

In-app advertising: a systematic literature review and implications for future research

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Abstract

Purpose – The purpose of this study is to review and synthesize the literature on in-app advertising, identify gaps and propose future research directions.

Design/methodology/approach – The authors use a systematic literature review (SLR) approach, following the PRISMA guidelines, to investigate the current state of research in in-app advertising. The study uses 44 shortlisted articles from the Scopus and Web of Science databases. Using the Theory-Context-Characteristics-Methodology (TCCM) framework, the authors analyze the gaps in theory, context, characteristics and methods.

Findings – Using thematic analysis, the authors identify five main themes in the in-app advertising literature, namely, ad platform optimization; mobile app user psychology and behavior; ad effectiveness; ad fraud; and security, privacy and other user concerns. The findings show the need for empirical research, with a strong theoretical foundation in emerging ad formats of in-app advertising, user behavior and buy-side of in-app advertising.

Originality/value – This is a maiden study to conduct a domain-based SLR in the emerging field of in-app advertising using the TCCM framework. The authors highlight the key differences between in-app advertising and mobile web advertising. The authors propose theories in the advertising field that could be used in future empirical studies of in-app advertising.

Keywords In-app advertising, Mobile app advertising, Mobile marketing, Systematic literature review

Paper type Literature review



Publicidad en las apps: revisión sistemática de la literatura e implicaciones Para futuras investigaciones

Resumen

Propósito – El propósito de esta investigación es revisar y sintetizar la literatura sobre la publicidad en Apps, identificar lagunas y proponer futuras direcciones de investigación.

Diseño – Utilizamos un enfoque de revisión sistemática de la literatura, siguiendo las directrices PRISMA, para investigar el estado actual de la investigación en publicidad en aplicaciones. El estudio utiliza 44 artículos preseleccionados de las bases de datos Scopus y Web of Science (WoS). Utilizando el marco Teoría-Contexto-Características-Metodología (TCCM), analizamos las lagunas en teoría, contexto, características y métodos.

Conclusiones – Mediante un análisis temático, identificamos cinco temas principales en la literatura sobre publicidad en aplicaciones, a saber: optimización de plataformas publicitarias; psicología y comportamiento de los usuarios de aplicaciones móviles; eficacia publicitaria; fraude publicitario; seguridad, privacidad y otras preocupaciones de los usuarios. Nuestros hallazgos muestran la necesidad de investigación empírica, con una sólida base teórica en los formatos publicitarios emergentes de la publicidad en Apps, el comportamiento del usuario y el buy-side de la publicidad en Apps.

Originalidad – Se trata de un estudio pionero para realizar una revisión sistemática de la literatura basada en el dominio en el campo emergente de la publicidad en Apps utilizando el marco TCCM. Destacamos las principales diferencias entre la publicidad en aplicaciones y la publicidad en la web para móviles. Proponemos teorías en el campo de la publicidad que podrían utilizarse en futuros estudios empíricos sobre la publicidad en Apps.

Palabras clave Publicidad en aplicaciones, Publicidad en aplicaciones móviles, Marketing móvil, Revisión sistemática de la literatura

Tipo de trabajo Revisión de literatura

应用内广告：系统文献综述及对未来研究的启示

摘要

目的 – 本研究旨在回顾和总结有关应用内广告的文獻，找出差距并提出未来的研究方向。

设计 – 我们采用系统性文献综述方法，遵循 PRISMA 指南，调查应用内广告的研究现状。研究使用了 Scopus 和 Web of Science (WoS) 数据库中的 44 篇入围文章。利用理论-背景-特征-方法 (TCCM) 框架，我们分析了理论、背景、特征和方法方面的差距。

研究结果 – 通过主题分析，我们确定了应用内广告文献的五大主题，即广告平台优化；移动应用用户心理和行为；广告效果；广告欺诈；安全、隐私和其他用户关注点。我们的研究表明，有必要在应用内广告的新兴广告形式、用户行为和应用内广告买方等方面开展实证研究，并奠定坚实的理论基础。

独创性 – 这是一项首次使用 TCCM 框架对新兴的应用内广告领域进行基于领域的系统性文献综述的研究。我们强调了应用内广告与移动网络广告的主要区别。我们提出了广告领域的理论，可用于未来的应用内广告实证研究。

关键词 - 应用内广告 移动应用广告 移动营销 系统文献综述

文章类型 研究型论文

1. Introduction

The exponential growth and penetration of mobile (6.5 billion smartphone users globally as per Statista, 2022) have bestowed unique opportunities to use it as an advertising medium. Lately, the focus of mobile marketing has moved from the mobile web to mobile apps (Keem and Lee, 2018), and in-app advertising has emerged as a new conduit for mobile advertising. The Interactive Advertising Bureau (2022) defines in-app advertising as “ads and ad campaigns that are delivered within mobile applications, including smartphones, tablets, or wearable devices”. Sensor Tower has estimated that global in-app advertising spending will reach US\$233bn by 2026 (Chan, 2022). Mobile apps are popular, as 97% of the apps are free to download (Statista, 2023), easily accessible round the clock and gratify a range of specific

user needs (Sigurdsson *et al.*, 2018). In-app advertisements have become an important source of revenue for app developers (Gao *et al.*, 2022; Mattke *et al.*, 2021; Truong *et al.*, 2019).

However, researchers posit that there is little understanding of the differences between the two mobile channels: mobile web and mobile apps (Park and Park, 2020). Mobile apps are considered catalysts for “new” customer experiences and engagement, delivering a unique source of customer value. The “always on” points of interaction in mobile apps shape positive and interactive customer journeys (Stocchi *et al.*, 2022). Mobile apps are developed for a particular operating system, whereas mobile websites are delivered through smartphone browsers. According to e-marketer, the in-app advertisement viewability rate exceeds mobile web and desktop viewability worldwide (Handel, 2022). The key differences between mobile web and in-app advertisements are summarized in Appendix 1. Compared to mobile web advertisements, in-app advertisements have a captive and more engaged audience. Targeted and personalized advertisements, with higher accuracy, can be placed due to the availability of location, demographics and app content.

Mobile advertising exists in many forms, such as web-based, mobile search, in-app, cross-app, location-based and social media (Jebarajakirthy *et al.*, 2021). Maseeh *et al.* (2021), in their recent meta-analysis of mobile advertising research, avow the underrepresentation of empirical studies on in-app advertising in the literature. Although in-app advertising has been celebrated for revolutionizing the advertising landscape, scholarly attention on in-app advertising is limited when compared to other domains of mobile advertising (Truong *et al.*, 2019).

Although there are a few comprehensive systematic literature reviews (SLRs) on mobile marketing, in general (Leppäniemi *et al.*, 2006; Narang and Shankar, 2019; Varnali and Toker, 2010) and specifically on mobile advertising (Billore and Sadh, 2015; Grewal *et al.*, 2016; Jebarajakirthy *et al.*, 2021; Maseeh *et al.*, 2021), there is limited discussion on issues in in-app advertising. Previous reviews in the domain have focused on the broader perspective of mobile advertising and a summary of literature reviews in the mobile advertising domain is presented in Appendix 2. Truong *et al.*'s (2019) review of in-app advertising specifically examines the relationships between factors controlled by publishers and the effectiveness of in-app advertising. However, there are no SLRs that examine the broader research issues in in-app advertising research.

Hence, this study reviews the extant literature on in-app advertising, focusing on three research questions:

- RQ1. What are the key overarching themes latent in the literature on in-app advertising?
- RQ2. What are the most prevalent theories, contexts, characteristics and methods used in the in-app advertising literature?
- RQ3. What are the future areas of research on in-app advertising?

This review makes several contributions to the emerging research area of in-app advertising. First, the review is the maiden attempt to examine the extant literature on in-app advertising and identifies five key themes. Second, the study identifies research gaps in the theories, characteristics, context and methods used in the in-app advertising literature. Third, the study proposes future areas of research and identifies potential theories that could shed light on new dimensions of in-app advertising.

2. Review methodology

The study uses a SLR, as suggested by Transfield *et al.* (2003). Systematic studies seek to discover, examine and summarize the contents in an integrative approach, thereby making

the evidence more conducive for scholarly audit (Bergman and Holden, 2010; Transfield *et al.*, 2003). SLRs are suitable for niche research areas with a narrow scope (Donthu *et al.*, 2021) and have a smaller number of papers for review (Snyder, 2019). Donthu *et al.* (2021) posit that SLR methodology is often used when the review goal is to summarize and synthesize findings of a research topic and the volume of the data set for review is small for manual review.

Paul and Criado (2020) broadly categorize SLRs into domain-based, theory-based and method-based reviews. The authors posit that a domain-based review can be termed a framework-based review if the study adopts an existing framework or develops a framework and uses it to organize the review. In this study, we perform a framework-based SLR with 44 shortlisted articles on in-app advertising. We adopt the Theory-Context-Characteristics-Methodology (TCCM) framework developed by Paul and Rosado-Serrano (2019) for examining and analyzing the in-app advertising literature and presenting the findings, gaps and future areas of research. The TCCM framework is extensively used in marketing to examine the literature and present the findings of the review (Bhattacharjee *et al.*, 2022; Celik *et al.*, 2022; Jebarajakirthy *et al.*, 2021; Singh and Dhir, 2019). In this paper, we use this framework to present theories on in-app advertising (used in the literature and potential for future research), context (country, industry, advertising format), characteristics (antecedents and outcomes, mediators and moderators) and methods (research approaches and analysis techniques).

We perform thematic analysis on the selected articles to identify themes in the in-app advertising literature. Thematic analysis is a method for identifying, analyzing and recording patterns within the data (Braun and Clarke, 2006) and synthesizing them into themes (Thomas and Harden, 2008). We followed the process outlined by Braun and Clarke (2006) and Thomas and Harden (2008) to conduct a thematic analysis as presented in Section 3.

2.1 Search strategy, information retrieval and information processing

The PRISMA guidelines have assisted the article search and selection process, as followed by Page *et al.* (2021). To address the aforementioned research questions, we follow a three-step process to identify the relevant studies. The first step is to determine an appropriate database to retrieve documents for the study. Articles were sourced from the Scopus and Web of Science databases, and articles until the end of May 2023 were included in this review. The two journal repositories are considered the largest and most widely used online databases and search engines by researchers (Paul *et al.*, 2021). Peer-reviewed journals in the English language constitute the prime source of articles included in this study.

The second step consists of selecting appropriate keywords to extract relevant documents. The search keywords “in-app advertisements”, “in-app ads”, “in-app advertising”, “mobile app advertisements”, “mobile app advertising”, “mobile app ads” and “mobile application advertising” were selected to exemplify the line of inquiry effectively. In the third step, the data set was gathered and refined for the study.

The search method of title, abstract and keywords was used with Boolean operators of relevant keywords. One additional round of search iteration with the cited references was carried out to ensure the inclusion of relevant research studies in the area. The PRISMA protocol for reporting literature in systematic reviews was used to report the search strategy (Page *et al.*, 2021). Figure 1 outlines the methodology of the SLR. The initial search yielded 209 studies published in the two databases.

The data retrieved were exported to Microsoft Excel for scrutiny and 105 studies were shortlisted for SLR after removing duplicates and non-English studies from the two databases. Book chapters, conference papers, editorials and lecture notes were excluded

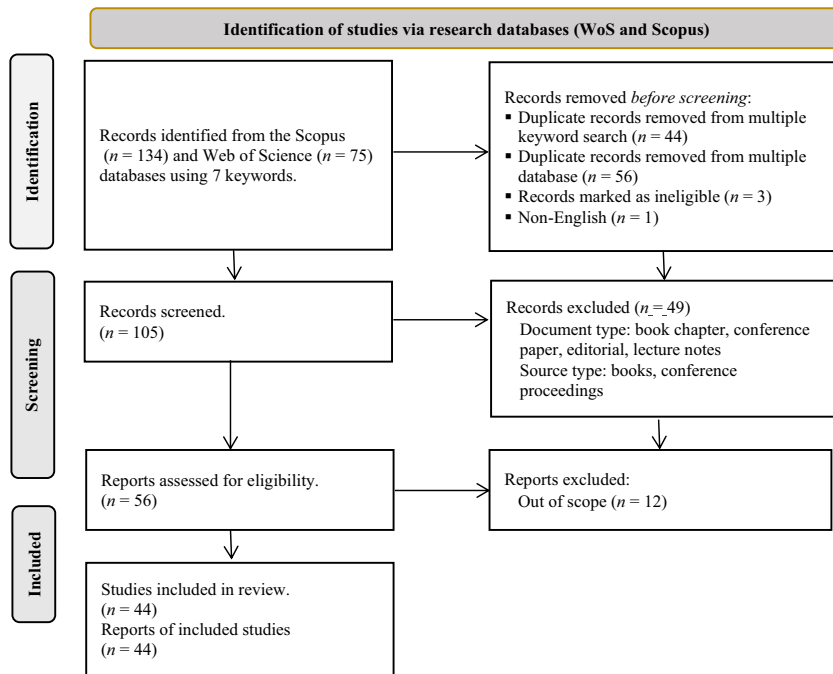


Figure 1.
Flow diagram of
systematic literature
review on in-app
advertising

because they were not necessarily peer-reviewed and the exclusion resulted in 56 records. To winnow down the out-of-scope studies, abstract screening was performed and 12 records were excluded because they did not encapsulate the essence and conceptual boundary of in-app advertising. Thus, 44 studies were included in the final analysis of this review.

3. Thematic analysis of in-app advertising literature

Research on in-app advertising spans several areas, such as information technology, consumer behavior and psychology, marketing, advertising and communication. We performed a thematic analysis of the shortlisted articles to identify the broad areas of research in the in-app advertising literature. The coding of text and generating and reviewing themes were performed based on the thematic analysis process suggested by [Braun and Clarke \(2006\)](#). Each shortlisted article was first coded manually by examining the title and abstract by the first author. Seventeen descriptive themes emerged by grouping similar codes. [Figure 2](#) illustrates the thematic map emerging from the literature. The descriptive themes were labeled based on their significance and context in relation to the findings of the primary studies. The descriptive themes were then verified for relevance by the second author and finalized after discussion.

In the next phase, the analytical themes were inferred from the descriptive themes ([Thomas and Harden, 2008](#)) and five themes emerged in the discussions between the authors: ad platform optimization; mobile app user psychology and behavior; ad effectiveness; ad fraud; and security, privacy and other user concerns.

The thematic analysis indicates the relationship between the two themes in the literature, namely, ad platform optimization – ad effectiveness ([Truong, 2023](#)) and ad effectiveness –

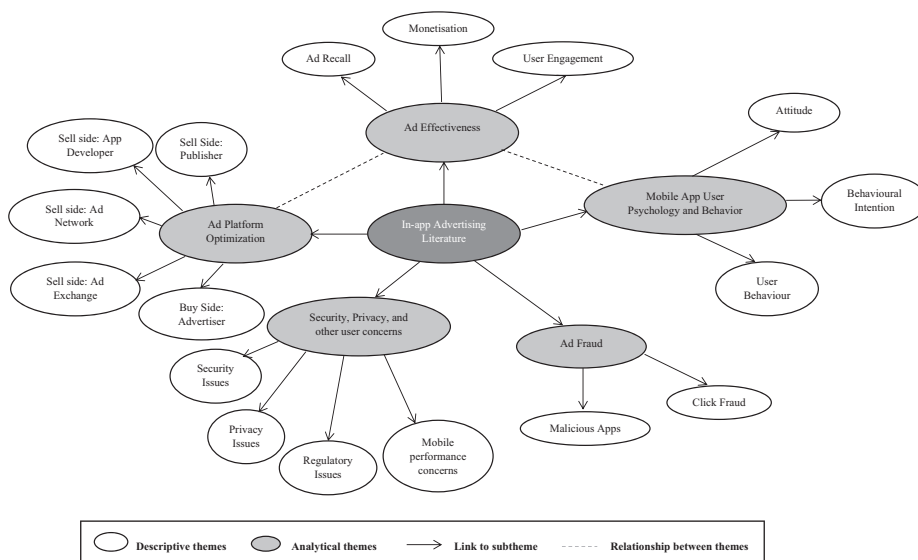


Figure 2. Thematic map of in-app advertising literature

mobile app user behavior (Mattke *et al.*, 2021). The click-through rate was one of the outcome variables that was investigated by several researchers for the optimal combination of in-app advertisement factors and the optimal sequencing of in-app advertisements (Adikari and Dutta, 2020; Sun *et al.*, 2017; Truong *et al.*, 2019). The relationship between the themes has explored the factors controlled by advertisers, consumers and ad networks on click behavior. However, the relationship between other themes was not explored in past literature.

3.1 Theme 1: ad platform optimization

The in-app advertising ecosystem is divided into players on the buy-side or demand-side and the sell-side or supply-side. Optimizing the in-app advertising platform is of utmost importance, keeping in view the interest of both buy-side and sell-side players. Each player in the in-app advertising ecosystem has varied outcomes of interest (Truong *et al.*, 2019).

Publishers can either sell their inventory directly to ad networks or buy-side or engage in real-time bidding (Kaplan, 2021). Truong (2023) found that the optimal combination of publisher-controlled factors such as duration, timing, size and position of the ad space significantly improves the click-through rate of in-app advertising.

Several recent studies have examined the techniques and guidelines for app developers to assist them balance the trade-offs in-app advertising costs and benefits. Ghose and Han (2014) find that demand for mobile apps decreases with in-app advertisements and suggest several app design choices for app developers. App developers often integrate ad libraries with apps and there are more than 63 ad libraries (Ahasanuzzaman *et al.*, 2020) in the Google Play Store. Ahasanuzzaman *et al.* (2022) develop a reference architecture for ad library integration for app developers.

The ad networks connect publishers and advertisers, allowing advertisers to bid on the ad space provided by the publisher. Although publishers may have many ad networks ready to buy ad inventories, the performance of networks differs. Adikari and Dutta (2020) have suggested an optimal mechanism for publishers to select the best ad network. Recent research

(Lee *et al.*, 2021; Rafeian and Yoganarasimhan, 2020; Sun *et al.*, 2017; Yang and Cao, 2018) examines efficient techniques for ad networks using machine learning techniques.

Ad exchange orchestrates the buying and selling of ads and can connect publishers with multiple ad networks. Revenue optimization is a vital task for an ad exchange. Scholars have examined techniques to improve ad auction mechanisms (Liu and Liu, 2019) and optimal revenue-sharing methods (Hao *et al.*, 2016; Hu *et al.*, 2023). Mukherjee *et al.* (2017) develop a machine learning-based in-app ad selection algorithm and propose an optimization model to maximize supply-side platform revenue.

The current research on this theme is primarily exploratory and uses data-driven approaches. There is no theoretical framework applied to the studies and machine learning techniques are prominent. Researchers provide either a novel optimal solution or suggest an extension of an existing technique. Although the sell-side platform has gained traction, academic literature on the buy-side is sparse. An exception is the field research by Rosenkrans and Myers (2018) that proposes how predictive analytics could be used by advertisers to optimize mobile location-based ads. The optimization of advertisements based on ad characteristics such as design, context, size and media types and their influence on information processing and consumer response remain unexplored.

3.2 Theme 2: mobile app user psychology and behavior

This theme primarily focuses on studies on attitude, behavioral intention and user behavior toward in-app advertising. Attitudes toward in-app advertising have been examined by several researchers and found to impact people's intention to use the app (Sigurdsson *et al.*, 2018). Logan (2017) posits that attitude varies according to the gratification sought from the mobile app category. Scholars posit that the perceived value of in-app advertising, trust toward ads, ad source and perceived irritation toward ads are significant factors affecting attitudes toward advertising (Aydin and Karamehmet, 2017). Users' propensity to trust affects their trust in in-app advertising and trust impacts attitudes toward in-app ads and their intention to view in-app ads (Cheung and To, 2017). Attitude also mediates the relationship between trust and purchase intentions (Sung, 2020). Ad factors such as credibility, information and perceived entertainment considerably improve attitudes toward in-app ads (Sigurdsson *et al.*, 2018).

The behavioral response toward ads is better when there is congruity between the ad and the mobile environment (Wang and Chou, 2019). Mattke *et al.* (2021) conduct a qualitative comparative analysis and empirically show the sequential processing of structural and semantic factors of in-app advertisements. Keem and Lee (2018) examine the types of advertisements consumers prefer or adversely react to when shopping through mobile apps.

Consumers control their in-app advertising performance through their behavior and personal characteristics (Truong *et al.*, 2019). However, studies on personal characteristics and their impact on in-app advertising are scarce. User psychology and behavior can vary based on the type of app used, user loyalty and ad formats. In addition, there is ample opportunity to understand aspects of user psychology and behavior through theoretical lenses.

3.3 Theme 3: ad effectiveness

Rodgers and Thorson (2000) categorize all factors affecting advertising effectiveness into factors controlled by consumers and advertisers. The researchers posit that attention, memory, attitude and outcomes are controlled by consumers. Therefore, these are important for advertisers to measure ad effectiveness. Ad recall is one of the popular metrics used to

measure ad effectiveness. [Cicek et al. \(2018\)](#) examine the effects of banner location, app type and orientation on ad recall and find that banner ads positioned at the top can trigger better recall.

Scholars have examined advertiser-controlled ad characteristics, ad content characteristics ([Cassioli, 2019](#); [Sigurdsson et al., 2018](#); [Wang and Chou, 2019](#)), interactivity ([Cassioli and Balconi, 2022](#)) and media type ([Sung, 2021](#); [Sung et al., 2022](#)). Several studies have examined the impact of ad characteristics on outcome metrics such as monetization ([Appel et al., 2020](#); [Ji et al., 2019](#); [Nuwamanya et al., 2018](#); [Rutz et al., 2019](#)) and user engagement ([Cassioli, 2019](#); [Cassioli and Balconi, 2022](#)).

The literature addresses only a few consumer/advertiser factors, as noted above. The impact of creativity on ad effectiveness has received less attention. Moreover, publisher-controlled factors (ad timing, ad position) and network-controlled factors (location, device type and size, which impact ad effectiveness) remain unexplored.

3.4 Theme 4: ad fraud

The rise in popularity of free and open-source Android platforms for mobile has resulted in fraudulent and repackaged apps. Repackaged apps are modified versions of existing popular apps, which are designed to capture advertising revenue and obtain user information. The lack of in-app ad-blocking solutions among mobile users has led to abusive in-app advertising practices such as click fraud and malvertising. App developers can generate fraudulent ad clicks in an automated manner, resulting in losses for advertisers. Recent studies have examined the vulnerability of ad networks to click fraud attacks and proposed techniques for ad networks to detect click fraud ([Cho et al., 2016](#); [Mouawi et al., 2019](#)).

[Cho et al. \(2016\)](#) note that there is a dearth of research on the vulnerability of ad networks to different varieties of ad click threats and methods to prevent them. New forms of ad fraud, such as ad stacking, click flooding, device ID reset fraud, bot fraud, app fraud, bundle ID spoofing and software development kit (SDK) spoofing ([TrendMicro, 2019](#)), have received little attention from researchers. There are ample research opportunities to leverage developments in machine learning algorithms and artificial intelligence to combat these threats.

3.5 Theme 5: security, privacy and other user concerns

Studies have examined the security, privacy and smartphone performance concerns of mobile users resulting from in-app advertising. A mobile app embeds a custom SDK given by an ad network to display ads. This gives greater control over the ad network on the mobile application. Scholars ([Su et al., 2018](#)) observe that in-app advertising poses a higher security risk to users by collecting their personal information, downloading malware in the background, disclosing images and personal data and exposing them to inappropriate content. Researchers have voiced their concerns about the noncompliance of app developers with existing relevant international guidelines or technology standards ([Haenschen and Wolf, 2019](#); [Scott et al., 2018](#)) and the need for regulation of ad libraries. Several studies have proposed techniques to detect malvertising in ad networks ([Shao et al., 2018](#)) and prevent third-party libraries from misusing the permissions of host apps ([Hsu et al., 2020](#)). Recent research ([Gao et al., 2021, 2022](#)) has identified user concerns with in-app advertising using app reviews.

Our review signals a lack of research on the brand safety of advertised brands and brands powering the app. Further research is needed on improper content, dark patterns in apps and their impact on the brand. Behavioral ad avoidance, such as closing or uninstalling

the mobile app, due to content inappropriateness of in-app advertising and dark patterns, is a major concern to publishers as well as advertisers. Future research can explore the impact of such issues on attitudes toward the ad and brand powering the app. Threats posed by in-app advertising among vulnerable groups such as children are another unexplored area.

4. Theory-Context-Characteristics-Methodology in in-app advertising: findings and discussion

In accordance with the TCCM framework developed and applied by [Paul and Rosado-Serrano \(2019\)](#) and following the examples of other TCCM reviews ([Billore and Anisimova, 2021](#); [Celik et al., 2022](#); [Ghorbani et al., 2022](#); [Jebarajakirthy et al., 2021](#)), we present a comprehensive outline of the findings and gaps existing in the literature.

In the theoretical perspective section, we present the most commonly used theoretical frameworks in the in-app advertising literature. In the context section, we present the research settings (country, industry) used in the in-app advertising literature and the diverse types of ad formats used. In the characteristics section, we examine the antecedents, outcomes, mediators and moderators used in in-app advertising studies. We summarize the TCCM framework for in-app advertising in [Figure 3](#).

4.1 Theoretical perspectives in the in-app advertising literature (T)

According to our review, previous studies in in-app advertising have not used theoretical frameworks to understand the unique complexities and features of in-app advertising. Only 11 studies (approximately 25% of the studies) in the in-app advertising literature have used theoretical underpinnings. The studies are primarily on the themes of “mobile app user psychology and behavior” and “ad effectiveness”. [Table 1](#) presents the theories applied in the in-app advertising literature.

Theoretical integration of multiple paradigms could serve to better understand and interpret the complex nature of the advertising phenomenon in digital media ([Rodgers and Thorson, 2000](#)). For effective advertising research, both exploratory research and theory-based research are important ([Huh, 2017](#)); hence, future researchers should establish connections between existing advertising theories and computational advertising research.

The review highlights that in-app advertising has relied on nine theories, as described in [Table 2](#). Uses and gratification theory was the most commonly used theory in the in-app advertising literature, with four studies applying it in their research. There is potential to use several advertising theories to examine new dimensions of in-app advertising research. We propose a few of them in [Section 5](#).

4.2 Context of the studies in in-app advertising (C)

The TCCM framework regard “context” as circumstances forming the research setting ([Paul and Rosado-Serrano, 2019](#)). We analyzed the countries, industries and ad formats that have appeared in the in-app advertising literature. In-app advertising has been researched in 16 different countries. Data were collected from US participants in 30% of studies, followed by China, (11%), Canada, India, Taiwan (approximately 7% each, i.e. 20%), Hong Kong, Italy, Korea, Turkey, UK, Vietnam (approximately 5% each, i.e. 28%) and Australia, Germany, Singapore, Lebanon, Malaysia, Uganda (approximately 2% each, i.e. 11%). Most of the studies used data from participants from a single country, except for studies by [Sigurdsson et al. \(2018\)](#), which used participants from two countries.

In the context of industries, in-app advertising research has been explored in tourism ([Sung, 2020](#)), health care ([Nuwamanya et al., 2018](#)), education ([Hsu et al., 2020](#)), news media ([Cassoli, 2019](#)) and gaming ([Jiao et al., 2022](#); [Rutz et al., 2019](#); [Wang and Chou, 2019](#)).

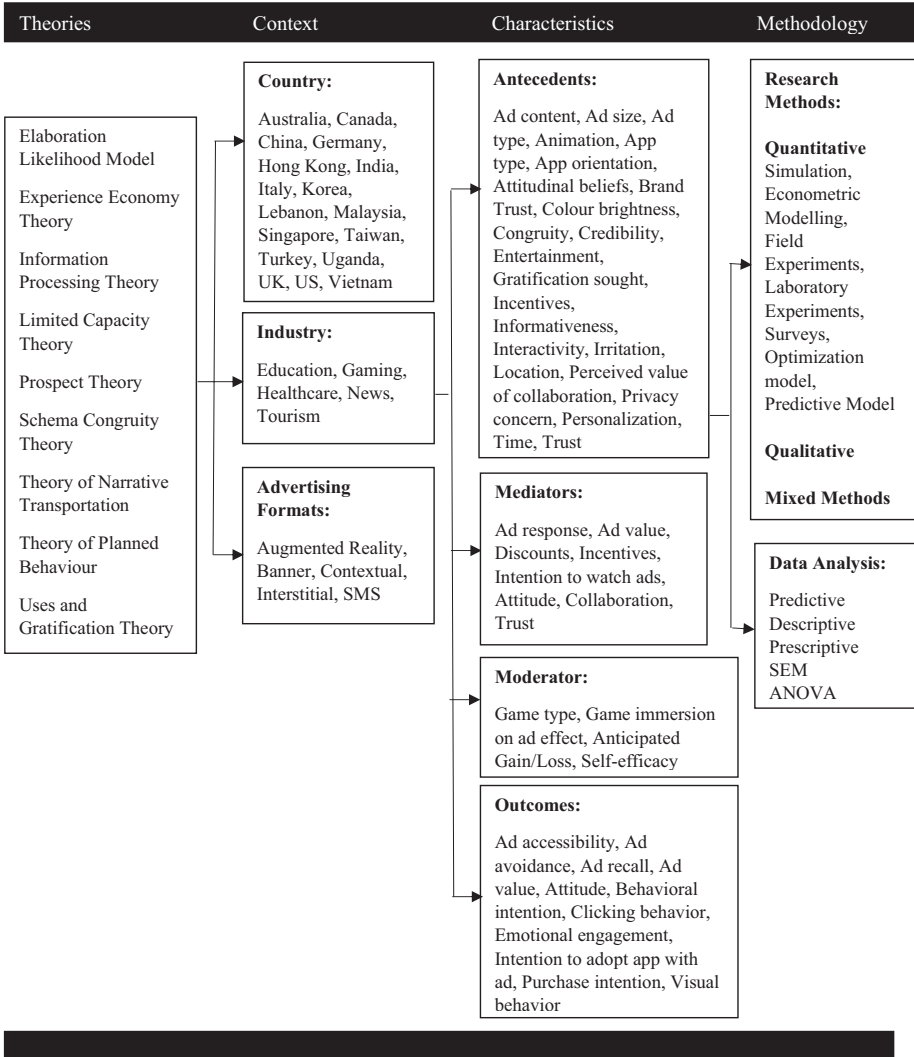


Figure 3. TCCM framework for in-app advertising

However, industries such as financial services, retailing, hospitality, media and entertainment have yet to be explored. The financial services industry extensively uses in-app advertising to upsell and cross-sell financial products and services (Upshot.ai, 2022). Along similar lines, hospitality, retailing, media and entertainment use in-app advertising for both marketing and revenue generation. Hence, there is a vast scope for research in these industries.

In the context of advertisement formats, studies have investigated contextual advertising (Graham *et al.*, 2021), banner advertising (Cicek *et al.*, 2018), interstitial advertising (Wang and Chou, 2019), short messaging services (Aydin and Karamehmet, 2017) and augmented reality advertising (Sung, 2021; Sung *et al.*, 2022). However, the Interactive Advertising Bureau (2022)

Theory and description	In-app advertising literature	Research objectives
<p><i>Experience Economy Theory:</i> Pine and Gilmore (1999) delineated four dimensions of the experience economy that drive consumer engagement</p> <p><i>Information Processing Theory:</i> Information is processed in distinct stages which normally consist of attention, elaboration and behavior (Miller, 1956)</p> <p><i>Limited Capacity Theory:</i> The theory posits that attention is limited in overall capacity (Lang, 2000)</p> <p><i>Uses and Gratification Theory:</i> The theory helps understand why people use particular type of media and what gratifications do they get from using them (Katz et al., 1973)</p>	<p>Sung (2021)</p> <p>Mattke et al. (2021)</p>	<p>The objective was to investigate consumer responses to augmented reality in-app advertising by measuring shared social experience and purchase intention</p> <p>The objective was to observe the processing of structural and semantic factors that leads to clicking behavior</p>
<p><i>Theory of Narrative Transportation:</i> The theory proposes that people are often influenced and changed by a narrative, and it can be used to persuade people to change their attitudes and beliefs (Green and Brock, 2000)</p> <p><i>Theory of Planned Behavior (TPB):</i> An individual's decision to engage in a specific behavior can be predicated by their intention to engage in that behavior (Ajzen, 1991)</p>	<p>Sigurdsson et al. (2018)</p> <p>Logan (2017)</p> <p>Aydin and Karamehmet (2017)</p>	<p>The objective was to investigate consumers' attitudes toward in-app ads in terms of ad value</p> <p>The objective was to investigate attitudes toward in-app ads in different app categories</p> <p>The objective was to determine the major factors influencing consumers' attitudes toward SMS and mobile application advertising</p>
<p><i>Theory of Narrative Transportation:</i> The theory proposes that people are often influenced and changed by a narrative, and it can be used to persuade people to change their attitudes and beliefs (Green and Brock, 2000)</p> <p><i>Theory of Planned Behavior (TPB):</i> An individual's decision to engage in a specific behavior can be predicated by their intention to engage in that behavior (Ajzen, 1991)</p>	<p>Sung et al. (2022)</p>	<p>The objective was to examine narrative transportation (in response to ad storytelling) and spatial immersion in AR advertising</p>
<p><i>Schema Congruity Theory:</i> Assimilation of new information is dependent on the levels of fit between new information and the existing schema (Mandler, 1982)</p>	<p>Cheung and To (2017)</p> <p>Hsu et al. (2020)</p> <p>Wang and Chou (2019)</p>	<p>The objective was to extend TPB to include the "propensity to trust" and "trust" as antecedents of users' attitudes toward in-app ads</p> <p>The objective was to investigate parental perspectives on the adoption of the m-Learning app with in-app ads</p> <p>The objective was to examine how the degree of congruity between promoted products in interstitial ads and the mobile gaming app environment affects consumer response</p>
<p><i>Elaboration Likelihood Model:</i> The model explains how humans process stimuli differently and how these processes change attitudes and, consequently, behavior (Petty and Cacioppo, 1986)</p> <p><i>Prospect Theory:</i> The theory assumes that losses and gains are valued differently, and decisions are made on perceived gains instead of perceived losses (Kahneman and Tversky, 1979)</p>	<p>Cicek et al. (2018)</p> <p>Sung (2020)</p>	<p>The objective was to investigate the effects of ad banner location, app type and orientation on ad recall</p> <p>The objective was to examine factors affecting the relationship between brand trust and purchase intentions. The moderating role of the anticipated gain, i.e. access to discounts was examined</p>

Table 1.
Theoretical perspectives used in the in-app advertising literature

Table 2.
Proposed advertising theories for future research in in-app advertising

Theory	Description	Future research
Interactive Advertising Model	Information processing is related to the function of the consumer-controlled aspects of the internet and the advertiser-controlled aspects like ad structures (Rodgers and Thorson, 2000)	The theory can help examine the array of responses that result from the encounter of consumer-controlled and advertiser-controlled aspects of in-app advertising and their influence on information processing and consumer responses
Perceptual Load Theory	The success or failure of selective attention is dependent on the processing demands of the current task (Lavie <i>et al.</i> , 2004)	The theory can help investigate the degree to which distractors (in-app advertisements) are processed during high and low perceptual loads
Media Engagement Framework	Engagement is conceptualized not as a behavior but as a motivational experience (Calder and Malthouse, 2009)	The theory can help explain the impact of in-app advertising on mobile apps based on the different app types and their engagement experience
Theory of Interactive Media Effects	The level of interactivity in the medium determines the type and strength of the media's effects (Sundar <i>et al.</i> , 2015)	The theory can aid researchers describe the positive, as well as negative effects, of various forms of in-app advertisements
Psychological Reactance Theory	When an individual's freedom is threatened, they experience psychological reactance, which is a motivational state that drives freedom restoration (Brehm, 1966)	The psychological reactance due to in-app advertisements and their impact on mobile app usage can be studied using the theory

lists many more advertisement formats, such as reward ads, native ads, video ads, emoji ads, virtual reality ads and audio ads. Future research can explore these emerging advertisement formats.

4.3 Characteristics of in-app advertising studies (C)

We examine the empirical research on in-app advertising that used theoretical frameworks and synthesized the antecedents, outcomes, mediators and moderators of in-app advertising in this section. Studies reveal that advertisement-related antecedents such as advertising content, animation and interactivity influence advertising value and have significant effects on emotional engagement (Cassioli, 2019) and visual behavior (Cassioli and Balconi, 2022). Antecedents such as informativeness, credibility, entertainment (Aydin and Karamehmet, 2017), personalization (Sigurdsson *et al.*, 2018), trust (Cheung and To, 2017), attitudinal beliefs (Hsu *et al.*, 2020) and gratification sought (Logan, 2017) influence attitudes toward in-app advertisements. Attitude influences the intention to watch in-app advertisements (Cheung and To, 2017), the intention to adopt m-learning platforms with in-app advertisements (Hsu *et al.*, 2020) and the behavioral intention to click on in-app advertisements (Sigurdsson *et al.*, 2018), which in turn influences user behavioral responses. Self-efficacy, the perceived value of collaboration and incentives influence the intention to interact with in-app ads (Qureshi *et al.*, 2022). Cicek *et al.* (2018) provides causal evidence that app type, app orientation and banner ad location influence ad recall. Mattke *et al.* (2021) studied structural factors of in-app advertising, including animation, color brightness, location prominence, size and similarity to background structure, and semantic factors, including perceived

entertainment value, informativeness, irritation, privacy concern, credibility, congruity and personalization, to investigate the consequences of clicking behavior. The influence of antecedents such as advertisement types affects the click-through rate (Rosenkrans and Myers, 2018), advertising avoidance behaviors (Keem and Lee, 2018), purchase intention (Sung, 2021) and social media sharing (Sung *et al.*, 2022). The interactive effects of publisher-controlled factors, namely, ad space size, ad space position ad space timing (Truong *et al.*, 2019), and ad space duration (Truong, 2023), with advertiser-controlled factors, namely, ad type, ad medium, location (Truong *et al.*, 2019) and time (Truong, 2023), on the click-through rate were investigated. Wang and Chou (2019) examine how the degree of congruity between promoted products in interstitial ads and the app environment affects consumer response toward the ad.

Mediator constructs such as trust, intention to watch in-app advertisements (Cheung and To, 2017), attitude (Sigurdsson *et al.*, 2018), ad response (Sung, 2020), perceived value of collaboration and incentives (Qureshi *et al.*, 2022) were used to study the impact on behavioral intention. Wang and Chou (2019) investigated the moderating effects of game types and game immersion on advertising effects. Aydin and Karamehmet (2017) examined the mediating effect of advertising value on attitude. Qureshi *et al.* (2022) assessed the moderating effect of self-efficacy on the intention to interact with in-app advertisements. Based on the synthesis of the literature, we found that with reference to outcomes, clicking behavior, behavioral intention and attitude are the most frequently studied consequences.

In the current studies, antecedents related to consumer-related factors such as personality traits, memory, feelings of intrusiveness, psychological reactance and their impact on behavioral outcomes are scarce. Understanding the unintended consequences of in-app advertising is important, and future studies can focus on reducing negative consumer reactance using an optimal combination of publisher-controlled, consumer-controlled and advertiser-controlled (Mattke *et al.*, 2021) antecedents. In future research, there is also a need to investigate the moderating effect of demographic variables such as age, income and gender on clicking behavior. Empirical studies using theoretical frameworks to examine user behavior in in-app advertising are scarce.

4.4 Methods in the in-app advertising literature (M)

The methodology-wise analysis suggests that quantitative research methods were prominent (93 % of the total). Only two studies (Haenschen and Wolf, 2019; Scott *et al.*, 2018) used a qualitative approach, and one study (Logan, 2017) used a mixed method.

As in-app advertising is an interdisciplinary topic, 50% of the studies were from the field of information technology. The methods in these studies were simulation experiments and the development of effective algorithms, optimization models, econometric models or machine learning models. The analysis techniques used in these studies examined the effectiveness of these models, and in two studies (Gao *et al.*, 2021, 2022), text mining was used.

The remaining 50% of the total studies were from marketing, advertising and consumer behavior. The methods in these studies include surveys (9), laboratory and field experiments (7), neuroscientific experiments (2), qualitative (2) and mixed methods (1). The analysis techniques used in these studies include SEM, ANOVA and descriptive analysis.

As in-app advertising is still emerging, a mixed-method approach can provide a comprehensive understanding of an emerging phenomenon.

5. Future research agenda

There are several gaps in the extant literature that provide avenues for future research. From a theoretical perspective, we observe that research in in-app advertising has not been examined through several theoretical lenses. Future empirical research with theoretical foundations would advance the understanding of consumer behavior in this emerging area. [Rodgers and Thorson \(2019\)](#) offer a comprehensive synthesis of the vast literature on advertising and provide theoretical approaches to advertising. Considering the unique characteristics of mobile apps and the high level of user engagement compared to other mediums, there is scope for applying several advertising theories. We propose five advertising theories in [Table 2](#) for future research on in-app advertising.

There is also ample scope for examining underexplored contexts (country, industry and ad format) in in-app advertising. As research from the USA dominates the literature, future research may examine app user behavior from Asia-Pacific and European regions. Country-specific issues examining the regulation and compliance of app developers could be undertaken. As there are only a few studies that examine the buy-side or publishers of in-app ads, future research may examine publisher-controlled elements and their impact on ad effectiveness and user behavior. As there are novel formats of in-app ads such as virtual reality ads and many multimedia ad formats, future research may examine issues such as ad avoidance, ad fraud and ad effectiveness in emerging ad types in in-app advertising.

Only a few users' behavior constructs in the in-app advertising context have been studied in the literature. Future studies may examine user demographics, personality traits, motivation, attention and their impact on attitude and ad avoidance. Age and gender can be examined as moderating variables, as they can also influence attitudes toward in-app advertising.

The mobile app is a pull medium and users are highly goal-oriented compared to other mediums. Hence, consumer-controlled aspects ([Rodgers and Thorson, 2000](#)) of mobile apps, such as motivation, attention, involvement and their impact on cognitive and emotional processing of in-app advertising, may be explored in future studies.

From a methodological perspective, analytical and quantitative research have dominated the literature. Future empirical research with a theoretical foundation and mixed methods research approaches (both quantitative and qualitative) could be used. Case studies in in-app advertising could also provide more insights into the in-app advertising phenomenon. New machine learning and artificial intelligence techniques need to be researched to combat ad fraud. [Table 3](#) highlights the key research gaps in theories, context, characteristics and methodology in the in-app advertising literature and proposes future research directions.

6. Theoretical and practical implications and conclusions

This study makes three main theoretical contributions to the growing literature on mobile advertising and digital marketing. First, the study is a maiden attempt to systematically review the literature on in-app advertising and synthesize it into five broad themes. The thematic analysis reveals that there are several research gaps in the in-app advertising literature and there is a need for empirical research on emerging ad formats of in-app advertising, user behavior and issues on the buy-side of in-app advertising. As in-app advertising is a fast-growing mobile advertising format, understanding consumer behavior and its effectiveness in different contexts is essential. We highlight some of the key differences between in-app advertising and mobile web advertising to spark interest in future researchers and undertake further studies.

Second, the study identifies the gaps in the literature and proposes future research areas (refer to [Table 3](#)) in in-app advertising based on the TCCM framework. The framework (refer to

TCCM	Research Gaps	Future Directions for Research
Theory	Only nine theories in marketing and psychology were applied to examine issues in in-app advertising literature. Need for more empirical studies with a theoretical foundation in in-app advertising	<ul style="list-style-type: none"> • Application of interactive advertising model, perceptual load theory, media engagement framework, theory of interactive media effects and psychological reactance theory
Context (Industry, country, ad format)	<p>Studies from the industry sectors such as financial services, retailing, hospitality, media, and entertainment are non-existent. These sectors use in-app advertising extensively</p> <p>Studies from US consumers are prominent. Lesser understanding of users from Asia-Pacific and European regions</p> <p>Lack of understanding of issues concerning the buy-side or publishers of in-app ads</p> <p>Scarce literature comparing user behavior in different types of mobile apps and ad formats</p>	<ul style="list-style-type: none"> • Comparative studies examining app user behavior across different industries • Cross-cultural comparative studies across different countries examining user behavior • Country-specific issues on regulation and compliance of app developers • Impact of publisher-controlled elements such as ad types, formats and ad position on ad effectiveness, information processing and behavior • Which type of in-app ad type is more effective if the advertising objective is to gain higher reach versus higher engagement with consumers? • Effects of different forms of in-app advertising on brand engagement • What formats of in-app advertisements lead to ad avoidance? • Research novel formats of in-app advertising such as reward ads, native ads, video ads, emoji ads, virtual reality ads and audio ads • Ad formats that have high ad fraud rate and mitigation
Characteristics (Antecedents and outcomes)	<p>Studies examining user psychology and behavior constructs in in-app advertising are scarce</p> <p>Personal characteristics and their impact on in-app advertising are not examined</p>	<ul style="list-style-type: none"> • Impact of content inappropriateness and data sharing in mobile apps on the brand • Effect of moderating variables such as age and gender on attitude and behavior toward in-app advertisements • Impact of motivation, attention and involvement on cognitive and emotional processing of in-app advertising • Possible outcomes of in-app advertising avoidance • User characteristics such as demographics, personality traits, culture on attitude toward the in-app advertisement
Methodology	Lack of mixed-method empirical research and qualitative research	<ul style="list-style-type: none"> • Empirical research with a strong theoretical foundation • Mixed method research • Qualitative research and case study • Effective machine learning techniques and artificial intelligence to mitigate ad fraud

Table 3.
Future directions for research in in-app advertising

Figure 3) developed for in-app advertising gives a holistic view of the body of knowledge. It presents the antecedents, outcomes, moderators and mediators in the current literature.

Third, we propose five advertising theories (refer to Table 2) that could guide future researchers to investigate issues in in-app advertising. We also highlight future research directions using the proposed theories.

The study has practical implications for advertisers and other stakeholders in the in-app advertising ecosystem. The review provides practitioners with an overview of the in-app advertising research that could be used to develop more effective strategies for its deployment. The review presents practitioners with an unbiased summary of in-app advertising research that can guide advertisers in designing and delivering in-app advertisements. By providing insights into the privacy and security concerns of users, we encourage practitioners to be mindful of using ethical practices in in-app advertising.

One of the limitations of the current review is the paucity of empirical studies. Quantitative analyses such as bibliometric analysis and meta-analysis could not be performed due to the heterogeneity of constructs and the paucity of empirical studies (Donthu *et al.*, 2021). Future research may examine a single phenomenon/construct in in-app advertising.

In-app advertising is set to be a key driver of mobile advertising over the coming years. Advances in mobile technology coupled with industry challenges such as ad fraud, ad avoidance and ad effectiveness measurement provide many opportunities for future research in the in-app advertising domain.

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Appendix 1

	In-app advertising	Mobile web advertising
Audience	Very niche and captive audience depending on the app	Broad
Targeting and personalization	High <i>Accurate ad placement based on location, demographics, app context</i>	Low
Ad formats	Emerging forms using augmented reality, 360 degree/virtual reality ads, rewarded video ads, in addition to traditional formats of web	Formats such as banner ads, native ads, video ads
User engagement	High	Low
User experience	High <i>User interface optimized for mobile</i>	Low <i>Content not usually optimized for small screens of the mobile</i>
Device compatibility	Developed for a specific operating system	Developed for browser
Push notifications	Always	Only during the session
Ad blockers	Not deployed readily	Ad and popup blockers are readily available
Privacy issues	High <i>Apps often require access to photos, contacts and location</i>	Low
Security risks	High <i>Sensitive data could be accessed by third parties</i>	Low

Table A1.
In-app versus mobile
web advertising

Author	Type of review	Focus of the review	Findings/research gaps in the context of in-app advertising
Maseeh <i>et al.</i> (2021)	Meta-analysis	Mobile advertising	Antecedents, attitudes and intentions to receive mobile advertisements were analyzed. In-app advertising received limited attention and was not included in the keyword search
Jebarajakirthy <i>et al.</i> (2021)	Systematic literature review	Mobile advertising	The scope of the paper is broad and in-app advertising received limited attention. Mobile marketing and mobile advertising were the keywords used. However, researchers posit privacy issues and security risks as one of the key concerns in in-app advertising
Narang and Shankar (2019)	Literature review	Mobile marketing	The review identifies a research agenda based on emerging technologies in the mobile marketing space and future research revolving around personalization in in-app advertising. Keywords and methods used for review are not specified
Truong <i>et al.</i> (2019)	Literature review	In-app advertising	Examines in-app advertising processes, in-app ad space supply and delivery process and participants. The paper develops a framework to enhance the effectiveness of in-app advertising. However, the review's focus is on examining relationships between publisher-controlled factors and the effectiveness of in-app advertising
Grewal <i>et al.</i> (2016)	Literature review	Mobile advertising	Develops a broad framework to examine mobile advertising effectiveness including market, firm, consumer and context factors along with ad goals, ad elements and outcome metrics. The review did not examine any issues related to in-app advertising
Bauer and Strauss (2016)	Systematic literature review	Location-based advertising	Focuses on location-based targeted advertising and in-app advertising is not part of the search strategy
Billore and Sadh (2015)	Literature review	Mobile advertising	Proposes framework for mobile advertising acceptance. However, issues in in-app advertising are not addressed
Varnali and Toker (2010)	Literature review	Mobile marketing	In-app advertising being a more recent phenomenon, is not included in the keyword search. The review summarizes key topics in mobile marketing research
Present study	Systematic literature review	In-app advertising	This review is a domain-based systematic literature review, using the TCCM framework. The study identifies five key themes in the current literature on in-app advertising using thematic analysis. Our findings reveal the need for empirical research, with a strong theoretical foundation in emerging ad formats of in-app advertising, user behavior and issues in the buy-side of in-app advertising

Table A2. Summary of literature reviews in mobile advertising in the past decade