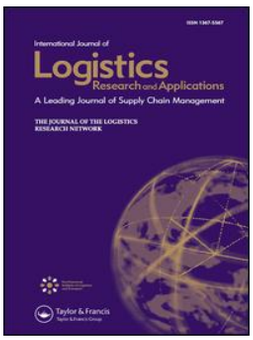

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Facilitating adoption of virtual communities through emotional connection in the global logistics industry

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ABSTRACT

This paper aims to analyse logistics service providers' (LSP) willingness to employ virtual communities (VC) through emotional connection. The factors influencing the willingness of using VC e-business with a theory of technology acceptance model (TAM) are first investigated. Structural equation modelling (SEM) and moderation analysis are adopted to examine the interrelationship of the intention of using VCs when considering the impact of emotional connection. The results show that the perceived ease of use and perceived usefulness positively affect the intention of using VC e-business. When LSPs strengthen their emotional connection, it will positively enhance the perception between two TAM dimensions and the use of VC e-business and thus stimulate more VC e-business opportunities. Based on the results, this research suggests: designing VCs should meet the staff's demand in practice, providing regular training to staff in VCs operations, enhancing staff's communication skills, and operating VCs with a genuine emotional connection.

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KEYWORDS
Virtual communities; emotional connection; technology acceptance model; logistics service providers; SEM

1. Introduction

Logistics service providers (LSPs) play an important role in the era of globalisation as they take the main responsibility of sustaining international trade. Nowadays, to enhance their competitiveness, LSPs devote themselves to providing a high-level facility, technology, know-how and services to fulfil clients' requests in a rapidly changing business environment. With the advent of e-commerce, logistics services are becoming part of such a technological revolution (Lagorio et al. 2022; Liu, Yang, and Shi 2022). Through this transformation, contemporary LSPs act as e-commerce fulfilment hubs, providing various logistics operations services to their clients. The benefits generated by e-commerce to strengthen LSP's competence are multi-faced including access of transportation management system technology solutions, reduced paperwork, more cost savings and efficiencies, leverage of the LSP carrier network, higher customer service satisfaction, more effective risk management, and an instantly driven excellent logistics solution for their clients' competitive advantage (Giuffrida et al. 2017).

The growing use of e-commerce has also led to a boom in firms' business through virtual transactions. With the continuous development of technology, VC participants (including firms and users) are expected to reach around $4.4 billion in 2025, compared to $3.6 billion in 2020 (Statista 2021). The use of VCs has thus become a crucial factor to construct a closer relationship between

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firms and their clients. To increase sales, especially due to the COVID-19 pandemic, more and more companies approach and communicate with their potential customers through virtual communities (VCs) (DHL 2021). Rheingold (1993) first proposed the concept of a VC, which refers to a platform where people share common interesting topics and social activities via online electronic group discussions.

Within this context, emerging applications of socially interactive technologies (SIT) further prompt the increasing popularity of real-time communication between social groups (Yang et al. 2022) such as the location services applications that combine mobile phone GPS sensors (Castro et al. 2013), encrypted verified user profiles and online reviews transaction platforms (Yu et al. 2017), software operating system-level positioning services, augmented reality, online chat robot service, logistics-as-a-service' (LaaS)-based business models (DHL 2020), electronic booking systems (Zeng, Chan, and Pawar 2021), and the promising applications of metaverse. However, the development of VC focuses not only on the use of advanced technologies but also on the understanding of the inner interactive requirements of community members. In this research, the distinction between VCs and conventional SIT is that VCs are served as technology-supported cyberspace by adopting an interactive perspective and establishing the emotional-connected relationship between participants' communication and interaction as the main elements.

In the global logistics industry, such online platforms can largely enhance the efficiency of communication with their clients. However, not all clients and staff are familiar with using VCs. It is expected that some clients and staff still prefer to use traditional interactive methods that they are accustomed to and satisfied with. Unless they are clearly aware of the convenience and practicality of virtual platforms, it has no obvious motivation for them to adopt this emerging trading method. The reasons that lead to their resistance are mostly due to the uncertainties of using new applications such as unstable technical issues, lack of trained staff, and cybersecurity (D'Hayer 2012; Tamjidyamcholo et al. 2014). They are afraid that such an uncertain result in a situation is different from what they have previously recognised. After reviewing the relevant works of literature, a feasible method to mitigate their doubt is to strengthen the emotional connection, which helps build and enhance stronger relationships between firms and clients (Sari and Wijaya 2019).

Emotional connection refers to people's motivation to receive services owing to a perception of friendliness, sense of group, moral sense, and other deep emotions (Youn 2016). When specific emotional experiences are conveyed in the process of satisfying clients' requirements, it is likely that clients will increase their willingness to continue trading in the way proposed by LSPs. For instance, XPO Logistics attempts to operate their Facebook page with a friendly atmosphere to maintain and manage the relationship with their clients. In addition, LSPs' staff play a pivotal role when in the process of emotional transmission. When staff are satisfied with employing the value of a new-launched technology application, they are willing to persuade their clients to adopt it (Hussain 2020). Staff's acknowledgement of a user-friendly and multi-functional VC encourages clients' acceptance of it. In other words, to ensure clients' willingness of utilising VCs, LSPs have to initially obtain recognition from their staff.

To investigate the willingness of using new technology, Technology Acceptance Model (TAM) deemed to be the most common theory has been widely used, including two main dimensions: 'Perceived Usefulness' and 'Perceived Ease of Use'. There have been a number of evidence showing the significant impacts of these two dimensions on people's willingness of adopting new technologies (see Section 2.2 for more detail). To encourage staff to adopt such a novel application while in transactions, global LSPs need to emotionally enhance staff's understanding and recognition of the benefits of 'usefulness' and 'ease of use' of VC. Therefore, by exploring staff's understanding of the 'Perceived usefulness' and 'Perceived ease of use' of accepting VCs applications when considering the effects of emotional connection, firms can understand the actual impact of adopting VCs. This paper aims to investigate the impacts of perceived usefulness and ease of use of VC on LSP staff's willingness to use VC e-business, as well as the moderating effects of emotional connection on the use of VC e-business by LSPs.

This research contributes to theoretically exploring the use of VC e-business in the logistics industry based on the TAM theory. It presents pioneering work on VC applications in the logistics sector given that to the authors' best knowledge, there is no research in the existing literature that addresses the use of VC in the logistics industry. In addition, this study takes into account the moderating effects of emotional connection to understand how it affects the use of VCs. The newly proposed framework for the VC applications in the logistics industry can be tailored for future research by adjusting the variables to fit the customisation.

The rest of the paper is organised as follows: Section 2 reviews the relevant literature. Section 3 discusses the research methodology, including research hypotheses, questionnaire design, sampling, and analysis methods. An empirical analysis is presented in Section 4. The conclusion and suggestions are drawn in Section 5.

2. Literature review

2.1. Benefits and management of VC

With the development of information technology and information communication technology, VCs provide cyberspaces for individuals to share their idea and interact with other participants without restriction (Choi et al., 2020). Koh et al. (2007) described a VC as a group of people who come together around a common interest, in which members are not physically collocated but communicate online to support interaction. In fact, interpersonal communication and interaction are crucial factors in VCs. If a harmonious relationship exists among members of the community, then a strongly enhanced centripetal force of members toward the VC occurs.

VCs bring many benefits to firm operations. For example, Porter (2004) stated that firms begin advocating the use of VCs to fulfil their business activities and integrating VCs into their e-commerce strategies to gain more benefits such as more advertising and sales, positive word-of-mouth image and brands, and more effective market segmentation. Many studies have addressed the applications of a VC in business management. For instance, Amazon utilises technical factors with interactive and personalised technology to create value together with clients via building an online community (Rindova and Kotha 2000). Ainin et al. (2015) found that a firm's performance, including financial and non-financial ones, can be affected by VCs. Roberts, Candi, and Hughes (2017) stated that VCs help firms reach potential clients, deliver marketing information, and promote new products to clients. Betzing, Kurtz, and Becker (2020) addressed the clients' participation in using VCs on local high streets. They found that a positive correction exists between clients' participation in VCs and the intention to visit physical stores.

In the logistics section, VCs can provide more efficient communication between LSPs and their clients, and thus more logistics booking services and transactions can be completed online virtually by mobile applications. The status of the cargo can be real-timely reported or updated, and clients can enquire questions to staff at any time. Apart from confirming real-time cargo status and online transactions, LSPs can also promote their service or outstanding news to their clients via VCs. For instance, DHL (2020) utilises several social media channels (e.g. Facebook, LinkedIn, WhatsApp) as virtual platforms to publish their marketing news and to communicate with their clients. Through online real-time information sharing as well as query responding functions embedded in VCs, clients' problems can be instantly solved more effectively and thus the LSP can obtain increased satisfaction from clients. In addition, LSPs can utilise VCs to build up and maintain customer relationships, and further enhance their customer loyalty by establishing a friendly atmosphere within the VC.

The state of the art of the VC studies reveals that the current studies mainly address the benefits and management of VC, trust relationship among users, and impacts of VC on technologies and society (Rolls et al. 2016), while little research investigates the factors that affect emotional connection between users (Youn 2016). In the logistics sector, there is yet any established research found

on the Web of Science when searching the keywords 'virtual community' AND 'logistics' in the year between 2010 and 2022. A research gap is thus identified, revealing the strong need of addressing the applications of VC in the logistics industry given the revealed benefits in other sectors and the significance of logistics in today's business world.

2.2. TAM theory

Apart from VC e-business itself, staffs' willingness of using a VC for transition is also considered in this study. To explain an individual's intention to use new technology, Davis (1986) proposed the Technology Acceptance Model (TAM) with two elements: Perceived usefulness and Perceived ease of use. This model addresses the following three statements: (1) people's behaviour when using new technology can be reasonably inferred from their behavioural intention; (2) Perceived usefulness is the main determinant of people's willingness to use science and technology; and (3) Perceived ease of use, which is used to develop and revise the strategies accepted by users and increase their willingness to use, is the second determinant of people's intentional use of technology (Legris, Ingham, and Collerette 2003; Scherer, Siddiq, and Tondeur 2019). Many studies have applied TAM in various fields such as brokers in the banking industry, online e-learning, autonomous electric vehicles, ride-sharing services, etc. (e.g. Scherer, Siddiq, and Tondeur 2019; Wu et al. 2019; Wang et al. 2020). For instance, Cegarra, Navarro, and Pachón (2014) analysed the attitude of 307 Spanish citizens toward e-government service and found that attitude is crucial for users to accept the e-government service. Scherer, Siddiq, and Tondeur (2019, 31) addressed teachers' acceptance of technology in education and found that TAM successfully predicts user behaviour and can thus be of interest to all potential users of new technology.

Some scholars argued that since TAM is used to explain the intention to accept new technologies, additional dimensions should also be considered to increase the explanatory power of the TAM theory (Legris, Ingham, and Collerette 2003; Scherer, Siddiq, and Tondeur 2019; Wu et al. 2019). Legris, Ingham, and Collerette (2003) critical reviewed the relevant studies of TAM and argued that it should also include several important dimensions, such as the process of human and social change, as well as the adoption of the innovation model. Banerjee and Dey (2013) stated that Facebook users are influenced by three dimensions – rich in usefulness, website design to enhance users' convenience and trustworthiness, whereas Lin and Filieri (2015) analysed airline passengers' willingness to use online check-in services from two additional elements, subjective knowledge and personal innovativeness. Wu et al. (2019) addressed the public acceptance of autonomous electric vehicles and include environmental concerns in their proposed model. By searching keywords of {'technology acceptance model' AND 'virtual community'} on the Web of Science, the results show 28 studies in total from 2007 to 2021. After removing one literature review-based paper in 2016, Table 1 shows the selected nine papers from 2016 to 2021.

Regarding application in logistics-related fields, Bienstock and Royne (2010) investigated the relationship between IT applications and satisfaction with logistics services quality (LSQ), which is found that has a mediating effect between perceived usefulness, perceived of ease of use and customer satisfaction. Brandon-Jones and Kauppi (2018) adopted an extended TAM in an e-procurement context and found that processing, usability, and professionalism affect employees' intention to use e-procurement. Ramkumar et al. (2019) also utilised TAM in e-procurement services and addressed user satisfaction as a crucial factor to analyse organisational buyers' willingness of e-procurement systems. Their research observed the mediating effect of individuals' perception between system characteristics and buyers' satisfaction. Yang (2019) addressed Blockchain-based technology applications in the maritime industry such as customs clearance and management, tracking and tracing, digitalising and easing paperwork. Loske and Klumpp (2021) conducted an empirical study about artificial intelligence (AI) applications for truck drivers in retail logistics. Since this research addresses the adoption of the new VC technology in the logistics industry, as well as the evidence of the above TAM theory references, it is appropriate to apply the TAM theory in this research.

Table 1. Selected papers related to the application of VC with the theory of TAM.

Authors	VC types	Country	Participants	Additional dimensions	Methodology
Waheed et al. (2021)	Mobile social apps	China	600 online shoppers	Trust in online store; Perceived risks	Structural Equation Modelling (SEM)
Tsai, Lee, and Ruangkanjanases (2020)	Facebook	Taiwan	289 users	Positive technology readiness; Negative technology readiness; Confirmation;	SEM
Peñarroja et al. (2019)	virtual communities of practice (VCoP)	Spain	110 NGO employees	Facilitating conditions; Sense of VC; VC of practice's effectiveness	hierarchical regression
Lin, Chang, and Kuo (2018)	Taiwan Agricultural and Food Traceability (TAFT) system	Taiwan	400 senior citizens	Social influence; System characteristic; Trust	SEM
Zhang et al. (2018)	Steam community	N/A	2,753 players	Interactive content; Interactive way; Interaction place; Instrumental utility; Psychological utility	multivariate stepwise regression
Wu et al. (2017)	Educational virtual community	China	326 users	Psychological ownership	SEM
Tamjidyamcholo et al. (2016)	professional virtual community (PVC): ResearchGate	N/A	140	Perceived security	SEM
Yap and Gaur (2016)	Facebook	Malaysia	387	Social influence; Self-efficacy; Need for cognition	hierarchical regression
Lu et al. (2016)	Runners' VC	Taiwan	276	Performance expectancy; Effort expectancy; Social influence; Facilitating conditions	SEM

2.3. Emotional connection

Interpersonal relation is an interactive way line. Establishing a good relationship requires the utilisation of communication to enhance the emotional connection between people. Emotional connection has been addressed widely in marketing, and a good emotional connection typically positively results in client satisfaction (Levy and Hino 2016; Sari and Wijaya 2019). Thomson, MacInnis, and Whan (2005) described emotional connection serves as an emotion-laden bond connecting an individual and a specific brand, which is characterised by feelings of affection. Zorfas and Leemon (2016) stated that emotional connection is impacted by client experience and increasing client emotional connection will significantly improve a company's performance. They also found two key drivers of emotional connection, including satisfying clients' desires to stand out from the crowd and to bring order and structure to their lives.

The emotional connection can be examined from the perspectives of both mood and cognitive motivation. Mood motivation is caused by human emotions, such as pleasure, anger, sorrow, and joy. Mood can motivate consumers to act positively or negatively. Cognitive motivation is a theory that explain human's behaviour in terms of the examination and deliberation of received information (Cacioppo et al. 1996). The question items used in this study to evaluate emotional connection are adopted from previous studies such as identity, belonging, conformity, expectancy, valence, instrumentality (Loureiro, Ruediger, and Demetris 2012; Zorfas and Leemon 2016; Claffey and Brady 2019; Sari and Wijaya 2019).

Emotional connection has also been investigated with the use of technology. For example, Kim, Lee, and Hiemstra (2004) suggested that shared emotional connection, a level of feeling of being a member and willingness to involve in the community, is a factor of sense of online VC that influences clients' loyalty in the tourism industry. Othman, Petrie, and Power (2011) found that emotional connection with technology usage is a factor that impacts visitors' experience in

museums. Loureiro, Ruediger, and Demetris (2012) suggested that brand emotional connection reinforces trust, interest in continuing a relationship and faith in the future of the brand. Straker and Wrigley (2016) addressed the fashion industry and argued that good client experience will generate positive emotional connections with shops and further enhance client loyalty.

It is believed that, with maintaining a close emotional connection in VC operations, firms can lead people to a positive emotional feeling such as affinity and trust, and further enhance people's engagement in interacting with them. For instance, motivation factors include fear of change, different perceptions, lack of participation, and other factors that affect the willingness of netizens to participate in the community (Youn 2016). Cheung, Lee, and Rabjohn (2008) pointed out that the stronger the user's emotional attachment to a VC, the more likely it is to recommend this VC to others through word of mouth, and the higher the reuse behaviour. Previous studies also found that a content-rich and reliable VC would greatly increase users' willingness to visit the platform repeatedly (Youn 2016; Claffey and Brady 2019). Hossain and Silva (2009, 4) also stated that 'online ties, like offline ties, are expected to be stronger to the extent that they demonstrate greater varieties of interaction, exchange, and emotional support'. Moreover, Lee, Xiong, and Hu (2012) addressed Facebook users' intention on going to a festival and proposed an element of 'Perceived Enjoyment' within a TAM.

3. Research method

3.1. Research architecture and hypothesis

Many studies have proved that such factors as ease of use and usefulness, have positive influences on the adoption of new technologies by enterprises. In addition, Perceived ease of use also has a positive impact on Perceived usefulness. In other words, once users perceive a low complexity of a VC, their feeling about the level of usefulness (e.g. beneficial to their works) of the VC will increase. For instance, Wu et al. (2019) addressed public acceptance of autonomous electric vehicles in China when considering environmental protection, and the results showed that Perceived usefulness and Perceived ease of use have a positive relationship with people's intentions to use autonomous electric vehicles. Wang et al. (2020) addressed ride-sharing and clients' intentions and found that Perceived ease of use positively influences Perceived usefulness, which further positively influences behavioural intention. However, it is interesting to find that perceived ease of use does not significantly affect behavioural intention in their model, which implies that mediating effects from perceived usefulness exist between these two factors (Wang et al. 2020). Apart from that, previous studies highlighted that the relative benefits (or Perceived usefulness) of innovation traits have a positive effect on willingness to adopt new technologies (e.g. Scherer, Siddiq, and Tondeur 2019; Wu et al. 2019). In addition, these studies also proved the effect of Perceived ease of use on the adoption of new technologies. Therefore, H1, H2, H3 and H4 are proposed as follows.

H1: Perceived ease of use of VC positively affects Perceived usefulness of VC.

H2: Perceived ease of use of VC positively affects VC e-business.

H3: Perceived usefulness of VC positively affects VC e-business.

H4: Perceived usefulness of VC has a mediating effect between perceived ease of use of VC and VC e-business

Youn (2016) utilised a Motivation-Experience-Behaviour model to investigate how different variables affect perceived values of using advanced devices and found that emotional connection presents a significant impact on value perceptions. Zorfas and Leemon (2016) stated that emotional connection enhances the relationship between a firm's staff and clients and further identified the effects of emotional connection that significantly contribute to the improvement of a firm's benefits. Claffey and Brady (2019) indicated that an emotional engagement experience aligned with firm-hosted VCs will increase the clients' participation in value-creating activities promoted by firms.

Therefore, this study further examines the moderating effect of emotional connection when there exists willingness to utilise VCs for e-business. H5 and H6 are thus hypothesised as follows:

H5: Emotional connection strengthen the effects between Perceived usefulness of VC and VC e-business.

H6: Emotional connection strengthen the effects between Perceived ease of use of VC and VC e-business.

A research framework addressing emotional connection influencing clients' acceptance of VC e-business is proposed, as shown in Figure 1.

3.2. Questionnaire design and content

3.2.1 Questionnaire design process

In order to accurately obtain the opinions of relevant personnel on VCs, a questionnaire with a Likert five-point scale is designed and sent to several selected personnel in both the logistics industry and academics for a pilot study to validate the questions and ensure the validity (Iacobucci and Churchill 2010). In total, 15 members of the potential sampling population review the question items to improve the chances of a precise outcome of this questionnaire.

The target samples of this research are global LSPs from the Directory of Members of Air and Sea Freight Forwarder Association in Taiwan. The questionnaires are distributed to business personnel and client service staff who are in direct contact with clients. A total of 500 questionnaires are sent to the members of the association on 1st July 2021. A month later, the second wave of questionnaires is sent out to the same target sample for more replies. After deducting questionnaires with wrong answers or incomplete information as invalid, the total number of valid questionnaires is 355. The sample recovery valid rate is 71%.

3.3. Methods for data analysis

After data collection, this study firstly conducts exploratory factor analysis (EFA) to cluster the question items based on their characteristics into several small groups (i.e. factors) underlying each dimension (the four ovals in Figure 1). A VARIMAX rotation technique is applied to transform a set of interrelated variables into a set of unrelated linear combinations of these variables. Only the variables with a factor loading higher than 0.5 are extracted to aid interpretation. An Eigenvalue greater than one is employed as the criterion to determine the number of factors in each dataset (Iacobucci and Churchill, 2010). In order to test whether a factor analysis is useful with collected data, scales are tested using the Kaiser-Meyer-Olkin

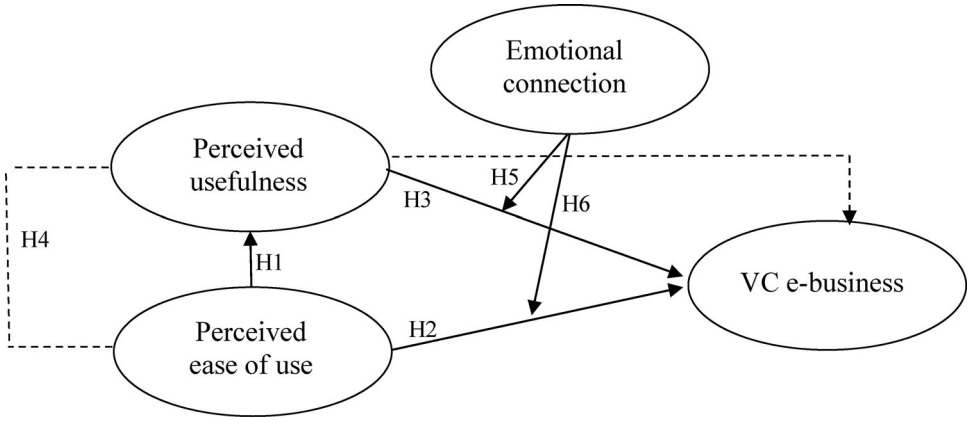

Figure 1. Research framework.

(KMO) and Bartlett test of Sphericity. The value of KMO is recommended to be close to 1.0, whereas the Bartlett test of Sphericity should have a *p*-value less than 0.05 to achieve the significance level (Hair et al. 2018).

After conducting the EFA, a confirmatory factor analysis (CFA) is then conducted to assess the uni-dimensionality, reliability and validity of the construct. A reliability test based on the Cronbach α value is first employed to test the internal consistency of questionnaire responses. The CFA involves the specification and estimation of one or more hypothesised models of factor structure, each of which proposes a set of latent variables (factors) to account for covariance among a set of observed variables (Koufteros 1999). After that, the composite reliability (C.R.) of each dimension should be more than 0.7 (Hair et al. 2018) and the average variable extracted (AVE) should be more than 0.5 (Fornell and Larcker 1981). The formulas of C.R. and AVE are presented by Equations (1) and (2) (Chang, Lu, and Lai 2022).

$$C.R. = \frac{\left(\sum_1^n \lambda\right)^2}{\left(\sum_1^n \lambda\right)^2 + \sum_1^n (1 - \lambda^2)} \tag{1}$$

$$AVE = \frac{\sum_1^n \lambda^2}{\sum_1^n \lambda^2 + \sum_1^n (1 - \lambda^2)} \tag{2}$$

where n is the number of items under each dimension.

Finally, structural equation modelling (SEM) and moderating analysis are conducted to examine the research hypotheses. SEM is a multivariate analysis that is used to investigate causal relationships between dimensions simultaneously. It has been applied in various areas such as logistics (Chang, Lu, and Lai 2022), supply chain management (Albishri, Sundarakani, and Gomisek 2020), and maritime (Yang, Lai, and Zhu 2021; Lin and Chang 2021). In this research, all analyses are carried out using the statistical packages SPSS 26 and AMOS 26.

Table 2. Profile of respondents.

Characteristics	Number of respondents	Percentage of respondents
Age		
30 or less	48	13.5%
31–40	179	50.5%
41–50	74	20.8%
51 or more	54	15.2%
Educational background		
High school or below	25	6.9%
Undergraduate	256	72.2%
Postgraduate	64	18.1%
PhD	10	2.8%
Job title		
Vice general manager and general manager	4	1.0%
Manager	6	1.8%
Assistant manager	10	2.8%
Chief	34	9.5%
Business specialist	214	60.4%
Customer service	87	24.5%
Work experience		
6 years or less	22	6.2%
6–10 years	181	50.9%
11–15 years	93	26.3%
16–20 years	45	12.6%
20 years or more	14	4.0%

4. Analysis results

4.1. Respondents' background

As shown in Table 2, among the 355 valid respondents, around 85% of them are younger than 50 years old. In terms of educational background, more than 93% of respondents have an undergraduate degree or above. Regarding job titles, business specialists make up the majority (60.4%), followed by customer service personnel (24.5%), chiefs (9.5%), assistant managers (2.8%), managers (1.8%), and vice general managers and general managers (1%). In terms of work experience, around 94% of them have more than 6 years of work experience. Based on the above results, young people comprise the majority of global LSPs and are considered as a generation that can be relatively easier to accept new technological applications. In addition, most of them obtained a college or higher education, and are accustomed to using technological social media (i.e. VC) as a tool when interacting and communicating with clients for business.

4.2. Results of EFA

A KMO test is conducted to examine the goodness-of-fit of the sampling before proceeding with an EFA. In this research, the KMO value is 0.894 (more than the recommended threshold of 0.8) and the *p*-value of the Bartlett test of Sphericity measure is less than 0.05 (reached a significance level), which means that the data used for the following EFA is suitable.

For the dimension of 'Perceived ease of use', one factor is identified from all items with Cronbach α 0.881 (see Table 3). The cumulative explanatory variance is 67.23% with an eigenvalue of 7.282, and the factor loadings are all more than 0.6. Most items are about perceived ease of use for VCs. Accordingly, this factor is named Perceived ease of use.

In the dimension of 'Perceived usefulness', Table 4 reveals that one primary factor is identified with Cronbach α 0.872. This factor contains five items with 69.354% of the total variance, and the five factor loadings are between 0.653 and 0.878 (more than 0.5). Most items are related to the perception of usefulness for VCs. Accordingly, this factor is named Perceived usefulness.

Table 5 shows that only one factor is extracted from the dimension of emotional connection, with Cronbach α 0.85. The high Cronbach α (higher than the recommended threshold of 0.8) indicates that the reliability of each dimension is good (Hair et al. 2018). The cumulative explanatory variance is 66.03% with an eigenvalue of 6.703, and the factor loadings are between 0.652 and 0.898. In addition, eight items are included in this factor and most of them are related to emotional connection between LSPs and clients with the use of VC. Accordingly, this factor is named emotional connection.

In terms of the dimension of VC e-business, the result shows that two factors are extracted, with Cronbach α between 0.885 and 0.925 (see Table 6). The two factors are described as follows:

Table 3. Factor analysis on perceived ease of use.

Items	Factor 1
I think that the use of virtual communities is clear to understand	**0.879**
I think that the use of virtual communities is simple	**0.822**
I think that the use of virtual communities is easy to learn	**0.788**
I think that the application of virtual communities is not complicated for me	**0.772**
I think that it is easy to apply virtual communities to existing workflows	**0.692**
Mean value	4.122
Standard deviation	0.221
Characteristic value	7.282
Percentage of explained variance %	67.233
Percentage of cumulative explanatory variance %	67.233
Cronbach's α	0.881

Table 4. Factor analysis on perceived usefulness.

Items	Factor 1
I think that using virtual communities will increase company profits	**0.878**
I think that using virtual communities can reduce company's operating costs	**0.822**
I think that using virtual communities can improve operational management efficiency	**0.773**
I think that using virtual communities meet company management requirements	**0.721**
I think that using virtual communities to increase the benefits of enhancing company's reputation	**0.653**
Mean value	4.082
Standard deviation	0.132
Characteristic value	7.232
Percentage of explained variance %	69.354
Percentage of cumulative explanatory variance %	69.354
Cronbach's α	0.872

- Factor 1 Mood Motivation

This factor includes three items with Cronbach α 0.925. The explanatory variance is 45.223 with an eigenvalue of 7.312 and the factor loadings between 0.648 and 0.841. Because most of the question items are related to the promotion of clients' identification by global LSPs, this factor is thus named mood motivation.

- Factor 2 Cognitive Motivation

This factor includes four items with Cronbach α 0.885. The explanatory variance is 11.388% with an eigenvalue of 2.677 and the factor loadings between 0.676 and 0.828. As most of the question items are related to transfer image and capability by VCs to stimulate clients' identification by global LSPs, this factor is thus named cognitive motivation.

4.3. Results of CFA

A confirmatory factor analysis (CFA) is undertaken in this section to measure the reliability of constructs. In the measurement model, each dimension is pair-correlated with the others. Further, several goodness-of-fit indices recommended by Bagozzi and Yi (1988) are employed to investigate the fit and unidimensionality of the measurement model.

Table 7 shows that all model fit indices achieve an acceptable level, including Chi-square/df ratio ($(\chi^2/df) = 1.24 < 3$), p-value = 0.10 (larger than 0.05), goodness-of-fit index (GFI) = 0.96, adjusted goodness-of-fit index (AFGI) = 0.97, normed fit index (NFI) = 0.98, and Tucker–Lewis index (TLI) = 0.97 (all more than 0.9); root-mean-square residual (RMR) = 0.01 (close to 0); root-

Table 5. Factor analysis on emotional connection.

Items	Factor 1
I am happy to use virtual communities to communicate with clients	**0.898**
I understand the importance of virtual communities in business contacts	**0.806**
I prefer to obtain real-time response from clients by virtual communities	**0.799**
I am happy that our company emphasises personnel's ability to provide information in virtual communities	**0.789**
I feel the need of using virtual communities from clients even it means using an additional tool	**0.771**
I am happy to maintain a relationship with clients through virtual communities	**0.704**
Some clients will discuss personal issues beyond business through virtual communities with me	**0.688**
I believe that the use of virtual communities is beneficial to both my company and clients	**0.652**
Mean value	4.435
Standard deviation	1.060
Characteristic value	6.703
Percentage of explained variance %	66.030
Percentage of cumulative explanatory variance %	66.030
Cronbach's α	0.854

Table 6. Factor analysis on VC e-business.

Items	Factor 1	Factor 2
Our company has an intention to use virtual communities to promote corporate business	**0.841**	
Our company has an intention to use virtual communities to post public activities to enable clients' understanding of the companies' capacity for services and operation	**0.809**	
Our company has an intention to use virtual communities to publish related work content	**0.648**	
Our company has an intention to use virtual communities to hold regular meetings with clients		**0.828**
Our company has an intention to prepare a budget to buy advertisements in virtual communities to enhance the companies' images		**0.812**
Our company has an intention to use virtual communities to set up an online service to respond to clients' questions in real-time		**0.702**
Our company has an intention to use virtual communities to strengthen staff's professional knowledge education and training		**0.676**
Mean value	4.315	4.427
Standard deviation	0.110	0.162
Characteristic value	7.312	2.677
Percentage of explained variance %	45.223	11.388
Percentage of cumulative explanatory variance %	45.223	55.601
Cronbach's α	0.925	0.885

mean-square error of approximation (RMSEA) = 0.05 (less than 0.08). This indicates that the proposed model is credible, and it can be acceptable for further SEM analysis.

Further, this study examines the overall fit of each factor in the model. The result of model identification is found significant (t-value = 0.00) with standardised residual values of more than ±1.96 (Hair et al. 2018) and without items to be modified based on the modification indices (MI) and t values of all items. To test the validity of the model, convergent validity and discriminant validity are applied in this study. Convergent validity is conducted through testing the values of constitute reliability (CR) and average variance extracted (AVE). As mentioned in Section 3.3, the recommended AVE values should be more than 0.5 and CR values should be more than 0.7 to achieve the requirement of convergent validity. In our research, the results show that AVE values range from 0.50 to 0.72, and CR statistics range from 0.85 to 0.92. It means that the result achieves convergent validity. Discriminant validity exists if the items share more common variance with their respective construct than any variance that the construct shares with other constructs (Koufteros 1999). Evidence of discriminant validity provided by the AVE for a construct is considered substantially higher than the squared correlation between the construct and all other constructs. The results reveal that the highest squared correlation is observed between dimensions, which indicates that a value is significantly lower than their individual AVE value. The results provided evidence of discriminant validity for the study's variables. Thus, convergent validity, discriminant validity, and AVE test results prove that the VC acceptance-related dimensions in the study are satisfactory.

4.4. Results of SEM

In the SEM analysis, this study validates the proposed model via a number of criteria. The assessment results show that the normed Chi-square ratio is 1.88 < 2; GFI = 0.95, AGFI = 0.92, TLI = 0.92,

Table 7. Goodness-of-fit indexes and acceptable criteria.

Fit indices	Recommended criteria	value
p-value	Non-significant	0.10
Ratio of χ^2 to degree of freedom	<3.00	1.24
Root mean square error of approximation (RMSEA)	<0.05	0.05
Root mean square residual (RMR)	<0.05	0.01
Goodness of fit (GFI)	>0.90	0.96
Adjusted goodness of fit (AGFI)	>0.90	0.97
Normed fit index (NFI)	>0.90	0.98
Tucker–Lewis index (TLI)	>0.90	0.97

and NFI = 0.9, are all equal or more than the recommended threshold 0.9; RMR = 0.01 and RMSEA = 0.02, are both within reasonable ranges (close to 0) (see Table 8). For the causality of the SEM model, the β value is used to verify the research hypotheses, whereas *p* values between two potential variables are used to explore whether a significant correlation exists. Table 8 shows that Perceived ease of use has a significantly positive effect on Perceived usefulness (supports H1) and VC e-business (supports H2). Perceived usefulness also has a significant effect on VC e-business (supports H3).

This paper further conducts a Bootstrap analysis to analyse the mediating effect of Perceived usefulness between Perceived ease of use and VC e-business. Table 9 shows the results that both Bias-corrected percentile method (BC) and Percentile method (PC) have *p*-values less than 0.05 in indirect effect, direct effect and total effect, whereas their 95% confidence interval are all more than 0 in the three effects. This implies a significant positive indirect effect of Perceived usefulness (with the estimated value of 0.384) between Perceived ease of use and VC e-business (supports H4). Besides, the direct effect between Perceived ease of use and VC e-business is also significant (with an estimated value of 0.551). Finally, the total effect between Perceived ease of use and VC e-business is 0.935 with significant *p*-values in both BC and PC.

4.5. Moderating effect of emotional connection

This study further used a moderating analysis to examine the relationship of emotional connection to the links between the two TAM dimensions and VC e-business. Considering the related activities of LSPs in promoting interacting connections in VCs, a significant willingness is observed from clients to conduct more transactions with firms when more emotional connections exist. A hierarchical regression approach is utilised for examining the relationship between the two TAM dimensions and VC e-business in terms of the role of emotional connection acts as a moderator. Initially, the control variable, such as respondent's age, educational level, job title and work experience are put into the regression model to verify their intervening effects. Then the perceived ease of use, perceived usefulness and emotional connection are entered into the regression model to test their effects on VC e-business. The evaluation of the effects of emotional connection is treated as a second-order factor structure that contains two layers of latent constructs in the research. The interaction variables of two TAM dimensions and emotional connection are placed into the model as a moderator to examine whether the moderating effect of emotional connection exists. If the interactions between two TAM dimensions and emotional connection are found to be significant, then there existed evidence to support a significant moderating effect exists. The results indicate that the interaction between perceived ease of use and emotional connection toward VC e-business shows positive and significant ($\beta = 0.80$, p-value < 0.01). The moderating effects of emotional connection on the relationship between perceived usefulness and VC e-business are also revealed to be positive and significant ($\beta = 0.55$, p-value < 0.01). This indicates that appropriate emotional connection operations offered by LSPs will have positive impacts on both paths of the two TAM dimensions to VC e-business, and further enhance the acceptance of VC operations in LSP staff. Therefore, the result supports H5 and H6. The results of standardised path coefficient in the proposed framework are shown in Figure 2.

Table 8. Estimated results of SEM coefficients.

	Path coefficient β				
Path	Standardisation	Non-standardisation	SE	CR	*P*
(ease of use) → (usefulness)	0.79	0.74	0.49	4.55	***
(ease of use) → (VC e-business)	0.80	0.78	0.75	6.28	***
(usefulness) → (VC e-business)	0.22	0.19	0.63	3.35	***

Note: Chi-square = 227.48; DOF (df) = 121; *P* value < 0.01 (presented by ***); Chi-square/DOF = 1.88; GFI = 0.95; AGFI = 0.92; TLI = 0.92; NFI = 0.90; RMR = 0.01 and RMSEA = 0.02.

Table 9. Results of Bootstrap analysing.

	Estimate	95% Confidence Interval		
		BC/PC *p*-value	BC	PC
Indirect effect				
Perceived ease of use-> Perceived usefulness -> VC e-business	0.384	0.009/0.010	0.213–0.530	0.211–0.529
Direct effect				
Perceived ease of use-> VC e-business	0.551	0.013/0.010	0.386–0.728	0.393–0.740
Total effect				
Perceived ease of use-> VC e-business	0.935	0.025/0.010	0.899–0.959	0.895–0.964

BC: Bias-corrected percentile method, PC: Percentile method.

5. Discussions

Compared with other industries, the global logistics industry has to possess the capability of quickly responding to clients' cargo handling needs. Therefore, LSPs strive to provide solutions to fulfilling their clients' requirements and act as a bridge between shippers and consignees. In most cases, information acquisition during the entire process of cargo transportation and the condition of the cargo en route are what the clients concern the most. The issues on how to establish a real-time communication and reply mechanism between the two parties to instantly respond to various needs to clients, frequently express concerns, improve clients' satisfaction, and maintain a stable business relationship in the context of the logistics industry are deemed as the most challenging tasks to global LSPs. The applications of advanced technology to VCs can greatly address the above communication problems.

5.1. Managerial implications

Although VC has been a prevailing technology in society with a diverse application model, it remains an emerging issue in the logistics industry. Based on the results, several managerial implications are proposed:

(1) In order to enhance staff's willingness to actively utilise the VCs for e-business, LSPs and VC designers should have good communication when designing VCs. The function of the VCs

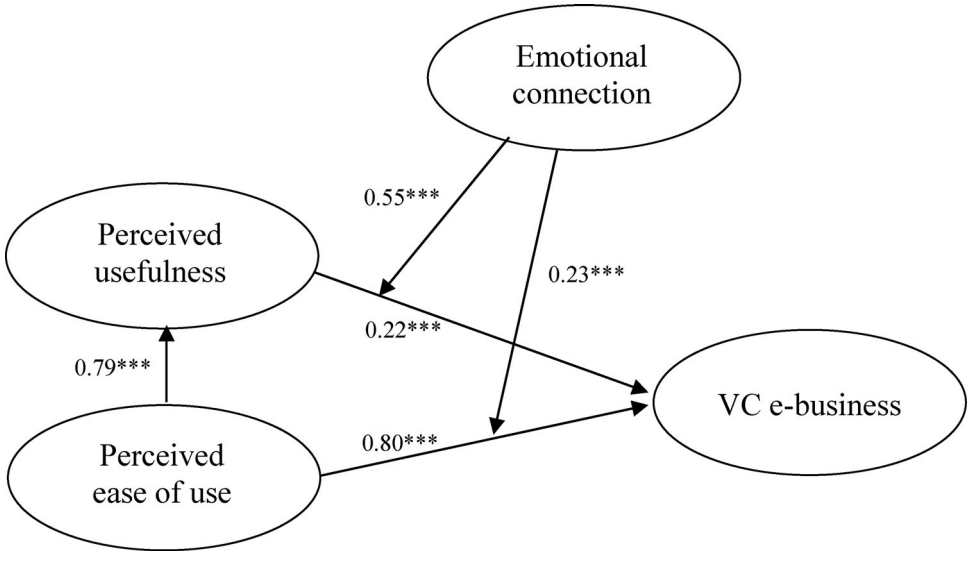

Figure 2. Result of SEM and moderating effect. Note: *** represents the *p*-value <0.01 of the hypothesis is significant.

should not only meet the demand of staff's daily operations (e.g. quoting price, tracking cargo status, answering issues with clients) but also provide more efficient operations and communication with clients. For example, Glockner et al. (2014) depicted that DHL ensures quality control by monitoring each work step when processing clients' shipments and reporting any exceptions online in terms of adopting a real-time mutual communicating platform. MAERSK (2022) reported that their 'Logistics Hub' proposed a new centralised supply chain visibility solution, to assist their clients to instantly gain control of their cargo in an interactive dashboard powered by AI. It gives a consolidated view of clients' shipments, tasks, logistics updates and information vital to the end-to-end supply chain. In the other words, a user-friendly and multifunctional VC would enhance staff's willingness of using VCs such new technology and further promote the VC e-business transition mode to their clients.

(2) From the distribution of the respondents' background, staff who work in this industry are relatively young with a higher level of education (more than 93% obtained a degree or above). This implies that the learning cost for them is low and thus they have a higher willingness to use VCs to conduct e-business. A series of proper training courses for enhancing staff's ability/skills to efficiently utilise VCs are an important element of a successful VC e-business (Lu, Zhao, and Wang 2010). This might include the ability to respond to clients' enquiries quickly, the ability to use VCs to promote business operations and information, the communication skills to quickly build up and maintain relationships with clients, etc. LSPs, who have or are attempting to use VCs e-business, can recruit more young staff to reduce training costs. Simultaneously, LSPs should also provide regular relevant training to all staff in order to ensure staff's understanding of the benefits of VCs in their daily operations, and further enhance their willingness of using VCs.

(3) Apart from the traditional skills that need to be equipped for the logistics industry such as language, economics, and transport management (Lin and Chang 2018), staff's skills for using VCs are also an important factor for successful e-business nowadays. For example, since emotional connection is a crucial factor, enhancement of communication skills can effectively formulate and further efficiently strengthen the emotional connection with clients. In addition, as VCs are operated in cyberspace, staff's cybersecurity knowledge can significantly reduce the impacts of cyberattacks (Park et al. 2019; Kanwal et al. 2022). It is therefore suggested that education for developing staff's competence should also consider lecturing the skills for VC operations to meet the trend of VC operations in the logistics industry.

(4) It is an arduous task to understand how LSPs initiate effective emotional connections with their clients to accept the use of a novel transaction method and to move away from the previous means. This research found that emotional connection facilitates the process of perceived usefulness and ease of use to the willingness of using VC. Thus, apart from building useful and user-friendly VCs, it is also suggested that LSPs operate VCs with a genuine emotional connection. VCs provide a platform for LSPs to promptly reply to clients' queries (e.g. obtain immediate responses, real-time cargo tracking, freight handling status confirmation, etc.), whereas operating a VC with an emotional connection can create a friendly atmosphere within the VC. Therefore, to enhance clients' acceptance of using VC e-business and further foster them as loyal clients, LSPs should encourage staff to utilise the effects of emotional relationships with clients to facilitate business opportunities through VCs.

5.2. Academic implications

The results express that the emotional connection activities provided by LSPs can readily enhance staff's willingness to conduct VC e-business with clients. Our research identified that under the emerging technology application of virtual communities, LSPs should not merely

pay attention to the development of hardware settings, but also focus more on how to harness technology for effective emotional connections with their clients. This ensures that global LSPs gain clients' trust and transform their current transaction behaviour, which attributes to staff's perception of the effectiveness of VC utility. By continuously formatting this positive emotional atmosphere and strengthening emotional perception, staff are anticipated to help increase the possibility of employing VCs for any business opportunity. When the emotional connection between staff and clients becomes stronger, the effect of convincing clients' intention of using VCs will get better. Furthermore, global LSPs can provide their clients with frequent emotional care through VCs to enhance clients' willingness for further cooperation opportunities. In addition, through relevant education, training, and promotion, LSPs can encourage their staff to develop appropriate emotional connections and internalise the value of VC as part of daily business communication and behaviour.

6. Conclusion

The adoption of virtual communities has become a promising interactive mode for maintaining the relationship between firms and clients nowadays, especially in the COVID-19 pandemic period. To date, most relevant studies focus on discussing the benefits of VC, users' trust relation, technological influence, and the effect of VC on society, but fewer studies address emotional issues in the context of LSPs. Therefore, this research investigates the impacts of both Perceived usefulness and Perceived ease of use on accepting the use of VC e-business from LSP perception. In addition, we further investigate the impacts of emotional connection on both links of Perceived usefulness and Perceived ease of use to VC e-business in the logistics industry.

The descriptive analysis results show that most of the respondents are young staff (younger than 40 years old) with higher education who are engaged in business in the global logistics industry. Younger staff reveals that they are more accustomed to adopting VC as a communication tool with their clients. The results of SEM analysis show that Perceived ease of use in VC operations significantly and positively affects Perceived usefulness and the intention of using LSP VC e-business. Perceived usefulness in VC operations also reveals a positive effect on the intention to conduct VC e-business. This indicates that an appropriate VC with an effective and user-friendly design radically facilitates LSP staff's acceptance to use VC e-business. The results also show the existence of moderating effect of emotional connection in the paths between two TAM variables and the intention of using VC e-business in the LSP industry.

This study has several limitations, which provide worthy directions for future research. First, clients' perception to the emotional connection and their willingness to use related VCs should also be considered. As such, LSPs can improve their interaction with clients through interviews and case discussions with personnel in charge of the operation departments in the planning of virtual platforms. Second, apart from the framework of TAM, several other research areas can also be considered in this emerging technology in the logistics industry such as preferred logistics skills, risk management, organisational performance, etc. Third, the identified factors and contributed results could further be tested to see their applicability in other industries and countries. The proposed framework can be a new direction for future research with other crucial factors that revealed practical effects of adopting VC. Forth, the respondents' background (e.g. age, educational background, job title) might affect the final results. This research analyses the distribution of these factors to support the reliability of the respondents. However, these factors could be further analysed beyond the research aim and the function of the methodology (i.e. SEM) defined in this study. It would be an interesting topic to investigate the impact of the respondents' background in future research. Finally, the importance of emotional connection and intention of using VC e-business may change over time. It is worth utilising a longitudinal study method in future research to compare the short and long-term effects of emotional connection to achieve more determining factors on VC within the context of the logistics industry.

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Appendix

Summary of abbreviation.

Abbreviation	Full name
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CR	Constitute Reliability
EFA	Exploratory Factor Analysis
KMO	Kaiser-Meyer-Olkin
LSP	Logistics Service Provider
SEM	Structural Equation Modelling
TAM	Technology Acceptance Model
VC	Virtual Community