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Development of the Measurement Scale of Online Convention Service Quality (OCSQ)

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Abstract: This study aimed to develop a scale for measuring the online convention service quality (OCSQ) for the effective management of conventions held online. This study followed three steps to develop the measurement scale of OCSQ. First, a literature review of existing research relating to convention service quality was conducted to generate initial OCSQ items. Next, the Delphi method was used to assess the suitability of items for the scale (from 7 May to 10 June 2021). Finally, a survey of attendees of online conventions was conducted (from 26 July to 6 August 2021) to prove the reliability and validity of the items. As a result, in this study, the dimension of security, initially in the category platform service, is separated from it. The results show that online convention service quality has five main components (human services, program services, platform services, security, and interaction services). In the conclusion, we propose the final measurement scale of online convention service quality, with five dimensions and 25 categories. This study has its own value for the initial exploration of online convention service quality, which has emerged as a significant area of convention research. It contributes to academic research and the management of online convention by addressing unique aspects.

Keywords: E-ServQual; convention service quality; online convention; scale development; online convention service quality (OCSQ)

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1. Introduction

At the initial outbreak of COVID-19, the service industry, which is based on human interaction, was hit hard. In particular, the tourism and event industry was one of the hardest-hit industries (Mohanty et al., 2022; S. Xiang et al., 2021).

A convention is an event that facilitates knowledge exchange, education improvement, the dissemination of the latest research data, and network expansion (Rogers, 2013). Due to the COVID-19 pandemic, which led to substantial restrictions on face-to-face meetings, there were cancelations of or delays to the vast majority of conventions (Rundle et al., 2020). Consequently, conventions with virtual elements (e.g., video technologies) have been emphasized as an alternative because they enable people to attend conferences.

Importantly, despite the turn of the 'living with COVID-19' era, many experts still feel that virtual events represent a hopeful prospect, stating that virtual elements will be used actively for events in the future given their advantages, such as cost efficiency, accessibility, and environmental sustainability (e.g., Atanassova & Russell, 2023; Roos et al., 2020;

The Bizzabo Blog, 2024). Participants of academic conferences have also expressed that they would prefer to attend virtual conferences in the future (Al-Geitany et al., 2023). These optimistic perspectives signal a paradigm shift in the convention industry, transitioning from traditional offline formats to hybrid or fully online models.

For convention research and the convention industry, service quality has been considered an important factor, being studied and developed for the better management and growth of conventions (e.g., J. S. Lee & Min, 2013). With the growth of online service industries and the importance of virtual elements in the world, online conventions have been taking on a leading role after the pandemic given their advantages, and there is an urgent need for research on developing the measurements of OCSQ for the better management of this new convention type. However, the existing research on measuring the service quality of conventions has primarily focused on items related to the in-person environment, such as facilities (e.g., Sung & Lee, 2015; Talebpour et al., 2017). Since online conventions require virtual technologies, there is a need to distinguish measurements for online convention service quality (OCSQ) from scales of offline convention service quality.

Considering the absence of research examining the service quality of online conventions and the rising importance of effectively managing online conventions, this study aims to develop a specific service quality scale for conventions held in online environments through exploratory and empirical research. Since South Korea has consistently ranked among the top countries for international congresses and meetings, being recognized as a global leader in the convention industry (Union of International Associations, 2023), this study establishes its regional context by focusing on South Korea's convention industry.

The current study is expected to propose a method of service quality scale measurement for online conventions that can be used by scholars in the convention field, thereby contributing to academic advancement. This research is also expected to assist convention managers and organizations, with the better management of online conference participants' satisfaction by improving the overall quality of conventions.

2. Literature Review

2.1. Concept of Online Convention

A convention can be defined as "a large formal meeting or assembly, as of members, representatives, or delegates, for discussion of and action on particular matters of common concern" according to Dictionary.com (2024). Similarly, from the industrial perspectives, the 'convention industry' has also been known as the 'conference/meetings industry'. Accordingly, in this study, we somewhat narrowly defined a convention with original characteristics as 'a medium/large-scale and multi-day event for the purpose of exchanging information and fostering human networks (e.g., academic conferences, forums, etc.)' for a more specific research approach.

Based on the definitions of conventions, the concept of an online convention can be defined as 'a meeting or conference held online'. An online convention is often held over multiple days, much like an in-person convention, and includes various programs, keynotes, sessions, and trends, as well as networking, among other features, in an online environment (Hunter, 2023). It has various benefits, such as providing attendees with a worldwide network and allowing for the use of multiple rooms without any limits. With these benefits, experts expected positive prospects for it (Atanassova & Russell, 2023). Online conventions can be conducted either entirely online or in a hybrid format, where attendees are allowed to choose between attending in person at a physical venue and participating virtually (Rundle et al., 2020). However, to enhance research accuracy, the current research focuses exclusively on fully online conferences, excluding hybrid conventions.

2.2. Service Quality

2.2.1. Convention Service Quality

Conventions encompass various characteristics, including service and venue requirements, such as equipment and staff, which collectively influence attendees' experiences (Shone, 2014). Additionally, they also feature diverse components, such as meetings and conferences, exhibitions, discussions, and networking events. As convention service refers to all services encountered by participants throughout their convention experience (T. H. Lee & Park, 2002), service quality in conventions, a key factor for competitiveness, is defined as the evaluation of the overall process experienced by participants (H. C. Wu et al., 2016). Convention service quality is crucial for participants' satisfaction with their participation goals (Al-Salami & Abdalla, 2022). Despite the growing importance of effective service management in the convention industry, recent studies on convention service quality remain scarce.

In line with the complexity of conventions' characteristics, we expanded the scope of the literature to include studies on the attributes of conventions, convention centers, conferences, and exhibitions, which collectively represent aspects related to convention service quality. While these attributes are not direct measures of convention service quality, they are considered relevant components that influence perceptions of service quality. Consequently, convention service quality attributes have been analyzed through both tangible and intangible elements, including facilities, human services, program quality, and various aspects of hospitality, as summarized in Table 1 below.

Table 1. Convention service quality attributes.

Researchers	Convention Service Quality Attributes
A. Wu and Weber (2005)	Accessibility, Food and Beverage, Convention Facilities and Services, Public Facilities and Service and Service Provider by the Hong Kong Convention Venue (HKCV)
Tanford et al. (2012)	Program, Networking, Out-of-Convention Activities, locations, Costs
Sung and Lee (2015)	Value-Added Services, Facility Services, Space Services and Employee Services
H. C. Wu et al. (2016)	Interaction Quality, Physical Environment Quality, Performance Quality and Accessibility
Talebpour et al. (2017)	Accessibility, Convention Center Quality, Convention Quality and Accommodation Quality
Cheon and Hong (2018)	Accessibility, Convenient Facilities, Human Service, Physical Service and Program
Vaid and Kesharwani (2020)	Tangibility, Reliability, Assurance, Empathy, and Responsiveness
An et al. (2021)	Facility-related Attributes, Staff and Service, Cost and Other General Attributes
Al-Salami and Abdalla (2022)	Tangibles, Reliability, Responsiveness, Assurance, and Empathy

Author's reconfiguration and modification using prior research.

2.2.2. E-Service Quality

We also reviewed previous research on e-service quality to derive important factors that can correspond to online service quality. The quality of e-services should be identified differently from traditional service quality, which is only applicable to the offline service industry (Parasuraman et al., 2005). Regarding the concept of e-service quality, Zeithaml et al. (2000) argued that it refers to the entire process by which customers effectively search,

purchase, and deliver goods and services using the website. E-services are the services that are offered using information and communication technologies in a user interface with which the consumer interacts (Fassnacht & Koese, 2006).

In a study of online service quality, Kaynama and Black (2000) first applied the SERVQUAL model to e-services with seven factors. In a subsequent study, Zeithaml et al. (2002) also developed e-SERVQUAL models with the components of 'reliability', 'responsiveness', 'accessibility', 'flexibility', 'easy navigation', 'efficiency', 'safety', 'price knowledge', 'site aesthetics', and 'personalization.' Thanks to the initiating work by Zeithaml et al. (2002), there has been thorough study into the quality of online services with various times dependent on contexts (Barrera et al., 2014). Since various researchers have studied it with a focus on a particular service industry, as shown in Table 2, the importance and items of the dimension vary across studies. Since online conventions can be considered a type of e-service, measurement items from various online contexts (e.g., general e-services, e-education, online meetings/events) can be adapted to assess their service quality, particularly in dimensions such as 'platform' and 'interaction', as participants are believed to value efficiency and fulfillment in these online settings.

Table 2. E-service quality measurement items.

Researchers	Context	Components
Li and Suomi (2009)	E-service	Website Design, Reliability, Responsiveness, Security, Fulfillment, Personalization, Information, and Empathy
Hien (2014)	E-Government Service	Reliability, Communication, and Responsiveness
Nasution et al. (2019)	E-Education	Reliability, Responsibility, Privacy/Security, Quality/Benefit Information, Ease of Use/Usability, and Web Design
Demir et al. (2020)	Online Meeting	Efficiency, System Availability, Fulfillment, and Privacy
Ali et al. (2021)	Online Meeting	Efficiency, Fulfillment, System-Availability, and Privacy
Ashiq and Hussain (2024)	E-service	Reliability, Responsiveness, Security, and Convenience
Kim (2024)	Online Event	Content quality, System Quality, Service Quality

Author's reconfiguration and modification using prior research.

2.3. Key Components of Online Convention Service Quality

As can be seen in Table 1, most prior studies focused on convention service quality measurement items considered physical characteristics about the accommodations/facilities as important of a factor as the human services or performance quality of the convention programs. However, there is a limitation in reflecting a unique online convention environment with these factors due to the format of the convention using virtual technologies. The biggest difference between offline conventions and online conventions is the "hosting place". Consequently, there is a need to change some of the original convention service quality measurement items that only deal with physical environments to be applied to OCSQ. Based on the literature review of traditional service quality and e-service quality, this study initially proposed five main components of OCSQ: human service, program service, platform service, security service, and interaction service.

2.3.1. Human Service

Human service refers to the services offered by employees or staff operating the convention to meet the diverse needs of convention participants (A. Wu & Weber, 2005; Cheon & Hong, 2018; Choi & Yoon, 2016; Lin & Lin, 2013). This encompasses genuine interest in assisting participants, empathy toward their needs, and prompt responses when participants require help (An et al., 2021; Vaid & Kesharwani, 2020).

Even when an event is held online, human service is considered to be an essential element in guaranteeing participants' satisfaction. First, as has been stated by prior e-service quality studies (e.g., Hien, 2014; Nasution et al., 2019; Vaid & Kesharwani, 2020), online employees must be passionate to assist their customers with responsiveness and promptness. In e-service quality research, these types of human services are often measured by customer service, responsiveness, and communication (e.g., Ali et al., 2021; Ashiq & Hussain, 2024). Furthermore, online conventions require additional services from staff, as virtual platform services are required. Thus, technical problems with the website or platform can be solved through employee service with a sincere interest (W. R. Xiang & Wang, 2024).

Following previous studies, we applied three categories of human service: 'responsiveness of employee', 'staff expertise', and 'staff readiness'.

2.3.2. Program Service

In this research, program service is defined as all tangible/intangible things related to the programs that are provided to help participants fulfill their goals. Specifically, it contains the program's quality (e.g., topic, information, and entertainment) and the quality of any person who works in the program, such as an invited lecturer. Program service also contains a smoothness throughout the procedure of the entire program. In this way, the present study dealt with program service as extensively as possible from the factors mentioned in prior studies and from the previously stated characteristics of online conventions.

In a prior convention service quality study, it was found that the importance of program service in convention services (e.g., Choi & Yoon, 2016; Cheon & Hong, 2018; Tanford et al., 2012; Talebpour et al., 2017) explained that the 'program' (e.g., interesting program topic, reputation of convention, program and quality of exhibitors) had a positive effect on the attendance and satisfaction of event attendees. Moreover, in prior e-service quality studies, many scholars considered program service in the form of 'content' factors in their measurement items (e.g., Kaynama & Black, 2000; Kim, 2024; Santos, 2003; Zhang et al., 2021).

Altogether, the current study proposes three components of program service: 'expertise and diversity of programs', 'attractiveness of programs', and 'convention planning'.

2.3.3. Platform Service

Compared to traditional service quality, in online service quality research, service quality regarding a hosting place refers to the quality of a website or platform where an online conference takes place. Thus, the platform discussed here refers to both the official website and the platform/application that is used to provide video conference services (e.g., Google Meet, Zoom, or Cisco Webex).

The prior studies on e-service quality have included many factors of platform service. DeLone and McLean (2003) presented an IS (information systems) model, explaining that system/information quality/service quality affect the use of and satisfaction with the e-commerce platform system. Many studies have dealt with this dimension in terms of website aesthetic design or appearance (Demir et al., 2020; Hansopaheluwakan, 2021; Li & Suomi, 2009; Nasution et al., 2019; Saxena et al., 2024). There are also many scholars

who include the functionality of the website in terms of efficiency, processing speed, responsiveness, and ease of use (Hien, 2014; Ho & Lee, 2007; O'Connor & Assaker, 2024; Kim, 2024). Above all, 'privacy and security' have increasingly been highlighted as key components of an online platform (Ashiq & Hussain, 2024; Demir et al., 2020; W. R. Xiang & Wang, 2024).

Following various prior studies, the present research derived the following four categories of platform service: 'platform aesthetics', 'platform functionality', 'platform convenience', and 'platform security'.

2.3.4. Interaction Service

Similar to other service industries, the convention industry has the characteristic of human-to-human interactions. Further, the human network in the convention industry is considered to be more important than it is in other service industries. Interaction is related to the formation of networks and the exchange of information between people. Thus, interaction service refers to any practices through which participants increase their networking opportunities and communications with other participants and providers. It can be divided into two types of networks: the one 'between participants (i.e., online convention attendees) and providers (i.e., online convention organizers/staff)' and the one 'between participants and participants'.

Interaction service can be found in existing studies regarding traditional convention service quality measurement, relating to the interaction between participants and providers or between participants and participants (H. C. Wu et al., 2016; J. Lee et al., 2020; Kim, 2024; Tanford et al., 2012; Talebpour et al., 2017; Vaid & Kesharwani, 2020). For instance, Tanford et al. (2012) measured networking in depth in terms of 'renewing business contacts, generating new business, networking opportunities, professional advancement, making new friends, and involvement in the association'. Talebpour et al. (2017) focused on the interaction between attendees and staff. Therefore, interaction services in previous convention research encompass a range of interactions among individuals within the convention setting.

We reemphasize the dimension of interaction services within the context of online conventions, drawing upon Social Presence Theory. According to this theory, social presence positively influences user experiences in online environments, fostering feelings of human warmth and a high willingness to engage in the community (Yusuf & Ratnawati, 2023). In line with this, interaction is considered a key attribute in e-services, as it helps individuals feel a sense of human connection in virtual spaces (Park et al., 2007). Therefore, managing this dimension is crucial in online conventions. Consequently, numerous prior studies on e-services have identified interactivity as a critical factor in measuring e-service quality (Fan et al., 2022; Hien, 2014; Li & Suomi, 2009; Nasution et al., 2019; Zhang et al., 2021). Building on these studies, the present work considers the dimension of interaction service to consist of the four components of 'increasing engagement', 'increasing network', 'usefulness of information', and 'after service'.

2.4. Proposing Initial Measurement Items of OCSQ

Following the preceding studies described above, the items used to measure the quality of online convention services reflecting the characteristics of online conventions are composed of four dimensions with 89 items, as listed in Table 3 below. In contrast to the physical characteristics of traditional convention services, we aim to focus more on the intangible service elements outlined in prior research according to the characteristics of online convention services. To measure these dimensions, this study first developed the scale items for all of the categories, as presented in Table 3.

Table 3. First version of measurement items of OCSQ (89 items).

Dimensions	Categories	Items	Researchers
Human Service	Responsiveness of Employees	5	A. Wu and Weber (2005); Cheon and Hong (2018); Vaid and Kesharwani (2020); An et al. (2021); Ali et al. (2021)
	Staff Expertise	5	
	Staff Readiness	4	
Program Service	Expertise and Diversity of Program	5	Santos (2003); Tanford et al. (2012); Choi and Yoon (2016); Cheon and Hong (2018); Zhang et al. (2021)
	Program Attractiveness	8	
	Convention Planning	8	
Platform Service	Platform Aesthetics	7	DeLone and McLean (2003); Santos (2003); Ho and Lee (2007); Li and Suomi (2009); Hien (2014); Ali et al. (2021); Hansopaheluwakan (2021)
	Platform Functionality	11	
	Platform Convenience	7	
	Platform Security	5	
Interaction Service	Increasing Engagement	7	Hien (2014); Talebpour et al. (2017); Nasution et al. (2019); Demir et al. (2020); J. Lee et al. (2020); Zhang et al. (2021)
	Increasing Network	6	
	Usefulness of Information	6	
	After Service	5	

3. Methodology

The research process is illustrated below in Figure 1. A Delphi study and a participant survey were conducted to refine and purify the items; the Delphi survey was conducted with 10 experts over two rounds. Then, to verify the validity and reliability of the measurement items, a survey was conducted on online convention participants.

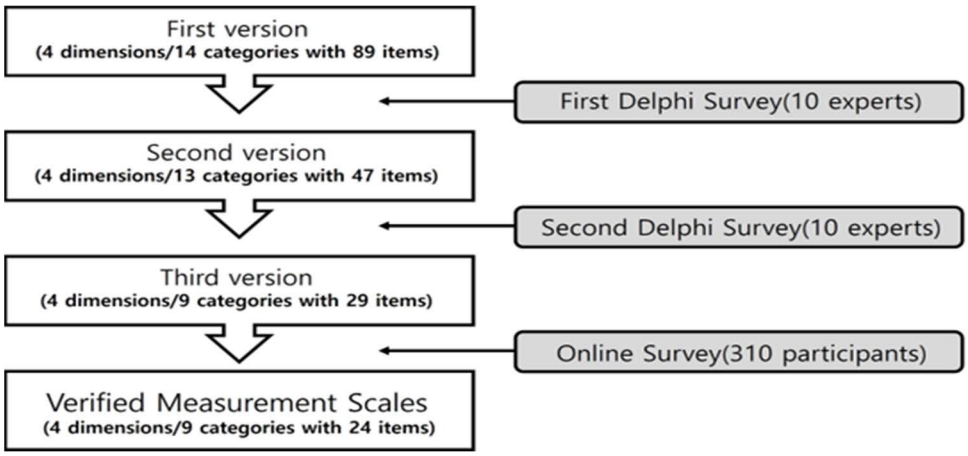

Figure 1. Process of purifying measurement items.

3.1. Delphi Technique

This study applies the Delphi technique to verify each item with 10 experts who have various types of knowledge of the online convention field, as specified in Table 4. Researchers often conduct two to four rounds of expert surveys when using the Delphi technique (Higgins et al., 2013). Lynn (1986) recommended setting the number of judges between 3 and 10. The expert survey was designed to ensure comprehensive feedback, allowing panelists to add new items and propose changes. A total of 10 experts were

surveyed via email over two rounds from 7 May to 10 June 2021. A 7-point Likert scale (not very essential–very essential) was used to further improve accuracy.

Table 4. Details of 10 experts.

Name	Age	Occupation	Duration of Work
A	40	Convention Bureau	16 years
B	40	Convention Bureau	14 years
C	43	Convention Centre	18 years
D	32	MICE Association	8 years
E	47	Professor in Convention Major	19 years
F	40	Professor in Convention Major	17 years
G	40	Professor in Convention Major	16 years
H	40	PCO	14 years
I	37	Professor in Convention Major	12 years
J	33	RTO	9 years

In every step of this analysis, we refined the measurement items using specific standards. To elaborate, the process began by reviewing the open-ended responses provided by the experts, with most feedback focused on adding new items and removing irrelevant or redundant ones. Additionally, items with lower values than the average were removed. Next, we applied the content validity ratio (CVR) threshold of 0.62 for 10 experts, a criterion initially proposed by Lawshe (1975) and widely adopted in this field (Ayre & Scally, 2014). After completing the second round, four experts (one employee from the Convention Bureau, two professors, and one PCO) and the authors discussed the results in an online meeting, during which two overlapping concepts (e.g., Speaker's Expertise and Content Accuracy) were removed due to their similar meanings: 'high-quality content' and 'schedule accuracy'. As a result, 29 items (across nine categories) remained, as listed in Table 5.

Table 5. Scale items (29 items) for online surveys.

Dimension	Category	Statements
Human Services	Staff Expertise	The convention staff responded kindly and favorably
		The convention staff promptly responded to questions and systematic errors with the platform (e.g., platform access)
		According to the situation, the convention staff approved participants appropriately (e.g., sharing screen)
		The convention staff had knowledge and expertise in their respective duties
		The convention staff had a sufficient understanding of the functions of the platform
	Staff Readiness	The pre-preparation (e.g., rehearsal and online system check) was appropriate to keep the convention running smoothly
		Overall, the convention was well planned and managed
		Risk management in this event was planned well
Program Services	Program Attractiveness	Overall, the program was well structured to increase immersion in the convention
		Speakers' presentation materials and content were of high quality
		Overall, the convention was interesting
	Convention Planning	The convention was run on a planned schedule
		The convention was run smoothly and worry-free
		Overall, the convention theme and content were attractive

Table 5. *Cont.*

Dimension	Category	Statements
Platform Services	Platform Aesthetics	The size and layout of the transmission screen were well structured with a suitable platform
		The official website's design (color, font, logo, etc.) was visually appealing
		The convention provided a sense of presence through the platform and online conference space
	Platform functionality	Necessary information was easily retrieved through the official website or platform
		The function of the screen and sound worked smoothly during the meeting
		The speaker's screen and presentation materials were simultaneously shared
	Platform Convenience	The access to the online convention platform was convenient
		Participation in the convention was possible through various online environments and devices
		Overall, the online platform was easy to use
	Platform Security	Privacy protection policies were well implemented
		Personal information and presentation materials were well protected
		The security system worked well
	Interaction Services	Participants could actively communicate with others (e.g., presenters, attendees) during the meeting
		Sufficient online space (section) was provided for individual networking with other participants
		The convention provided various opportunities for active networking for participants and organizers (e.g., providing prior information actively)

3.2. Reliability and Validity Test

Based on the initial measurement items, the survey questionnaire was prepared using a seven-point Likert scale, ranging from 'strongly disagree (1)' to 'strongly agree (7)'. An online survey was administered from 26 July to 6 August 2021 through an online survey platform to verify the validity and reliability of the items.

The respondents were limited to Korean individuals who had participated in more than one online convention within the past year, selected through a screening method. This approach ensured that participants were familiar with online conventions and could provide informed responses regarding their experiences and perceptions. The data were collected by Embrain, a renowned Korean data collection company recognized for its reliability and expertise in survey research.

A total of 310 respondents participated, and 26 questionnaires were excluded due to issues with the validity of the answers (e.g., consistently choosing the same response for every question or providing inconsistent answers within the same dimension). Ultimately, 284 samples were considered valid. Both Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) were performed using SPSS 26.0 and Amos 23.0.

4. Results

4.1. Frequency Analysis

The frequency analysis revealed that individuals aged 30 to 39 represented the largest group, comprising 37% of the participants. In the case of gender, the proportion of men was 50.4%, whereas the proportion of women was 49.6%. The frequency of participating in online conventions over the past year was the highest at two times 38.4%. The detailed result is shown in Table 6.

Table 6. Demographic statistics.

Demographic Statistics	N (%)	Demographic Statistics	N (%)
Age		**Gender**	
20~29	76 (26.8%)	Female	143 (50.4%)
30~39	105 (37.0%)	Male	141 (49.6%)
40~49	59 (20.8%)	**Income**	
50~59	26 (9.2%)	Less than KRW 1 Million	17 (6%)
60~69	18 (6.3%)	KRW 100 to 199 Million	30 (10.6%)
Education Level		KRW 200 to 299 Million	81 (28.5%)
Below High School Graduate	16 (5.6%)	KRW 300 to 399 Million	66 (23.2%)
Currently in 2, 3 year College or Graduated	23 (8.1%)	Over KRW 400 Million	90 (31.7%)
Currently in 4 year University	26 (9.2%)	**Job**	
4 year University Graduate	153 (53.9%)	Public Officer	6 (2.1%)
Currently in Graduate School	13 (4.6%)	MICE-Related Workers	1 (0.4%)
Graduate School Graduate	53 (18.7%)	Student	24 (8.5%)
Frequency of convention participation over the past year		Professor	6 (2.1%)
1 time	78 (27.5%)	Owner-Operator	21 (7.4%)
2 times	109 (38.4%)	Not Employed	10 (3.5%)
3 times	47 (16.5%)	Company Staff	194 (68.3%)
4 times	15 (5.3%)	Housewife	8 (2.8%)
Over 5 times	35 (12.3%)	Etc.	14 (4.9%)

4.2. Exploratory Factor Analysis (EFA)

EFA was conducted to verify the suitability and reliability of the scale of the measurement of online convention service quality to be developed in this research. In general, many researchers claim that the cutoff of 'good' factor loadings is 0.40 (e.g., Howard, 2016). The result indicated that there are five items of error that have lower factor loading values (<0.4) (e.g., schedule accuracy, smooth running, realistic platform, and easy search) and cross-loading items (e.g., screen layout) in conducting EFA in 29 items. From this process, we deleted 5 items and conducted EFA again with the remaining 24 items. Looking at the result of the second EFA, an analysis based on the score of the eigenvalue of factor 1 showed that the Kaiser–Meyer–Olkin (KMO) value for the 25 online convention service quality items was 0.950 and that the Bartlett's test of sphericity value was 5128.210. When KMO values, which measure the adequacy of samples, are above 0.6, the factors of the measurement scale can be considered to be appropriate (Hutcheson & Sofroniou, 1999), indicating that we developed an appropriate measurement scale.

As a result of the analysis, the dimensions were divided into five (human service, program service, platform service, security, and interaction service), with good value of factor loading and Cronbach's alpha, indicating that the factor analysis is appropriate. The details are shown in Table 7.

Table 7. Result of Exploratory Factor Analysis.

Dimension	Measurement Variables	Factor Loading	Eigen Value	Variance Explanation Power (%)	Cronbach's Alpha
Human Service	Prompt Response to Technical Issues	0.809	5.292	22.048	0.927
	Staff Expertise	0.732			
	Online Platform Understanding	0.724			
	Authorization	0.717			
	Staff Kindness	0.697			
	Risk Management	0.669			
	Planning and Management	0.655			
	Pre-Preparation	0.618			
Platform Service	Platform Compatibility	0.798	3.681	15.339	0.897
	Ease to Use	0.728			
	Accessibility	0.719			
	Functionality of Shared Screen	0.581			
	Stability of Shared Screen	0.516			
	Website Design Attractiveness	0.503			
Program Service	Content Interests	0.783	3.358	13.991	0.887
	Well-Structured Program	0.724			
	High-Quality Content	0.673			
	Theme Attractiveness	0.657			
Security Service	Personal Information Protection	0.835	2.703	11.264	0.825
	Security System	0.788			
	Privacy Protection Policy	0.554			
Interaction Service	Active Communication	0.816	2.162	9.008	0.820
	Networking Space	0.813			
	Networking Opportunity	0.571			

Total Variance Explained: = 71.650%, KMO = 0.950, Bartlett's Test of Sphericity = 4844.244 (p = 0.000).

4.3. Confirmatory Factor Analysis (CFA)

Since the Confirmatory Factor Analysis (CFA) technique is commonly used to validate scales following Exploratory Factor Analysis (EFA) (Hair et al., 2010), CFA was conducted in this research. The analysis confirmed that the 24 items identified through EFA are appropriate factors for measuring online convention service quality. The detailed results of the Confirmatory Factor Analysis (CFA) are presented in Table 8 and Figure 2. The CFA demonstrated a good model fit, with values meeting the stricter criteria suggested by Hu and Bentler (1999): the Chi-square to degrees-of-freedom ratio (CMIN/DF $\leq$ 3), Root Mean Square Error of Approximation (RMSEA $\leq$ 0.06), Comparative Fit Index (CFI $\geq$ 0.95), and Standardized Root Mean Square Residual (SRMR $\leq$ 0.08). Additionally, Average Variance Extracted (AVE) and Construct Reliability (CR) values were assessed to verify convergent validity, with AVE values of 0.50 or higher indicating sufficient variance explained

and CR values of 0.70 or higher reflecting acceptable internal consistency (Anderson & Gerbing, 1988; Fornell & Larcker, 1981).

Table 8. Result of Confirmatory Factor Analysis.

Measurement Variables		Regression Weight	Standard Error	Critical Ratio	Standardized Regression Weights	Average Variance Extracted (AVE)	Construct Reliability
Human Service	Prompt Response to Technical Issues	1	-	-	0.727	0.603	0.924
	Staff Expertise	1.098	0.085	12.972	0.779		
	Online Platform Understanding	1.142	0.089	12.891	0.774		
	Authorization	1.104	0.088	12.555	0.754		
	Staff Kindness	0.92	0.07	13.171	0.706		
	Risk Management	1.218	0.089	13.722	0.821		
	Planning and Management	1.23	0.09	13.73	0.821		
	Pre-Preparation	1.158	0.085	13.706	0.820		
Platform Service	Platform Compatibility	1	-	-	0.658	0.562	0.884
	Ease to Use	1.246	0.088	14.201	0.761		
	Accessibility	1.051	0.086	12.265	0.682		
	Functionality of Shared Screen	1.37	0.118	11.628	0.815		
	Stability of Shared Screen	1.32	0.114	11.564	0.810		
	Website Design Attractiveness	1.206	0.109	11.03	0.757		
Program Service	Content Interests	1	-	-	0.794	0.648	0.881
	Well-Structured Program	0.992	0.061	16.351	0.795		
	High-Quality Content	0.916	0.063	14.593	0.809		
	Theme Attractiveness	1.063	0.071	14.891	0.823		
Security	Personal Information Protection	1	-	-	0.670	0.538	0.777
	Security System	1.039	0.071	14.587	0.766		
	Privacy Protection Policy	0.985	0.096	10.255	0.762		
Interaction Service	Active Communication	1	-	-	0.689	0.552	0.785
	Networking Space	1.077	0.085	12.716	0.668		
	Networking Opportunity	1.112	0.1	11.11	0.857		

Model Summary: χ^2 = 382.768 ($p < 0.001$.), CMIN/DF = 1.679, RMSEA = 0.049, SRMR = 0.046, GFI = 0.902, AGFI = 0.872, CFI = 0.967, NFI = 0.923, RFI = 0.907, IFI = 0.968, TLI = 0.960.

In conclusion, the results of CFA suggested that this model satisfied the requirement of goodness of fit. Based on factor analyses, the final measurement items of OCSQ, including 5 main factors with 24 sub-items, were extracted.

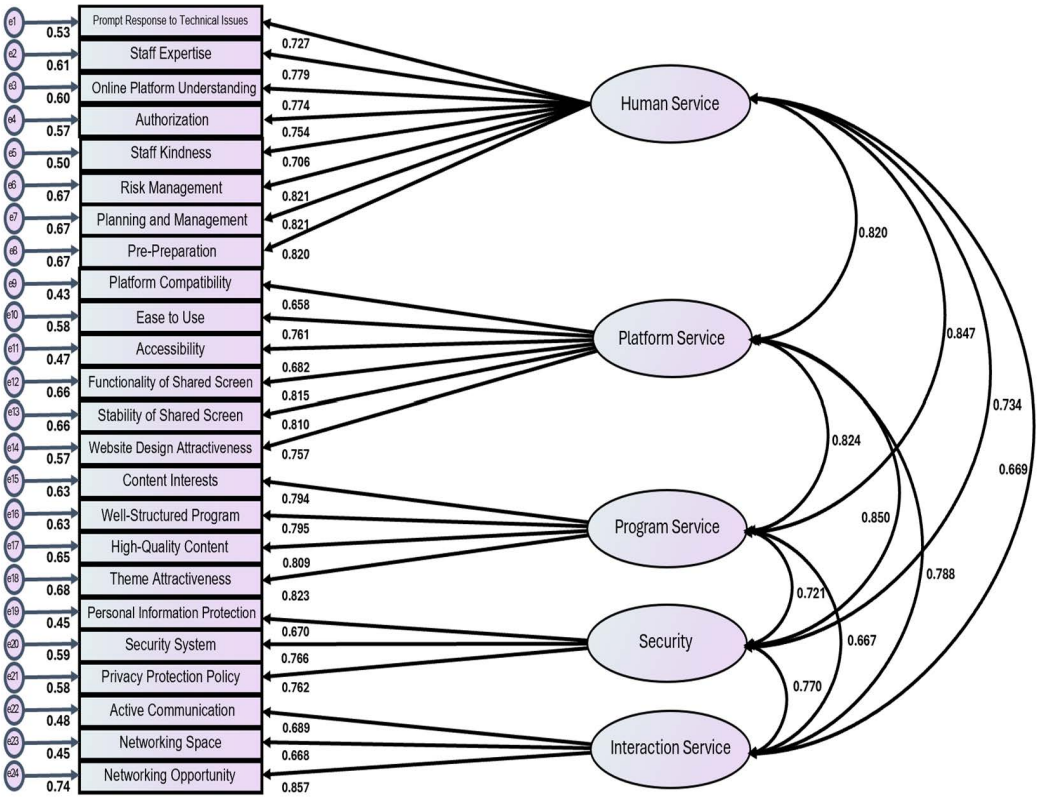

Figure 2. Diagram of Confirmatory Factor Analysis.

5. Discussion and Implications

Although humans are inherently social beings who require face-to-face interactions, social distancing policies during the COVID-19 pandemic forced people to minimize such interactions (Singh & Singh, 2020). Consequently, the pandemic compelled thousands of companies to seek innovative solutions and strategies for their businesses (Carnevale & Hatak, 2020). Notably, digitization emerged as a viable alternative to overcome challenges in the event industry during the pandemic (Svensson & Radmann, 2023), and there is growing recognition that the online convention model will persist due to its advantages beyond the pandemic era.

While a significant body of research has examined convention services, most studies have focused exclusively on offline characteristics, considering only those factors related to offline convention service quality, which presents considerable limitations when studying and managing online conventions. This study, therefore, aimed to develop a measurement scale for online convention service quality (OCSQ) to effectively manage online conventions.

This study proposed definitions for online conventions and OCSQ by integrating elements of both convention service quality and online service quality. Using Delphi and online surveys involving experts and participants, a scale was developed with 24 subfactors across five dimensions. Based on the findings, the results of this research offer both theoretical and practical implications.

5.1. Theoretical Implications

First, this research contributes to the development of online convention service quality (OCSQ) research by addressing a critical gap in the literature. Building upon the legacy of extensive service quality research within the hospitality field (PJ et al., 2023), we introduce a pioneering scale that identifies unique characteristics of online conventions, building

on prior convention service quality and e-service quality studies (e.g., Demir et al., 2020; Ho & Lee, 2007; Kaynama & Black, 2000). Compared to previous research related to convention service quality that only focused on a specific dimension, such as the platform service quality of online meetings (Demir et al., 2020; W. R. Xiang & Wang, 2024) or venue service quality and program (An et al., 2021; Talebpour et al., 2017), we merged various dimensions that are needed for the management of online convention service quality. By emphasizing the importance of the unique environments of online conventions, this study extends earlier research on convention service quality in offline settings with five dimensions (human services, program services, platform services, security, and interaction services).

This study highlights two novel dimensions in OCSQ, platform service and security service, which suggests that academia should focus on factors regarding online convention management research. These dimensions reflect the evolving nature of online conventions, where platform functionality serves a role analogous to the physical hosting environment in offline conventions (An et al., 2021; H. C. Wu et al., 2016; Talebpour et al., 2017). While we initially categorized 'security' as part of the 'platform service' dimension, the survey respondents identified security as a standalone dimension. This finding underscores the significance of security as a distinct and critical component of OCSQ, reflecting its unique impact on service quality. While prior studies regarding convention service quality have not addressed these dimensions (e.g., Tanford et al., 2012; Talebpour et al., 2017), the result identifies them as essential components of OCSQ, positioning them as critical for ensuring seamless experiences in virtual settings.

At the same time, while acknowledging the significance of new factors in online convention service quality, this study emphasizes the need for providers to maximize some essentials of existing convention service quality. This study bridges previous convention service quality research with online convention service quality (OCSQ), highlighting that the basic elements of convention service quality are still considered crucial factors. As the composition of human service factors in OCSQ includes many similar components to existing convention service quality, program service and interaction service in OCSQ also contain factors that were already considered important in existing scales (e.g., Cheon & Hong, 2018; H. C. Wu et al., 2016; Tanford et al., 2012). This implies that the essential characteristics of conventions should remain valued in online conventions, regardless of technical evolution. Specifically, this includes tailored content plans to enhance participant engagement and the implementation of networking solutions to facilitate relationship building among attendees.

Last, we provide insights into the current stage of online convention adoption, where attendees prioritize stability and essential platform functionality over advanced technologies and aesthetics. Initially, we expected that technology-related factors, such as the use of advanced virtual technology and platform aesthetics, would be highly important for better service quality, as suggested by previous studies on e-service quality (e.g., Demir et al., 2020; Hien, 2014). By contrast, the results revealed that these factors held lower importance values during the Delphi process or were removed due to low importance and factor loading values. However, as online conventions become more commonplace in the near future, we anticipate that technological advancements and platform aesthetics will likely gain greater significance.

5.2. Practical Implications

The findings of this research offer actionable insights for convention organizers navigating the transition to online formats. First, this research underscores the need for technical expertise and rapid response capabilities among staff. While traditional offline conventions emphasized qualities such as staff attitude and language skills, online conventions further

require staff to possess technical proficiency and the ability to resolve platform-related issues promptly. This shift necessitates targeted training for staff to enhance their familiarity with virtual technologies and to build specialized support teams capable of addressing attendee concerns efficiently. At the same time, effective communication during issue resolution, as emphasized in prior convention and e-service quality research (Hien, 2014; Ho & Lee, 2007; Lin & Lin, 2013), remains essential for attendee satisfaction.

Second, our findings emphasize the importance of balancing new technological elements with traditional service quality attributes. While the technical aspects of platform functionality are critical, tailored program content and interactive networking opportunities remain central to attendee satisfaction. In other words, organizers should avoid focusing primarily on the technical innovation of their conventions. Convention organizers should design content plans that resonate with participant interests and implement networking solutions that foster relationship building in virtual spaces, which has remained important even in the virtual environment of conventions. For example, creating interest-based chat rooms or incorporating interactive activities such as quizzes can enhance participant engagement. The use of features like emojis and facial expressions in messaging systems can further facilitate emotional interaction, aligning with previous findings on effective communication in online environments (Rourke et al., 1999). Furthermore, adopting beneficial technologies for select parts (e.g., VR technology) can also foster attendee involvement and interaction with others. However, convention organizers will need to prepare for future shifts by investing in aesthetically pleasing and immersive platforms.

The present study also underscores the critical role of platform service and security service as integral components of OCSQ. The functionality and stability of platforms are now as important as the physical hosting environment in offline conventions. Organizers must ensure that platforms are user-friendly, stable, and capable of handling high participant volumes. In addition, robust security measures, including anti-hacking protocols and data protection systems, are essential to address attendees' heightened privacy concerns.

Next, the OCSQ scale developed in this research provides a valuable diagnostic tool for convention organizers. It enables a systematic evaluation of event strengths and weaknesses, allowing organizers to identify areas for improvement and enhance service offerings. The scale can also be adapted for hybrid conventions, combining online and offline elements to meet diverse participant needs. By regularly collecting attendee feedback and refining their services, convention organizers can ensure continuous improvements and sustained success in the evolving landscape of online conventions.

Last, as virtual conventions are still in the early stages of development, we highlight the need for policymakers to support their growth through targeted initiatives. Governments can provide financial incentives, such as subsidies or tax breaks, to encourage investments in platform stability, functionality, and security. Workforce training programs are essential to enhance organizers' and staff members' technical proficiency for managing virtual events. Additionally, fostering collaboration between organizers, technology providers, and educational institutions is needed to drive innovation in virtual platforms.

5.3. Limitations and Future Research Agenda

This study also has some limitations. First, it mainly focused on online conventions rather than hybrid conventions, which limits the applicability of the findings to environments that integrate both offline and online formats. Additionally, since this research represents the initial stage of OCSQ scale development and was conducted solely in South Korea, there may be limitations in applying the developed items to measure various types of online conventions globally. Over time, as convention attendees become more familiar

with online technologies, their expectations may evolve, potentially impacting the relevance and applicability of the scale.

Therefore, future research should consider extending these measurement items or adapting the scale through further validation and refinement to capture more complex aspects of service quality than those addressed in this study (e.g., seven dimensions). Researchers could also expand the scale by incorporating additional variables to gain deeper insights into participants' attitudes and behaviors toward online conventions, in line with the evolving acceptance of virtual conventions as technology continues to advance. We anticipate that additional important items will emerge within the platform service dimension, as global participants become more familiar with attending online conventions using various platforms. This would help both researchers and managers better understand the needs of online convention participants. Additionally, since hybrid conventions combine both in-person and online elements, it is important to differentiate between these two dimensions of service quality in order to develop effective managerial strategies for organizing successful conventions, utilizing this research scale.

Furthermore, there is a need for research that examines cultural differences, as the accessibility of online conventions is likely to attract a more diverse participant base. Participants from different cultures may exhibit varying behaviors toward online conventions. For instance, attitudes toward security/privacy concerns or comfort levels with technology may differ between Asian and Western cultures.

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Abbreviations

The following abbreviations are used in this manuscript:

OCSQ	Online convention service quality
EFA	Exploratory Factor Analysis
CFA	Confirmatory Factor Analysis

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