

Influence Of Short Video Live Broadcast On Network User Behavior And Sales—From Meta-Analysis, Experimental Analysis To Empirical Analysis

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Abstract

Background: There are more than 1 billion users of short video media in China, and enterprises have long recognized that the influence of short video media has strong marketing achievements, such as short video community and information sharing platform participating in sales. Many enterprises have established active short video media so that they can directly interact with their customers. Among them, the content of webcasting can also stimulate and influence users' participation (like, comment or share) and users' stickiness (collection and attention).

Research purposes and methods: In order to explore the underlying logical relationship between "media-content-goods-users-sales", firstly, it is necessary to find out the influence mechanism of short video live broadcast on network users' participation and sales. Therefore, in the first experiment, we conducted a meta-analysis on a large number of researches on webcasting media and short video media, and analyzed their differences along the content differences, background (industry, presentation, life cycle, demand and platform) and characteristics of webcasting media. Secondly, it is necessary for us to find out the differences in the influence of the level of webcasting and the behavior of network users (participation behavior and sticky behavior) on the sales level. Therefore, in Experiment 2, based on the data of 802 live events in Tik Tok, the internal relationship between the degree of webcasting and the degree of commodity sales was analyzed. Thirdly, it is necessary for us to understand the mechanism of the influence of webcasting marketing on consumer decision-making. Therefore, in Experiment 3, the psychological mechanism of webcasting affecting purchase intention was verified by structural equation model, and the adoption intention of webcasting users was determined and verified by three factors-webcasting, participation behavior and sticky behavior.

Research results: This paper makes a comprehensive and in-depth analysis and verification through three experiments. The result of Experiment 1 supports some existing viewpoints, for example, webcasting media can promote the sales of new products more effectively, but it highlights some new insights. The webcasting media mainly promotes the sales of goods and hardly affects the stickiness of users. The average citation of webcasting media stickiness is 0.137, and the sales citation is 0.353. In addition, the research results also put forward a better way to adjust the content of webcasting media to meet the communication target. Experiment 2 found that it has a higher degree of webcasting ($\beta_1=.715$, $P < .01$; $\beta_2=-.090$, $p<0.01$) more effectively produces the degree of commodity sales, and further verifies the potential moderating effects of two kinds of user behaviors: user participation behavior and user stickiness behavior. Experiment 3 verified that webcasting ($b = 0.247$, $t=3.317$, $p< 0.05$) directly and significantly affected the degree of online sales, while the behavior of online users (participation of live users and live fans) adjusted the degree of online sales to a certain extent, which indirectly affected the degree of online goods sales.

Research conclusion: With the rapid development of short video media today, enterprises can realize the online sales of goods more efficiently through a powerful short video live media based on media content and media users, and further realize the balanced operation between network users and fan users in a healthy and orderly manner.

Keywords: Webcast, Meta-analysis, User behavior, Social media sales, Field experiment

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1. Introduction

There are more than 1 billion short video media users in China, and enterprises have long recognized the powerful marketing achievements of short video media, such as short video media participation sales^[1](Guo Na et al. 2020). Many enterprises have established active short video media so that they can directly interact with their customers. This kind of on-site production is synchronized with the occurrence and development of events. Video media with two-way communication process is usually called "Webcast Video Media"^[2](Zhang Yuan et al 2023). A recent survey shows that the marketing budget of webcasting media will increase in the next three years (more than 85% of companies), and 69% of consumers believe that in the long run, enterprises will succeed if they have a strong webcasting media^[3](Shi Jing 2018). Although enterprises continue to increase investment in webcasting media, they still question the overall return on webcasting media and how they can design more effective webcasting media activities along the purchase channels^[4](chen J 2023). In this paper, we discuss the three problems faced by webcast media marketers.

Main problems:

First of all, enterprises share their content through webcasting media channels, expecting that webcasting can affect the sales of products or services. However, the content of webcast can also stimulate and influence users' participation^[5](Like, comment or share; Du Yanwu 2018), or the live webcast media only affects the sales of video media.

Secondly, regardless of whether the webcasting media can significantly affect different indicators of enterprises, such as participation or sales, not all webcasting media are the same: the content of webcasting promoting sales does not necessarily bring extra participation and stickiness. Can the participation and stickiness of short video content attract customers to trade better than other content forms? Compared with other short video messages, are they also a better way to enhance user participation and stickiness?

Finally, different types of enterprises may need different types of strategies: the effective strategies and methods for emotional content of stories may not apply to functional information content, and what is suitable for artistic beauty may not apply to emotional management. Managers who change industries or seek inspiration from different industries may want to know whether webcasting media is equally effective in different scenarios, so that they can build on their own or other products' experience, or whether they must reconsider the contribution of webcasting media to their corporate performance.

In order to solve these problems, we conduct comprehensive and in-depth analysis and verification through three experiments. In experiment 1, we performed a meta-analysis on a large number of researches on webcasting media and short video media, and explained their differences from three dimensions: the differences of media content along webcasting, the background (industry, presentation, life cycle, demand and platform) and the research characteristics (see Figure 1-1). In the second experiment, based on the field data analysis of 802 marketing activities such as Tik Tok, plus laboratory and observation experiments, it is proved that there is a significant correlation between the live broadcast degree of the network and the sales degree of sponsored goods. In the third experiment, the psychological mechanism of webcasting affecting purchase intention was verified by structural equation model. The consumer's willingness to sell goods in webcasting media is influenced by three factors-webcasting, user participation behavior and user stickiness behavior. In addition, we have made theoretical contributions in three ways.

First, there are differences on the effectiveness of webcasting media. Webcast activities will produce two marketing results: live participation, live powder conversion and live sales. Based on meta-analysis, thousands of citations were extracted from 86 studies, involving 2 industries, 2 presentation modes, 2 life cycles and 2 short video platforms. Contrary to the traditional idea that webcasting media is mainly a trading and sales tool, we have observed that webcasting media also has a stronger influence on participation and powder transfer. In order to consolidate the literature, we studied how the content and background characteristics of webcasting media adjust the influence of webcasting media. Our research results emphasize that different goals (that is, increasing video media participation or promoting sales) need different content (that is, emotional content of stories drives video media participation and stickiness, and functional information content drives sales).

Secondly, based on the live data of Tik Tok activities, plus laboratory and observation experiments, it is proved

that there is a significant correlation between the live broadcast degree of the network and the sales degree of sponsored goods, and the potential moderating effects of two kinds of user behavior activities are further tested: user participation behavior and user stickiness behavior. The higher participation behavior of live users and the higher sticky behavior of fans show that live broadcasters attach importance to their relationship with followers and participants, thus making the significant relationship more stable.

Thirdly, based on the theory of the influence of webcasting marketing on consumers' decision-making, the psychological mechanism of online celebrity's influence on purchase intention is verified by structural equation model. Based on the analysis and verification of two new constructed models (platform and user), we can see that webcasting directly and significantly affects the degree of online sales, while the behavior of online users (participation of live users and live fans) regulates the degree of online sales to a certain extent, which indirectly affects the degree of online goods sales.

This study is for the impact: The determinants of the willingness to sell short video live broadcasts on the Internet and the Internet provide a direction.

2. Theoretical background and literature

Enterprises use webcast media to communicate with consumers. In order to better understand the role of webcasting media in marketing results, we distinguish between media content (functional information content vs. story emotional content) and background (industry characteristics, presentation form characteristics, life cycle characteristics, demand characteristics and platform characteristics) based on user needs (see Figure 1). In this section, we will make a conceptual analysis of the impact of these dimensions on the interaction between consumers and corporate webcast media and the downstream links of sales.

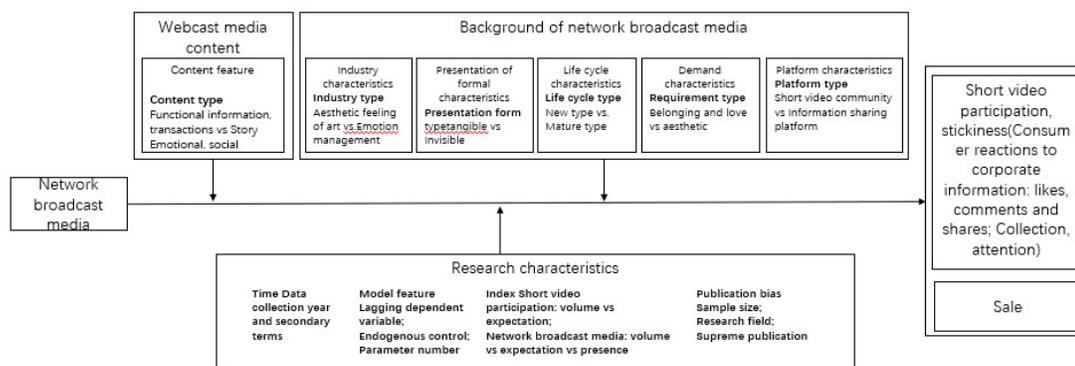


Figure 1. Conceptual Framework

2.1 Webcast media achievements

Webcast media may cause different reactions in the process of consumers' purchase, which leads to different sales in video media participation and consumption^[10](Liu Yang et al. 2020). To illustrate this point, we distinguish the two results.

Video media participation. To measure consumers' acceptance of the content shared by enterprises on the live webcast media, managers tend to track their participation in replies. Consumers can interact with these posts in the following ways, such as "liking" or "appreciating" them, commenting on them, or sharing with others. These behaviors are called webcasting media participation^[11](Zhou Liying et al 2022), which constitutes an expected response to corporate content, because they help the content to spread or "relate" to other consumers.

Video media stickiness. E-commerce live broadcast from consumer cognition. Transforming to emotion, creating a marketing system, and embedding consumer psychology into the marketing scene will help to construct a good psychological contract, which will encourage consumers to participate in the commodity purchase situation, better perceive the entertainment and practicality of live broadcast, and then enhance the consumption stickiness^[7](Bao Zheshi et al 2023; Ma Yingying et al 2023; Wangyi 2023).

Sales. Ultimately, the purpose of corporate communication is to increase sales. In fact, a large number of studies

have shown that corporate webcasting media has a positive impact on sales^[14](Zhao Ruohan et al. 2020), for example, by enhancing the awareness of enterprises to highlight and create related products^[15](Lee.et al 2012), and establishing customer-company relationship^[16](Chen Huaqian et al. 2023).

2.2 Webcast content type

Webcast video communication documents generally divide the communication content into functional information type and story emotion type. The first type of appeal focuses on introducing the objective attributes of products, while the second type focuses on stories or daily life, supplemented by introducing product content^[17](Hao Yan Zijian 2023; Sun Zhumo.et al 2023). The research in the field of webcasting media (see Table 1) has been based on this difference, which divides webcasting media information into functional information and story emotional content^[18](Xin Baogui.et al 2023; Duan Menghan 2023).

Through the research on a large number of beauty videos on the Internet, it is found that consumers' attention to informative and emotional content is obviously different, which is manifested in the positive correlation between the functional value perception and social value perception of live webcast content and consumers' cognition and behavior, and the strong correlation between entertainment value perception and consumers' emotion.

In the content of functional information, we distinguish two types of product information: the content of information provided to consumers, which involves (1) the attributes of products or information^[21](Chen Hao.et al 2022), or (2) other aspects of transaction and price^[22](Liu Lanying et al. 2022). In the emotional content of the story, we distinguish between emotional orientation and social orientation. The emotional content of some stories is more emotional-oriented, providing entertainment value or triggering emotional reactions^[23](Tang Xingyan 2022). The emotional content of this latter type of story is also called "socialization" or "social orientation"^[24](Wang Fei.et al 2022). Table 2 provides enterprise and industry sample content types with informative functions and emotional stories.

Functional information and emotional content of stories are different in degree, and which of them is suitable for achieving the goals of user stickiness and sales. For the media participation in webcasting, our prediction is that the emotional content of such stories is more effective than the functional information content (including information and transaction-related). Compared with the functional information content, the emotional content of the story has a kind of perceptual information and provides more emotional arousal information to praise and share^[25](Su Bo et al. 2023). The emotional content of the story emphasizes that a social motivation may provide less emotional awakening, and it may still be an effective way to create online live media participation because it makes the society.

Table 1. Webcast Media for Literature Refining

Research topic	Research author	Concept of webcasting media	Output variable	Short video media participation	sell	Webcast media content				industry	appear	Life cycle	demand	platform	
						Functional information type	trade	Story emotional type	social contact						
Analysis on Marketing Strategy of Domestic Cosmetics in the Environment of Online Video Live Broadcasting Take the beautiful diary as an example.	Zhouwenyi Xubifang(2020)	live video streaming	Star marketing, content marketing, event marketing	√	√	√	√		√	Artistic aesthetic feeling	invisible	Mature type	appreciation of the beauty		
E-commerce live broadcast platform interaction			User interaction												
Research-Taking Taobao Live Broadcasting as an Example	Jiang Rui(2020)	E-commerce livestreaming	Watching and consumption behavior	√	√	√	√		√	Emotional management	invisible	new type	social contact	Taobao	
Webcast content production			Live content												
Analysis of Mode —— Taking Yingke Live Broadcasting as an Example	Ma Chen(2018)	livestreaming	Content production mode	√	√	√	√			Artistic aesthetic feeling	tangible	new type	appreciation of the beauty	Yingke	
Analysis on the Profit Model of Webcast Platform —— Taking Huya Live as an Example	Pan Rui(2020)	livestreaming	Profit model, content ecosystem and Elements of profit model	√	√	√	√		√	Emotional management	tangible	mature	social contact	protruding canine tooth	
Discussion on improving the ability of webcasting based on novice anchors in the new media era-to shake	Liu JinhuaMazhaoxia	livestreaming	Live broadcast ability compliance	√	√	√	√		√	Artistic aesthetic feeling	invisible	new type	appreciation of the beauty	Douyin	
Take the sound APP platform as an example.	(2021)														
The Construction and Rebellion of Audio Live Broadcasting to Aesthetics —— Taking litchi FM as an example	Cui Jing(2019)		Construction of Aesthetics and Rebellious Voice	√					√	√	Artistic aesthetic feeling	invisible	new type	appreciation of the beauty	Litchi F M
		Audio live	And content												
Strategic product showcasing mode of E-commerce live streaming	Xin Baogui et al. (2023)	E-commerce livestreaming	Sensitivity of live broadcast stimulation and quality of service	√	√	√	√			Artistic aesthetic feeling	tangible	Mature type	appreciation of the beauty		
Research on the Practice of Webcast of Mainstream Media under the Background of Media Convergence —— Based on Aauto Quicker Platform data	Lu Xueyao(2020)	livestreaming	Live content type	√		√	√			Artistic aesthetic feeling	invisible	new type	Belonging and love (social)	Kuaihou	
...	

Table 2. A Case Study of Webcast Media Content Types in Related Industries

study	subdivide	Artistic aesthetic feeling		Emotional management		Literature case
		China Li Ning	Juduo	Senior LEO	Let's decompress together	
Functional information	product information	Li Ning Sports Flagship Store: How much can these pants hold? The elasticity is too good! # Li Ning # breathable sweatpants #AKLT541	The official flagship store of Orange Blossom: Fix the volume and highlight a plate, and you can have the stereo highlight if you want it. ~ # Orange Blossom # High-gloss Capacity Repair Disk # Capacity Repair	@ Senior LEO My new book "Learning Master" has officially met with you. I hope that my learning methods in the past 20 years can help you improve your grades and accelerate your growth # Learning.	Let's decompress together: old people, children and adults can play, and the last one will succeed in the middle. Welcome everyone to challenge and exercise their mental and logical thinking skills. Force # Decompression # Educational Toys # Single Chess	Research on the Characteristics of Food Short Video Based on Content Analysis (Liu Lei, Yuan Meng, Li Shiyu., 2023)
	Transactions and prices	Li Ning Sports Flagship Store: China Li Ning short sleeves only cost this price today! !! # Li Ning # China Li Ning # Her home Nice clothes, good quality and not expensive.	The official flagship store of Orange Blossom: If this big wool is missed, there will be no # bonus hunter # Student Party Fair Price Makeup Recommendation.	@ JingJingJing "appeared" in Huainan Road, Shanghai with my book "Learning Master". I hope to go offline with me at the reader's meeting. Meet? :) # Event site	Let's decompress: Mom, I want to buy toys.	"Price wins" or "word of mouth is supreme" -Research on marketing strategy of e-commerce enterprises based on product quality. (Ma Shuzhong, Guo Jiwen, 2021)
Story emotion	emotion	Li Ning Sports Flagship Store: Strawberry Bear co-branded short sleeves are coming, and girls need cocoa and love! Come to the live broadcast room. Go # Li Ning # Couple Wear #AHST755	Official flagship store of Orange Blossom: Eight people used this dish # Save the Handicapped Party # What is this fairy eye shadow # Sisters, this little thing is amazing.	@ JingJingJing All introverted friends: This # Reading # Cognition # Inspirational # Introversion	Let's decompress: be happy, stranger	An empirical study on the influence of inspirational theme brand stories on purchase intention (Chen Xiang., 2020)
	social contact	Li Ning Sports Flagship Store: Show your Li Ning buyer show and buy it! # Show my Li Ning to wear.	Official flagship store of Orange Blossom: detailed tutorial on butter dish # Concealer # Base Makeup # Brighten # Makeup Tutorial	@ Senior LEO This is a list of good books I read in a year to share with you. Read and grow together! # Reading Sharing # Reading	Let's decompress: family, what is the word in the middle of your name?	Influence of short video marketing content on consumers' purchase intention-based on international beauty brands Empirical Research (Sheng Xueping, 2021)

Social contact is more prominent in consumers' minds, thus calling for "participation" with others, which may promote comments and sharing content. For sales, we predict that functional information content is more effective than emotional content of stories^[26](Wang Fu 2022) Interpretation. It is said that functional informative content provides convincing information to help consumers make product attribute decisions. The emotional content of the story provides less decision-making information, so it is a weak sales driver. Akpinar and Berger focus on functional information content, which can provide information about product attributes rather than

transaction information. But we hope that their findings can support the emotional content of the latter type of story: the content about the transaction is aimed at more purchase goals than participation goals^[27](Tian Rui.et al 2022), transaction information has a positive effect on sales^[28](Liu Pingsheng et al. 2020). We expect that this effect will also occur in the live webcast media.

2.3 Characteristics of the industry

Industry characteristics: artistic aesthetic feeling and emotional management. Because services are rarely tangible, inconsistent and more difficult to evaluate^[29](Leal Fátima .et al 2021), having social media may be more critical in building relationships and the trust that service brands need. Even if the posts of service and product brands are similar in content, consumers may respond to them differently because they have greater demand for service information. Therefore, we expect to have a greater impact on the participation and sales of our own social media services than products^[30](Hou Tianyi et al. 2021).

Formal features: tangible and intangible. Many people think that products are tangible. In fact, products are anything that can be provided to meet market desires or needs, including tangible goods, services, experiences, events, people, places, property, organizations, information and ideas. Products can be tangible or intangible. Some things are visible, direct vision. At this point, the water cup you see, the clothes you can touch, the software interface you can operate, and the perfume you can smell are all tangible items. Intangible things also have the ability to satisfy desires or needs, and they can be felt by people. It also expands outward, and persuasion, communication, ideas, etc. which cannot contact with direct senses, but can be communicated with each other or perceived separately.

Product life cycle: new products vs mature products. Taking literature from advertisements shows greater advertising flexibility as compared with mature products^[31](Dall'Olio Filippo.et al 2022), we expect consumers to respond more to the video media of new products. This is because consumers have not yet formed their own preferences and know less about brand products^[32](Plum 2022), so that they are more plastic and have the motivation to deal with new product information, rather than mature products^[33](Chen Tong.et al 2023) leads to greater participation. This will also lead to an increase in consumers' attention and interest in buying new products^[234](Shen Zhanbo, Dai Liang 2021).

2.4 Characteristics of demand

Maslow's five-level needs: Maslow's hierarchy of needs is an incentive theory in psychology, including a five-level model of human needs, which is usually described as a hierarchy within the pyramid. From the bottom of the hierarchy to the top, the needs are: physiology (food and clothing), safety (job security), social needs (friendship), respect and self-realization. Maslow's seven-level needs: Maslow's hierarchy of needs divides the complex and diverse needs of human beings into seven categories from low to high, and calls the first four lower levels, namely, physiological needs, security needs, belonging and love needs, and respect needs, as basic needs. Their common nature is that they are all caused by some physical or psychological deficiencies, so they are also called lack (missing) needs. The last three advanced levels, namely, cognitive needs, aesthetic needs and self-realization needs, are called psychological needs or growth needs. Table 3 provides the hierarchy and content of Ma Si Nuo's requirements.

Table 3. Ma Si Nuo's hierarchy of needs and content

levels and ranks	concept	Maslow's demand content
first floor	Physiology (food and clothes)	Food, water, air, sleep, sexual needs, etc. They are the most important and powerful in people's needs.
second floor	Safety (job security)	People need stability, safety, protection, order and freedom from fear and anxiety. (1943, 1954)
Third layer	Belonging and love (social)	A person wants to establish an emotional connection or relationship with others. Example: making friends and pursuing love.
Fourth layer	respect	Respect yourself (dignity, achievement, mastery, independence) and the reputation or respect for others. (e.g. status, prestige)
Fifth floor	cognition	Knowledge and understanding, curiosity, exploration, meaning and predictability. (Maslow, 1970a)
Sixth layer	appreciation of the beauty	Appreciate and look for beauty, balance, form, etc. (Maslow, 1970a)
Seventh floor	Self - realization	People pursue to realize their own ability or potential and make it perfect. (1943, 1954)
Eighth floor	exceed	One's motivation is to transcend one's own values. (Maslow, 1970b)

2.5 Characteristics of platform

Platform type: short video community vs lifestyle sharing platform. The difference between short video community and other digital channels lies in the structure of social groups and the relationship between participants (see Table 4), although not all video media are created equally. The important difference between short video communities (for example, Tik Tok, Billie Billie, Aauto Quicker, Micro Vision, Volcano Video) and information sharing platforms (for example, Today Headlines, Jane Books, Douban, Facebook) is the expectations and goals of the audience^[35](Yan Huang et al. 2023). Short video community revolves around users' social relationships, which creates trust and personal connections and involves the goal of establishing relationships^[36](Ren Jifan et al 2021). In contrast, information sharing platforms are content-based and focus on communication: they are more public and visible than other types of social media, allowing wider access^[37](Xu Xiang, Wang Yuchen 2021).

Table 4. Difference between Digital Platforms

	Relationship	Participate in	Mutually	Private & public	Authority	This text
Short video communities (for example, Tik Tok and Mile Mile)	strong	tall	tall	privately own	medium	x
Information sharing platform (for example, today's headlines and short books)	weak	low	middle	public	low	x
Blog, Forum & Network Community	strong	tall	tall	privately own	tall	x
Comment platform (such as public comment)	without	low	low	be publicly-owned	tall	
E-commerce platforms (for example, Taobao and Pinduoduo)	without	low	low	be publicly-owned	tall	

These differences between short video communities are likely to translate into different effects of short video community media, stickiness and sales content. However, it is difficult to predict the direction of these effects. A forecast may be the content shared on short video communities such as Tik Tok and Bili Bili, which is more influential than the content shared on today's headlines and short books of the information sharing platform, because the channels of the former have stronger social relations and more frequent interactions. In contrast, the information sharing platform is more suitable for wider dissemination of content and general scope to gain more consumers in a longer period of time.

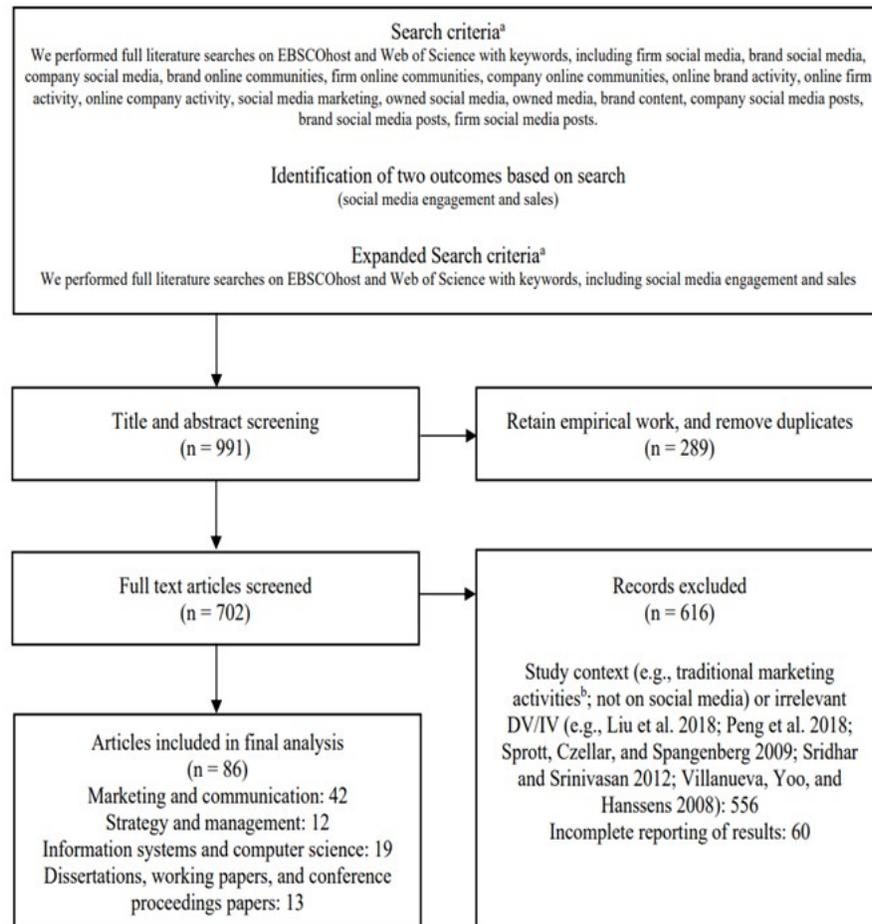
3.Experiment 1: Meta-analysis of the influence of webcasting media on sales

3.1 Data collection and coding

For our meta-analysis, we collected some empirical studies on webcasting media. In the Figure 2, we outline the detailed procedures of database construction^[38](Preferred report items and meta-analysis of system reviews; Xu Jiahuan et al 2020), and in Table 5, we report the final list of the research.

Meta-analysis statistical method is re-statistics of many existing empirical documents. By using the corresponding statistical formula, the statistical analysis is carried out again, so that the real correlation between two variables can be analyzed according to the statistical significance obtained.

Figure 2. Article research and inclusion process



^aPRISMA: Preferred Reporting Items for Systematic Reviews and Meta-Analyses (Moher et al. 2009). ^b These studies were retrieved after using keywords such as sales. Notes: DV = dependent variable; IV = independent variable.

Note: DV= dependent variable; IV= independent variable.

Table 5. The Main Research of Webcast Media

author	age	Publish periodicals	Volume (issue) page	Research background	dependent variable	Be cited	download
Chen Yingxin and others	2022	china soft science	375(03):183-192	The 14th Five-Year Plan promotes the rapid development of digital economy.	Stickiness, sales, like	one	1721
Lu zhaoyang	2021	china soft science	363(03):18-30	Local governments consciously guide webcasting to drive e-commerce development.	Stickiness, marketing, sales volume	39	4923
Qi Zhiwei et al.	2021	China administration	433(07):85-92	The new economic fashion of "live broadcast with goods" is of great value to digital governance at the grassroots level.	interaction	13	3704
Deng zhe	2020	China administration	424(10):80-85	Against the background of decisive battle to build a well-off society in an all-round way and to fight poverty.	Sales interaction stimulates stickiness.	84	8034
Chen Yingxin and others	2021	chinese journal of management science	29(02):228-236	Online users are increasing the uncertainty of network virtuality.	Interaction, customer attitude, marketing	79	4597
Wang le et al.	2023	chinese journal of management science	1-12	The introduction of live broadcast helps to increase sales, but it also brings trouble costs.	Sales, purchase intention, interaction	0	1907
Xiao Quan et al.	2023	chinese journal of management science	1-13	Academic research on the live e-commerce platform itself is very scarce.	Interaction, liking, purchase intention	0	1534
Xiao yongbo and others	2023	chinese journal of management science	1-16	The live broadcast e-commerce ecosystem has brought many new management challenges to related enterprises.	Stickiness, sales	0	2340
Guo Yanlu et al.	2023	chinese journal of management science	1-15	Under the new situation of online celebrity carrying goods, the quality problems of the products with goods are constantly emerging.	Sales, interaction, customer consumption	0	6997
Li Hengyu et al.	2023	chinese journal of management science	1-16	With the rise of webcasting, manufacturers will sign two kinds of sales contracts with shippers.	Marketing, attraction	0	2487
Zhou Chi et al.	2023	chinese journal of management science	1-12	With the development of digital economy, a large number of brands entrust e-commerce to provide product recommendation services.	Consumer preference, sales	0	1599
Liu Jiangan et al.	2023	chinese journal of management science	31(03):143-154	The abuse of resources by the three parties and the maladjustment of process docking will lead to the risk of co-destruction of the value of the live broadcast platform system.	encourage	0	2611
Zhang Yongan et al.	2017	forum on science and technology in china	260(12):182-192	Webcast transforms information into a more advanced real-time image form, which has attracted great attention from business and academic circles.	reward	81	3146
Feng Jun et al.	2020	soft science	34(12):128-133+144	The emergence and popularity of webcasting on various platforms in the era of mobile internet has led to the sales model of online live marketing.	Willingness to buy, interaction	110	8174
Liang Ling et al.	2022	soft science	36(12):118-126.	Taking live broadcast with goods as the research background, this paper analyzes the factors that affect consumers' purchase intention.	interaction	0	2679
Liu Yang et al.	2020	soft science	34(06):108-114	As a new shopping mode, live shopping has become one of the main ways for enterprises to increase transaction volume.	interaction	312	27163
Yan Jun et al.	2023	soft science	1-12	The research on the inconsistency of product reviews between anchors and viewers is basically blank, which does not match the rapid development of live e-commerce	comment	0	863
Wang hong et al.	2022	Management modernization	42(06):59-65	Live broadcast with goods has become an important online port for enterprises' external marketing, and it is also a booster to stimulate consumption and promote new economic growth.	Purchase intention	0	4030
Xu Chunqiu et al.	2022	Management modernization	42(06):85-92	Direct selling makes the decision-making of agricultural products supply chain members more complicated.	Live delivery, return strategy (marketing)	0	1050
Yan Kewei and others	2022	Management modernization	42(02):72-80	What webcasting has created for consumers and how to promote brand communication when consumers participate in webcasting are worth discussing.	Pay attention, like, forward, reward and interact.	six	2454
Shan Yude ng	2021	Manage the world	37(03):84-104+7	Under the "new normal" with increasingly obvious characteristics of VUCA	Live interview, platform interaction	113	24612
Ge anru et al.	2020	management of scientific research	41(12):112-120	With the cross-border integration and innovation between enterprises and organizations, a large number of new species are constantly emerging and rising rapidly.	Live marketing, live rewards	five	785
Wang Xingang et al.	2022	economic management	44(02):172-191	Live e-commerce has become an important support for online consumption, but there are frequent "rollover" incidents in the live broadcast process.	Online review, live broadcast with goods, live broadcast marketing	10	4013
Cai Shoujie et al.	2023	journal of industrial engineering and engineering management	1-11	Live video is becoming a new trend in the field of e-commerce.	Live rewards, participation, fan interaction	0	481
Wang Chenyu et al.	2023	journal of industrial engineering and engineering management	1-10	Sales model will affect the direct marketing decision of supply chain members.	Interaction, fan interaction, attention, stickiness	0	2817
Jiao Yuanyuan and others	2022	journal of industrial engineering and engineering	1-18	E-commerce platform is facing the competitive dilemma of how to retain customers.	Internet stickiness, live marketing, fan interaction	0	2148

Xiong Hao et al.	2022	journal of industrial engineering and engineering management	1-8	The live broadcast sales channel with goods has formed a certain competitive relationship with the traditional online retail channel.	Live marketing, network attention	0	2166
Liu Chenglin et al.	2023	journal of industrial engineering and engineering management	37(02):60-70	With the rise of e-commerce live broadcast, what characteristics should merchants choose for their own anchors?	Live media, participation, fan interaction	one	2479
Jiang Ning et al.	2023	industrial engineering and management	1-13	The scarcity of products is a common information in the live broadcast room, and it is common for consumers to snap up goods and make impulsive consumption in the live broadcast room.	Live marketing, user and fan interaction, and network attention.	0	1543
Huo Jiale et al.	2022	nankai business review	1/29	With the rapid development of live broadcast business, the language output by the anchor has become a key factor for the success of live broadcast business.	Purchase behavior and reward behavior (sales, stickiness)	0	3899
Gong Yanping et al.	2022	nankai business review	1/23	Social presence plays an important role in live broadcast marketing.	Social presence (stickiness)	0	6585
Fan Jun et al.	2021	nankai business review	24(06):195-204	The head effect of network reward is very obvious, and the head effect of network reward is very obvious.	Willingness to reward (stickiness)	12	4328
Su Yufen et al.	2021	nankai business review	1/20	The rapid development of "live stream economy" from 2016 to 2020.		0	6007
Huang Min studies, etc.	2021	nankai business review	1/21	With the rapid development of social shopping industry, how to choose the anchor type of live shopping has become the focus of enterprises.	Purchase intention and behavior (sales, marketing)	0	14368
Zhu Donghong et al.	2021	nankai business review	1/25	With the rise of e-commerce live broadcast, some county magistrates began to try to be anchors to promote local agricultural products.	Willingness to buy, feeling close to the people (sales, stickiness)	0	6956
Xie Ying et al.	2021	nankai business review	24(03):28-36+37-38	Classical marketing theory has been difficult to explain many problems derived from the new marketing model at present.	Live marketing, fan interaction (marketing, stickiness)	17	3335
Meng Lu et al.	2020	nankai business review	23(01):131-143	Live online celebrity marketing is a new marketing method in the era of online media.	Consumer's willingness to buy (sales, marketing)	343	30431
Lixiaoxia et al.	2023	e-government	2023(03):106-117	New mode of virtual live broadcast e-commerce	Technical optimization	0	1222
Li Liwen et al.	2023	e-government	2023(04):68-79	Official live broadcast with goods	User stickiness, marketing	0	1518
Lu Zhaoyang et al.	2022	e-government	2022(08):2-14	E-commerce live broadcast is conducive to alleviating relative poverty in rural areas	Brand building, marketing	three	2999
Meiao	2021	e-government	2021(03):28-37	"live broadcast+e-commerce" emerging sales model	Consumer rights	107	10436
Wang Xinping and others	2019	e-government	2019(04):16-56	The imperfect supervision system has hindered the healthy development of the webcast industry.	Webcast industry health	58	2539
Gao Yifei et al.	2014	e-government	2014(06):79-86	The Preliminary Formation of China's Rules for the Trial of Live Media Broadcasting	Rules of live trial	16	580
Zhang Jieqiong et al.	2022	foreign economics & management	44(11):49-62	It is urgent to explore the mechanism of the impact of live webcasting on users' continuous use and recommendation willingness.	Social telepresence (sticky) interaction	one	2343
Wu Na et al.	2020	foreign economics & management	42(08):81-95	Achieve sales targets through online real-time interactive communication between anchors and users.	Interactive perception of purchase intention	94	6456
Hu jiao et al.	2022	Theory and Practice of Systems Engineering	42(03):755-766	Optimize the dynamic price decision with the participation of webcast platform and anchor.	Purchase behavior, sales interaction	12	2706
Zheng Sengui et al.	2020	Theory and Practice of Systems Engineering	40(05):1221-1228	At present, the profitability of most live broadcast platforms in China is insufficient.	Interaction likes profit (reward)	33	2410
Yu Tianyang et al.	2022	chinese journal of management	19(05):714-722+748	Optimal operation decision of all parties in live broadcast e-commerce supply chain	Professional interactive purchase intention	seven	2880
Li Qi et al.	2021	chinese journal of management	18(06):895-903	Few mathematicians discuss the consumption behavior of webcast users from multiple perspectives such as immersion theory.	Interaction between audience attitude and purchase intention	55	7977
Pei Xueliang et al.	2020	chinese journal of management	17(11):1632-1641+1696	Live e-commerce is different from e-commerce and offline shopping.	Value Co-creation (Interactive) Consumption	102	6680
Peng Yuhong et al.	2021	chinese journal of management	18(11):1686-1694	Corporate relationship ties are an important driving factor to promote the transformation of marketing strategies.	Customer commitment (purchase intention)	23	7667
Zhang yanfen and others	2023	chinese journal of management	20(02):278-286	Income distribution and incentive contract design of live broadcast e-commerce supply chain	Brand value of sales volume	0	1720
Gong Xiaoxi	2019	chinese journal of management	16(06):875-882	Based on the economic background of China, the empirical research on atmosphere clues, flow experience, moderate	Impulsive consumption will	247	16242

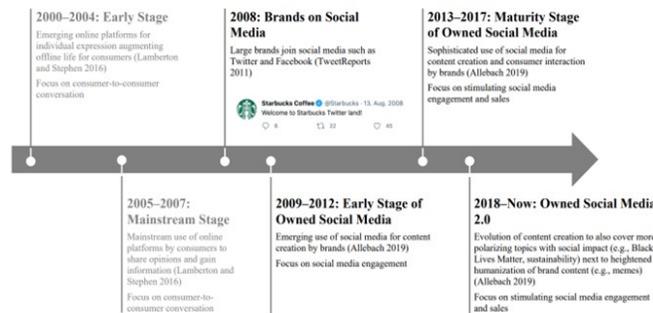
ao and others				thinking and impulsive consumption is not rich enough.			
Liu Fengjun et al.	2020	chinese journal of management	17(01):94-104	At present, there is little research on the internal psychological mechanism of live online celebrity to enhance consumers' willingness to buy products.	Interactive attraction purchase intention	306	25207
Wang chunyi and others	2023	scientific management research	41(01):74-79	Explore the supervision mode of digital platform enterprises and maintain the innovation vitality of digital platform enterprises.	Like, brand attitude	0	267
Fei Wei et al.	2023	Macroscopic quality research	11(01):87-98	Establish and improve the behavior mechanism of brand owners and anchors on food safety under the background of live e-commerce	Marketing, interaction	0	229
Meng Lu et al.	2021	management review	33(05):319-330	Emotional dependence plays an intermediary role in the influence of the characteristics of live broadcast online celebrity information sources on virtual gift consumption.	Purchase intention and behavior, consumer preference	22	3973
Luo Xingwu et al.	2021	management review	33(11):259-274	The role and influence mechanism of strategic business model design, ecological openness and platform leadership in this process.	Internet marketing, stickiness	five	1774
Xu sheng et al.	2021	management review	33(05):341-352	Reveal the mechanism of the influence of brand experience on consumers' response under the new media situation.	Consumer preference, brand experience, attention, stickiness	20	3595
Han Yutong and others	2022	Management science	35(01):17-28.	The information richness and emotional polarity peak of real-time comments affect the key psychological state of consumers' decision-making and promote their purchase behavior.	Comments, purchase intention, stickiness	one	2171

Three editions of the study (2021, 2022 and 2023) were included in this paper, because additional results were reported in the latest edition.

First of all, we conducted a comprehensive search of the published literature in the academic database. Secondly, we have manually reviewed the management world, nankai business review, journal of industrial engineering and engineering management, China soft science, management journals and China management science one by one. Thirdly, we applied a snowball program to identify other studies from the list of references. We completed this search process in February 2023. In the initial confirmed articles, we included articles that meet the following criteria: (1) the influence of live webcast media was considered in the preliminary study, (2) the background was the video media platform, and (3) the research reported statistical information, which enabled us to calculate article citations.

We have identified two main results of webcasting media: video media participation and sales, which are two dependent variables^[39](23 video media participation, 11 sales, 15 stickiness; Dong Zhaofeng 2022). In this process, 60 paper samples were produced, which were published between 2014 and 2023, and 2338 articles were cited based on 517,591 observations ($M = 58071$, $SD = 175061$). We use 2014 as the start date of our literature retrieval, because it represents a milestone for large enterprises to join the webcast media for the first time (see Figure 3) and the date when the first article was published on the webcast media^[40](Zhou Ziyu et al. 2014). About 81% of the articles were published between 2016 and 2021, which shows that the importance of short video media has been increasing in recent years. Of the live broadcasts, 46% came from marketing literature, 23% came from management and strategy, and 31% came from information systems and computer science. About 10% of flexibility comes from working documents and meeting minutes.

Figure 3. Research Innovation and Major Milestones of Webcast Media



When collecting the information in each study, in order to reduce errors, we specified a coding protocol error! The reference source was not found (Verschuere Bruno et al 2020) (see live broadcast calculation in Table 6).

Table 6. elastic transformation equation

Regression definition	statistical model	Elastic (reference) expression
linear	Y_1 (participation) = $\alpha + \beta x$ (webcast media) + ε	$\beta (\bar{X} / \bar{Y}_1)$
linear	Y_2 (stickiness) = $\alpha + \beta x$ (webcast media) + ε .	$\beta (\bar{X} / \bar{Y}_2)$
linear	Y_3 (Sales) = $\alpha + \beta x$ (webcast media) + ε	$\beta (\bar{X} / \bar{Y}_3)$
Log-linear	$\ln(y) = \alpha + \beta x + \varepsilon$	$\beta \bar{X}$

Note: These regression norms are most used in the research of webcasting media; y_1 = dependent variable (video media participation); y_2 = dependent variable (video media viscosity); y_3 = dependent variable (video media sales); x = independent variable (webcast media); β = β coefficient; \bar{y} = the mean of the dependent variable; \bar{x} = the mean of the independent variables. For the existence and non-existence of webcast media, the elasticity (citation) calculation can be summed up as an arc elasticity: $(\Delta y / \Delta x) * (\bar{x} / \bar{y}) = \beta (\bar{x} / \bar{y})$.

3.2 Variable manipulation

Table 7 lists the whole operation of variables. For the relationship between the participation of webcasting media and short video media, we searched 237 live broadcasts (56 focused on the capacity of webcasting media, 88 focused on the degree of webcasting media and 93 focused on the existence of webcasting media). As a robustness test, we also ruled out the participation of short video media. We collected 292 live broadcasts between webcasting media and sales (211 focused on webcasting media, 19 on the effect of webcasting media, and 62 on the existence of webcasting media).

Table 7. Variable Description and Operation

variable	Description and operation
Webcast transmission	
Video media participation	Capture the outcome variables of social media participation, including consumers' communication responses to the company, such as likes, comments, sharing, forwarding and posting on the brand control channel (Colicev et al. 2018; De Vries, Gensler, and Leeflang 2017)
sell	Capture sales, the number of sales categories, sales rankings and display the watched result variables (Kumar et al., 2016).
Webcast content	According to the content of the live broadcast (according to Maslow's demand level) and the way of transmission (Zhou Liangfa, 2017; Gong Siying, 2021; Chen Siqi, 2016)
Function (5) Information (23)28 27%	Function refers to what information can do through its form (Bai Chunxiang, 2020; Yang Gang, 2018; Li Qin, 2019)
Story (9) Emotion (66)75 73%	Emotion is a part of the whole attitude, which is in harmony with the introverted feelings and intentions in attitude. It is a complex and stable physiological evaluation and experience of attitude (Jia Chaoran, 2017; Wang Yaqian, 2019; Liu Shengzhi, 2018)
Webcast background	
Industry characteristics	Refers to the particularly remarkable signs and signs that distinguish an industry from other industries (Xu Xiangdong, 2018; Jie Chen, 2016; Peng Jin, 2016)
Art (120) Aesthetic Feeling (9)129 54%	The so-called aesthetic feeling is a subjective experience based on aesthetic emotion, which is an aesthetic perception (Li Jinghan et al., 2016; Zhang Zhifeng et al., 2019; Yu Jie, 2018)
Emotional management (110)46%	Emotional management is a process of emotional perception, control and adjustment of individuals and groups (Chen Chunzhu et al., 2017; Zhu Bingjie, 2016; Zeng Yizhen et al., 2017)
Presentation form	
Tangible (708)57%	The specific form presented in the market is also a specific form to meet a certain demand of consumers, and it is the form in which core products can be realized (Li Zhongjun, 2013; Wang Shuxiang, 2014; Li Haoyuan, 2018)
Intangible (541)43%	Refers to intangible labor products and paid economic words and deeds that make all tangible resources have value and use value attributes through materialized and non-materialized transformation (Pei Changhong et al., 2018; Tang Zhen, 2015; Season, 2016)
life cycle	It refers to the whole process of products from entering the market to upgrading and delisting places (Xiao Zanjun et al., 2016; Wang Peishan, 2018; Zhou Orange Min, 2020)
New (23)11%	Refers to the product from the design and production to the market to enter the testing stage and when the product enters the introduction period, after the sales are successful, it enters the growth stage (Zhou Zimeng, 2020; Li Wu, 2019; Li Hui, 2019)
Mature (189) 89%	Refers to the products entering mass production and stably entering the market. After the growth period, with the increase of the number of people buying products, the market demand tends to be saturated (Chen Mingyang, 2019; Xu Yaping, 2018; Shi Anbin, 2021)
Demand characteristics	In every period, people will have a demand that is dominant, while other needs are subordinate (Liu Jia, 2017; Wang Yong, 2014; Jiang Jiaqi, 2019)
Belonging (11) and love (8)25%	Refers to people's need to establish emotional ties with others and the need to belong to a certain group and enjoy a position in the group (Yan Bo, 2017; Jiang Hang, 2021; Huang Yiqun, 2018)
Aesthetic (57)75%	Refers to the need for symmetry, order, structure and behavior perfection, which includes both our aesthetic needs for external things and our own internal aesthetic requirements (Dong Tiantian, 2020; Meng Huan, 2017; Mach, 2021)
Platform	Each media platform presents different characteristics according to its content and mechanism differences (Su Zhi, 2018;

characteristics	Xu Weiyi, 2016; Wu Longlong, 2013)
Short video community (5)50%	Popular social applications with short videos as the main content (Li Chenfang, 2019; Qiao Xueyan, 2019; Sun Yujie, 2020)
Information sharing platform (5)50%	It is an information sharing platform, and the purpose of establishing this platform is to eliminate information islands (Zhao Peng, 2018; Zhao Fang, 2017; Guo Renzhong, 2012)

We coded the actual sales volume and related agents. For the research using sales ranking (18 references), we inversely coded the effect size to count the inverse relationship^[41](Liu Hui et al. 2021). Table 8 lists summary statistics, and Table 9 reports related matrix adjustment variables.

Table 8. Summary statistics of research variables

	Short video media participation		sell	
	k	M (SD)	k	M (SD)
Webcast media	1,349		292	
Story emotional type	579	.429(.495)	38	.130(.337)
emotional	300	.429(.495)	38	.130(.337)
sociality	279	.429(.495)	38	.130(.337)
Functional information type	373	.429(.495)	38	.130(.337)
Informative	282	.429(.495)	38	.130(.337)
Trading	91	.429(.495)	38	.130(.337)
Undefined	397	.429(.495)	38	.130(.337)

Remarks: The connection between webcast media and related output variables, k= the number of effects; M= mean value of continuous variables and frequency of dummy variables; SD = standard deviation; DV= dependent variable.

Table 9. Correlation matrix of variables

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) Webcast media								
(2) emotional story type	.262							
(3) Emotional	.127	.138						
(4) Sociality	.330	.301	.204					
(5) Functional information type	.085	.086	.003	.212				
(6) informational	.057	.040	.112	.009	.033			
(7) transactional	.132	.109	.066	.154	.128	.159		
(8) Undefined	.052	.044	.024	.027	.031	.044	.006	

Webcast media. For 1058 live broadcasts, we encode the media content of live webcasts and convert it into functional information or emotional stories. We further operate on functional information (accounting for 27%) (1) informational content (for example, including information about companies, industries, demands, products, etc.) and transaction-related (for example, price promotion or price information, marked as "transaction" succinctly). We operate the emotional content of the story (38%) as (1) emotional (that is, it contains emotions, arouses emotions, and is highly aroused) or (2) related to the story content (that is, concerned with the story, involving the story plot or interactive plot).

Industry characteristics. Citation related to industry mainly focuses on two categories: artistic beauty and emotional management. Most applications are art (120) and aesthetic feeling (9) accounting for 54%, and emotional management (110) accounting for 46%. We use a dummy variable to divide the categories into two groups, which are used as reference for art category (129) and emotion category (110) respectively.

Present formal characteristics. Presentation can be divided into tangible and intangible forms. Tangible form, that is, the concrete form presented in the market, is also a specific form to meet a certain demand of consumers, and is the form in which core products can be realized. Intangible form refers to intangible labor products and paid economic words and deeds that make all tangible resources have value and use value attributes through materialized and non-materialized transformation. Tangible features (708) account for 57%, and intangible features (541) account for 43%.

Life cycle characteristics. We capture the characteristics of life cycle, including new product activities, which means that products enter the growth stage (23), accounting for 11%, from design and production until they enter

the market and enter the testing stage, and when the products enter the introduction period and the sales are successful. As well as mature products, it means that products enter mass production and enter the market stably. After the growth period, with the increase of the number of people buying products, the market demand tends to be saturated (189%), accounting for 89%^[42](Lei Zhang.et al 2013).

Demand characteristics. According to Maslow's demand characteristics, this paper gains ownership from the third-tier demand and the sixth-tier demand respectively.

(11) and love (8) accounted for 25%, and aesthetics (57) accounted for 75%. The third layer of need attribution and love (19) refers to people's need to establish emotional ties with others, as well as the need to belong to a certain group and enjoy a position in the group. The sixth level of demand aesthetics (57) refers to the need for symmetry, order, structure and perfect behavior, which includes both our aesthetic needs for external things and our own internal aesthetic requirements.

Characteristics of the platform. The preliminary study found that it was quoted on 14 video media platforms: Tik Tok, bilibili, Aauto Quicker, Today Headline, Little Red Book, Keep, Public Comment, Ctrip, Sina Weibo, Baidu, Zhihu, Douban and so on. To capture the platform type, we include two virtual variables, one for short video community (5), which is a popular social application with short video as the main content, accounting for 50%, and the information sharing platform (5), which is an information sharing platform. The purpose of establishing this platform is to eliminate information islands, accounting for 50%.

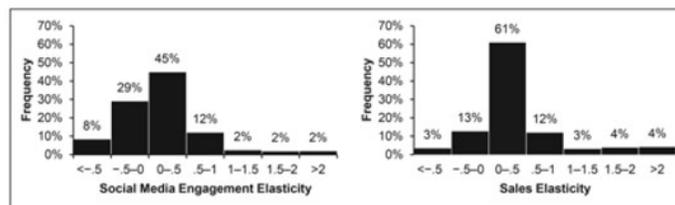


Figure 4. Frequency Distribution of the Observed Elasticities of Owned Social Media

Research field control. We include virtual variables in the research field, which are divided into management (23%), information systems and computer science (31%) and marketing (46%, for reference).

3.3 Reference calculation method

We retrieved the citation (η) from the reported primary research. If the reference is not available, we calculate the reference from the parameter estimation and description statistics in Web Appendix G^[43](Fang Aili et al. 2007). We corrected the quoted measurement error^[44](Sun Ning.et al 2022).

3.4 Meta-analysis model and estimation

Our analysis follows a two-step approach^[45](Xu He et al. 2020). First of all, we calculate the average webcast media citation variables of each dependent, and analyze the citation distribution. Secondly, we use a two-level linear element analysis model to identify important regulatory variables^[46](Zhao Yun et al. 2019), using the citation embedded in the article (the second layer) (the first layer). We evaluate the following models of short video media participation and sales. Level 1 (reference):

$$\begin{aligned}
 Y_{ij} = & a_{0j} + \sum_{m=1}^2 \beta_m \text{ContentCharacteristics}_{mij} \\
 & + \sum_{n=3}^4 \beta_n \text{IndustryCharacteristics}_{nij} \\
 & + \sum_{f=5}^6 \beta_f \text{FormCharacteristics}_{sij} \\
 & + \sum_{l=7}^8 \beta_l \text{LifeCharacteristics}_{lij} \\
 & + \sum_{r=9}^{10} \beta_r \text{Re quireCharacteristics}_{rij} \\
 & + \sum_{p=11}^{12} \beta_p \text{PlatformCharacteristics}_{pij} \\
 & + \sum_{s=13}^{16} \beta_s \text{StudyCharacteristics}_{sij}
 \end{aligned}$$

Among them, Y_{ij} Cited by the I-th webcast media in article J; 0_j is the intercept of article j; Where n, f, l, r, P and S are the parameter estimates of different message features M, industry features N, presentation features F, life

cycle features L, demand features P, platform features P and research features S, respectively; E_{ij} is the random error related to the first citation in article J. We use maximum likelihood

However, these meta-analysis models enable us to explain the cross-study difference variables and their relationships, and pay attention to the content of live webcast media (functional information, emotional story, unspecified) and five background adjustments: (1) industry characteristics, (2) presentation characteristics; (3) Life cycle characteristics; (4) demand characteristics; (5) Platform features. At the same time, we also pay attention to different methodological characteristics, such as the year of data collection, whether the model contains lag dependent variables, how many parameters are used, research fields (marketing, management or information systems and computer science), and whether the papers are published correctly in top journals. We take continuous variables as the center and subtract the mean value of each variable to facilitate the interpretation of the results^[47](Cui Fang et al. 2017).

3.5 Descriptive analysis

In Figure 5, we show the distribution of short video media business participation and sales after measurement correction. Combined with the summary of the report in Table 10, these descriptive statistics provide the first model-free evidence that webcasting media has a positive impact in two aspects. On average, the quotation is positive, 37% of short video media participation cases are negative, while 16% of sales cases are negative. Table 10 explains the changes of references over time.

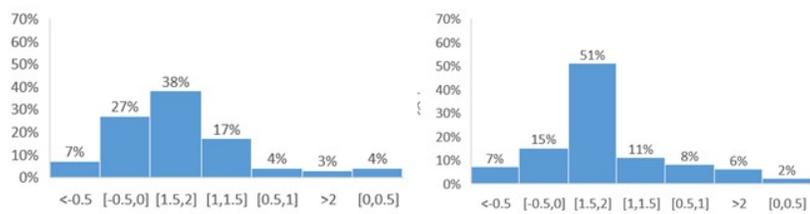


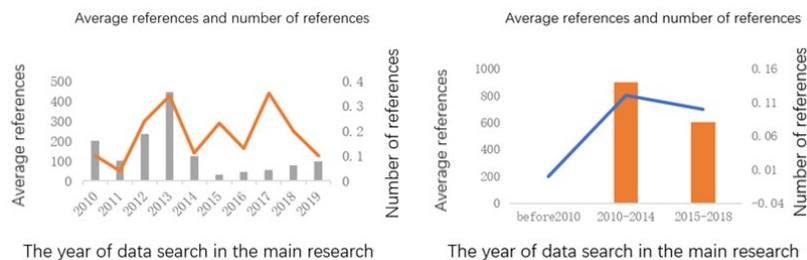
Figure 5. Frequency Distribution of Webcast Degree

Table 10. Descriptive Statistics of Webcast in Online Media Participation and Sales

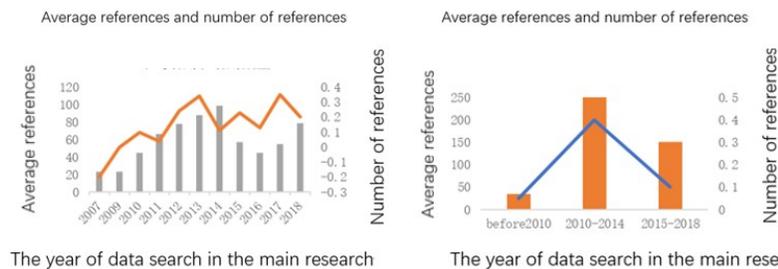
t-Value												
	N (k)	essay quantity	M	SD	(H0: M=0)	+Sig.	-Sig.	+n.s.	-n.s	Mdn	Min	Max
Social media participate in	73,311,101 (1,349)	60	.133	.614	7.992***	601	361	217	188	.505	-2.62	3.074
sell	5,357,017	fifty-six	.401	.877	7.331***	171	21	103	30	.045	5.028	5.226

Figure 6. The change of average webcasting citations with time

A. Social media participation



B. Sales



Generally speaking, we found that an increase of 1% in webcast media led to an increase of 0.137% in video media participation, while an increase of 0.353% in sales (the effects are obviously different from each other; $P < .001$). We found a similar significant effect. When we pay attention to the number of live webcasts ($P < p < .10$) and the presence or absence of live webcasts ($P < p < .001$), there is no significant difference between participation and sales. The strong impact on sales seems surprising, because short video media is usually regarded as a tool to increase participation rather than sales. However, it should be pointed out that the comparison between the results is not straightforward, just as different results refer to different levels of analysis. This stronger reference to sales may be the result of two effects: "self-competition" effect and "fan base and customer base" effect. In the first case, if an enterprise increases the number of live webcast media posts, for example, the number of posts posted per day changes from 1 to 5, a hypothetical user may defend against one post, but will not respond to all five posts; These extra posts compete with each other for consumer participation ("self-competition"). In addition, short video media allows everyone to participate in an enterprise, even if they don't consume the enterprise products. This leads to the effect of "fan base and customer base": the number of users who participate in a product on video media is often higher than the actual number of consumers who buy the product, which leads to the influence of webcast media on short video media participation is less than that on sales.

There are considerable changes in the media citations of webcasts with different content types. We observed that short video media participated in the citation of emotional stories ($M = .167$, $SD = .526$), compared with the citation of functional information ($M = .004$, $sd = .498$; $P < .001$), significantly larger. In the emotional content of the story, we observed that the citation of emotional content is higher ($M = .227$, $SD = .526$) than that of story content ($m = .106$, $SD = .559$; $P < .001$), but in the functional information content, there is no difference in observation (information content: $M = .003$, $SD = .588$; Transaction content: $M = .003$, $SD = .724$). For sales, we observed the opposite situation: functional content cited more ($M = .327$, $SD = .401$), which exceeded the emotional reference of stories ($M = .085$, $SD = .213$; $p < .001$); We also find that there is no obvious difference, and the reference of function information class (function content: $M = .352$, $SD = .399$; Sales content: $M = .234$, $SD = .309$) and emotional quotation of stories (emotional content: $M = .055$, $SD = .227$; Story content: $M = .101$, $SD = .261$).

Generally speaking, these descriptions show that webcasting media has a positive impact on the participation and sales of short video media. In addition, the different functions of content types in webcasting media emphasize the importance of clear definition, that is, the target result variable creates the most effective webcasting media content.

3.6 The Moderating Role of Content and Context

For the webcast media content, the results are very consistent with our research expectations. For short video media participation, we found that information content ($\beta = .248$, $P < .01$; $\eta = .018$), transaction ($\beta = .254$, $P < .01$; $\eta = .012$), the story content ($\beta = -.154$, $p < .01$; $\eta = .112$), which is more effective than emotional content. This discovery is important because it is in sharp contrast with the traditional concept. It is suggested that managers pay attention to the content of transactions or stories and improve their participation in short video media. We found that this is the information content ($\beta = .652$, $p < .05$; $\eta = .580$) and social content (461 , $p < .10$; $\eta = .338$) can affect sales more than emotional content. However, there is no significant difference between the information and the story content ($P > 0.10$).

Industry characteristics. Although we didn't find any significant difference between artistic aesthetics and emotional management, we observed that studies based on multiple categories tend to report fewer citations than those focusing on only one category ($\beta = .215$, $p < .05$).

Present formal characteristics. There are some differences between the presentation forms of tangible and intangible products in the analysis results of video media. Compared with intangible products, tangible products

will lead to larger sales quotations ($\beta=.485$, $P < .01$; $\eta=.530$).

Life cycle characteristics. For new products, we will look for larger sales quotations than mature products ($\beta=.545$, $P < .01$; $\eta=.650$). This may be because video media may be more related to new products, because enterprises can provide more content to consumers, who have not yet formed their own preferences and do not know much about this product[48](Signe Mørk Madsen 2020).

Characteristics of the platform. Consistent with our prediction, the live media in short video community is less effective in stimulating media participation than that in information sharing platform ($\beta = .164$, $p < .05$; $\eta = .028$). In addition, we find that advertising on the video media platform will reduce the sales effect of live webcast media ($\beta = .600$, $p < .01$; $\eta = .211$). This shows that advertising not only does not strengthen my trust, but also reduces consumers' trust in video media content, because it does not conform to the social nature of social media background.

Demand characteristics. Some influences of consumers on media acceptance may be due to the diversification and hierarchical improvement of their own needs. For video media participation, we find that belonging and love have more positive effects than aesthetics ($\beta = .014$, $P < .01$; $\eta = .216$). This may indicate that consumers are more willing to use video media to participate in information sharing platforms when they have higher belonging and love (Zhang Lifan et al. 2017).

Research field control. We tested the moderating effect of research characteristics in the main study[49](Liu Xin et al 2023), we find that the research on information systems and computer science tends to have greater sales impact than the research on marketing ($\beta=.365$, $P < .10$; $\eta=.533$).

Robustness check. Cross can be interpreted as average forecast citation, and the average observed citation values reported in Table 2 are consistent (η participation $=.157$, η sales $=.394$). In order to evaluate the stability of the results, we conducted several robustness tests. First, we run the model using ordinary least squares. Second, we perform sensitivity analysis and remove one article at a time by running the model again; The results remain basically the same. Thirdly, two articles have studied the influence of webcasting media on TV program viewing (12 citations) and found robust results. Fourth, more variables can be used to capture industry, life cycle, demand, platform and research characteristics. This leads to the relevant results displayed by the model.

4.Experiment 2: How does the number of webcasts promote social media sales?

4.1 Foreword

As consumers become more and more alert to traditional forms of advertising^{[50][51]}(Huang Xiaotao, Huang Hu 2021; Melissa Aronczyk 2020), short video social media platforms such as Tik Tok and Bili Bili are gaining more users' attention, transforming from a short video community to a social marketing media platform market worth more than 43.83 trillion yuan in 2022^{[52][53]}(Guo Quanzhong, Liu Wenqi 2022; Ge Jiaojia et al 2021). In short video marketing, participation behavior usually refers to user interaction behavior (for example, like, Comments, sharing, rewards, etc.), and participation is captured by the number of user interactions; Sticky behavior usually refers to the binding behavior of becoming fans and loyal users (for example, collection, attention, etc.), and the degree of stickiness is determined by the success of user binding; The degree of sales is usually obtained by the number of goods sold (for example, adding shopping carts, placing orders, etc.). Although webcasting marketing is becoming more and more popular, it seems that advertisers do not fully understand which form of webcasting (high-frequency live broadcast or long-term live broadcast) can achieve better sales results^[54](Zhang Zhihua, Dong Xinjia 2018). The number of webcasts or the length of time defines the depth and breadth of the live broadcast that can directly reach the audience through the content^{[55][56]}(Du Yanping 2021; Eun Yu et al 2018), which ranges from a low-frequency live broadcast to an average high-intensity live broadcast once a day; Or from an efficient one and a half hours to a two-hour live broadcast. However, it is still an open question whether high or low intensity webcasting is more effective in generating market sales. On the one hand, advertisers want to take advantage of the influence range of a user's sales behavior, which refers to the number or time of live webcasts that come into contact with the marketing effect. Therefore, some brands "have been competing to invest a lot of money in live webcast media with a large number of users' participation or user stickiness"^{[57][58]}(Li Zhi, Zhu Chunhong 2021; Jialin Snow Wu et al 2021). On the other hand, users on social networks often seek interactive and social relationships, and are willing to enter the influence mechanism of this network demand matching function^{[59][60]}(Liu Bo 2023; Le Wang. 2022). Therefore, one form of webcasting (that is, many users participate in it) may have a relatively large interactive impact, but it may have a relatively small sales impact (that is, it may have a small transaction

possibility), while another form of webcasting may have a relatively small interactive impact, but it is more likely to sell. In the end, which form of webcasting generates more market sales (that is, higher order quantity) through the user's behavior? In order to answer this question and clarify the important details of how the strength of webcasting is related to the sales level, we put forward a new concept of correlation, that is, with the increase of webcasting level (frequency and period), the positive impact may be offset by the negative ordering effect, which makes webcasting users less motivated to continue to follow the product ordering, and the overall ordering level will decline.

In this framework, we also assume that some features of the activity can be enhanced by enhancing the correlation between webcasting and ordering. Specifically, we studied two user activity attributes: (1) User participation behavior, which enhanced the user's praise, comment, sharing and reward; (2) User's sticky behavior, which describes the sticky degree of users' collection and attention to webcasting anchors or protagonists. Diagnose according to contextual clues^{[61][62]}(Li Aixia.et al 2021; Zhu Jiali et al. 2021), we think that these two kinds of user activity attributes can help webcasts devote themselves to the relationship with users, which should enhance their negative influence on the possibility of placing orders for products, thus enhancing the relationship with the overall purchase.

In order to test our framework empirically, we conducted a multi-method research, centering on the data of Tik Tok observed on the spot, and enriched it through laboratory research, additional simulation research and a set of auxiliary qualitative interviews. We conducted these studies to deepen our understanding of the broader field of webcasting marketing. The conclusions drawn from these studies found that the intensity of webcasting had a significant impact on online commodity sales, and also found the empirical support of the hypothesis-regulating effect of user activity attributes: higher user participation behavior, higher user participation behavior, and higher user participation behavior.

4.2 Related documents of webcasting and sales

In order to contribute to the research of social network, live broadcast marketing and user behavior marketing, we theorize the relationship between the degree of user behavior and the sales of sponsored goods. In this paper, these concepts are applied to the webcasting in the targeted social network (namely Tik Tok). Table 11 provides a brief overview of the most relevant studies.

Table 11. Summary of Key Empirical Research on Webcast in Social Networks

author	On the research following part	Main dependent variable	Main webcast photos The antecedent of Guan	regulated variable	Related research results
Zhang Xiaorui et al. (2019)	Live broadcast	Live sales	Online celebrity anchor sales category Communication behavior	Spread to sales category Research on behavior classification	Point out the problems existing in webcasting and Put forward practical suggestions
Liang Zhixuan (2019)	Taobao	User trust	Real-time output of live broadcast information and live broadcast content Commodity attribute	Communication mode of e-commerce live broadcast	Enhance users' trust by learning and improving live broadcast ability.
Zhaodonglin (2018)	Betta	Sales transformation of shopping live broadcast platform	Non-threshold webcast	Use live broadcast platform to promote products.	Find out the key factors that affect the sales transformation of shopping webcasting platforms, and the most Then put forward some targeted suggestions.
Rao junsi (2019)	Taobao	E-commerce live marketing	Live broadcast technology, Interactive marketing	Optimize e-commerce live broadcast marketing	Realized the sales attribute of e-commerce Combined with the traffic attribute of live broadcast

Fengxingyao (2020)	Wechat live broadcast	Live sales	Shaping brand image	Immersive marketing, emotional marketing, experience Type marketing	Improve the conversion rate of live marketing
Renbo (2020)	protruding canine tooth	The driving force of industrial policy, the driving force of market demand, the driving force of enterprise competition and digital technology. reduce	Literature analysis and case analysis	Exploring the Motive Force, Mechanism and Mode of the Integration of Digital Economy and Sports Industry	Form the internal mechanism of the integration of digital economy and sports industry
Hanxiaoyi (2020)	Douyin	Consumer's Behavior Intention of Online Sharing and Online Ordering	Charm attribute, recommendation attribute, display attribute and interaction attribute.	Trust plays an intermediary role in the process that charm attribute, recommendation attribute, display attribute and interaction attribute affect consumers' online collection intention. use	Excitement, value and trust also have significant moderating effects on consumers' online sharing and online ordering behavior intention.
Chenhong (2018)	Taobao	Customer stickiness Enhance the shopping experience	Marketing strategy of customer loyalty Sales transformation	Customer's personalized service and consumption upgrade demand	Complete the upgrade and innovation of e-commerce live broadcast, meet customers' personalized service and consumption upgrade needs, and increase customers. Stickiness, enhance the shopping experience
Jiayi (2022)	Douyin	Sales law and consumption experience	Audience media consumption	Propagation pattern and elimination Logical echo of the formation of fee mode	Drive changes in industrial structure and business model.
Huang Binhuan et al. (2021)	Kuaishou	Deep embedded marketing	Substitution experience, immersive product interaction, entertainment and shopping are integrated.	Sales is a process of effectively linking producers and consumers and creating product interaction.	Create a new production-consumption system
Sunlei (2017)	Sina Weibo	Enterprise marketing	Practice summary, external ring Environment, Weibo's present situation and the	Fan economy and dual platform	Provide solutions to enterprise marketing strategy

			transformation mode of commercial value		
Guo Na et al. (2020)	Douyin	sell	Online celebrity effect	Brand effect platform affect	Guide agricultural products under the economic background of online celebrity. Sustainable and healthy development of online sales
Zhang Han et al (2019)	livestreaming	sell	Anchor professionalism, product features	Live content	Enrich the content situation of direct marketing of agricultural products, strengthen supporting services and brand culture construction.
Tang siqi (2020)	Weibo, I live-streaming	sales volume	livestreamer	Consumer participation	Promote consumer culture in the era of online shopping The prosperity and healthy development of
Wei Chao (2020)	Kuaishou	User's purchase intention	Users trust their loyalty.	User perceived value	Live broadcast the tripartite value of e-commerce users through the positive leadership and positive attributes of the platform. A win-win situation

4.3 Theoretical framework

How does the degree of webcasting affect the sales of sponsored goods? Based on the existing research and 13 semi-structured interviews with industry experts (see Table 2), we come to the conceptual framework of the relationship in Figure 7. We first explain why we expect the inverted U-shaped relationship (H1) in theory, and then discuss two user behavior attributes: user participation behavior (H2) and user stickiness behavior (H3) to discuss their potential regulatory effects.

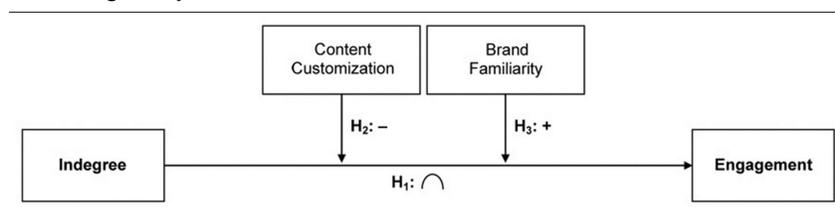


Figure 7. Conceptual Model Framework

1. How does the degree of webcasting affect the degree of sales?

The degree of sales refers to the number of goods sold by users on social platforms for live webcasting^{[63][64]}(Yan Zhouhang 2023; Zhang Wen.et al 2023). Following Hinz et al^{[65][66]}(Li Xiaoxia, Zhao Xiufeng 2020; Cui Xueqing.et al 2023), we developed our framework based on a simple two-decision model, which links sales with webcasting. Tie it. On the social media platform, the broadcaster I has a webcast $D_i(D_i > 0)$ to indicate the number or time of webcasts in a given period of time. Live broadcaster I publishes sponsored commodity content (short video or news) for concerned users, so it provides an effective coverage for measuring live broadcaster I. Assuming the specific average selling possibility of live broadcast ($P_i = P_{iN} \in N_i$), the expected selling degree E_i of live broadcast content sponsored by the broadcaster I is given as follows:

$$E_i = D_i * p_i \quad (1)$$

Increasing user sales requires increasing N_i (allowing more users to access live content) or p_i (increasing the possibility of each user's ordering behavior), both of which may be functions of D_i . To sum up, we believe that the degree of correlation is an important clue, which helps to explain the possibility of participation and predict:

H1: Webcast plays a significant role in the sales of sponsored goods.

2. How can user behavior adjust the impact of webcasting on online sales?

User participation. Webcast is usually organized in an activity composed of multiple links, including live

protagonist, live user group, sales goods and sales methods. Then, the behavior of the whole user fans or user groups may adjust the relationship between sales levels through the connection between webcasting and sales possibilities (H1). We pay attention to two factors that are easy to observe. The user behavior obtained from our expert interviews is related to management and controlled by marketing, and should change the way users evaluate the degree of webcasting when deciding whether to buy or not. User participation describes the degree of interaction between different webcasts in creating content. Participation behavior usually refers to user interaction behaviors (such as likes, comments, sharing and rewards), and participation is captured by the number of user interactions. Therefore, the positive impact of webcasting on the possibility of selling goods online may be enhanced. We formally assume that:

H2: Higher user participation enhances the significant effect of webcasting on the sales of sponsored goods.

User stickiness. User stickiness refers to the dependence of network users on the live webcast or live role. User stickiness refers to the degree of dependence and expectation of re-consumption formed by the combination of users' loyalty, trust and benign experience to the brand or product. Viscosity is usually determined by becoming fans and loyal users (for example, collection, attention, etc.), and it is determined by the success of user bundling. The degree of sales is usually obtained by the number of goods sold (for example, adding shopping carts, placing orders, etc.). User stickiness should arouse people's positive views on the value of the relationship between concerned groups and webcasting, so the positive impact of webcasting on the possibility of selling goods online may be enhanced. Therefore, we formally assume that:

H3: Higher user stickiness enhances the significant effect of webcasting on the sales of sponsored goods.

3. Overview of empirical strategies

Our empirical background is related to the live webcasts in Tik Tok and Mile Mile. Tik Tok and Mile Mile are one of the largest social media networks in China, with over 751 million active users^{[67][68]}(Zhao Mengyuan 2016; Zhang R, Jing X 2023), so 93% of advertisers plan to use it for webcast marketing^{[69][70]}(Teng Wei 2023; Yang Zhang, Dongphil Chun 2023). In order to test our hypothesis, we adopted a two-pronged empirical strategy. First of all, in study 1, we formally tested H1 through large-scale field research and observation data. Secondly, we have verified the strength that supports our conceptual framework in a series of additional two studies. Through study 2 and study 3, we tested how user behavior (user participation and user stickiness) can adjust the possibility of higher sales level caused by higher webcasting. Table 2 summarizes our empirical methods, findings, and the parts of the Web appendix that provide additional analysis and robustness testing.

4.4 Evidence of the Relationship between Webcast and Sales from the Field (Study 1)

1. Data description and samples

The data analyzed in the experiment is our foundation, some of which are not publicly visible (for example, likes and shares) or inaccessible (for example, collection and attention), and may be manipulated by influencers afterwards (for example, rewards), and can't perfectly identify which content belongs to a given activity. In order to avoid these challenges, we adopt the secondary processing of data set, which is composed of the classification and secondary arrangement of existing data. These collected data include information of 802 activities, which are randomly selected from a random combination of activities. From the perspective of the generated participation, they neither represent unusually successful activities nor unsuccessful activities. Webcast content represents different categories, including artistic beauty and emotional management (clothing, fashion and jewelry), so these activities provide a representative group of advertisements in Tik Tok^{[71][72]}(Li Wei 2023; Chandruangphen et al 2022). This sample contains 6,422 live events and 6,178 short videos from 1,738 webcasts released between 2022 and 2023. Generally speaking, these online sponsored live broadcasts generated a large number of sales and orders, among which, Tik Tok e-commerce sold 23.9 billion single-2 commodities in 2022.

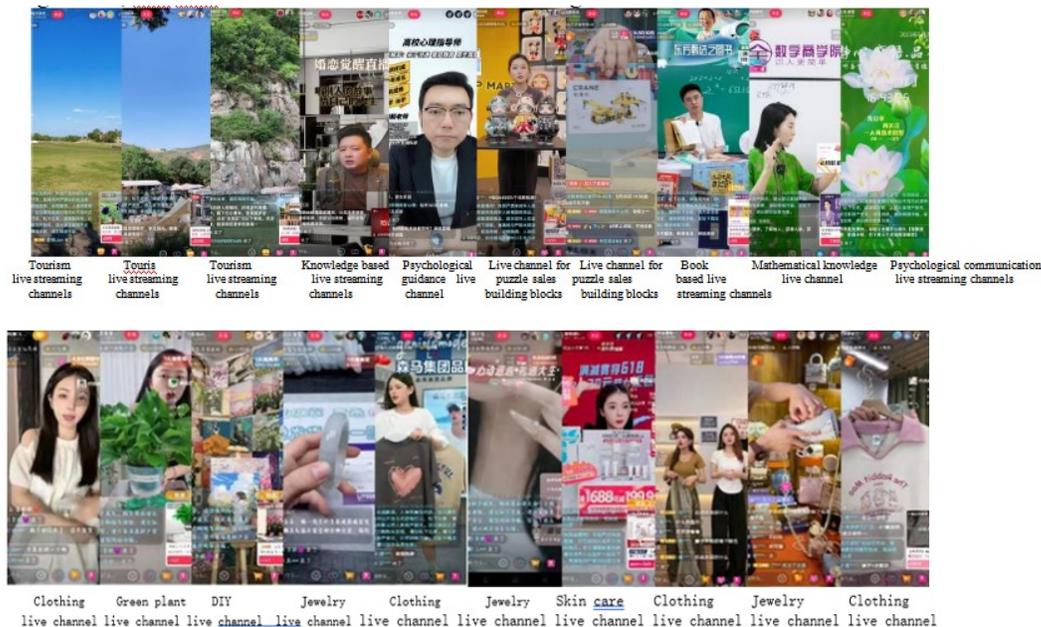


Figure 8. Webcast Type Content Display Diagram

2. Muesure

Online sales. We distinguish between two types of sales, which are related to the interaction of live content, and both types are highly related to marketers. For the degree of live broadcast sales, we have determined a purchase quantity. All live broadcast indicators are measured within one week after the live broadcast, which is the time when the degree of sales in this kind of market occurs the most. We regard this variable of live order quantity as a reflective index of live sales. Degree of webcasting. The independent variable we are concerned about is webcast, which is equal to the number of webcasts. Degree of online sales. The dependent variable we are concerned about is the number of orders placed, which is equal to the number of orders placed by webcasts in the live space product links.

3. Sample description

Table W3 in Web Appendix F provides descriptive statistics and variable correlation. The average degree of influencers in our sample is 179,000, which varies greatly, with followers ranging from 3,400 to 6.45 million. We also observed the full changes of webcasting, and we noticed that the changes of commodity sales can be well explained by webcasting and specific effects of activities to support our hierarchical model selection. Specifically, according to the likelihood ratio test of variance between activities, in these two models, we can reject the hypothesis that there is no variance between activities at the standard significance level ($p < 0.01$). Activity-specific intra-class correlation ranges from 0.11 to 0.55. On average, 29% of the variance of online sales cannot be explained by covariates.

Occurred due to unobserved specific characteristics of user behavior. As far as webcasting is concerned, our sample contains activities with different degrees of user participation behavior (ranging from 0 to 917) and user sticky behavior (scoring from 0 to 96). Figure 3 provides further model-free evidence.

4. result

How does webcasting affect commodity sales? We first examine the relationship between the degree of webcasting and the degree of sales. As predicted in H1, on the whole, these models are statistically significant and explain the substantial variance. The first column in Tables 4 and 5 reports the results. The variance expansion factor is much lower than 10, which indicates that multicollinearity is not a problem. Significant positive and negative square terms of two live broadcast degrees ($\beta_1 = .715$, $P < .01$; $\beta_2 = -.090$, $p < 0.01$) and live broadcast sales ($\beta_1 = .414$, $P < 0.01$; $\beta_2 = -.061$, $p < 0.01$) implies the support of H1 hypothesis. In order to support H1, webcasting has a significant impact on commodity sales.

This effect translates into a significant increase in the sales level of each webcast. For a webcast with 6 times a

week, we have noticed that the sales level of each webcast has increased by 314 when the broadcast frequency has increased by 10%, but the sales success rate has declined.

How does user behavior adjust the influence of webcasting on sales? Turning to the moderating effect of two users' behaviors, we show the regression results of users' participation in sales and users' sticky sales in Table 5 in columns 2 and 3 of Table 4. Compared with the main effect model, the proposed model shows better fitting test. We plot the moderating effects of user participation and user stickiness in Figure 3.

5.robustness testing

In order to ensure the validity of the results, we conducted several robustness tests, which confirmed our findings (see Table 6 for details). For example, we found that there were no systematic differences among the five data providers that we collected data from. We also confirm that our hierarchical model structure is carefully selected, and the results are robust to other forms of sales-specific effects. In addition, when several control variables and two activity-related regulatory factors are replaced, we prove the robustness of our findings.

4.5 Evidence of the power behind the relationship between webcasting and sales (Studies 2 and 3)

Based on the results of this field, in studies 2 and 3, we further clarified the mechanism proposed in our conceptual framework. In a series of five experimental studies, we pay attention to the positive correlation between the degree of webcasting and the possibility of commodity sales. To this end, we first established evidence. Then, we seek to further understand the moderating effect of user behavior (user participation and user stickiness) (studies 2 and 3).

Research Foundation: Webcast and Sales Possibility

In an online laboratory experiment, we manipulated the degree of webcasting, and the possibility of establishing this sales degree under controlled conditions increased with webcasting, and showed how webcasting affected the sales possibility through the perceived connection strength, as shown in Figure 4.

Participants and design.

We use inter-subject design to test how to promote the sales possibility under the conditions of low, medium and high live broadcast. The data comes from 151 users in Tik Tok (Mage=33.1 years; 59.6% of women) passed the attention check. Participants must imagine paying attention to low, medium or high-level webcasts, and then evaluate their possibility of buying webcasts. In addition, participants also completed the measurement of the intermediary.

Procedures and measures.

In order to build a consensus, we briefly introduced the webcast to the testers. Then, in order to encourage them to immerse themselves in the scene, we showed two fictional scenes of "its", Box Horse Fresh and Oriental Selection, and asked them to follow one of them. Next, the tester saw the selected webcast of Tik Tok (Figure 6.A). Presented in the form of influencers with low degree ("live broadcast once a week"), medium degree ("live broadcast three times a week") or high degree ("live broadcast seven times a week"). Testers were also told that today, webcasting appeared in their Tik Tok recommendation. Testers evaluated the possibility of their interaction with the live broadcast with the item, "How likely are you to make a sale there in your imagination" (for example, place an order?) (1= "very unlikely" and 7= "very likely").

Because participation indicators (like, comment, share and reward, etc.) should capture the same potential interaction with live broadcast.

Machine. This approach regards webcast participation and user stickiness as the sum of various interactions (participation: like, comment, share and reward, etc.; Stickiness: collection, attention), and obviously assume that they are interchangeable and mutually replaceable in obtaining the participation and stickiness of webcasting^{[73][74]}(Jin Yiwei 2023; Po Chien Chang 2023). When creating a comprehensive measure of the participation behavior and sticky behavior of webcasting (as the average of several standardized indicators), we also took several steps to establish the internal consistency and effectiveness of our method. Cronbach's alpha value is 0.83, which exceeds the recommended threshold of 0.70. In confirmatory factor analysis, the average variance (0.55) and composite reliability (0.79) extracted from our indicators exceeded the recommended values of 0.50 and 0.70 respectively. Finally, the load of all factors of user participation behavior is highly significant ($p < 0.01$) and exceeds 0.60.

(Like =0.68, Comment =0.74, Share =0.63, Reward =0.61). Similarly, all factor loads of user's sticky behavior are highly significant ($p < 0.01$) and exceed 0.60 (collection =0.72, attention =0.75).

Study 2: the possibility of user's participation behavior regulating market sales

In order to support our view that the strong influence of higher webcasting degree on commodity sales is driven by the strong relationship between webcasting degree and sales degree, we used a 2 (webcasting: low vs high) \times 2 (user participation: low vs high) inter-subject experiment (see Web Appendix K.3 for details). We adjusted the settings of the previous study, so that under the condition of high user participation, the webcast is seemingly consistent with the description of goods by other live broadcasts. Under the condition of low user participation, webcasts describe goods in their own unique language, unlike other webcasts in the event. The results of variance analysis are based on the responses of 502 users in Tik Tok (Mage=31.0 years; 50.8% of women) paid attention to at least one webcast space in reality, and passed the attention check, and the results showed significant interaction effect ($F(1,498)=3.91$, $p=0.049$). Under the condition of low user participation, testers under the condition of low webcast ($M=4.13$, $SD=1.53$) reported that the possibility of placing a purchase order was significantly lower than that under the condition of high webcast ($M=3.24$, $SD=1.80$; ; $F(1,498)=17.78$, $p<0.001$). However, under the condition of high user participation, the low degree of webcasting ($M=4.13$, $SD=1.70$) and the high degree of webcasting ($M=3.83$, $SD=1.73$; ; $F(1,498)=1.86$, $p=.173$). These results show that user participation can enhance the positive impact on the possibility of commodity sales, which is helpful to explain the results of study 1.

Study 3: the possibility of user's sticky behavior regulating market sales

In order to study the moderating effect of user stickiness, we adopted another inter-subject experiment of 2 (webcast: low vs high) \times 2 (user stickiness: low vs high) (see Figure 6.B). In this study, we adopted the previous research settings, that is, under the condition of low user stickiness, webcasting recognized a live broadcast space that few people knew on the surface, while under the condition of high user stickiness, many people knew this live broadcast space. The result of variance analysis reflects the input of 484 Tik Tok users (Mage=31.4 years; 50.0% of women) paid attention to at least one live broadcast space in reality. Under the condition of high user stickiness, the tester under the condition of low webcast ($M=3.92$, $SD=1.76$) reported that the possibility of placing an order was significantly lower than that under the condition of high webcast ($M=3.22$, $SD=1.74$; $F(1,480)=9.62$, $P=.002$). However, under the condition of low user stickiness, low webcasting ($M=4.00$, $SD=1.65$) and high webcasting ($M=3.87$, $SD=1.86$; Testers under the condition of $F(1,480)=.33$, $p=.568$) reported similar input possibility. These results are helpful to further clarify the findings of study 1, that is, higher user stickiness weakens the impact of webcasting on market sales.

4.6 General discussion

Our work has contributed to market research and practice in several important aspects. Theoretically, we have deepened our understanding of the relationship between the degree of webcasting and the sales of live products by users. Webcast behavior is related to product sales through the user's behavior. We also introduce two important user behavior attributes, user participation and user stickiness, as related concepts of influencer marketing literature, and how influencer webcasting promotes sales.

Empirically, by using in-depth and extensive domain data, we can more accurately identify the impact of webcasting on sales, and expand the previous research on the effectiveness of webcasting marketing. In particular, we base this analysis on the complete activity data including the impact of all webcasting behaviors, so that we can go beyond the previous work that tends to ignore the composition effect of activities. In terms of methods, we not only capture participation according to likes, comments, sharing and rewards of posts, but also capture user stickiness according to stickiness such as collection and attention. Live content is particularly relevant on Tik Tok and Bili Bili, because they can contain links to redirect users to place orders for goods sales, which is an indispensable commercial function in posts^{[75][76]}(Hong Pingping 2023; Karen Jin Wu et al 2022). More than one-third of the sponsored content on Tik Tok and Bili Bili appeared in the form of live broadcast^{[77][78]}(Little Gourd Big Data 2021; Dave Loma,Lipner Shari R. 2022), 83% Of the marketers plan to use Tik Tok product links in their live events^[79](Li Xue, Shen Lei 2020; Ye Dingyu.et al 2022).

In essence, we provide novel and operational insights to help advertisers improve their live marketing strategies. We emphasize the danger of over-saturation effect of sales when the live webcast becomes too large, and reveal that the most effective level lies between the very small and the very large level of behavior that is usually recommended. These contributions also help marketers better explain their investment in live marketing, which is of special value to this young and rapidly developing social media strategy.

5. Experiment 3: Webcast Promotes the Verification of Social Media Sales Model

5.1 literature review

For different types of live broadcast platforms and commodities, there are a large number of research articles on the Internet and academic literature. These rich documents from different journals are helpful to get the possible variables of our research. The main basis of this study is the technology adoption model.

An extended form of (TAM). The technology adoption model is famous for its predictive ability, which makes it easy to be applied to various situations (Venkatesh & Morris, 2000). The technology adoption model is mainly suitable for information systems, so it is suitable for webcasting platforms and Internet users, and it is sought to expand the model (Kim, Mirusmonov & Lee, 2010; Schierz, Schilke & Wirtz, 2010), innovation diffusion theory (IDT) (Mallat, 2007), and unified theory of technology acceptance and use (UTAUT) (Luo, Li, Zhang & Shim, 2010) to study the influence of webcasting media on users' participation behavior and sales.

Webcast: Consumers like their online shopping experience. They may make more exploratory browsing in online stores, and pay more attention to interface marketing activities, thus leading to more impulsive purchases^[80](KOUFARIS M 2002). Authenticity, entertainment and visibility in online live shopping significantly positively affect consumers' arousal mood; Interaction, authenticity, entertainment and visibility have a significant positive impact on consumers' pleasant mood; Authenticity and visibility significantly positively affect consumers' perceived trust; Awakening significantly affects the perception of pleasure, and together with pleasure significantly affects the consumer impulse buying; Pleasure significantly affects perceived trust, and together with trust significantly affects consumers' purposeful purchase behavior^[10](Liu Yang et al. 2020).

User participation behavior: real-time interaction and media richness positively affect attractiveness; Visibility, shopping guide and media richness have positive effects on cognitive assimilation; Cognitive assimilation and attractiveness positively affect consumers' purchase intention; Cognitive assimilation and attraction play a partial mediating role in the influence of technical and social factors on consumers' purchase intention of live shopping^[81](Dong Xueyan et al 2023). To a great extent, sending and receiving barrage information satisfies users' purpose of getting a sense of existence and enjoyment in the virtual network. In order to get more enjoyment, users will actively participate in barrage information interaction^[82](Yu Wei et al. 2017). User sticky behavior: Live broadcast improves the shopping experience and reduces uncertainty. With the increasingly fierce competition, direct broadcasting How to retain existing customers has become a challenging task for business platforms. It is very important to explore the factors that affect customers' willingness to stick to the live e-commerce platform^[7](Bao Zheshi. et al 2023). The sticky behavior of the network is based on the continuous use of users. A kind of overuse behavior accompanied by psychological changes, which is influenced by subjective and objective factors^[83](Zhao Qing et al 2012). Sales behavior: live broadcast marketing refers to the technical means of live video broadcast in the Internet era, with the live broadcast platform as the carrier. An online marketing model that simultaneously produces and broadcasts programs at the event site to achieve brand promotion and sales promotion^[84](Chen Roulin et al 2022). Between product differentiation marketing and purchase intention, network centrality plays a positive regulatory role^[85](Li Wenwu 2023). All the dependent variable and independent variable measurement items refer to the literature^{[86][87][88][89][90]}. The purpose of this study is to extend the TAM model to the background of social network live broadcast media. The purpose of this study is to further determine the relationship between social network live broadcast media and social media participation and sales through the structural equation model based on the previous meta-analysis and experimental analysis of online live broadcast.

5.2 research method

This study was conducted by a structured questionnaire (see Appendix 1). The first part of the questionnaire leads to the personal details of the respondents. In the second part, Richter 5 scale is used to make statements, from strong disagreement to strong agreement, in order to get the response to the questionnaire.

All the interviewees have Tik Tok APP and account, and have used the webcast service. The questionnaire selected 36 students from Sichuan Tourism College, Chengdu University of Information Science and Technology, Sichuan University and other universities for testing, so as to improve the measurement items. Then, the questionnaire was conducted in eight major cities in Sichuan (Chengdu, Mianyang, Luzhou, Yibin, Nanchong, Leshan, Meishan, Neijiang) in different key business districts and regions of Tik Tok to buy users, these users have got the package through express delivery. Among these survey testers, 427 students responded, after excluding the incomplete questionnaire results; Among them, 388 available questionnaires were considered for data analysis and interpretation, and the results were analyzed by SPSS software package.

5.3 Data presentation and discovery

The sample included 220 males and 168 females. This is equivalent to 80% of men and 20% of women. Most of the users who participated in the survey were between the ages of 21 and 30. The characteristics of the respondents are summarized in Table 12.

In order to determine whether the data can be subjected to factor analysis, the sampling adequacy test is carried out according to Table 13. Next, factor analysis is carried out on the data by SPSS software to obtain the rotating component matrix and the important factors of the sales intention of the webcast. Kaiser-Meyer-Olkin test of sampling adequacy basically shows whether the data is suitable for factor analysis. The data obtained by KMO test in this study is 0.788. Because this value is greater than 0.5, it shows that the variable meets the conditions of factor analysis (Hair, Anderson, Tatham & Black, 1998). Bartlett's sphericity test also showed a significant value ($p < 0.05$), indicating that there was a relationship between variables. Principal component analysis was used to extract these factors. The rotation method is Kaiser normalized variance, and the rotation converges in 18 iterations. The factor load of rotation is shown in Table 14.

Table 12. Sample Population Statistics

serial number	Item	Number of testers	percentage
one	male	221	56.96%
2	woman	167	43.04%
three	Under the age of 30	247	63.66
four	Over 30 years old	141	36.34

Table 13. Sample Adequacy Test

Sample adequacy Kaiser-Meyer-Olkin		0.795
Bartlett's test of sphericity	Approx. chi-square	126.637
	Df	388
	Sig.	0.000

Table 14. Factor Load and Descriptive Statistics of Research Variables Related to Webcast Sales

Measured variable	factor loading	mean value	Percentage of standard deviation
Factor 1: Webcast		4.33	0.674
Have you ever watched live sales programs on the webcast platform?	0.789		
Do you think that live webcast sales is an effective way of shopping?	0.771		
Will you be demonstrated or recommended by the anchor in the live webcast sales program?	0.803		
Have a desire to buy?			
Do you think webcasting has an impact on your shopping decision?	0.796		
Factor 2: User participation behavior		4.02	0.552
What's the main purpose of watching the webcast?	0.617		
When you watch the live webcast, will you actively participate in the interactive session?	0.609		
What is your main way to participate in the live webcast interaction?	0.735		
Will you participate in the lottery or other activities in the webcast?	0.801		
Factor 3: User sticky behavior		4.51	0.666
How long do you usually watch live webcasts every week?	0.796		
Will you take the initiative to pay attention to the bloggers or channels of webcasting?	0.811		
Will you stop watching because of the change of anchor?	0.812		
Will you suffer from problems such as poor picture quality or stability of webcast?	0.799		
And stop watching			
Do you get hurt because of too many advertisements or gifts in the live webcast?	0.767		
Stop watching			

Factor 4: Sales Intention		5.08	0.561
Do you usually choose live shopping?	0.862		
Will you buy goods because of the promotion of live webcast?	0.847		
Will you buy something you don't usually buy in the live webcast sales program? Commodities?	0.809		
Do you think the price of goods in live webcast sales has an impact on your purchase intention? Is it ringing?	0.742		

In addition, the descriptive statistics of the extracted factors (mean and standard deviation (SD)) prove that webcasting, user participation behavior and user sticky behavior are the potential factors of webcasting sales intention. The average is between 3.93 and 4.26, and the standard deviation is between 0.336 and 0.636. See Table 14 for the obtained mean value and SD value. The eigenvalues of each factor extracted above are greater than 1, which can explain 69.88% of the total variance. Reliability analysis was carried out to check the internal consistency of the factors, and it was found that Cronbach's alpha in each case was higher than the acceptable level described in Table 5-4. It can be observed from Table 15 that Cronbach's alpha value ranges from 0.792 to 0.899. This range exceeds the minimum alpha value of 0.6.

Table 15. Reliability Indicators for Testing Internal Consistency of Privacy

serial number	Factor name	Cronbach's Alpha
one	livestreaming	0.783
2	User participation behavior	0.848
three	User sticky behavior	0.894
four	Sales intention	0.837

The results show that webcasting, user's participation behavior and user's sticky behavior are important factors of product sales intention on webcasting platform or media. From the factors that appear in the factor analysis about the willingness to sell goods on the webcast platform or media, this paper makes a correlation analysis to test the relationship. Table 16 gives the correlation matrix. It can be clearly seen from the table that all factors, that is, webcasting, user participation behavior, user sticky behavior and variable behavior intention of commodity sales intention, are significantly related to the correlation at the level of 1%, and the correlation value between all factors is 0.425-0.569. Then the data are regressed to determine whether the extracted factors significantly affect the willingness to sell dependent goods. The results are summarized in Table 5-6.

$R^2 = 0.723$ R^2 (Adj.) = 0.614 $F = 41.08$.

The value of R^2 (j) = 0.583 shows that this model is statistically significant, in which 58.3% of the dependent variable's intentional variance of commodity sales is explained by the independent variables: webcasting, user participation behavior and user stickiness behavior. The range of B value in the regression results is 0.218 to 0.301 and all independent variables show P value < 0.05, which indicates that it has a strong influence on the sales intention of the dependent variable.

It can be observed from the table that webcasting (b = 0.247, t=3.317, p< 0.05) is significantly related to the willingness to sell goods, thus proving H1. Therefore, commodity manufacturers or advertisers should make every effort to provide as comprehensive marketing as possible through webcasting, so that webcasting becomes very useful.

User participation behavior (b= 0.328, t=3.223, p<0.05) also has a significant impact on the willingness to sell goods, thus proving H2. Webcasters need to make efforts to let users participate in the process of webcasting as much as possible, which is conducive to driving sales.

The user's sticky behavior (b = 0.253, t=6.1226, p< 0.05) is significantly related to the willingness to sell goods, which proves that H3. Webcasters well tap the fans of online media as a potential influence to enhance the sales of goods.

Table 16. Relationship between Research Variables Related to Commodity Sales

correlation					
		livestreaming	User participation behavior	User sticky behavior	Sales intention
livestreaming	Pearson correlation	one	0.426**	0.513**	0.548**
	Sig.(2-tailed)		0.001	0.000	0.000
	N	388	388	388	388
User participation behavior	Pearson correlation	0.512***	one	0.529**	0.481**
	Sig.(2-tailed)	0.001		0.000	0.000
	N	388	388	388	388
User sticky behavior	Pearson correlation	0.417**	0.537**	one	0.416**
	Sig.(2-tailed)	0.000	0.000		0.000
	N	388	388	388	388
Sales intention	Pearson correlation	0.552	0.516**	0.511**	one
	Sig.(2-tailed)	0.000	0.000	0.000	
	N	388	388	388	388

Note: ** The correlation is significant at the level of 0.01 (two tails)

Table 17. Regression analysis of commodity sales intention.

Coefficientsa					
	Nonstandard coefficient		Standard coefficient		
model	B	standard deviation	Beta	T	Sig
(constant)	1.107	0.227		3.543	0.000
livestreaming	0.166	0.104	0.255	4.091	0.000
User participation behavior	0.215	0.177	0.209	4.331	0.000
User sticky behavior	0.246	0.103	0.261	4.762	0.000
Commodity sales intention	0.233	0.088	0.333	6.582	0.000

Note: Dependent variable: the intention of selling live webcast products.

5.4 Conclusion and influence

1. Research conclusion

The main purpose of this study is to study the intention of live webcast media (such as Tik Tok) to participate in and sell social media. The results of this study show that the consumer's willingness to sell goods in webcast media is influenced by three factors-direct webcasting, user's participation behavior and user's sticky behavior. Under the background of the development of China Internet short video social platform, this paper first constructs a TAM model according to its two constructs (function and user), and then expands the TAM model to include two new constructs (platform and user), which come from the literature about online media. This study provides a direction for the determinants of the willingness to sell short video live broadcasts on the Internet and the Internet.

2. Management influence

The significance of this research is various. The TAM model and extended application have been verified here. Another important factor is user behavior, as the survey results show, because users of short video platforms tend to follow the behavior effect. This paper suggests that if it is necessary to increase the user management and operation of online short video platforms and communities, commodity advertisers should create an atmosphere of user behavior circles around online media through various practical actions, so that potential live broadcast fans and participating live broadcast users can feel more and richer behavioral activities. In fact, the live webcast media strongly influences the live broadcast users and fan users who intend to purchase goods.

Based on the results of this study, this paper puts forward a model (as shown in Figure 9) for the reference of webcasting merchants, webcasting advertisers and network operators.

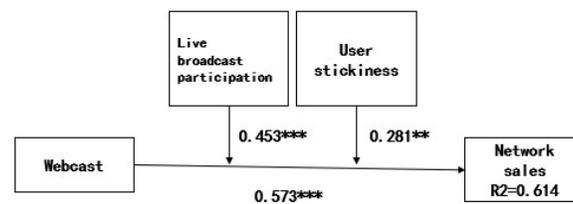


Figure 9. Research Model of Social Network Live Broadcasting on Commodity Online Sales

6. Discuss

Social media is an important marketing tool to maintain customer relationship and improve company performance. John Legere, a former CEO, for example, T-Mobile USA turned around the company's performance through his social media strategy: "We have a growing relationship with customers on Twitter, and this is something that many people are interested in." Other successful brands, such as Wendy's, Nike, Netflix and National Geographic, have similar high-profile advertising social media strategies. For this reason, in the past decade, marketing scholars have paid more and more attention to social media, revealing the influence of their own social media on different marketing results. We provide new experiences to summarize the impact of owning social media, and also provide insights into when and how owning social media affects user stickiness and sales.

6.1 Main harvest and its management significance

Generally speaking, webcasting media has a positive and significant influence on the participation and sales of short video media, and the influence of such video media participation ($\eta=.14$) will be weaker than that of sales ($\eta = .35$; $P < .001$). Although managers are investing more and using live webcast media, they even monitor the effect of live webcast media, such as those related to the participation of short video media. Webcast media is a powerful tool to stimulate sales. Marketers have much more control over the enterprise webcasting media than they do over eWOM. In addition, our meta-analysis shows that there are great differences in the above effects, which shows that managers need to pay attention to that not all webcast media activities are so equally effective.

Experiments show that there is a significant relationship between the number of live broadcasts on the network and the sales of sponsored goods. A higher degree of webcasting means a wider range of influence, and the degree of user sales will rise first, but it also implies a limited incremental relationship, thus reducing the increase of online users' sales orders. At the same time, the experiment further tests the potential moderating effects of two kinds of user activity attributes: user participation behavior and user stickiness behavior. Higher user participation behavior and higher user stickiness behavior also have a good and significant relationship with the degree of online sales, indicating that webcasts attach importance to their relationship with live users and fan users, thus making the sales relationship stronger. Managers can use these novel results and relevant operational guidelines to improve their marketing strategies for webcasting.

Live network marketing is a new marketing method in the network media era. Based on live online celebrity marketing to consumers

The theory of policy influence and structural equation model verify the psychological mechanism of live broadcast of online celebrity's influence on purchase intention. The consumer's willingness to sell goods in webcasting media is influenced by three factors-webcasting, user participation behavior and user stickiness behavior. Based on the analysis and verification of two new constructed models (platform and user), we can see that webcasting directly and significantly affects the degree of online sales, while the behavior of online users (participation of live users and live fans) regulates the degree of online sales to a certain extent, which indirectly affects the degree of online goods sales. This study provides a direction for the determinants of the willingness to sell short video live broadcasts on the Internet and the Internet.

6.2 Webcast media management guide

Our research results can help managers to formulate reasonable marketing strategies by paying attention to

webcasting and user behavior, so as to better control the sales effect. For example, they can focus on "how" to attract consumers with more emotional content and "what" to stimulate sales with more informative content. Surprisingly, although short video content helps enterprises stand out on the Internet, it is obviously not as good as the live webcast media with strong emotional content. Enterprises often adopt network agents. However, in order to stimulate sales, these growth strategies are not necessarily completely effective, and sometimes we should focus on the quality rather than quantity of webcasts.

In addition, managers should pay attention to the changes in the future platform environment, and they will change the way consumers interact with enterprise content. We have observed that the introduction of advertisements on different network short videos or live broadcast platforms will increase the number of live webcast users, but there are still shortcomings in the stimulation and mining of online fan users. Therefore, it is the key to the future development of live webcasts and short videos.

In terms of methods, we can not only capture participation according to the likes, comments, sharing and rewards of posts, but also capture user stickiness according to stickiness such as collection and attention. In Tik Tok and Mile Mile, more than one-third of the sponsored content appears in the form of live broadcast, which is particularly relevant. 83% of marketers plan to use Tik Tok product links in their live broadcast activities. Therefore, they can further promote users to redirect to the links of goods sales and place orders, and finally form the purchase intention and order placing behavior. In essence, we provide novel and operational insights to help advertisers improve their live marketing strategies. These contributions also help marketers better explain their investment in live marketing, which is of special value to this young and rapidly developing social media strategy.

6.3 Limitations and further research

Our experience generally reveals several promising research directions. First of all, the owned social media are divided into content types, so that the newly owned social media have more content classifications. Secondly, study the marketing results that the social media has a wider impact on society, and analyze which online content has won the largest social media share participation among similar customer groups. The distribution of the effects of different platforms is unequal among variables, and most of the research focuses on one platform at a time, mainly social networks. Further research can explore more diversified platforms, cross-platform comparison and quantification of spillover effects from one platform to another. Emotional experience (perceived pleasure and perceived arousal) is an important factor leading to consumers' impulsive purchase. In the context of e-commerce live broadcast, the stimulation of high pleasure and high arousal or emotional experience is worthy of further study in future consumers' purchase intention.

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