Who's Watching? Classifying Sports Viewers on Social Live Streaming Services

Abstract

To further broaden our knowledge of the groups of sports viewers that exist in social live streaming services and their distinct usage behaviours, this research is designed to understand different sports viewers' distinct engagement behaviours through analysing the large-scale web behavioural data of the social live streaming services viewers. A mixed-method approach is adopted. Microsoft's Excel spreadsheet software and the Visual Basic for Applications programming language are used for preliminary processing of the viewers' behavioural data and arranging the data from chronological order into viewers' overall viewing time, the number of messages sent, and the number of virtual gifts sent based on user ID. The two-step clustering analysis, conducted using the SPSS software, was then employed to deal with the large size of the sample and to classify the viewers into four groups, namely content consumers, super co-creators, co-creators, and tourists. A series of interviews with a representative sample of sports viewer(s) from each group was conducted to obtain qualitative insights into the nature of these behaviours. The findings have important implications for social live streaming services marketers and other sporting event stakeholders to understand different groups of viewers' preferences and effectively engage with them.

Keywords Sports viewers · Social live streaming services · Value co-creation · Engagement behaviour · Big data

1 Introduction

The absence of live sport throughout the COVID-19 pandemic has been felt strongly by sport fans across the world. Most major sporting events at the international and national levels have been cancelled, delayed, or played in empty stadiums. Fans have been missing out on the physical game that offers communal experiences. The entire sports ecosystem needs new ways to deal with threats to fan attendances and engagement. However, video streaming presents new opportunities to generate revenue and maintain fan engagement. In response to this COVID-19 crisis, sport event organisers have heavily adapted social live streaming services (SSLSs), such as YouTube and Facebook live, to supercharge the fan communal experience through providing rich, real-time, and immersive experiences of watching events online (Kim & Kim, 2020). Therefore, live streaming platforms are not an extra mainstream of revenue but play a central role in connecting with fans during crises (Neureiter, 2021). For example, in 2020, Twitch attracted 7 million unique streamers, with over 30 million followers, who create and stream sporting events and games on the platform (Twitch, 2020).

Compared with the traditional social media that uses second screens to interact, these newly emergent services provide the sport event consumers with a synchronised viewing experience. The sport viewers can interact in real-time with streamers and other viewers when they are watching the sport events through sending real-time messages and sending virtual gifts to express their personal feelings about a sport event instantly (B. Li *et al.*, 2018). It is evident that live streaming can provide immediate benefits in the time of the pandemic. However, live streams can continue to attract reviewers and provide benefits for sponsors when the stadiums reopen. Therefore, it is important to understand the fan experience in this new virtual sports environment.

Sport management scholars have examined usage, psychological consequences, adoptions, usage motivation, and users' gratification expectations (Friedländer, 2017; Hilvert-Bruce et al.,

2018; Scheibe et al., 2016). However, we know very little about the unique usage of different types of users and their distinct usage patterns. Compared with traditional media, the sport event viewers on SSLSs are not only watching the events, but also seeking interaction opportunities provided by the live streaming platform, such as real-time messaging and sending virtual paid gifts. As a result, the viewers will behave in different ways while watching the game, which can be classified into different categories. Today, big data is available from both firm and consumer activities, making it possible to understand consumer behaviour (Kunz *et al.*, 2017; Grover et al., 2020; Zhan & Tan, 2020; Tan *et al.*, 2015). Live streaming platform managers may benefit from adopting big data analysis to obtain more accurate knowledge of customer engagement on social media and consequently formulate more effective customer engagement strategies (Liu et al., 2019; Tan et al., 2017; Zhan et al., 2018; Li et al., 2018; Mishra & Singh, 2018)

In line with the Service Dominant Logic (SDL), value is co-created by actors integrating the service providers' value propositions, and is always determined by the beneficiaries as there is no value until the customer uses the offering (Vargo & Lusch, 2008; Vargo & Lusch, 2016). That means customers not only contribute value propositions to the service ecosystems, but they also evaluate and decide the value of other actors' contributions according to the specificity of their usage (Vargo & Lusch, 2008). Consequently, it is important for sport SLSSs firms to classify their viewers based on how viewers utilise the platform. This can then enable the sport SLSSs firms to understand more deeply their customer contributions and preferences, and then effectively engage with their customers, audience, or users.

This research is exploring the viewers groups through analysing the large-scale web behavioural data of the sport viewers on SLSSs. In the second part of this study, we present the

findings from a series of interviews with representative viewers from each group to obtain more in-depth qualitative insights into the nature of these contribution behaviours.

2 Literature review

2.1 Definition of engagement behaviour

In the social media literature, the most widely supported conceptualization of social media engagement behaviour is a behaviour-based model (Dolan *et al.*, 2016; Brooks *et al.*, 2014). The activities performed by customers on social media range from merely reading and commenting on posts to posting messages that show different levels of engagement (Vale & Fernandes, 2018). Van Doorn et al. (2010) state that customer engagement is a customer's behavioural manifestations that have a brand or firm focus, beyond purchase, resulting from motivational drivers. Similarly, Vivek et al. (2012) define 'consumer engagement' as the intensity of an individual's participation and connection with the organization's offerings. However, in the SLSSs, the virtual gifting behaviour is a mixed function of engagement behaviour that is similar to 'liking' a social media post, but it is in the form of paid virtual gifts (Lu et al., 2018). During the live streaming, a viewer can purchase and send a virtual gift to a streamer to express their emotions. Therefore, the virtual gifting is both a transactional and community-related behaviour. Therefore, this research adopts a holistic definition of customer engagement behaviour provided by Kumar *et al.* (2010) and defines customer engagement behaviour in sport SLSSs as a mechanism that allows customers to add value both directly (transactional behaviour) and indirectly (non-transactional behaviour) to organisations.

2.2 Typology of customer engagement behaviour on social media

Existing typologies of social media users' behaviour usually categorise behaviours based on two criteria: usage and user types. Among typologies that classify social media behaviours into

usage types based on the engagement level, Muntinga (2011) define these behaviours as consuming, contributing, and creating. These dimensions correspond to a path of gradual engagement with brands on social media, from low (passive) to high (active) activities. Consuming behaviour is consumers passively receive company– and consumer-related content. The contributing behaviour is the medium level of consumer activity, which reflects consumers' contribution to companies' content through participation. Researchers pay a lot of attention to consumer actions such as "Like", share, and comment. The creating behaviour includes consumer creation of different types of content. Building on this, Dolan *et al.* (2016) capture not only the intensity, but also the valence of brand-related activities, by considering positively and negatively valenced engagement. Positively valenced engagement levels are low (consuming), medium (positive contribution), and high (co-creation). Negatively valenced engagement levels are low (detaching), medium (negative contribution), and high (co-destruction). Uhrich (2014) expand the behavioural view into a customer-to-customer value co-creation context through a series of qualitative research approaches including in-depth interviews, naturalistic observation, and netnography. He identified five types of customer value co-creation practices: associating and dissociating, engaging and sharing, competing, intensifying, and exchanging. Usage typologies, however, are limited in the sense that the result is largely dependent on the researchers' understanding and interpretation. Meanwhile, users engaging in the social media may act out multiple types of behaviours at the same time. A single type of engagement behaviour cannot represent the whole behaviour of a group of users.

The usage typologies are thus oversimplifications of reality, whereas user typologies that classify behaviour into user types are not, because they assume people engage in more than a single behaviour at the same time and usually with the analysis of intrinsic motivations (see **Error! Reference source not found.**). For instance, Pongsakornrungsilp and Schroeder (2011) focus on value creation in a particular type of co-consuming group: an online football fan

community. They demonstrate that consumers can play dynamic roles in the value co-creation as providers (creative posters, brand warriors, and moderators) and beneficiaries. These roles of social media users represent the behavioural nature of social media engagement. Van Osch et al. (2016), based on the core-periphery theory, reveal four groups of enterprise users according to their posting and viewing behaviours, namely core-users, promoters or super-promoters, and peripheral user.

However, the above typologies of customer engagement behaviours are based on the non-transactional behavioural manifestations (Yoshida et al., 2018). Live streaming has emerged as a new form of participatory social media that enables viewers to interact with each other and the streamers. In the study of live streaming services, both the non-transactional and transactional features of customer engagement have been identified. Studies have found that, in general, SLSSs have explored the users' information behaviours, including broadcasting, watching, rewarding, and chatting (Scheibe et al., 2016). Hilvert-Bruce et al. (2018) explain four types of live stream viewer engagement, including emotional connectedness, time spent, time subscribed, and donation, via an international online self-report survey of Twitch users. The donation behaviour is highlighted to be a transactional engagement that represent a customer engagement behaviour of financial donation to the streamer (via PayPal) or charities. Similarly, Lu et al. (2018) highlighted a mixed function of paid virtual gifting, whereby a viewer can purchase and send a gift to a streamer during the live stream. This new and innovative function has led to the emergence of a new monetization model in live streaming.

2.3 Value co-creation of viewers engagement behaviour

Many studies have discussed the reason for customers engaging in different behaviours. In the literature over the last decade, studies of brand-related social media have been considered both self-directed (consuming) and others-oriented (contributing and co-creating) behaviours

(Dolan *et al.*, 2016; Muntinga et al., 2011). In line with the service dominant logic, studies focused on value co-creations and suggest that customers access and integrate resources to create value for themselves and others (Akaka et al., 2013).

On the one hand, actors within a system co-create value with their contributions. For example, at a sports stadium, fans and spectators contribute to the atmospherics through their behaviour (e.g., by singing battle chants) and their appearance (e.g., wearing fan merchandise) (Uhrich & Benkenstein, 2012). When it turns to the online community, customers can also contribute to the community, such as by contributing knowledge, comments, and information, by acting as a provider (Pongsakornrungsilp and Schroeder, 2011).

However, on the other hand, although the customer can make the contribution, they cannot create value, but rather value propositions, because the contribution of customers may only be a potential input for the value creation of other actors. According to SDL, actors integrate the service providers' value propositions (competencies and capabilities) to acquire co-created value perceptions (Vargo & Lusch, 2016； Horbel et al., 2016). In this way, the value is always assessed and determined by the beneficiary based on the specificity of their usage, which is called value-in-use (Vargo et al. , 2008; Woratschek et al., 2014). Value-in-use is the 'customers' experiential evaluation *of service proposition in accordance with their individual motivation, specialized competencies, actions, processes, and performances*'(Ranjan & Read, 2016: 293). Accordingly, beneficiaries can acquire a unique perceived use value through enjoying usage (Ranjan & Read, 2016; Merz et al., 2018).

In the SLSSs context, viewers engage with different actors (streamers, other viewers, and the platforms) through gifting and real-time messaging for value co-creation. For example, viewers sending real-time messages to cheer for players can contribute to the live streaming room atmosphere, which can form the other viewers' perceptions. Besides, the viewers can

also perceive value from other actors' contributions. For instance, viewers watching the players' on-pitch performance listen to the streamers' commentary and discuss with other viewers to acquire perceived epistemic value on SLSSs (Horbel *et al.*, 2016).

Given the fact that the SLSSs are a newly emerged social media for sport event watching, there is lack of explanation concerning viewers' engagement behaviours and related value co-creation in live streaming. The lack of a theoretical understanding of this phenomenon offers an opportunity to explore the viewers of sport SLSSs, and their distinct contribution and perceived value. This research seeks to provide insights into the nature and dynamics of typifying consumers' roles based on live streaming usage, which remains extremely limited in the literature to date.

3 Research setting and Approach

To achieve the research objective of exploring the sport viewers groups in the SLSSs, we collected data from China Sport, a leading sport specific SLSSs in China. China Sport owns a vast range of world-class sports events live streaming copyright deals including table tennis, billiards (e.g., Snooker and nine-ball), basketball, badminton, fighting, racing, and so forth. It provides high quality live streams of sporting events with an interactive viewing experience via their website, and Android and IOS apps. As China Sport is one of the largest and popular sport live streaming platforms in China, and China is almost the most developed and advanced country in the world in terms of its live streaming industry, the insight gained from China Sport could be valuable.

The workflow of this research consists of two stages. In stage one, using the SPSS software, the two-step clustering analysis is carried on a large sample of the viewers behavioural data, which leads to the classification of the viewers into groups. Afterwards, a series of interviews

with representative viewers from each group is conducted to obtain more in-depth qualitative insights into the nature of these behaviours.

4 Cluster analysis of SLSSs viewers groups

Clustering analysis is an appropriate research technique for classification as it can identify and classify individuals according to similarities via a set of multivariate statistical techniques (Hautbois et al., 2020; Coppi et al., 2012). Clustering analysis has been widely adopted in social science studies, including sport practices and consumptions (Downward & Riordan, 2007), and social media community (Van Osch et al., 2016). The classifying of viewers is done by using historic data to allocate viewers into groups based on various features. In order to identify the types of sport viewers that existing in a SLSSs, two-step clustering analysis was conducted in SPSS. The criteria that this research used to define the clusters were the viewers' overall viewing time, the number of messages sent, and the number of gifts sent during a single match.

4.1 Data collection

The viewers behavioural data from the men's singles finals match (Dec 16, 2019, 20:30 to Dec 16, 2019 21:40) of a world level competition, the ITTF World Tour Grand Final 2019, were provided by China Sport for this study. The data were allocated into four separate Microsoft Excel spreadsheets. All of the data were collected in chronological order. Summary statistics of the dataset are presented in

Table 1.

Table 1 Data collected from China Sport

Sheet No.			Category	Content		Amount
1	Sheet 1	ID	real-time message text	Sending time		3615
2	Sheet 2	ID	Virtual gifting content	Virtual gifts value	Sending time	3668
3	Sheet 3	ID	First enter time	last left time		88711

4.2 Data pre-processing

In order to execute the clustering analysis through SPSS, these data were pre-processed to arrange them according to the user ID, following which all the data were allocated into one spreadsheet. It would be time-consuming if these data were handled manually due to the large quantity of data. Therefore, Microsoft's Excel spreadsheet software and the Visual Basic for Applications (VBA) programming language is adopted for preliminary Big Data processing (Grover et al., 2020). Firstly, the same user IDs that appear in the different datasheets are merged into one sheet. Secondly, based on the user ID, the number of real-time messages and the number of virtual gifts were counted. For example, ID '10718023' appears six times in Sheet 1. This means that ID '10718023' sent real-time messages for six times. Therefore, the number of real-time messages of ID '10718023' is six. Afterwards, the value of the total number of virtual gifts sent by each ID was also calculated by summing each ID's total gifting price. Finally, the viewing duration time was filtered out by using 'last left time' minus the 'first enter time'. In total, 52545 users' behavioural information were collected.

4.3 Data analysis

In this research, the two-step clustering analysis based on the SPSS software was employed to deal with the large size of the sample and the variety of continuous and ordinal scales used to measure the variables. It enables both categorical and continuous data to be processed and analysed simultaneously (Hautbois et al., 2020). In this study, because there are limited quantity virtual gifts and real-time messages, we transferred the data of gifts and real-time messages from continuous data into categorical scale. The two-step clustering analysis in SPSS can automatically group the data set based on its algorithm (Van Osch et al., 2016). The two-step clustering analysis involves two steps. In the first step, the software identifies the groupings by pre-clustering. In the second step, the software runs a standard hierarchical

clustering algorithm (Norušis, 2011). The Schwarz's Bayesian Information Criteria (BIC) will then define the best solution (Chiu et al., 2001). The BIC needs to be above .0 and ranges from –1 to 1. It identifies the validity of the within-cluster distance and the between-cluster distance (Norušis, 2011).

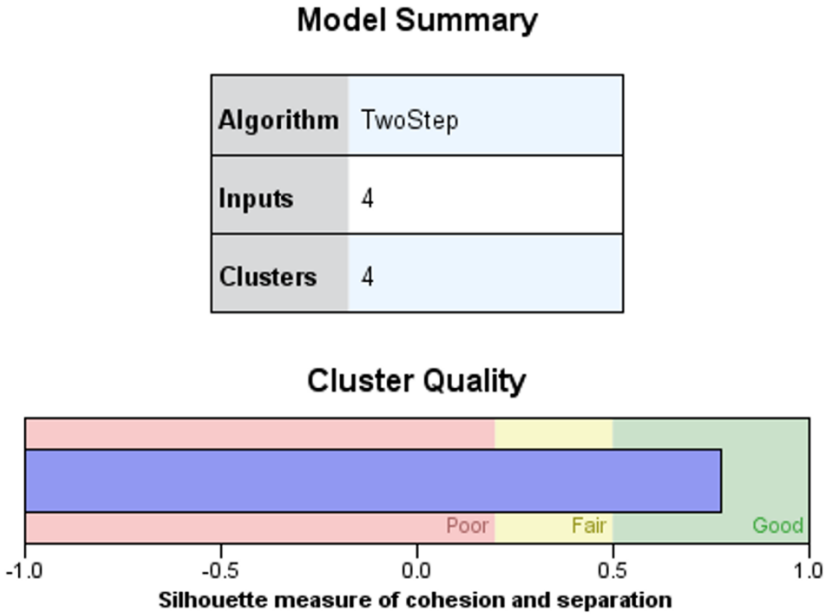

Figure 1 The test of classification.

The results of BIC display four clusters, and the value is between 0.5 and 1, which shows a high quality of the classification (see Figure 1). The four distinct types of SLSSs viewers contained 21445, 538, 637, and 17109 viewers, corresponding to 54%, 1.6%, and 43.1% of the total viewers, respectively.

Table 2 below show the descriptive statistics for each cluster. Cluster 1 is the largest group of viewers in the sample, consisting of about 54% of all users. These viewers have the longest average viewing time, which is 36.982 minutes. However, they do not send real-time massages and gifts. Therefore, they are labelled as content consumers. The second cluster of viewers is much smaller than the first group. This group consists of only 538 viewers, accounting for 1.4% of the total viewers. Although this group of viewers has a shorter viewing duration time (28.19

minutes) compared to cluster 1, they are actively engaging in sending messages and gifts. On average, each of these viewers sent 77 real-time messages and 538 gifts totalling 63.89 RMB in value. Compared with cluster 1, this group of viewers not only consumes the content, but they also contribute to other actors in the live streaming room by sending real-time messages and gifts. Therefore, we label this group of viewers as super value co-creators. The third cluster contains 637 viewers, making up 1.6% of the total viewership, which is just slightly higher than that of the cluster 2. Viewers in this cluster have a slightly shorter viewing time (27.393 minutes) than the second group. Despite being the biggest group that sends real-time messages, they were not sending virtual gifts when watching the sports games on SLSSs. Therefore, we named those in this group as co-creators who contribute to the community by only sending real-time messages. The last cluster of viewers is labelled as the tourist cluster as these viewers only spend an average of 1.75 minutes on viewing the live streaming sports event with no other engagement behaviour. These viewers are like tourists who visit different live streaming platforms but do not stay long time. It is worth noting that this cluster makes up about 55% of all users of SLSSs.

Table 2：Cluster Analysis Results

Cluster #	Cluster label	Viewing duration (Min.)	Realtime message (N)	Gifting (N)	Gifting amount (¥)	Cluster Size (N)	Cluster Size (%)
		AVE.	Sending	Sending	AVE.		
1	Content consumers	36.982	0	0	0	21445	54
2	Super co-creators	28.198	77	538	63.89	538	1.4
3	Co-creator	27.393	637	0	0	637	1.6
4	Tourist	1.753	0	0	0	17109	43.1

5 Unravelling value co-creation of viewer Groups

5.1 Data collection and analysis

In order to understand the value co-creation in each cluster of viewers, this research adopted semi-structured interviews. Semi-structured interviews were conducted with 20 viewers who are the users of China Sport. The interview protocols were developed based on identifying how viewers co-create value with other actors: 1) the ways viewers engage in the live streaming room; 2) the motivation and perceived value of engagement. The questions originated from studies that examined value co-creation in a sports context, social media, and live streaming studies (Horbel et al. 2016; Kunkel et al., 2017; Vale & Fernandes 2018; Pongsakornrungsilp & Schroeder, 2011). As the initial questions were developed in English, it was translated from English to simplified Chinese to match the purpose of the study. These steps were refined through three stages of the translation process (Kim et al., 2020). Firstly, two bilingual individuals translated the questionnaire into simplified Chinese. Secondly, another bilingual individual translated the questionnaire back to English. Thirdly, in order to establish the clarity and accuracy of the translated items, three Chinese-English students assessed the discrepancies between the original protocols and the translated ones. The researchers interviewed each participant independently through WeChat video calls. These interviews duration ranged from 45 to 65 minutes. All the interview transcripts were digitally recorded and transcribed into a spreadsheet. In terms of data analysis, the computer-assisted software, NVivo 12, was employed to code and categorise and decide the representatives of different viewer's clusters. The interview results provide further insight into the nature of viewers engagement behaviours across the four distinct viewer groups. Figure 2 presents a summary of the results.

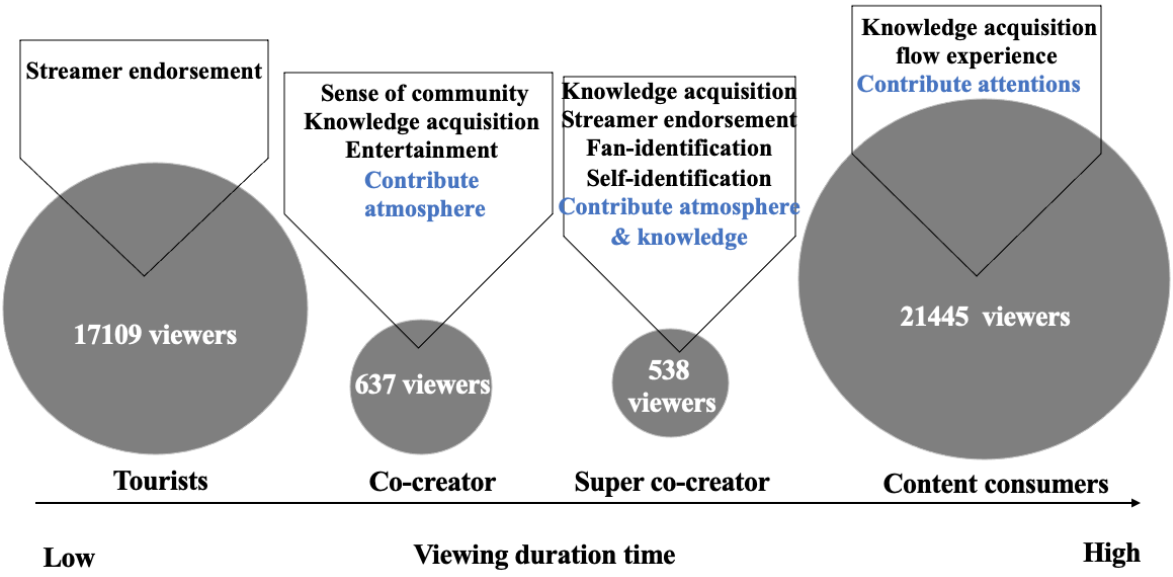

Figure 2: Understanding usage behaviours of viewer groups through qualitative analysis

5.2 The result of data analysis

5.2.1 Content consumers

The first group of viewers place high value on only consuming the provided content, which in this case is the sport event live streams. Therefore, this group of viewers is labelled as content consumers who are only consuming the sports event contents while not directly creating any value to other viewers and platforms. Consumers emphasise that the knowledge acquisition and flow experience are their main motivation for viewing the sport event on SLSSs. For example, one respondent emphasised that concentration on the match can help them to gain more knowledge:

> My original intention to watch the sporting event here is to view and enjoy the players' performance, in a focused manner. I don't send messages or virtual gifts as it might distract me. I sometimes even switch off the floating message function, and zoom into the screen to watch the videos, to avoid distraction. Therefore, I can learn how world-

> class players use skills and tactics to counter the different styles of their opponents and different solve problems in any situation.

Other viewers explained their behaviour and illustrated the perceived flow experience that is acquired from the new functions of China Sport. For example, one respondent stated that:

> I enjoy watching games on China Sport by using its new functions, such as the 360 degree and multi-angle views. I like viewing from the player's angle. It makes me feel like I am a VIP who is sitting on the side, and the players are playing just in front of me. I don't send real-time messages, but I do listen to the streamers and sometimes have a look at what other viewers are saying.

However, although this group of viewers does not contribute directly via real-time messages and gifting, they can indirectly influence other viewers' behaviours and add value to the platform. In the age of the 'attention economy', viewers' attention can be perceived as a product- 'eyeballs' to attract advertisements and generate revenue (Webster and Ksiazek, 2012). In the current study, we also found that the content consumers can attract more viewers to enter the live streaming room. On a related note, one participant stated that 'When I first came to the platform, I would choose a room with the most viewers. Now, if my favourite streamer is not on live, I would also go for the room with highest number of viewers, implying that other viewers enter rooms to seek a sense of community, which is established by a certain number of viewers.

5.2.2 Super value co-creator

Apart from knowledge acquisition, the super value co-creator of viewers referred to their sending message and gifting behaviours in several ways. One such way is 'endorsement' — sending virtual gifts and real-time messages to show their appreciation and admiration for the

streamers. Another way is ‘fan-identification’ — sending virtual gifts and real-time messages to show their commitment of the players and teams. The final way is ‘self-identification’ — commentating on the sporting events via sending real-time messages to express their own knowledge of table tennis and build their reputation in the community.

On SLSSs, the viewers are provided with an opportunity to interact with streamers and other viewers by sending virtual gifts. When viewing the sports live streaming events, the viewers can purchase and send virtual gifts during the game time. The super co-creators share a mutual game experience with one another and create a party-like atmosphere in the virtual online community. Some viewers described sending virtual gifts as a way to show their appreciation and admiration for the streamer in front of all viewers of the stream:

> I am a fan of ‘Xiao Ma Ge’ as he is very professional in commentating on sport events. I like to listen to his commentary as I can acquire much knowledge and information from him. I send virtual gifts to him to thank him for his hard working in providing useful information, and, more importantly, to attract his attention. If he notices my gifts and responds to them, I feel very excited. I think we are very close.

There are also interviewees who stated that sending gifts is a way to cheer for the players and express their support. This is described by one of the interviewees as follows:

> I like to send gifts to celebrate when the Chinese team wins a game or encountered when they are playing against strong opponent. If Liu Shiwen is playing, I would send much more. I am her fan.

In this study, the results also reveal that the super co-creators are concerned with ‘self-identification’. The reason for sending real-time messages is to answer other viewers’ questions related to techniques, strategies, scores, the players styles, and so forth. This is in line with the

view that consumers would like to present themselves in the online community to seek and develop influence and build an identity among the community viewers (Thorbjørnsen, Pedersen and Nysveen, 2007). Due to few streamers are lack of professional knowledge of the sport, they could not truly satisfy the needs of the viewers who are professional players. Value co-creators want to improve the streamers' level of expertise by commentating on the match. In this way, Value co-creators not only provide knowledge to the streamers and other viewers, but they can also be satisfied by gaining a sense of self-identity through self-presentation.

5.2.3 Co-creators

Co-creators have a similar usage duration to consumers and super co-creators in terms of consuming content. However, co-creators do not co-create value in the same way as other groups of viewers: they are sending an abundance of real-time messages to achieve their perceived values. Their motivations for sending real-time messages display some striking differences compared with super co-creators. Compared with super co-creators, co-creators have lower fans identification and less streamer endorsement, but they seek for a relatively strong sense of community. A few respondents mentioned that they are not willing to pay for virtual gifts:

> I like to engage in the community through sending real-time messages. It makes me feel that I am part of the fan community. For example, when other viewers cheer for players, I would follow them by typing 'go go go', when I see 886 (bye bye) with the streamers' name when the game finishes, I will copy them. I also attend streamers' interactive quizzes by typing '1' or '2' to vote for guessing which player would win potential presents.

Similarly, other respondents noted that:

> I like the atmosphere of everyone cheering together. I think the purpose of live streaming is to get people to watch the games together and cheer. I have the national pride. The sense of unity is a very important feeling that the live streaming can bring to me. As you can't be there to support the players, sending a real-time message on the live stream platform makes me feel like I am encouraging them. When I watch live sports platforms, sometimes my message will be selected and read out by the anchors, and I may have some opportunities to communicate with others who are fans like me.

Co-creator also look to acquire knowledge when watching sport live streams. However, they are not only passively listening to streamers, but also sending real-time messages to ask questions. Meanwhile, they are keen to communicate with streamers and other viewers to discuss the players' techniques, skills, and strategies. Many of them mention that:

> If the streamer is a professional in table tennis and I have doubts, I will send my questions by real-time messages. I also interact with other viewers. When the streamers don't answer some of my questions, some viewers answer me by sending real-time messages. I can learn a lot in this way.

Apart from acquiring professional expertise from watching and interacting, they expect to access more information about the sports equipment or players since such information may not accessible elsewhere. As one of the respondents stated:

> In my opinion, this is a good way to get to know the information about the players, especially young players. I often send real-time messages to ask about the players background, past achievements, and their equipment.

Interestingly, some respondents of the co-creators firmly believed watching sport event on SLSSs is entertaining. For example, one comment illustrate their perceived value of entertainment when viewing the sport events on SLSSs:

> There is a lot of contents in the real-time messages, such as expressions of love and hate between viewers. Although, I am not often engaging in such debates, I like to watch other people quarrel.

5.2.4 Tourists

Tourists describe their behaviour in terms of looking for the right streamers. There can be more than a dozen streamers covering important matches at the same time, and viewers seek to choose a channel selectively to meet their particular viewing needs (Smith et al., 2013). Tourists are the nimblest group, who most easily shift between streaming rooms and platforms to optimise content discovery and perceived value. Among those who were found to be tourists, 85% said that they are not very professional at table tennis and are newcomers to China Sport. They explain that they will choose the streaming room with the highest number of viewers at the beginning. They travel around different streaming rooms to try to find a suitable streamer who can meet their requirements. As one respondent stated:

> At the beginning, I would switch around, but I believe I would stay in one streamer's room when I found a streamer that suits my taste. For me, the first element is to see whether the streamer is good at technical commentary. The second element is the style of the streamer. I would say that for me the importance is weighted at around 70% for their technical skills and 30% for their personality.

Furthermore, another respondent also mentioned that the appearance and interactivity of the streamers might also be a factor affecting whether or not their streaming room is chosen:

> When there is no important game, I would flick through different streaming rooms to find a beautiful female streamer. However, I will look for a streamer who is professional in table tennis when this is semi-finals and finals.

6 Discussion

In this paper, we set out to investigate the viewers groups in sport SLSSs and their distinct usage behaviours by analysing large-scale web behavioural data of the SLSSs users. This study focusses on identifying the viewers' groups regarding their engagement behaviour (viewing duration time, real-time messaging, gifting, and gifts value) and their value co-creation of engagement in SLSSs community. This understanding assists the decision-making processes of marketers and operators to effectively anticipate viewers and enable viewers' co-creation.

6.1 Implications for research

The findings of this study have several important implications for research. Firstly, by applying VBA and clustering analysis, this research is the first attempt that has used the SLSSs reviewer behavioural big data (real-time messaging, gifting, and gift value) to investigate and identify different viewer groups. The online data deliver demographic insights for viewers and revealed four groups: content consumers — longest viewing duration without real-time messaging and gifting (21445 viewers); super value-co-creators — relatively long viewing duration with real-time messaging and gifting (538 viewers); co-creators — relatively long viewing duration with only real-time messaging (637 viewers); and tourists — shortest viewing duration time and without messaging and gifting (17109 viewers). This is in line with an earlier study on enterprise social media, which found that the majority of content is created by a minority of users. However, different from the 'promoters' identified by Van Osch, et al. (2016), who occasionally post, we found that the first and last group of viewers do not contribute content to the community. The clustering analysis is also an important preliminary step required for exploring the viewers' value co-creation in the context of SLSSs. Secondly, combining the findings from a qualitative empirical study, it provides an insight into what value different group viewers perceive from viewing on SLSSs and how they contribute to platforms and other

views. This study adds to our understanding of what the value co-creations of different types of viewers are and builds on the existing literature that has focused mainly on customers value co-creation based on usage typology.

Furthermore, the findings of this study may suggest a novel form of viewers' group — tourists — that exists in the SLSSs setting. The SLSSs should not only consider whether tourists contribute to the community, but rather consider how long they pay attention to other actor's contributions. This is because, just like the content consumers identified in this study, the viewers' attention can attract other viewers as well as contribute to potential avenues for live streaming platforms. A community on a platform can only boom once there is a consistent source of attention as well as frequent engagement with the provided content and contribution of information to the platforms.

6.2 Implications for practice

This study also has important implications for operations managers of the sport SLSSs and the streamers. First, the SLSSs platform should not only use the statistics of page views (PV) and daily active users (DAU) as these parameters can neither reflect the reasons behind the data rise and fall, nor can they be used to explore the real characteristics and value of users, so it is far from meeting the analysis needs of the sport SLSSs. The current study will allow sport SLSSs managers to understand the perceived value and contributions of each group of viewers in order to guide the specific operation strategy. Secondly, the previous literature has assumed the importance of encouraging people to interact and contribute knowledge to the social media community. This research argues that a large base of the content consumers is important for attracting tourists to enter the live streaming room and their attention could benefit the platform in the long run, such as through increased advertisement revenue. Therefore, the sport SLSSs should consider how to increase the content consumers' levels of stickiness and activity.

According to the findings of this research, the sport SLSSs could increase the level of professional knowledge of sports and improve the relationship marketing skills of streamers by providing online tutorials in order to transfer more content consumers into value co-creators. Thirdly, it seems that the tourists do not contribute value to the platforms and other viewers, but they are the potential fan base of the platform. Therefore, the sport SLSSs should also increase the number of tourists through a series of marketing strategies.

7 Limitations and future work

This study has shed some light on using customer behavioural big data to cluster viewers in the SLSSs to facilitate operations management and set up marketing strategies. However, in this study, there are a limited quantity of gifting and messaging data, so the clustering analysis according to frequency failed. Therefore, future research could adopt approaches that are based on more behavioural data to analyse the viewers groups in terms of their usage frequency and duration. This would allow managers to design a strategy that is more accuracy and effective. Furthermore, future studies could be based on collecting data from similar sports SLSSs of other niche mass sport events to examine viewers' groups. Future research can also examine to what extent the streamers can impact the viewers' engagement behaviours. Whether awards, quizzing, voting, and drawing can change different viewers' value co-creation could be explored by using the gamifications theory.

Both organisations and consumers in the sport context have gradually accustomed themselves to the growing wave of live streaming use before and during the COVID-19 pandemic. In the future, sport live streaming platforms will adapt all kinds of technologies to improve their business performance and participation performance. Therefore, it is imperative for researchers to attach more importance to the research of the sport SLSSs use and customer engagement.

8 Conclusion

The aim of this study is to identify groups of sport SLSSs viewers according to their engagement behaviour when watching sports events to understand different groups of viewers' contributions and perceived value. Some insights have been generated from analysing the viewers' behavioural big data from China Sport. This study has found four groups of viewers: content consumers, super co-creators, co-creators, and tourists. The distinct engagement behaviours and value co-creation of each of the groups have been analysed. Overall, our findings offer clear implications for the sport SLSSs to convert the results into useful operations and marketing strategies for improving viewer engagement and facilitating consumption behaviours. The main limitation of this study is that there is insufficient data to facilitate an analysis of engagement frequency. Whilst this study does provide some interesting insights, it would be valuable to conduct similar studies with more behavioural data. During the COVID-19 pandemic, live streaming has helped to address the urgent need for new solutions to the question of how to keep sports fans engaged and create new revenue streams. As the live streaming benefits can continually serve the sport industry once everything returns to normal, more research on sport SLSSs is encouraged.

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