-app purchases for added revenue. This business model is commonly found in informative apps such as maps and in the navigation and dictionary categories (Tang, 2016).

Table 2
The number of top 100 Best global brands in 2018 that launched apps on Apple Store and Google Play.

Categories	Total no. of brands in that category	Brands that launched apps on Apple iOS Store	Brands that launched apps on Google Play
Apparel/fashion/jewelry /accessories/cosmetics/	14	13	12
Automotive	15	15	15
Banking/Financial services/professional services	13	13	13
Food processing/Beverage/brewery)	12	10	8
Computer hardware /Cloud computing/ software	12	12	11
Retail (Food and beverage)	3	3	3
e-commerce/mass media/entertainment	9	9	9
Conglomerate/ Consumer electronics/toys	10	10	10
Manufacturing/heavy equipment/oil & gas	4	4	4
Consumers goods (health care/personal care)	5	4	4
Delivery services/supply chain management	3	3	3
	100	**96**	**92**

Table 3
Differences between branded apps and revenue-generating business apps.

	Branded apps	Revenue-generating business apps
Developer	Existing brands such as retailers (e.g. Nike, Wal-Mart, Pizza-hut)	Mobile app software houses or individuals
Purpose	To support the operations of current business (e.g. brand building, promotion, online purchase)	To earn profit directly through apps
Brand elements (e.g. logos, mascots, brand color)	The app adopts the same brand elements as those of the parent brand	The app is a brand itself with its own brand elements

3.3.7. Models with revenues generated from business partners (In-app advertising)

Some apps are completely free of charge, yet they can earn profits through in-app advertising. Revenues are not directly generated from end customers but business partners. They are monetized by means of advertising or through non-personally identifiable data selling (Roma and Ragaglia, 2016). In-app advertising involves advertisements that appear periodically within a mobile app and earn profits based on the impressions and conversions of advertisements (Tang, 2016). In-app advertisements target users according to their personalization criteria such as app types and device characters (Cheung and To, 2017). They induce target users to click and watch the advertisement by offering in-app items to app users such as virtual game currency and items (Tang, 2016).

Product placement is a kind of paid form of advertising utilized by marketers in apps (Lin, 2014). This business model is most commonly found among mobile game apps that refer to gaming applications that are played on small mobile handheld devices such as a smartphone or tablet computer with wireless communication functionality (Roma and Ragaglia, 2016). Lin's (2014) study examined app users' attitudes towards products placed in game apps and found that gamers who have more positive attitudes towards product placement were more likely to display stronger purchase intentions. It was also found that consumers were most tolerant of in-app advertising when it was encountered in apps used for assistance and informational purposes (Logan, 2016). Particularly, the advertising effect in app games was examined in Chou and Wang's (2016) study in which red backgrounds (vs. gray and blue) and promotional incentives have better ad effects.

3.4. Literature gap in studies of branded apps and revenue-generating business apps

Previous studies on branded apps have focused on how the apps affect the brand image and customer purchase intentions, such as continued use of the branded apps increased future spending by providing an interactive engagement with the brand on a habitual basis (Kim et al., 2015). Content analysis revealed that global brands employ customization engagement attributes (vividness, novelty, motivation, control, customization, feedback, and multi-platforming) in their branded apps (Kim et al., 2013). Free branded apps were found to attract more users and strengthen the brand image (Stocchi et al., 2017). Most of the studies focused on the brand image and influence on sales, yet there are relatively few studies that examine the impact of branded apps on positioning and differentiation strategies of the brand.

Most of the studies on branded apps were carried out in retail, banking and hotel contexts such as the impact of retail apps on positive WOM (Kang and Kim, 2015), how mobile augmented reality shopping apps enhance the shopping experience (Dacko, 2017), how perception in usage and demographic characteristics of users affect mobile banking app adoption (Veríssimo, 2016), and usage intention of apps in a hotel booking environment (Ozturk et al., 2016). Studies in other contexts such as automotive, fast moving consumer goods, and delivery services are relatively scarce despite the real-business situation in which apps are also widely adopted in the above mentioned industries.

For literature on revenue-generating apps, monetary value of apps has been widely studied such as mobile app-bundling strategy (Wan

et al., 2017), customers' lifetime value in app business model (Voigt and Hinz, 2016), in-app purchase intention (Hsiao and Chen, 2016), and in-app advertising (Hao et al., 2017). Gaming apps are one of the most commonly examined contexts due to the prominence of gaming apps in the global app market with the highest download rate and largest revenue generated among all app categories (Rauschnabel et al., 2017b; Tang, 2017b). Other contexts studied include mobile social apps (Gong et al., 2018), food delivery apps (Lee et al., 2017), and video and music streaming (Oyedele and Simpson, 2018). Studies in revenue-generating apps mainly focused on technical levels such as how to generate more profit and increase customer engagement. Yet relatively few studies investigated the strategic level such as how to create sustainable competitive edge to outperform the competitors.

For both of the studies in branded apps and revenue-generating apps, customer responses are the major stream. In the coming section, customer motivation, attitudes and behaviors in using mobile apps are reviewed in detail grounded on cognitive (think), affective (feel) and conative (do) perspectives.

4. Consumer responses (motivation, attitudes and behaviors) in using mobile apps

In the literature, many scholars show their interest in studying consumer attitudes and behaviors in using mobile apps. Despite the fact that all these studies are consumer attitude/behavior related, studies focus on different themes and stages in the mental processes of app users. In order to categorize the results of these findings systematically, this article utilizes the classic framework from Kolbe's (1990) cognitive-affective-conative model that illustrates three major dimensions in the processes of our mind concerning why we do things the way we do. Cognition refers to the thinking and understanding process; affective refers to our emotional response or evaluative judgment (Kolbe, 1990). Compared with cognitive thinking, affective feeling is more enduring (Chitty et al., 2011). Finally, conative is regarded as our behavioral action or choice of purchase (Kolbe, 1990; Ray, 1973).

We categorized the key insights and findings from consumer responses in the mobile app literature into the cognitive (think), affective (feel) and conative (do) perspectives.

4.1. Cognitive perspective (thinking and motivation)

Numerous studies have examined cognitive factors such as the perception of and motivations for using mobile apps. This article categorizes these factors into two groups: intrinsic subjective factors and extrinsic objective factors. Subjective factors are related to intrinsic thinking (e.g. I play the game because I want to be happy, I want to have a sense of achievement; I want to find the map of a place conveniently); while objective factors are related to extrinsic aspects such as the feature of the apps (e.g. game, music or news), and where the apps are downloaded (e.g. Apple App Store or Google Play Store).

4.1.1. Intrinsic subjective factors in the cognitive dimension
4.1.1.1. Hedonic motivations. Hedonic refers to pleasant or unpleasant sensations in the cognitive process. When people are more dependent and connected to a mobile device, the sense of importance will positively affect the emotional benefits they get from apps (Kang

et al., 2015). Some apps are designed with fun and entertaining elements to induce usage attention (Hew et al., 2015). For example, having enjoyed watching the anime "Pokemon" in the past drives users to play the app game "Pokemon Go" (Rauschnabel et al., 2017a; Tang, 2017b). Enjoyment and app aesthetics are found to have positive effects on user satisfaction and app continuance intention (Xu et al., 2015).

People may use mobile apps when they want to engage in leisurely activities or escape boredom; entertainment is thus one of the motivations that influence continuance intention (Kang, 2014). Hur, Lee and Choo (2017) studied the impact of playfulness on usage intention for consumers of different ages, and found that the impact on mature consumers was higher than that on millennial consumers. Hedonic benefits and personal integrative benefits were found to influence consumer satisfaction to different degrees that further generated purchase intentions (Alnawas and Aburub, 2016).

4.1.1.2. Utilitarian motivations. While hedonic motivations relate more to emotional or experiential aspects, utilitarian motivations are related to functional, rational, practical, or extrinsic benefits (Martínez-López et al., 2014). Utilitarian benefits can be related to app utility and quality, performance expectancy and effort expectancy, as well as economic orientation when people seek to obtain the best value at the lowest price (Kang and Kim, 2015; Xu et al., 2015). Ease of using the app is considered the top priority, while the fundamentals of continuance intention lie in the mobile app traits that are easy to access, download and use (Kang, 2014). The design and information quality of mobile apps, which are regarded as the performance of an app, also have a positive impact on customer engagement with mobile apps (Tarute et al., 2017).

Hew et al. (2015) discovered that performance expectancy significantly influences behavioral intention—that consumers would use the mobile apps if they find them useful in daily life. Similarly, other performance aspects such as app utility and app quality also have positive effects on user satisfaction and app continuance intention (Xu et al., 2015). Hur et al.'s (2017) study found that millennial consumers tended to focus on utilitarian value since they were accustomed to using innovative services, and the age of the user played an important role in accepting and using new information technology. Learning benefits and personal integrative benefits were also found to influence consumer satisfaction and create purchase intentions (Alnawas and Aburub, 2016).

While hedonic and utilitarian motivations are examined separately, some studies also suggested relationships between the two constructs. Empirical findings indicated that enjoyment in a mobile app game was driven by the system's capacity of regeneration, visual attractiveness and easy-to-use interface (Merikivi et al., 2017). Hur et al.'s (2017) research echoes the findings that a stronger perception on the app's ease of use would increase the perception of its usefulness and playfulness, which would subsequently increase the perception of enjoyment when using the service.

4.1.1.3. Normative social factors. Normative social factors are widely examined in studies of cognitive consumer behavior in using mobile apps. Social norm is defined as the degree to which a user believes that other people expect him or her to perform a particular action (Rauschnabel et al., 2017a). People participate in activities to seek gratification for social identity and social relationships (Logan, 2016). Social utility motivations positively influenced continuance intention, but communication motivations were not directly related to continuance intentions (Kang, 2014). A similar viewpoint is supported by other scholars that social influences do not significantly affect behavioral intention (Hew et al., 2015) and interaction features are insignificantly correlated with customer engagement with mobile apps although social networking applications are most commonly used (Tarute et al., 2017). Rauschnabel et al.'s (2017a) study found self-concept drives players' positive attitudes towards playing the game

while social norms only show partially significant effects on the intention to continue playing app games and in-app purchases. In the context of in-app advertisements, social norms were found to positively predict users' intention to watch in-app advertisements, which in turn affected their behavioral response (Cheung and To, 2017).

4.1.2. Extrinsic objective factors

While intrinsic thinking and feeling are subjective, scholars suggest extrinsic objective features such as types of apps, payment models (free, paid, freemium, paidmium), rating and ranking may affect the behavior of app users.

The types of apps influence users' attitudes toward using the app. Informative apps can increase consumers' trust in and preference for a company through building brand image and consumers' consideration, preference and purchase intention (Chang, 2015). If apps can provide consumers with helpful information, that can increase consumers' trust in and preference for the brand or company (Urban and Sultan, 2015). Apps with higher app ratings are found to have a direct impact on intention to purchase paid apps (Hsu and Lin, 2015). Users displayed a stronger attitude toward using a game app when the reputation source is top of the charts that show apps' popularity, while attitude toward a dictionary app is stronger when reputation draws on users' rating scores (Shen, 2015). Perceived app popularity also makes users less concerned about privacy (Gu et al., 2017).

Yet, functionality features in apps such as mobile payment and screen touching are not positively related to the emotional dimension (feelings and emotions directed to using a particular mobile app) of customer engagement in a mobile app (Tarute et al., 2017). To compare the usage context between web and mobile apps, findings suggest that users have greater perceptions of performance quality values and feel the quality on the web is better than in mobile apps (Chang, 2015).

The effects of payment models (paid, free, freemium, paidmium) on app revenue performance measured by the app daily revenue rank in different app stores were studied by Roma and Ragaglia (2016). Their results showed that the app daily revenue rank of paid and freemium models were equivalent in Apple's App Store, and both models were more effective than the free model in terms of app revenue performance. In Google Play, no significant variations were found between paid and free revenue models, but the freemium model was found to be less effective than the free model (Roma and Ragaglia, 2016). Arora et al (2017) found that although the practice of offering free versions of paid apps was popular, it was negatively associated with paid app adoption; and this negative association between free version presence and paid app adoption speed was stronger both for hedonic apps and in the later life stages of paid apps. Another study suggested that while consumers' opinions on product quality occupied a larger portion of consumer reviews, their comments on service quality had a stronger unit effect on sales rankings of the app (Liang et al., 2015). In the context of in-app advertising, consumers were most tolerant of the advertisements when they were encountered in apps used for assistance and informational purposes (Logan, 2016).

4.2. Affective perspectives (attitudes and feeling)

While the cognitive dimension is related to thinking and motivation, studies in affective perspectives scrutinize feelings and attitudes. Attitude refers to a general and somewhat enduring feeling or evaluative judgment of an issue (Chitty et al., 2011) For example, providing promotional incentives in ads improves ad and product attitudes (Chou and Wang, 2016). Satisfaction and loyalty are classified as affective because they are the scrutinized feelings towards a company or the app after a sequence of events. Trust and perceived risk are classified under the affective perspective because they involve the judgement of an issue and are relatively long-lasting once they are built. Formation of trust involves repeated evaluation on transaction experiences and satisfaction (Siau and Shen, 2003). Similarly, perceived risk arises from

judgments of various factors such as economic incentives, search cost, quality and reliability (Salam et al., 2003). Once perceived risk is formed, it shows persistence or changes very slowly (Slovic et al., 1980). Therefore, trust and perceived risk are classified as "affective".

4.2.1. Satisfaction and loyalty towards the apps/ brands

Satisfaction and loyalty have been found to be the key constructs that link cognitive motivation with behavioral outcomes. Utilitarian and hedonic benefits are found to directly influence satisfaction with apps, which in turn positively affect the continuance intention and intention to recommend the apps to others (Xu et al., 2015). Factors such as perceived playfulness, connectedness, rewards, price and access flexibility are found to significantly impact loyalty to mobile games, which in turn positively affect a player's intention to make an in-app purchase (Hsiao and Chen, 2016). In the context of branded apps in particular, customer satisfaction would lead to greater purchase intentions (Alnawas and Aburub, 2016). However, if customers are satisfied with offline service, even when they perceive the alternative apps from other companies are more useful, they are less likely to switch to other branded apps (Chen et al., 2018). It is interesting to note that perceived price and social integrative benefits do not significantly influence consumer satisfaction (Alnawas and Aburub, 2016; Xu et al., 2015). A study also indicated that satisfaction was not significantly related to the continuance intention of mobile social apps (Gong et al., 2018).

4.2.2. Trust and perceived risks

Trust has been identified as an antecedent of mobile users' attitudes toward in-app advertisements that further affect mobile users' intention to watch the in-app advertisements (Cheung and To, 2017). In addition, perceived risk such as physical and data privacy risks were also examined in previous studies. Perceived permission sensitivity makes users more concerned about privacy, while permission justification and perceived app popularity make them less a concern (Gu et al., 2017).

Rauschnabel et al.(2017a) found physical risks, but not data privacy risks, hinder consumer reactions in playing app games. Empirical results suggest that perceived risk moderates an app reputation's effect on users' attitudes toward the app; that high-rating score reputation's effect is greater when users are in high perceived-risk situations (Shen, 2015). In the context of mobile social apps, trust plays an important role in continuance intention (Gong et al., 2018).

4.3. Conative (Behavioral outcomes)

There are several key desired behavioral outcomes on mobile apps usage. Intention to continue mobile app usage, recommend others to use the app (word-of-mouth), and purchase (buy the app/in-app purchase) are the three common research focuses.

4.3.1. Continue intention

Tarute et al. (2017) studied mobile apps users' intention to continue usage and found that consumer engagement was positively correlated to users' continuance intention. In other words, higher consumer engagement led to higher user intentions to continue using mobile apps. Behavioral intention to use mobile apps was significantly influenced by habit (Hew et al., 2015). Cheung and To (2017) discovered that attitude towards in-app advertisements and perceived behavioral control were positively related to the intention to watch in-app advertisements.

4.3.2. Word-of-mouth (recommendation)

When users are more satisfied with the apps, their intention to recommend the apps will become stronger. As mentioned earlier, intention to continue using apps, satisfaction with apps and the hedonic benefits obtained from using apps have direct influences on users' intentions to recommend the app (Xu et al., 2015). Kang and Kim's (2015) study showed that positive word-of-mouth behaviors were

positively influenced by multidimensional perceived benefits including conditional epistemic benefit, social self-concept benefit, emotional benefit and functional benefit of mobile local-based services apps (Kang and Kim, 2015).

4.3.3. Purchase (buy the app/ in-app purchase)

Whether the app users make a purchase or not is always the top concern of apps developers because it is directly linked to the amount of revenue gained. Empirical findings show that perceived value-for-money and social value significantly affect intention to purchase paid apps; non-paying player's intention is determined only by subjective factors including perceived good price. App rating was also found to be a significant factor influencing consumers' intention to purchase paid apps (Hsu and Lin, 2015). This shows that users' reviews were crucial in motivating purchasing intention. Besides, demographic factors such as gender and income can be influential factors in affecting purchase intentions of paying players (Hsiao and Chen, 2016).

4.4. Inter-linkage of consumer responses (cognitive, affective and conative)

It should be noted that cognitive, affective and conative components are inter-related and the sequence may vary, as suggested by Michael Ray (1973). While cognitive refers to learning and understanding and affective refers to feeling and emotional response, conative behavior refers to action outcomes or choice to purchase in the context of buying decisions in which different sequences would dominate in different situations (Ray, 1973). In order to sum up the findings of past studies that examine consumer motivation, attitudes and behavior, Table 4 summarizes the key findings of past studies by examining consumer responses from cognitive, affective and conative perspectives.

4.5. Moderators and mediators examined in app literature

Among the app literature, app types were found to be significant moderators. Among various app types, hedonic apps and utilitarian apps moderated reputation source's effect on users' app attitude (Shen, 2015); social networking, gaming and productivity apps were also found to moderate the intention of continued use (Peng et al., 2018); and informational and experiential mobile apps moderated the effects of time convenience, interactivity, and compatibility on mobile app engagement (Kim and Baek, 2018). Other than app types, ad background colors and incentives were found to moderate the ad effects of happiness congruity (Chou and Wang, 2016). Negative reviews compared to positive reviews and two-sided reviews compared to one-sided reviews were more influential in trial attitude formation in apps (Huang and Korfiatis, 2015). Usage frequency significantly moderates the effects of app ease of use in retail apps (Newman et al., 2018). Gender was found to only partially moderate the intention to use service mobile apps (Leon, 2018). Perceived risk, particularly in high risk situations, moderates high-rating score reputation's effect on users' attitudes toward the app (Shen, 2015).

Mediators, which are also considered as intermediate variables, help explain how or why an independent variable influences an outcome. Full mediation effects of satisfaction and habit were found in the relationship between perceived usefulness and intention to continue use (Hsiao et al., 2016). However, both satisfaction and habit partially mediate the relationship between perceived enjoyment and continuance intention, and between social ties and continuance intention (Hsiao et al., 2016). Perceived benefit was partially identified as a key mediator in the relationship between psychological engagement and behavioral engagement intentions (Fang et al., 2017). How a user feels personally connected to apps was also found to mediate the effect of ease of use on purchase intentions with the branded apps (Newman et al., 2018).

Table 4

Findings of past studies in examining consumer responses from cognitive, affective and conative perspectives.

Authors	Key findings
Cognitive (think) → Affective (feel)	
(Xu et al., 2015)	When users perceive more hedonic and utilitarian benefits, users are more satisfied with the apps
(Chang, 2015)	High level of perceived value (emotion, social, price) for mobile apps have strong positive relationships on satisfaction and subsequently influence mobile apps loyalty.
(Hsiao and Chen, 2016)	Perceptions of a mobile app game (playfulness, connectedness, access flexibility and reward) have a direct influence on players' loyalty.
(Hsu et al., 2015)	Confirmation and unexpectedness have a positive effect on satisfaction.
(Hsu et al., 2015)	Confirmation and unexpectedness have a positive effect on delight.
(Chen and Fu, 2018)	Utilitarian value had a positive influence on satisfaction.
	Hedonic value and sociability did not have a significant effect on satisfaction
Cognitive (think) → Conative (do)	
(Hur et al., 2017)	Higher perceived usefulness and playfulness derived from using the apps result in stronger customer usage intention
(Xu et al., 2015)	Hedonic benefits obtained from using apps are the direct antecedents of intention to recommend
(Kang, 2014)	Hedonic motivation of entertainment, utilitarian motivation of effort expectancy and normative social factor of social utility have positive correlations with the intention to continue use of mobile apps.
(Kang and Kim, 2015)	Social self-concept, emotions, and functionality are positively related to word-of-mouth.
(Hur et al., 2017).	The effect of usefulness on usage intention is stronger among millennial consumers than mature consumers while the effect of playfulness on usage intention is stronger among mature consumers
(Tarute et al., 2017)	Perception of features such as design solutions and information quality will result in higher engagement leading to continuous usage of mobile apps.
(Merikivi et al., 2017)	Enjoyment drives continual playing of mobile games.
(Rauschnabel et al., 2017a)	Hedonic benefits and social norms drive in-app purchases.
(Alnawas and Aburub, 2016)	Learning benefits and hedonic benefits are found to generate purchase intentions
(Hew et al., 2015)	Performance expectancy, effort expectancy, facilitating conditions, habit, and hedonic motives have direct effects on behavioral intention to use apps.
(Leon, 2018)	Information quality, self-efficacy, perceived ease of use and usefulness, and attitude influence millennial's intentions to use service mobile apps.
(Chen and Fu, 2018)	Hedonic, utilitarian and sociability value had significant influences on continuance intention.
	Hedonic and sociability value, but not utilitarian value, were positively related to willingness-to-pay.
Affective (feel) → Conative (do)	
(Hsiao and Chen, 2016)	Loyalty to the mobile app game has significant influence on a player's intention to make an in-app purchase.
(Alnawas and Aburub, 2016)	Consumer satisfaction leads to purchase intentions in the context of branded mobile apps
(Cheung and To, 2017)	Trust affects intention to watch in-app advertisements.
(Kang et al., 2015)	Positive feeling evoked by mobile retail apps, rather than cognitive utilitarian motives, is a significant determinant of intention to download and use mobile retail apps.
(Xu et al., 2015)	Satisfaction with apps directly influences users' intention to recommend the apps.
(Rauschnabel et al., 2017a)	Gamers' intention to continual gaming is induced by their flow experience and their attitude towards playing the game.
(Kang et al., 2015).	The intention to download and use were found to be driven by the positive feelings induced by these branded apps
(Gong et al., 2018)	Perceived trust is positively related with the continuance intention of mobile social apps
(Hsu et al., 2015)	Satisfaction and delight have a positive effect on customer citizenship behaviors
(Hsu et al., 2015)	Satisfaction and delight have a positive effect on continuance intention.
(Chen and Fu, 2018)	A user's satisfaction with an image-based app will increase continuous intention and willingness-to-pay

5. Theoretical implications and directions

Given the scarcity of studies systematizing the research in the field of mobile apps, this article engages in a systematic literature review on this theme, identifies the literature gaps and highlights academic directions for future scholars as follows.

5.1. Directions for branded apps studies

A majority of the previous studies in branded apps focused on the retailing, banking and hotel contexts. Our research reveals that in real-business contexts, apps have also been widely adopted in automobile, fast moving consumer goods and delivery service industries. Yet academic studies in these industries are relatively scarce. Future studies can be carried out in those industries to investigate how apps affect customers in terms of brand preference and purchasing behavior. Studies across markets and categories can also be conducted to compare consumer responses and the effectiveness of apps in respect to various industries.

Most of the branded app studies focused on the brand image and their influence on customer purchases, yet relatively few studies examined the impact of branded apps on positioning and differentiation strategies of the brand. Further development in academic research may reveal additional features and effects of branded apps in strategic competitive advantages.

5.2. Directions for revenue-generating apps studies

Monetary value such as in-app purchase, in-app advertising, customers' lifetime value, monetary model (freemium/paid/paidmium) and pricing of revenue-generating apps have been widely studied in the literature. Gaming apps is one of the most popular examined categories. Other commonly examined contexts include social apps, food delivery apps, video and music streaming. Instead of examining on the technical level such as how to generate more profit and increase customer engagement, future studies can focus on strategic levels such as how to build up unique and valuable elements differentiating them from the competition.

5.3. Directions for studies in comparing and connecting branded apps and revenue apps

Apps can be classified as branded apps and revenue-generating apps—with various business purposes respectively. Branded apps such as apps developed by retailers serve as business supportive tools which help brand building, sales promotions, and customer relationships. Revenue-generating business apps, on the other hand, are developed for direct profit-making through apps. Our review indicates that past studies examine either branded apps or revenue apps in a single study -few studies have conducted joint-studies between these two types of apps. Observations in the real-business context show that some brands cooperate with revenue-generating gaming apps for a win–win situation. For example, McDonalds Japan cooperated with a popular app game

called "Puzzle and Dragons" in an event that players who cleared certain tasks in the game could get free McDonalds coupons (Gungho, 2019). Future studies may investigate how such cooperation affects both the branded apps and the revenue-generating apps.

5.4. Direction for studies in considering contextual factors, moderating and mediating effects

This literature analysis reveals that even though the constructs are the same, the relationship can vary depending on the contexts. For example, studies found user satisfaction was positively related to continuance of usage in the context of branded apps but no significant relationship was found in the context of mobile social apps. App users' cognition, affection and conation are major themes in mobile apps studies in an attempt to perceive how different motivations affect the behaviors and actions of mobile app usage. The inconsistent findings among the previous studies suggest mediating and moderating effects may exist. Our literature review identified several significant moderators examined in the past such as app types, app background, online review, usage frequency, and gender. The mediating effects of satisfaction, habit, perceived benefits, and how a user feels personally connected to apps were also found to be significant. Scholars may incorporate the above mediators and moderators to examine whether and when these mediation and moderation effects exist in various contexts among endogenous and exogenous variables.

5.5. Direction for longevity and triangulation of research methodology

The majority of the research on mobile apps mainly employed questionnaire surveys in the methodology. Cross-sectional surveys have shortcomings of lacking longevity and the perceptual answers may not reflect actual behavior. Future scholars may consider combining data collection such as carrying out experimental research on top of the questionnaire survey for triangulation and validity. Academia would also benefit from empirical evidence based on observational longitudinal data. Digital footprints, which refers to the information shared by users on their social media profiles such as personal information about age, place of residence along with shared texts, pictures, and videos (Azucar et al., 2018), can also be a credible source of observational longitudinal data. Actual behavior rather than intended behavior can be detected.

6. Managerial implications and conclusion

The systematic classification of this literature with key insights highlighted should help practitioners to understand mobile apps from a wider perspective and drive their business forward by leveraging the trend of mobile apps as follows:

6.1. Leverage the app trends and gain new promotion/ business opportunities

Our study sends a signal to practitioners that mobile apps are overtaking traditional platforms. Branded apps are transforming not only promotion routines but the operational modules in the banking, finance and retail industries. It highlights how capable apps have become, and practitioners should be aware how these core experiences

Appendix 1

will become increasingly prominent on their business. Findings show gaming apps account for the highest percentage in terms of download and revenue across the entire app market. Practitioners in other industries can consider leveraging the trend in mobile gaming apps and capitalize on them such as organizing joint events with gaming apps, increasing the in-app advertising in games, or use gamification to introduce new products or educate the customers.

6.2. Understand customer motivation and response to drive higher engagement and retention

App developers who target different types of users for different purposes are keen to know how to attract targeted users, retain current users and encourage them to recommend their apps to others. This study sums up and highlights the key factors of motivation, attitudes and behaviors of app users. In particular, hedonic, utilitarian and social values are the key antecedents to continued usage, retention and recommendation behavior as revealed in abundant empirical studies. The perceived benefits for users affect satisfaction and loyalty toward the company, which in turn affects purchases and word-of-mouth recommendations.

6.3. Optimize business by identifying the right monetization model and best practices in apps

From this study, practitioners can understand how apps monetize through various revenue-generating models including paid, freemium, paidmium and in-app advertising models. Determining the best practices and effectively targeting the audience, practitioners should consider the characteristics, values and functions of these models to maximize their customer acquisition and profit-making potential. Customer relationship management (CRM), for example, can also be optimized by apps to collect user information, generate product recommendations, and enhance engagement with loyal customers. Companies can also consider utilizing apps in facilitating product innovation and development by understanding customers' purchase history, consumer preference, and decision making processes. Apps can thus be regarded as value-added tools to serve customers better, thereby leading to increased sales and improved profitability.

The present literature synthesis highlights potential research opportunities. Based on our in-depth content and scope classification, researchers can develop concepts and models that help practitioners execute practices in using mobile apps. The empirical results summed up in this study should serve as a credible and reliable source of reference when practitioners develop their own strategies.

Table A1

Research approaches, themes and key research variables in the quantitative mobile app studies.

Research Approach	Authors	Theme of study	Key Research variables
Experimental research	(Rese et al., 2017)	Adoption of Augmented Reality (AR) technologies in retailing	Perceived informativeness, perceived enjoyment, perceived usefulness, ease of use, attitude toward using, intention to use
	(Shen, 2015)	Adoption of mobile apps with moderating effect of product type and message framing	App type, perceived risk, reputation source, users' app attitude
	(Bellman et al., 2011)	Effectiveness of branded mobile apps	Popularity, brand attitude, brand purchase intention
	(Lin, 2014)	Effect of product placement on players of app games	Recall of brands, familiarity of brands, product placement, purchase intentions.
	(Chou and Wang, 2016)	Effects of happiness types and happiness congruity on game app advertising	Ad background colors, incentives, happiness congruity.
	(Chen et al., 2017)	Participation in collaborative consumption via mobile apps	Timing , message framing, chance of an individual deciding to invite strangers
	(Huang and Korfiatis, 2015)	The effect of online reviews on trial attitude of apps	Positive/negative reviews, trial attitude formation, product trial experience, product attitudes, types of apps (functional/hedonic)
Survey	(Yang, 2013)	Consumers' acceptance of mobile apps	Perceived behavioral control, usefulness, mobile Internet usage, apps usage intention
	(Kapoor and Vij, 2018)	Design and engagement of food-ordering apps	Visual, navigational, information and collaboration design, conversion rate for online aggregator
	(Hsiao and Chen, 2016)	In-app purchase intention for mobile games	Playfulness, good price, and reward, players' intention
	(Dinsmore et al., 2017)	Purchasing tendency of apps	Bargain proneness, frugality, mobile app payment, in-app purchase
	(Gurtner et al., 2014)	Mobile apps for different age groups	Age groups, convenience, perceived quality, enjoyment, perceived ease of use, perceived usefulness, acceptance of business apps.
	(Lu et al., 2017)	The impact of perceived enjoyment and mobility on user continuance intentions	Salience of disconfirmation, enjoyment, mobility, satisfaction, continuance intentions, post-usage attitude
	(Rauschnabel et al., 2017b)	Mobile game adoption	Hedonic, emotional, and social benefits, social norms, physical risks
	(Lee et al., 2017)	Behavioral intention to use food delivery apps.	User-generated information, firm-generated information, system quality positively, perceived usefulness, system quality, design quality, perceived ease of use, perceived usefulness, attitude toward apps
	(Wan et al., 2017)	The effectiveness of app-bundling strategy	App-bundling attributes, consumer attitude
	(Ozturk et al., 2016)	Continued usage intention of hotel booking app	Perceived risk, subjective norm, innovativeness perceived ease of use affected continued usage intention
	(Chang, 2015)	Mobile apps customer loyalty and the moderating effect of use contexts	Perceived value, social value, satisfaction, loyalty
	(Fang et al., 2017)	Effect of Design and performance attributes on mobile travel apps engagement	User Interface attractiveness, compatibility, behavioral engagement, psychological engagement
	(Hur et al., 2017)	Comparison between millennial and mature customers in usage intention in apps	Age (millennial and mature customers), technological innovativeness increases, perceived usefulness, ease of use, playfulness
	(Wei and Lu, 2014)	Antecedents of playing app games	Network externalities, individual gratifications, intention of playing app games
	(Ding and Chai, 2015)	Emotions and continued usage of apps	Positive emotions was related to inherent benefits; negative emotions were related to instrumental benefits.
	(Wang and Lin, 2017)	Location-based apps on trust, perceived privacy risk, and continuous usage intention	Perceived trust, information quality, system quality, and service quality, continued usage intention
	(Hsiao et al., 2016)	Factors in continuance usage of social apps	Utilitarian, hedonic, and social, satisfaction, habitual use
	(Lu and Wei, 2014)	Antecedents of playing social games apps	Individual gratifications, intention of playing social game apps
	(Hsu and Lin, 2015)	Purchase intention for paid mobile apps	Confirmation, value-for-money, perceived value, satisfaction, intention to purchase apps
	(Hsu and Lin, 2016)	Mobile app stickiness and in-app purchase intention	Stickiness, social identification, app usage intention.
	(Jin and Park, 2016)	Continuance intention of mobile messaging apps	Perceived network size, perceived innovativeness of services, continue usage of apps.
	(Alnawas and Aburub, 2016)	Effects of branded mobile apps on consumer satisfaction and purchase intentions	Learning, hedonic benefits, purchase intentions
	(Hong et al., 2017)	User satisfaction with social apps	Network externalities, herd behavior, perceived benefits
	(Tarute et al., 2017)	Customer engagement in mobile apps	Design solutions, information quality, continuous usage, engagement, apps usage intention
	(Cheung and To, 2017)	Propensity to trust on mobile users' attitudes toward in-app advertisements	Propensity to trust, trust, attitudes and intentions to watch in-app ad.
	(Rauschnabel et al., 2017a)	Attitudinal and intentional reactions on mobile app games	Risks, benefits, norms, attitude toward playing app game, intention to reuse, in-app purchase
	(Kang, 2014)	Factors influencing intention of mobile app usage	Easiness, continuance intention of apps usage
	(Kang et al., 2015)	Downloading and usage intention toward mobile retail apps	Perceived interactivity, compatibility, affective involvement downloading, usage intention.
	(Kang and Kim, 2015)	Word-of-mouth for retail apps usage	Users' characteristics, conditional epistemic benefit, social self-concept benefit, emotional benefit, and functional benefit, word-of-mouth (WOM)
		In-app purchase intention and loyalty	Utilitarian, hedonic, and social perspectives, user satisfaction, habitual use

Table A1 (*continued*)

Research Approach	Authors	Theme of study	Key Research variables
	(Hsiao and Chen, 2016)		
	(Morosan and DeFranco, 2016)	Intentions to use hotel apps to personalize hotel services	Involvement, privacy concerns, perceived personalization, intention to use hotel apps
	(Merikivi et al., 2017)	Key antecedents of enjoyment and its effect on continuance intention	Continual gaming app use, enjoyment, system's capacity, regeneration, visually attractive, easy-to-use interface
	(Peng et al., 2018)	Moderating effects of app type on the intention of continued use of mobile apps	App type (social networking, game, and productivity apps), intention of continued use
	(Kim and Baek, 2018)	Antecedents and consequences of mobile app engagement.	Time convenience, interactivity, and compatibility, app engagement, relationship commitment, self-brand connections.
	(Logan, 2016)	Attitudes towards in-app advertising	Attitude towards in-app advertising, purposes of apps
	(Chen et al., 2018)	Adoption barriers, satisfaction and attitudes towards brand apps	The usage barrier, image barrier, value barrier, knowledge of alternatives quality of brand app
	(Xu et al., 2016)	The impact of personality traits on mobile app adoption	Personality traits, types of apps adoption
	(Newman et al., 2018)	Consumers' actual experiences using retailers' apps	Perceived ease of use, personal connections to apps, purchase channel preferences, actual purchasing behavior with the app, app usage frequency
	(Veríssimo, 2016)	Adoption of mobile banking apps	Perceived risk, compatibility, perceived ease of use, perceived usefulness, banking app usage
	(Hsu et al., 2015)	The effect of unexpectedness and confirmation on app users' delight, satisfaction, and continuance intention	Satisfaction, confirmation, delight, unexpectedness, continuance intention.
	(Kim et al., 2017)	Mobile apps possession and mobile purchase	App possession, purchase, digital experience, browsing pattern of non-shopping apps
	(Kwon et al., 2016)	Addictive dependence on mobile social apps	Addiction, education, income, age
	(Hew et al., 2015)	Mobile app usage intention	Performance expectancy, effort expectancy, facilitating conditions, hedonic motivation, and habit, app usage intention
	(Oyedele and Simpson, 2018)	Perceived consumption values and self-identity related to streaming apps	Consumption values, identity salience, recommendation of apps
	(Karjaluoto et al., 2019)	The effect of perceived value on the use of mobile financial services apps	Self-congruence, new product novelty, consumer satisfaction, commitment to the bank.
	(Song et al., 2014)	Satisfaction in app stores	Discoverability facilitators, quantity of applications, user satisfaction
	(Chopdar et al., 2018)	m-shopping apps adoption and perceived risks	Perceived risks, m-shopping app adoption.
	(Harris et al., 2016)	Factors of intention to install apps	Perceived security familiarity, intention to install apps
	(Xu et al., 2015)	Customer value, satisfaction, and loyalty perspective of mobile app recommendations	Satisfaction, users' app continuance intention, and hedonic benefits, app recommendation
	(Gu et al., 2017)	Privacy concerns for mobile app download	Perceived permission sensitivity, privacy concern, victim experience
	(Leon, 2018)	Millennial's intention to use service mobile apps under the moderating effect of gender	Information quality, self-efficacy, perceived ease of use, usefulness, intentions to use apps, gender
	(Gong et al., 2018)	Factors of continue using mobile social apps	Trust, user satisfaction, perceived critical mass, continuance intention of using WeChat
	(Chen and Fu, 2018)	Effects of perceived value in the app usage	Hedonic, utilitarian, sociality, perceived values, gender
Secondary database analysis	(Stocchi et al., 2017)	Market performance of mobile apps	Branded apps image, types of apps
	(Lee and Shin, 2016)	Selection of potential active users for advertised apps based on users' previous app usage behaviors.	App session time, no.of apps a user possess, level of activeness
	(Lee and Shin, 2017)	In-app reward advertising	In-app reward advertisements, in-app purchases.
	(Roma and Ragaglia, 2016)	Revenue models, in-app purchase, and performance	In-app purchase, paid, freemium and in-purchase models, types of app stores
	(Kim et al., 2015)	Effects of branded mobile apps on customers' purchase behavior	A brand's mobile app adoption, repeated use of the app, purchase
	(Feng et al., 2018)	App users' usage patterns.	Individual apps' spatial distributions
	(Garg and Telang, 2013)	App Demand	Rank-demand relationship for the paid apps
	(Lee and Raghu, 2014)	Success factors of mobile apps	App offerings, seller- and app-level characteristics, sales performance
	(Wang et al., 2018)	Impact of copycat apps on the demand for the original apps	Copycats apps, original apps, demand
	(Ghose and Han, 2014)	Demand for mobile apps	App demand, in-app purchase option, in-app advertisement
	(Liu et al., 2014)	Freemium Strategy in apps market	Types of app, sales
	(Arora et al., 2017)	Implications of offering free versions for the performance of paid mobile apps	Types of apps, market performance
	(Liang et al., 2015)	Effects of consumer reviews on the sales of mobile apps	eWOM, sales rankings.
	(Liu et al., 2017)	Deriving user preferences of mobile Apps	Behavioral patterns, user preferences of an app

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