Live Streaming: Its Relevant Concepts and Literature Review

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Abstract

Live streaming is a new form of social applications involving video content, consumption and real-time human interaction to facilitate users' ability to interact with each other. Despite the increasing popularity of live streaming and its influence on business and society, relatively little research has been conducted to understand what we know and what we need to know about it. Therefore, a systematic review of the existing literature was carried out to synthesize the research findings. Accordingly, we systematically reviewed 133 useable papers published across 52 academic journals and 10 conferences with regards to research trends, topics, methodology, and contexts. This study offers a thorough understanding of current practices in live streaming, which may help businesses to better realize their live streaming deployment objectives.

Keywords: social media, live streaming, live streaming commerce, metaverse, literature review.

1. Introduction

Live streaming is a new form of social applications, involving video content, consumption and real-time human interaction to enable users to interact with each other [2]. It developed rapidly worldwide since 2011 [11]. Recently, major businesses such as YouTube, Facebook and Tik Tok started taking advantage of real-time social interaction as a novel approach for adding value to their services, thus contributing to the spread of social commerce. Clarke [8] stated that the streaming industry may reach $70.05 billion by 2021. Research in diverse fields such as marketing [16], computer science [23], sociology [11] and psychology [17] has shown that the application of live streaming enhances user experience [32], fosters user participation in collaborative activities [10], stimulates creativity and engagement [6], and increases business profits [18].

Live streaming can be divided in two major categories. One category is traditional social media platforms integrating live streaming services; the other is based on platforms that have inherent live streaming functionalities [5].

Despite the rapid proliferation of live streaming and its significant effects on commercial services and society [32], few studies have been conducted to understand what is known and what needs to be known about it and how users interact with this new form of social commerce. Even those rare studies that explored user experience in live streaming [27] did not identify the factors associated with live streaming use from users' perspective. We believe that it is the best to conduct a systematic review that account for design features with user considerations. Moreover, live streaming is usually inspired by social media concepts [2]. It can be argued that there is a lack of research that addresses the unique characteristics of live streaming, such as video content, real-time interaction and complex context of use.

Therefore, a systematic review of live streaming literature that analyzes research findings and identifies gaps within the state of the art can be a valuable guide for future research. The systematic review covers live streaming and its platforms, and analyzes research trends, topics, methodologies, and contexts. More specifically, the following questions will be answered. (1) What are the trends and focus of live streaming literature? (2) What are the major theoretical foundations of previous live streaming studies? (3) What are the research contexts and methods that appear in previous live streaming studies? (4) What are the factors associated with live streaming use? The answers to these questions contribute to the understanding of user experience and performance in live streaming and identify best practices of live streaming performance.

This paper begins with literature review of social media, live streaming, live streaming commerce, video streaming, and the difference between live-stream and pre-recorded (Section 2). This is followed in Section 3 by a description of the data search process and some

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initial results. Section 4 concludes the paper and points to the future research directions.

2. Literature Review
2.1. The development of social media

Social media is a type of Internet-based applications, which was developed on the foundations of Web 2.0. It allows sharing and exchanging user generated content [15]. The origins of social media can be traced to more than 30 years ago [15], where radio was publicly used as a social media channel. Many studies have been done on the concepts of ''media'' and ''social''. These studies focus mainly on broadcasting, technology and social issues, such as responsibility and risk [33].

Social media might have started with the initial social networking sites that built an online community to gather users. Weblogs were first introduced at that time, and their name was changed to ''blogs'' one year later [15]. Advances in high-speed Internet and web technologies accelerated the development and introduction of social applications, such as the social networking websites MySpace in 2003 and Facebook in 2004 [15]. Later, more developments in information technology led to virtual worlds, such as Linden Lab's Second Life, which is a computer-based simulated environment created on three-dimensional technologies [33].

In 2008, social media started to attract the attention of more researchers [1]. A formal definition of social media covers two closely relevant concepts, which are web 2.0 and user generated content. Web 2.0 refers to a new approach which support social interaction and user generated content in order to assist users in acquiring information [13]. User generated content is about various forms of media content that are produced by users [13]. Impact of social media can be measured by the business value, such as word-of-mouth marketing, communication, sales promotion, and relation development, etc. [33].

Many social media applications have been developed, including collaborative intelligence, Blogs, content communities, social networking sites, and social shopping [12]. Collaborative intelligence enables user access to social knowledge and experiences to complete collaborative work. Blogs are distinctive sorts of websites that frequently present date-stamped content in reverse chronological order. Content communities share media content, such as text, images, and videos among users. Social networking sites are applications that allow users to connect with others through personal profile creations, friend invitation and message exchanges between users. Social shopping involves user interaction

between users through online social networks in the course of shopping. More recently, with the development of 3D and virtual reality technologies, the metaverse has emerged as a new mode of social media. It refers to an interactive, immersive and collaborative virtual world inhabited by avatars representing real people [16].

Among the different types of social media, live streaming is regarded as a new form of social media, which can significantly impact business organizations' performance [35]. It is also seen as a type of Internet-based multimedia entertainment platform [11].

2.2. The definition of live streaming

Live streaming can be simply defined a media for people to interact in real-time [6]. Bründl and Hess [3] capture the social aspect of live streaming and describe it as users watching live video content in real time to facilitate sociability. Focusing on the communication aspect, Wang [27] explains live streaming as a new media category that broadcasts video content to achieve communication between users and streamers. Tang et al. [25] state that live streaming services display asymmetrical interfaces, where streamers produce video content and users communicate through chat.

Live streaming involves multiple disciplines, including business, computer science, sociology and psychology, which leads to various definition of this nascent concept. Especially during the pandemic of COVID, live streaming commerce and related online games gain a lot of attentions by both the users and practitioners. This is because live streaming is about a new trend of online business, where live streaming combines social commerce attributes with real-time video interaction [5]. Focusing on computer technology, Mueser and Vlachos [20] describe live streaming as a hybrid social platform combining audio-visual, digital and transmission technology. With respect to sociology, live streaming refers to using online communities to socially influence the interaction among users [35]. Finally, Li et al. [17] address live streaming from the perspective of psychology of social shopping. User behavior in live streaming differs from traditional online shopping because users shop for virtual gifts to reward streamers for their efforts.

While the abovementioned definitions imply different scopes for live streaming and other broadcasting and video services, its suggest that live streaming is an evolution of social commerce [3, 35]. Therefore, we define live streaming as a hybrid social application, involving video content, consumption and

real-time human interaction to facilitate users' ability to interact with each other.

The differences between live streaming and other broadcasting and video services can be seen mainly in terms of user interaction and monetization model [17]. With regard to user interaction, broadcasting and video services focus on maximizing user interaction through text, broadcast video and audio, and content. Live streaming however offers real-time social interaction between the streamer and viewers, facilitating viewers' ability to interact with each other [11]. Regarding the monetization model, broadcasting and video services make profits through users subscribing to the services. Live streaming, however, offers a new monetization model that allows viewers to show their appreciation for streamers monetarily [17]. Moreover, Scheibe et al. [22] emphasize four characteristics to distinguish live streaming from other broadcast or video services, including real-time shows of self-recorded material, the use of mobile devices, social interaction and a gift system. In contrast to traditional e-commerce systems where users mainly receive product information by looking at static product information, live streaming enables users to have better capabilities to evaluate the products through real-time social interactions with sellers, streamers and product manufacturers [27].

2.3. The definition of live streaming commerce

Live streaming commerce is defined as a subset of social commerce that is embedded with simultaneous interaction [4]. Users top up their accounts on the live streaming platform with real money through a variety of payment methods, and purchase different kinds of virtual gifts with their account balance. Users send their virtual gifts to streamers in their respective channels. Streamers and the live streaming platform split the proceeds. Streamers can choose to cash out or convert their proceeds back into their own account balance on the platform [34]. Live streaming shopping can be implemented in two ways. One is live streaming based e-commerce systems (e.g., Amazon live style code, Taobao.com, VIP.com), the other is e-commerce embedded in live streaming platforms (e.g., Live.me and Livby) [5].

Live streaming has changed traditional social commerce in several aspects. First, in traditional online shopping, the major way to learn about products is through pictures and text; while in live streaming commerce, users receive product information through real-time video on live streaming [29]. Second, in traditional social commerce, users need to visit a contact page to communicate with the seller to ask questions about a product. Compared with live streaming shopping, users are allowed to pose query through the interactive interface (or page) [29]. Third, in traditional social commerce, users are not always given enough support to guide their purchase, which leaves users uncertain about their online shopping process. Live streaming shopping tries to solve this issue by providing users with highly personalized services and guidance to support their purchasing and use of products [24].

The real-time interaction of live streaming allows users to have a strong sense of social presence and social interaction [28]. This can largely improve users' trust and reduce their uncertainty [17]. As a result, live streaming commerce is being used worldwide and is attracting large numbers of users.

Many studies address live streaming commerce behavior as a managerial research issue or a psychological research issue [4]. The key theories of live streaming behavior research, covering Stimulus-organism-response model, media richness, decision-making theory, planned behavior theory, trust theory, IT affordance, and social presence theory [36].

2.4. Video streaming

Video streaming is defined as online streaming media that are delivered in video content in real time to users [27]. It achieves synchronous communication among a streamer and viewers [30]. As reported, 48% of Internet users in America watch live videos at least once a week, and a quarter of them buy live videos at least once a day [30]. Prior research on video streaming addresses sport events and various social activities based on online communities [9]. Relevant studies show a variety of channels of user participation driven by a streamer. Streamers engage in two-way communication with their users who have similar interests [10]. Their social relationship is established by sharing their online experiences and social motivations [23].

In general, video streaming is classified into two categories, namely live streaming and video on demand [19]. In live streaming, the video stream can be downloaded and reviewed, while video on demand is popular for reviewing pre-recorded movies and programs as they become available on video on demand platforms [19].

2.5. Difference between live-stream and pre-recorded

The differences between live stream and pre-recorded can be highlighted in aspects of participation interaction, business strategy, social presence and

design and user behavior. In aspects of participation interaction, real-time interactions organized by anchors with the participation of viewers are an essential component of live streaming [7]. Real-time interaction empowers user control over the form and content of the interaction. However, a pre-recorded view is a non-real-time interaction.

As for business strategy, live streaming is characterized as a social strategy, which uses video content to attract users for marketing purposes. These include real-time sharing, bi-direction interaction, live chats and instant messages. On the other hand, a pre-recorded viewing strategy uses previously recorded marketing video content to socially interact with users [2].

With respect to social presence and design, a live streaming social presence incorporates cues such as "Live" and "Number of People Watching Now" to highlight a real-time shared relationship. However, a pre-recorded social presence uses cues such as "Number of Views" and "Number of Comments" to indicate non-real-time shared viewership [2]. Moreover, Ang and Wei [2] find that live streamed content is more interesting and attractive than pre-recorded content.

For user behavior, live streaming users may perceive a sense of being together with others [28], whereas users in a pre-recorded social viewing context are likely to perceive a sense of others being in the same place at various time points [29].

Some studies point out other differences between live-stream and pre-recorded. For example, Novak [21] found that viewers perceived more trustworthiness, enjoyment, and participation in live presentations vs pre-recorded presentations. Sjöblom et al. [23] address the distinctions in aspects of service platform, indicating that a pre-recorded video content is mainly through service platforms, such as YouTube and live video broadcasting, while live streaming is provided on service platforms, such as Twitch, Facebook Live or YouTube Live. Ang and Wei [2] further analyze the cost related participation in interactive platforms from users' point of view, indicating that there is a larger volume for live streaming viewing than pre-recorded viewing.

3. Data and Initial Results

3.1. Literature search

To answer our research questions, we should track as many related publications as possible. Therefore, we considered relevant databases such as ACM Digital Library, EBSCOhost, ProQuest, ScienceDirect, Emerald, Wiley, Springer, Scopus, InderScience, IEEE Xplore, Sage, AIS e-Library and Web of science. In addition, we considered search terms such as streaming, live-stream, livestreaming, video stream, audio stream, Social streaming, real-time broadcasting, live broadcasts, real-time video. We searched for example, "social media, live streaming, live streaming commerce" as the keywords from the Title, Keywords and Abstract fields. Finally, we searched all the databases from 2010 to the end of 2021. This is because that is the date when few star-up companies launched applications to allow sharing live video. All selected papers were assessed using a checklist that was formulated to examine the research in terms of rigor and relevance. Rigor relates to the presentation of the context, the study design, and the validity. Relevance includes subject, scale and research method.

3.2. Initial findings

After excluding the papers that we could not use in our literature analysis, we reviewed 133 useable papers published across 52 academic journals and 10 conference articles. Table 1 shows the publication distribution within two decades. It seems that 2018 was a tipping point where live streaming research started its noticeable increase. The increasing trend was more pronounced starting in 2020.

Table 1. Frequency of publication

Year of publication	Number
2010	1
2011	1
2012	1
2016	2
2017	8
2018	18
2019	17
2020	43
2021	42
Total	133

Table 2 shows the major methods that were employed in the selected publications. Among them, survey was the most frequently employed methodology. Experiment placed next. The interview method ranked third with 17 identified papers. Some studies (14 papers) employed the case study method and few studies (6 papers) used the literature analysis method. Other studies (13 papers) developed their own research approaches, such as discursive analysis, conjoint analysis, ethnographic research, and hierarchical regression analysis.

Table 2. Summary of research methods

Research method	Number
Case study	14

Experiment	20
Experiment & Survey	3
Interview	17
Interview & Observation	5
Survey	52
Survey & Interview	3
Systematic Review	6
Others	13
Total	133

Table 3 lists the major live streaming platforms covered in the selected publications. Our review identified YouTube as the most used platform. Twitch was second, and Facebook was third. Surprisedly, there was a large number of other live streaming platforms that have been widely used, such as Snapchat, Xiongmao, Kuaishou, FreeTV, Netflix, Fortnite, and Ustream.

Table 3. Summary of live streaming platforms

Major platform	Number
Twitter	18
Facebook	28
YouTube	42
Douyu	10
Huya	3
TikTok	3
YouNow	5
Twitch	36
Instagram	9
Periscope	3
Others	75

Beyond the live streaming platforms, various theoretical and conceptual frameworks were employed in live streaming research (see Table 4). These include the common uses and gratifications theory, users' behavior theory, stimulus–organism–response model and social exchange theory. Our review found that cognitive transactional theory, affordance theory and perceived value theory are also used in live streaming studies. It is worth to note that since live streaming covers multiple disciplines, other theories, such as satisfaction theory, cultural semiotic theory and IT acceptance theory were also considered in live streaming research.

Table 4. Theoretical and conceptual frameworks

Theoretical framework	Number
Use and satisfaction theory	2
Logic-robot model	2
Perceived value theory	5
Generational cohort theory	2
Cultural semiotic theories	2
Uses and gratifications theory	13
Behavior theory	8
Stimulus–organism–response model	7

Social exchange theory	7
IT acceptance theory	2
Cognitive transactional theory	6
Affordance theory	5
Others	18

Table 5 depicts the key themes addressed in the selected live streaming studies. As can be seen in the table, user engagement has drawn the most attention from researchers and practitioners. Studying live streaming design and content provision are also important. Some studies focused on how socialization and enjoyment through live streaming increase social connectivity and strengthen social communities. Moreover, it seems clear that a variety of interesting themes were covered in live streaming research, including self-efficacy, emotional stimuli, behavioral loyalty, guidance shopping, materialism, trustworthiness and so on.

Table 5. Key themes addressed in the literature

Key themes addressed	Number
User engagement	13
Self-efficacy	4
Cultural inclusion	2
Socialization	7
Entertainment value	6
Platform design	8
Perceived enjoyment	6
User motivation	22
Content	8
Others	13

4. Conclusion and Further Research

4.1. General discussion

Generally, live streaming seems a new development in social commerce that is characterized by novel forms of online business models.

Live streaming links to various connective activities. It influences the ways where synchronous and asynchronous forms of online audio-visual communication to users. The factors, including social interaction, easy content accessibility and advertisement motivate users to spend more time on live streaming. Furthermore, users' heavy involvement of streaming services becomes new addictive behavior. Additionally, other social implications that may lead to excessive usage of live streaming services include the lack of self-control, lack of self-esteem and use motive of information seeking.

Regarding user engagement within live streaming, social connectivity has a curvilinear relationship with user engagement. Users perceive that utilitarian and hedonic values also affect user engagement. Environmental stimuli are positively related to both cognitive and emotional organisms, which in turn influences user involvement. Furthermore, factors such as interactivity and humor have a big impact on continuous watching of live streams. Moreover, virtual gifts are a vital way for users to communicate with the streamer. Tie strength is intermedia between interactivity and user participation. Other factors that can moderate the relationship between interactivity and tie strength include membership and popularity. Additionally, entertainment is found to be a major influence on users' intention to join live streaming sessions.

For business organizations that own live streaming platforms, streamers generate content and foster interaction between streamers and users, therefore enhancing buying experience and increasing sales. This is the first-order effect of Internet celebrity endorsement. The second-order effect on sales takes place through interactions within the fan community. Additionally, sales and loyalty can be increased by building user trust through live streaming.

With respect to business management, live streaming can effectively re-organize the social structure around social representations. Managers of live streaming can improve their applications to users by highlighting various consumption values and make their applications more attractive to users. Meanwhile, live streaming can positively influence users' perception of usefulness and negatively affect their perceived risk, encouraging social commerce engagement.

The cinematic live transmission of performing arts challenges current conceptual categories and business strategies. Live streaming can be an important option for social commerce in the digital world. However, there is no one-size-fits-all strategy, live streaming can be used in all fields.

To design better live streaming platforms or applications, the potential utility of a functional approach to understanding the relationship between user motivations and their behavioral live stream interaction, and user characteristics from a Human-Computer Interaction perspective need to be addressed in order to support users to achieve their desirable service output. Furthermore, a participation design approach needs to be implemented during live streaming development.

4.2. Limitations and future research

This study has several limitations. First, we searched relevant databases from 2010 to the end of 2020, which may provide limited insights. Another limitation is the research ideas been proposed in this study. It would be interesting to conduct an assessment for different types of live streaming to validate relevant design features. This study is the first step, and the following future research will be conducted.

To better understand live streaming and its related disciplines, we will employ the Information model (I-model introduced by Zhang and Benjamin [31] to classify the related factors. The model focuses on the Internet-based applications that are related to the concepts and phenomena of information with social purposes, identifying four core dimensions including people, technology, organization and society, and information.

Given that live streaming as a new form of social applications is concerned with information related phenomena, it therefore can be explained by all four key dimensions in the I-model, including people, technology, organization and information. More specifically, people are one of the most important dimensions, providing a fundamental drive for socialization, connection, commerce, content creation and information distribution. People can be a single reviewer or streamer, small or large groups of people, or a community of users.

Technology is also an essential dimension. It ensures that all relevant applications and services provided by live streaming platforms can be achieved through its technical support and capabilities. It provides a variety of functionalities and properties that aid people and businesses use and interact with live streaming.

Organization and society are related to aspects of policies, strategies, and management.

Regarding information, live streaming has a large number of user generated content and a lifecycle that covers various processing activities, such as creation, sharing, editing, categorizing, dissemination, storage and usage.

Therefore, our study will adopt the I-model to analyze and investigate various aspects of live streaming and its evolution. By doing so, our study will offer a systematic understanding of current practices in live streaming, which may help businesses to better realize their live streaming deployment objectives.

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