



Article Knowledge Co-Creation during the COVID-19 Pandemic: A Dual-Regulated Learning Model in Virtual Hospitality Communities

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Abstract: The evolution of the internet has increased the development of virtual communities. This has created an enabling environment for hospitality industry owners to interact, share and exchange information and ideas virtually. The COVID-19 pandemic has been a further catalyst in the dramatic expansion of virtual communities. This study aims to fill the gap by investigating the adoption of professional knowledge by the hospitality industry during the COVID-19 pandemic. Employing a sample of 285 members, this study found that self- and socially regulated learning affects knowledge adoption outcomes. In addition, technological innovation and benefits affect self- and socially regulated learning. These findings allow us to provide theoretical and practical implications.

Keywords: hospitality industry; virtual community; knowledge post-adoption behaviors; self and social regulated learning factor; benefit and innovation factor

1. Introduction

The popularity of the internet has driven the rise of social media, which has in turn triggered a dramatic evolution of communities and technological devices [1]. In this regard, social media models that allow for knowledge management include traditional messaging platforms and virtual communities (VC). The result has been an expansion of online communities for industry knowledge, with an increase in the number of restaurants that interact and share ideas via VC. The characteristics of VC have enabled the expansion of merchandising through members and partnerships among stores. To add to these developments, VC also act as small entrepreneurial accelerators. Thus, restaurant owners can establish VC environments through social interactions and can exchange product knowledge via unrestricted geographical boundaries or differences in time zones, cultures, languages, or other factors [2]. To develop an outsourced community for entrepreneurship, communities can use the hospitality industry model to seek assistance through supply chains and business knowledge. In this study, we investigated a virtual entrepreneurial hospitality community that shared professional information. We explored whether, and for what reasons, its users were satisfied with the business information they gathered from this VC [3].

VC have replaced traditional websites in terms of sharing information, as the rate of communication and interaction on social media is high. Discussion and co-buying groups are expanding the models of e-commerce and commodity attributes. A seller's discussion group provides information on suppliers, customers, industry developments, supply chains, and regulations [4]. Members in VC provide relevant information, and their relationships grow into a mutually beneficial model. In such a community, concepts of hospitality



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Copyright: © 2022 by the authors. Licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC BY) license (https:// creativecommons.org/licenses/by/ 4.0/). entrepreneurship come from mutual support from sellers, such as the interworking of a small business accelerator. The use of VC for knowledge exchange is a common part of everyday life. However, the collaboration of business communities and the patterns and perceptions of knowledge applications among community members are changing [5].

Traditional entrepreneurs usually learn from past work experiences and failures when preparing to establish a new business [6,7]. The professional community is dynamic and fast-moving, and there is enough shared information for its members to find solutions or delegate problems to their peers. In this study, we used the knowledge community of the hospitality industry as a perfector in the technological and innovation factors [8,9]. In the socially regulated factor, the member satisfaction rate for the hospitality industry indicates whether community users are satisfied with the delivery of commissioned information. When community member share common goals and needs, they can search for suitable knowledge solutions targets through joint exploration and interaction. They can exchange suggestions with peers to identify appropriate members to put their visions into practice [10]. Entrepreneurs may turn to physical communities, business accelerators, or VC to acquire knowledge or pose questions for help based on their work needs [11]. If a professional community is influenced by the evaluation of benefits and innovation, exchanges of opportunities for cooperation and alliances in the hospitality industry can lead to new business models or products. Turning knowledge into practice and feeling satisfied with the output of a professional hospitality knowledge community are necessary for behaviors to be adopted.

Hospitality models are changing rapidly due to advances in knowledge and technology. Hence, the hospitality model of entrepreneurship can be easily replicated, as it has a short technology cycle. Members in VC can identify the skills, abilities, and self-regulate and socially regulate their learning among their peers. This learning relationship is set within professional hospitality communities [1,12,13]. Each community provides members with the opportunity to present their needs and skills to each other. Through consultation or professional resources, members in VC to meet the technical and capacity needs of the industry.

During the ongoing COVID-19 pandemic, the hospitality industry has experienced a dramatic increase in knowledge adoption through VC. In this study, we explored how members in VC learn about socially regulated factors and how society influences their satisfaction with hospitality knowledge and behaviors. Using the technology factor and a creative atmosphere to investigate the innovation and benefits of mass engagement, we explored the satisfaction rate and the number of engagement behaviors that member in VCs adopt after mass engagement. Member of the hospitality industry use professional knowledge to seek support and mutual knowledge as a form of professional consultation [12,14].

Moreover, VCs enable firms to obtain information, and connect and maintain relationships, especially with like-minded individuals [15]. VCs facilitate and enable entrepreneurs to have growth through social learning processes compared to the face-to-face medium [16]. The rise of the internet and the incessant demand to interact via online platforms has increased the power of consumers [17–19]. Consumer demands have triggered the development of online communities where VC members share, interact and exchange and co-create ideas, and have equally deepened the relationship with consumers [20]. During the COVID-19 pandemic, researchers have delved into the antecedents, importance, and consequences of VC in order to understand the mechanisms that drive them in this turbulent business environment. Employing the cognitive appraisal theory, Claffey and Brady [21] found that cognitive appraisal affects consumers' affective commitment to the firm and the virtual community. In other words, cognitive appraisal assumes that a person's behavior, which is driven by emotional intensity, underpins consumers' involvement and participation [21,22].

It is important to underscore that fewer studies have been done on members' satisfaction with VC. Claffey and Brady [21] maintained that consumers' satisfaction with a virtual community triggers their participation and involvement in it. They also indicated the significant identification of consumers with virtual communities. Notwithstanding the useful insights uncovered by this study, there is a lacuna on what drives virtual community members' satisfaction and benefits in the context of hospitality industries during the COVID-19 pandemic. Hence, employing technology factors and a creative atmosphere, this study is guided by the following objectives:

- 1. To investigate how regulatory learning (self-regulated and socially regulated) affects VC members' adoption behavior.
- 2. To ascertain how the knowledge co-creation of benefits and innovation factors affects VC members' normative behavior (self-regulated and socially regulated learning).

This study is timely and critical as it provides both theoretical and practical implications for the study of VC. It has revealed the knowledge adoption gap situated in the hospitality professional community.

2. Literature Review and Hypothesis Development

2.1. Satisfaction with Knowledge Co-Creation

Knowledge and technology solutions can help hospitality community members improve their consulting strategies and make business model adjustments to enhance their technical capabilities and market responsiveness. Enough knowledge and information are shared to enable entrepreneurs to make decisions based on consultations within their budgets [23]. VC members' satisfaction with the knowledge and technology provided in the community becomes apparent in their behavior after adoption. The content of the messages during the consultation and the status of the consultation output after adoption impact VC members' satisfaction with the knowledge in a community [24]. According to Chou and Hung [18], the post-adoption phenomenon has the tendency to discourage e-community members from switching and maintaining long-term relationships. However, the hospitality expert community has many types of relevant consultation and ways of solution information. Members in VC can seek knowledge and skills that suit them and industry trends. If they cannot produce something themselves, they can develop it in the community, which is similar to building a new product.

In this study, we sought support from members of the hospitality industry community. They have the same experience with, or technologies for, developing new products. They may require the knowledge support of a professional display shop or the regulatory support of a related business. They may need to find the right vendor, consult with an editor, fix a function on a new technology platform, or understand a relevant issue [22]. The issues raised in hospitality knowledge communities are the same as those raised in knowledge management communities [9,23]. Small issues can be shared and resolved, or more involved approaches can be sought through consultation and contracts. The knowledge, skills, and information of members in VC provide solutions and determine the level of VC satisfaction.

As an online community transforms and grows, the number of its members seeking support and expertise increases, and competition in fast-moving markets becomes more intense. With limited resources, how can businesses acquire the right support through the community? The professional community can provide timely, useful solutions or outsource trade between members. By communicating needs, members' ideas can be quickly addressed, and useful suggestions shared. These factors affect the satisfaction of hospitality industry members in the community [25].

The satisfaction of VC members positively affects users' adoption behaviors [5]. The perception of an event, as represented by the level of satisfaction, is key to evaluating the decision of community members to delegate or adopt knowledge and technology. Satisfaction with experiences of interacting with the community about technology and knowledge is an essential reference point in making consultation decisions [26]. VC members' increased satisfaction with the knowledge and technical content shared in a community leads to proactive post-adoption behaviors, including responses and interactions. Based on the aforementioned literature, these hypotheses are developed:

Hypothesis 1. *Hospitality VC members' self-regulated learning positively affects the satisfaction of the community following the adoption of co-creation knowledge.*

Hypothesis 2. *Hospitality VC members' socially regulated learning positively affects the satisfaction of the community following the adoption of co-creation knowledge.*

2.2. Self-Regulated Learning

"Self-regulated learning" refers to a process in social cognitive theory through which people understand their deficiencies by acquiring, enhancing, or correcting their technical and professional skills [27,28]. Self-regulated learning, therefore, involves a complex process that includes behavioral and psychological changes [29]. People effectively practice and consciously adjust their behavior and pursuit of personal goals [30,31]. In a hospitality industry community, the exchange of information among members raises individuals' awareness of the knowledge and skills they lack. Members' self-evaluate the effectiveness of their knowledge acquisition and skill development through self-regulated learning [31,32]. They learn independently or seek support from outside groups and delegate skills from the process to their thought practice through consultative learning [33]. Member in VC who have a high degree of self-regulated learning can study independently or off-site, depending on their objectives. Highly self-regulated member in VC actively respond to new information in the hospitality industry community and initiate discussions to assimilate the knowledge with their own. When they encounter obstacles, they are proactive in finding solutions. They also establish a procedure for the self-assessment of the need for consultative learning, and thereby determine whether consultation is needed on important items and judge the output benefits [33].

In a hospitality industry community, when a member releases new technology and knowledge, self-regulated learners take the initiative in absorbing and discussing the information. Hospitality members in VC with a high degree of self-regulated learning plan their learning objectives according to the attributes of the knowledge community. These types of members take the initiative in understanding the founding owners of hospitality businesses [34]. They consult them to absorb their information. When faced with similar knowledge and technical consultation needs, they consult others in the professional community. The practical operationalization and validation of the results and the internalization of their knowledge and skills factor into future consultative projects.

2.3. Socially Regulated Learning

The most significant differences between virtual and physical communities lie in the interactions between members and influences within the communities. Hospitality VC members' self-regulated learning helps individuals solve problems and overcome obstacles through discussion. The fixed topics and professionalism of a community allow members in a VC to be influenced by social regulations shaped by the community as they work together on entrepreneurial issues in the hospitality industry. Co-learning involves active participation in cognitive restructuring [35,36]. The interactions between community members deepen the exploration of expertise. The professional atmosphere of the hospitality industry community regulates the professional skills and knowledge demanded by members in a VC through social groups [37].

Training for knowledge or skill transfer happens within an organization. Usually, the members of an organization come from different departments and do not know each other. "Socially regulated learning" refers to individuals' learning from each other in groups to accelerate the acquisition of skills and knowledge during training [33]. Virtual communities are less likely to trigger socially regulated learning than physical organizations are; they need to shape the professionalism and specificity of the community. The hospitality industry community that we selected for this study was purposeful in its skill and knowledge learning [38].

People join such a community to gain work-related knowledge and skills or consult others to improve performance. Socially regulated learners require relatively little time to acquire skills and knowledge through exchanges with members in VC. Interactive learning reduces alienation. When socially regulated learners encounter a problem that they cannot solve, they delegate it to other members or discuss it with them. This arrangement reduces the cost, innovation, and uncertainty associated with starting a business. Hospitality professionals with higher levels of socially regulated learning behaviors absorb new knowledge and skills from other members in VC. Through the exchange of knowledge and skills, members in VC can learn on their own or delegate the acquisition of relevant skills and knowledge to other members. By applying socially regulated learning to professional communities in the hospitality industry, members in VC can learn about trends in the industry that may make entrepreneurs vulnerable to problems [38]. Other members can either propose relevant solutions or consult on the issue. Members in VC can also grow with advances in knowledge or technology, and socially regulated learning accelerates the acquisition of this information. We proposed the following hypotheses.

Hypothesis 3. *The benefits factor of hospitality members in VC positively affects members' selfregulated learning.*

Hypothesis 4. *The benefits factor of hospitality members in VC positively affects members' socially regulated learning.*

Hypothesis 5. The innovation factor of hospitality members in VC positively affects members' self-regulated learning.

Hypothesis 6. *The innovation factor of hospitality members in VC positively affects members' socially regulated learning.*

2.4. Benefits Factor

The benefits factor represents the potential innovation for entrepreneurs in facing the hospitality knowledge community and expanding the use of the hospitality industry [9]. In contrast to the traditional supply list, it involves a small number of innovative attempts. The potential advantage of bringing technological innovation through professional communities is that it increases the motivation for mutually beneficial collaboration among professional community members [39,40]. The uncertainty of adopting innovative concepts in the community is reduced when hospitality members in VC have more information, technology, or knowledge when seeking resources [3,41]. The more the members in VC know about their expertise and skills, the more likely they are to integrate resources. Understanding the feasibility of knowledge and technology and effectively consulting or contracting solutions demonstrate the strengths of the professional community [42,43]. Limited resources and technical conditions usually restrict entrepreneurship in the market. Through its professional community, the hospitality industry can generate solutions at lower costs. More collaborative benefits support innovative solutions that facilitate entrepreneurship in the market through technical support and services [39]. Individuals within social networking sites are, therefore, able to exchange information through virtual communities [44].

2.5. Innovation Factor

To enhance competitive advantages, organizations need to know how to innovate continuously [7,45]. Starting a business usually happens on a small scale, making the business model relatively easy to replicate. Thus, there is more competitive pressure in this market. Innovation is the best solution for maintaining production capacity with limited resources. Technology offers a competitive tool for creating new products, business models, and services [46]. The innovation within the hospitality community represents the

inventiveness of hospitality members in VC in promoting the market. Allowing community members to interact with an innovation and adopt new approaches to problems enables communities to bring their expertise and skills to the market. When members support the innovation in the hospitality community, they increase the rate at which individuals in the community seek out others for problem-solving and technical or knowledge consultation [47,48]. Innovations are encouraged in professional communities that depend on different types of ideas.

The knowledge generated among hospitality members in VC comes from different cultural backgrounds and goes beyond the provision of original equipment manufacturers or buying solutions [46]. The composition of the community is influenced by the encouragement of innovation, where members in VC are willing to experiment and use innovation to solve problems with new skills and knowledge [7,49]. Promoting the exchange of ideas within the professional community of the hospitality industry increases the opportunities available for community members to interact with and help each other. Alternatively, when problems are encountered with an innovation, consulting with other members to discuss new approaches can facilitate the exchange of expertise [8,50]. In a hospitality knowledge community, members absorb and convert knowledge by exchanging information with each other. When interacting with other members, they learn about and explore innovations and revise industry knowledge and technology [18]. The problems and solutions raised by members of the hospitality knowledge community can include combinations of ideas from different fields, leading to breakthroughs.

2.6. COVID-19 Pandemic's Impact on the Hospitality Industry

Studies conducted by Chung and Choi [34] and Tuaycharoen [51] say that the impact of crises (diseases) on hospitality and tourism has received great academic attention. In particular, emphasis has been placed on the economic impacts, labor-related issues and learning [13,51]. It is important to underscore that apart from the COVID-19 pandemic, similar infectious diseases have been experienced. Notable among these are severe acute respiratory syndrome (SARS), the H1NI influenza, Ebola, and the Middle East respiratory syndrome.

The COVID-19 pandemic has had serious ramifications on the hospitality and tourism industries. In their studies of the impact of COVID-19 on the hospitality market, Huang, Makridis [13] underscored that business closures attributed to the COVID-19 pandemic led to significant declines in employment and affected the operations of small businesses operating in the hospitality industry. Equally, the COVID-19 pandemic has heightened innovation and health awareness at the individual level in the hospitality industry [52]. Members in the hospitality industry are motivated to comply with the COVID-19 protocols and this has changed their perceptions and safety procedures during the pandemic. In addition, Kaushal and Srivastava [14] contended that the surest way to revive and sustain the hospitality sector during the COVID-19 era is to practice the multiskilling and professional development of members, follow hygienic practices, ensure better crisis preparedness, among others.

The COVID-19 pandemic has impacted hospitality's digital transformation and has triggered VC knowledge adoption behavior. In their study of virtual community engagement in the COVID-19 era, Tajvidi and Tajvidi [6] argued that cyber entrepreneurship has become eminent during the COVID-19 era to provide entrepreneurs with community engagement to ensure the survival of their businesses. The advent of the COVID-19 pandemic has triggered the need for entrepreneurs within the hospitality industry to rely enormously on technological advancements. Therefore, cyber entrepreneurship enables business owners to obtain relevant information on marketing, understand consumers' perception, and develop innovative strategies for products through virtual communities. In a related study, Gursoy and Chi [12] underscored the relevance of technology and its adoption into hospitality operations to sustain and revive the industry during COVID-19. This has resuscitated the use of artificial intelligence and social service robot technologies during the pandemic

as public safety issues have become critical. It is not surprising that technology has become indispensable for business strategy during and post-COVID-19 [8,12,53]. The COVID-19 pandemic has conscientized the need for innovative technologies and business models (for example, virtual offices) to ensure sustainable development [8,54]. Nonetheless, these studies by Gretzel, Fuchs [53], Gursoy and Chi [12] and Tajvidi and Tajvidi [6] provided the need for technology to sustain and make the tourism and hospitality industry resilient during the COVID-19 pandemic, but they did not address how the extent of regulatory learning in VC is affecting behavioral adoption during the COVID-19 pandemic.

3. Materials and Methods Results

This study used the innovative technology factor from cognitive theory to analyze how members of the hospitality industry community socially and self-regulate their learning through benefits and innovation factors. The increasing satisfaction of hospitality industry members with the skills and knowledge generated by the community is indicated by selfregulated learning and socially regulated learning. Hence, Table 1 shows that all reference sources of all variables in this study. The extent of hospitality VC member use of the knowledge and information received from the VC is another indication of satisfaction level. The main purpose was to propose the concept of VC-based entrepreneurial knowledge and skills as the basis for meeting the needs of the hospitality knowledge community. This study developed an innovative technology factor of dually regulated learning and adoption behavior outputs. We treated VC member use of post-enterprise professional community knowledge and skills in building behaviors in the hospitality industry as a measure. We sought to understand whether learning through social regulation or self-regulation changes the adoption behavior of a professional community. Uncertainty over peers' knowledge and skills in delegating issues may lead to failure in the hospitality industry, based on low satisfaction and post-adoption behavior. Figure 1 shows our research factor, based on the literature review and hypothesis development.

Structural Surface	Definition	References
Satisfaction with knowledge co-creation	Message satisfaction contributed by members of the hospitality industry.	Kaushal and Srivastava [14] and Zhao, Lu [25]
Self-regulated learning by members in VC	The members of the hospitality industry are autonomous in learning the knowledge and problem solving of newly delegated content.	Wan, Compeau [33]
Socially regulated learning by members in VC	The group's outsourced members learn and absorb new information through cooperation and help from others.	Wan, Compeau [33]
Benefits factor	Access to information in the hospitality community is fast and helpful.	Chih, Hsu [55] and Mishra and Agarwal [39]
Innovation factor	Within the hospitality community, innovative ideas or concepts are proposed to solve problems and barriers.	Durcikova, Fadel [46]

Table 1. Summary of reference sources of all variables in this study.



Benefit-Innovation Frames -----> Dual Regulated Learning -----> Knowledge Adoption Outcome

Figure 1. Research model.

3.1. Data Collection

Data were collected from VCs social media platforms which included Facebook, line and online forums. The study obtained data using the purposive sampling technique. In other words, respondents were selected based on our judgment and their suitability to address the research questions posed. Hence, Table 2 shows that all questionaries item of the study. As argued by Altinay, Paraskevas [56], purposive sampling becomes necessary when a group of people are deemed more appropriate for a study than others. The questionnaires were administered online to members in VC to elicit information on their regulatory learning and how it affects their behavior and how innovation and technology factors influence the normative behavior of community members.

Table 2. Summary of questionaries in this study.

Item		Construct/ Reference Source
KOS1.	I feel satisfied with my recent experience using co-creation knowledge in the virtual communities.	
KOS2.	Adopted co-creation knowledge in the virtual communities provides exactly what I need in my recent experience.	Adopted Co-Creation Knowledge's
KOS3.	I have had a positive recent experience with using co-creation knowledge in the virtual communities.	Satisfaction/ Zhao, Lu [25]
KOS4.	I am satisfied with my decision to use co-creation knowledge in the virtual communities.	
SEL1.	I will "self-evaluate" and "co-create the quality of knowledge" in the virtual communities.	
SEL2.	I will "reorganize and absorb" the knowledge I have "gained" in the virtual communities.	Self-regulated learning/
SEL3.	I will "read and re-create" the "new information" in the virtual community	Wan, Compeau [33]
SEL4.	I will "analyze and evaluate" the "impact" of the knowledge that I "provide" in the virtual community.	

 Table 2. Cont.

Item		Construct/ Reference Source
SOL1.	I will seek help from members of the virtual community to "get knowledge".	
SOL2.	I will seek help from "experts in the virtual community" to "solve problems".	learning/ Wan, Compeau [33]
SOL3.	I often discuss issues with members of the virtual community.	
SOL4.	I often engage in knowledge co-creation with members of my virtual community.	
BF1.	I think it is helpful to search for knowledge and co-creation through social networking.	
BF2.	I think that through the virtual community, "useful knowledge" can be obtained "more quickly".	Benefits factor/ Mishra and Agarwal
BF3.	I think the knowledge I "get" through social networking is "very helpful" for me to learn.	[39]
BF4.	I think it is "convenient" to "get different knowledge" through the community.	
IF1.	I think that "innovative ideas" in the virtual community will be "affirmed by everyone".	
IF2.	I think there are often members of the virtual community who "publish innovative ideas".	Innovation factor/ Durcikova_Fadel [46]
IF3.	I feel that members of the virtual community will "propose" new ways to effectively solve mistakes.	
IF4.	I think members of the virtual community discuss with each other and generate new ideas.	

A sample size of 285 members from a community of hospitality industry. Respondents were drawn from the hospitality-related group including information and communication (F&B and hotel information systems providers), government agencies (F&B, hotel, and hospitality-related for-profit and non-profit organizations), manufacturing and retail services (F&B, and hotel materials providers), and hospitality industry supervisors. Structural equation modeling was used to explain the causal relationship between the potential variables. Table 3 summarizes the demographic information of respondents.

Table 3. Basic information of the sample (sample size: 285).

Variables	Type of Information	Sample Size	Percentage (%)
Conden	Male	124	43.5%
Gender	Female	161	56.5%
	Below 25 years old	120	42.1%
	25~30 years old	119	41.8%
Age	31~35 years old	39	13.7%
	35~40 years old	5	1.8%
	Above 40 years old	2	0.7%

Variables	Type of Information	Sample Size	Percentage (%)
	High school	9	3.2%
F1 (* 11 1	Colleges and universities	227	79.6%
Educational level	Master's degree	45	15.8%
	Doctoral degree	4	1.4%
	Facebook Group	117	41.1%
Social media platforms	Line Group	91	32.1%
	Business Online forum	77	27.2%
Experience with the	1 to 3 years	139	48.7%
hospitality knowledge	3 to 5 years	111	39%
community	5 to 10 years	35	12.4%

Table 3. Cont.

3.2. Measurement Model

To validate the measurement model, the reliability, convergent validity, and discriminant validity were assessed. The results in Table 4 show that the factor loadings of all the items exceeded 0.5 [57] and were significant. The results in Table 5 show rho_A, composite reliability, and Cronbach's alpha to assess the reliability of the internal consistency. In this research, the rho_A were between 0.856 and 0.905, composite reliabilities were between 0.901 and 0.932, and all the Cronbach's alpha values fell between 0.854 and 0.903. Convergent validity was assessed using the AVE for each construct. The AVE value of each construct exceeded 0.5, which indicated that the construct explained at least 50% of the variance of its items [58]. To evaluate the discriminant validity, the Fornell–Larcker ratio of correlation was examined. As shown in Table 6, a construct's correlations with other constructs were all smaller than the square root of the construct's AVE [59–61]. Therefore, the results confirmed the model's discriminant validity.

Construct	Subject	Loading	t-Value	S.D	Skewness	Kurtosis
	KOS1	0.888	52.577	0.017	-0.73	0.91
Satisfaction with adopted	KOS2	0.870	42.452	0.020	-0.55	0.73
knowledge co-creation (KOS)	KOS3	0.911	68.882	0.013	-0.42	-0.13
	KOS4	0.850	39.304	0.022	-0.45	-0.10
Self-regulated learning (SEL)	SEL1	0.832	34.032	0.024	-0.73	0.21
	SEL2	0.861	45.313	0.019	-0.53	-0.11
	SEL3	0.835	40.551	0.021	-0.32	-0.39
	SEL4	0.806	32.262	0.025	-0.35	-0.13
	SOL1	0.875	39.828	0.022	-0.48	-0.22
Conicil recordstand loarning (COI)	SOL2	0.869	38.210	0.023	-0.55	-0.23
Social-regulated learning (SOL)	SOL3	0.881	33.736	0.026	-0.06	-0.80
	SOL4	0.856	27.741	0.031	0.11	-0.80

Table 4. Weights and loading of measures (sample size: 285).

Construct	Subject	Loading	t-Value	S.D	Skewness	Kurtosis
	BF1	0.883	57.240	0.015	-0.53	0.24
	BF2	0.889	55.246	0.016	-0.78	0.65
Benefits factor (BF)	BF3	0.860	40.999	0.021	-0.49	0.03
	BF4	0.839	33.877	0.025	-0.54	-0.03
	IF1	0.835	40.269	0.021	-0.22	0.03
Lange (Lange (Lange (IF))	IF2	0.876	57.726	0.015	-0.26	-0.10
Innovation factor (IF)	IF3	0.858	31.036	0.028	-0.17	-0.04
	IF4	0.819	29.909	0.027	-0.37	0.04

Table 4. Cont.

Table 5. Results of reliabilities and AVE (sample size: 285).

Construct	Cronbach's α	rho_A	Composite Reliability	AVE
Satisfaction with knowledge co-creation	0.903	0.905	0.932	0.774
Self-regulated learning	0.854	0.856	0.901	0.695
Social-regulated learning	0.894	0.896	0.926	0.759
Benefits factor	0.891	0.898	0.924	0.753
Innovation factor	0.869	0.869	0.911	0.718

Table 6. Correlation among constructs and the square root of the AVE.

Construct	KOS	SEL	SOL	BF	IF
Satisfaction with knowledge co-creation	0.880				
Self-regulated learning	0.553	0.834			
Social-regulated learning	0.261	0.259	0.871		
Benefits factor	0.690	0.622	0.349	0.868	
Innovation factor	0.466	0.434	0.513	0.576	0.847

Note 1: The value of the diagonal represents the square root of the average variance extraction; Note 2: The non-diagonal values represent the correlation values of the variables (correlation).

3.3. Structural Model Analysis

The theoretical model was constructed by verifying the relationships between the independent variables in the model and the settings between the variables. The causal analysis and model construction of the relationship among the variables were used to determine whether the model holds [62]. The purpose of the structural model analysis was to present cause-and-effect relationships. The study examined the impact of the output of knowledge adoption (expertise satisfaction, post-adoption behaviors) and the innovative technology factor (benefits factor and innovation factor) on dually regulated learning (VC members' self-regulated and socially regulated learning) and analyzed the direct effects of each of the constructs. We verified the findings with SmartPLS statistical software. The main measurements were the β value and the R² value. The β value is a measure of the correlation between the independent and dependent variables, and the R² value is the explained power of the variables (see Figure 2). The results of the structural model analysis were used to verify the causal relationships between the variables. We conducted a main effects analysis of the structural model using the relevant variables as the benchmark. See Table 7.

Benefit-Innovation Frames ------> Dual Regulated Learning ------> Knowledge Adoption Outcome



Figure 2. Structural model analysis results graph (sample size: 285). Note: * p < 0.05 = t > 1.96; *** p < 0.001 = t > 3.29; *n.s.* = non-significant.

Table 7. Results of hypothesis testing (n = 285).

	Hypothesis	β-Value	t-Value	Result
H1	Self-regulated learning \rightarrow Satisfaction with knowledge co-creation	0.520 ***	7.519	Support
H2	Social-regulated learning \rightarrow Satisfaction with knowledge co-creation	0.126 *	2.462	Support
H3	Benefits factor \rightarrow Self-regulated learning	0.556 ***	8.893	Support
H4	Benefits factor \rightarrow Social-regulated learning	0.081 ^{n.s.}	1.173	Non-Support
H5	Innovation factor \rightarrow Self-regulated learning	0.113 ^{n.s.}	1.878	Non-Support
H6	Innovation factor \rightarrow Social-regulated learning	0.467 ***	7.135	Support

Note: * *p* < 0.05 = t > 1.96; ** *p* < 0.01 = t > 2.58; *** *p* < 0.001 = t > 3.29; *n.s.* = non-significant.

3.4. Analysis of Mediation

Since the Table 7 shows the result of hypothesis testing, found the H4 and H5 to be nonsupporting the hypothesis, we proposed to test the mediation effect of this research model, as shown in Table 8 which suggests that the confirmation mediates the effect of the benefits factor and the innovation factor with the dual-regulated learning model (social-regulated learning and self-regulated learning) on the satisfaction with knowledge co-creation in hospitality virtual communities. To elucidate the mediation effect, we followed the formal mediation test proposed by Zhao, Lynch Jr [63] and Shiau, Yuan [64]. As shown in Table 8, first, the indirect effect of the benefits factor and self-regulated learning on knowledge satisfaction (axb) is significant ($\beta = 0.290^{***}$, t = 5.407). Second, the direct effect of the benefits factor on the satisfaction with knowledge co-creation (c) is significant ($\beta = 0.525$ ***, t = 6.781). Third, the direct effect and indirect effect operate in the same direction (axbxc is positive), and the result supported the partially mediated effect. Therefore, complementary partial mediation was confirmed. Similarly, the indirect effect of the innovation factor and social-regulated learning on knowledge satisfaction (axb) is significant ($\beta = 0.059$ *, t = 2.001), and the direct effect of the innovation factor on knowledge satisfaction (c) is non-significant ($\beta = 0.090$, t = 1.574, (N.S.)). As with the analysis above, the direct effect and indirect effect operate in the difference direction, and the effect of the innovation factor and social-regulated learning on knowledge satisfaction (axbxc) is fully mediated by confirmation.

	Effect	Std. β	t-Value	Result
Direct effects	Benefits factor \rightarrow Satisfaction with knowledge co-creation	0.525 ***	6.781	Support
	Innovation factor \rightarrow Satisfaction with knowledge co-creation	0.090 ^{n.s.}	1.574	Non- Support
Indirect effects	Benefits factor \rightarrow Social-regulated learning \rightarrow Satisfaction with knowledge co-creation	0.010 ^{n.s.}	0.847	Non- Support
	Innovation factor \rightarrow Self-regulated learning \rightarrow Satisfaction with knowledge co-creation	0.059 ^{n.s.}	1.792	Non- Support
	Benefits factor \rightarrow Self-regulated learning \rightarrow Satisfaction with knowledge co-creation	0.290 ***	5.407	Support
	Innovation factor \rightarrow Social-regulated learning \rightarrow Satisfaction with knowledge co-creation	0.059 *	2.001	Support

Table 8. Structural model assessment for direct and indirect effects (n = 285).

Note: * *p* < 0.05 = t > 1.96; *** *p* < 0.001 = t > 3.29; *n.s.* = non-significant

4. Discussion

We used the relevant variables in the main effects analysis of the structural model. The results are shown in Figure 2. The results of the relevant hypothesis testing indicate that VC members' satisfaction with the professional knowledge output in the hospitality professional community does not necessarily affect their authentic engagement behavior. Satisfaction with content does not indicate the application and sharing of knowledge or that one has the content one needs. Our results suggest that the self-regulated learning behavior of members in VC in the professional knowledge community ($\beta = 0.520$, t = 7.519 ***), supporting H1. Supporting H2, the results show that satisfaction with knowledge output comes from socially regulated learning among community members. Satisfaction with knowledge has the same significant demonstrative effect as self-regulated learning among members in VC. The path coefficient of self-regulated learning ($\beta = 0.520$, t = 7.519 ***) was much larger than that of socially regulated learning ($\beta = 0.126$, t = 2.462 *) on satisfaction with knowledge co-creation in terms of the starting point of the demand for expertise.

This is perhaps because studies (see example, Tajvidi and Tajvidi [6]) have shown that there is an eminent reliance on online platforms during the COVID-19 pandemic. Tajvidi and Tajvidi [6] argued that cyber entrepreneurship has become eminent during the COVID-19 era to provide entrepreneurs with community engagement to help their businesses survive. The advent of the COVID-19 pandemic has triggered the need for entrepreneurs within the hospitality industry to rely enormously on technological advancements.

Knowledge and information within the community are valid and can be adopted by most members. This trend increases the actual adoption behavior of members in VC more than the engagement behavior resulting from self-learning goals. The satisfaction with knowledge co-creation's R² explanatory power was 32.1% for satisfaction with knowledge output based on self- and socially regulated learning. The self-starting and socially normative starting points of dually regulated learning affect the content expectations and evaluations of the VC knowledge of hospitality, resulting in differences in the satisfaction with the path coefficients of post-adoption behaviors.

The results for the self-regulated learning of members in VC by the benefits factor of the innovative technology factor were $\beta = 0.556$, t = 8.893 ***, which supports H3. This shows that members of the VC are motivated to self-learn when the benefits of the knowledge acquired would have a phenomenal impact on their business. This is in consonance with Mishra and Agarwal [39] assertion that innovation solutions facilitate entrepreneurship in the market through technical support and services. However, the benefit driven cannot have an effect on the social-regulated learning. However, the results for the benefits factor

for VC members' social-regulated learning were $\beta = 0.081$, t = 1.173 (N.S.). These results are not significant, and thus do not support H4. The judgments and perceptions of benefits in the benefits factor are based on the VC members' assessment of their needs. Whether their professional knowledge impacts self-benefits make a difference to how they conduct their learning and present and meet their needs. It is equally important to note that, most entrepreneurs were eager and anxious to find new ways to sustain their businesses during the COVID-19 era based on their individual needs. George, Lakhani [54] underscored that the COVID-19 pandemic has conscientized the need for innovative technologies and business models (for example, virtual offices) to ensure sustainable development. The effect of the innovation factor on the self-regulated learning of community members was $\beta = 0.113$, t = 1.878 (*N.S.*). These results do not support H5. The assessment of the innovation factor's impacts, and the actions of community members' self-regulated learning is not a reason for member to increase their own concept of innovation. However, the social impact and the results for the effect of the innovation factor on socially regulated learning were $\beta = 0.467$, t = 7.135 ***. These results supported H6, indicating that social norms have an influence on the assessment of the innovation factor in the use of consultative innovation strategies that may require the assessment of acceptable innovation.

When members in VC are required to use knowledge and information adopted by a professional knowledge community, the innovation assessment of the content is mainly according to the VC members' own perceptions and control of the innovation, not the perceptions of the majority. The innovation factor is based on the members' assessment of the real situation that is socially related. A common perception of the expertise or trend of an innovative project will lead a group to identify and adopt the project together. The influence of the innovation on socially regulated learning by members in VCs is significantly stronger than the perception of socially regulated learning on innovation. From the structural model analysis (see Figure 2), the exogenous variable (benefit and innovation factors) could explain self-regulated learning ($R^2 = 39.5\%$) and socially regulated learning ($R^2 = 26.8\%$). This suggests that benefits and innovative factors have a greater impact on self-regulated learning than socially regulated learning.

The innovation and benefits to members in VC are higher when the members selfregulate than when they are socially regulated. Therefore, to adopt and implement knowledge, members in VC must first achieve the benefits of recognition and innovation management before producing and accepting expertise. Due to the nature of this virtual community, users from different disciplines and at different levels of the hospitality industry exchange relatively innovative ideas. The innovation is more effective for social learning than for self-regulated learning. The innovation depends on the power of the community and the assessment of the effectiveness and innovation management of members in VC. Evaluating whether shared expertise is being produced increases the satisfaction of members in VC with the knowledge post-adoption situation. Differences in satisfaction with knowledge adoption occur through the complementary effects of self-regulated and socially regulated learning. The impact coefficients and explanatory power of the model were very high. See Figure 2.

5. Implications

The findings of this study showed that there is a gap in the knowledge adoption output of the hospitality professional community (e.g., the difference in impact between self-regulation and social regulation). Using a dually regulated learning factor to increase the knowledge and technical stability and norms of the hospitality industry with the members in VC can improve the business behavior of the professional community and enhance the entrepreneurial expertise of the hospitality industry community [22,65]. It can enable member to decentralize their business models for consultation within the professional community. Members who participate in a hospitality community evaluate the innovation and benefits of the community in terms of its professionalism and consistency of

There is value in transforming knowledge and technology exchange through interactions between professional community members. Such members can gain business benefits through consultation and enhance their satisfaction and adoption through behavioral research. Knowledge and technology adoption models of professional communities can reduce the uncertainty of consultation and guide exchanges of business model knowledge and technology within professional communities [22]. Member in VC is used their professions to consult or contract toward mutually beneficial business model growth. However, VC members' decisions on whether to adopt knowledge happen in light of their individual ability to assess the related innovation and benefits. Therefore, in the dual model of regulated learning, there is a preference for individual self-determination. The benefits and convenience of VC expertise are recognized as a benefit to the hospitality industry.

The highly evaluated self-understanding of innovation and benefits affects the self-regulated learning behaviors of community members. In the research model, the innovation is similar to a group of socially influential individuals in the hospitality knowledge community. The atmosphere is generated by the abilities and orientation of those in the community. The innovation is likely to have a positive impact on socially regulated learning. Such results are related to the social exchange theory as seen in the relationship between the benefit/constraint binary factor of the self and community [23,24]. Individuals and groups evaluate the innovative technology factor. The results of the study are consistent with the theory.

Research Limitations

This study focused on the member of a knowledge-based hospitality VC. We did not survey every type of hospitality sub-industry, such as F&B (chain restaurants), tourism, dining, or travel. We could not evaluate and define the degree and level of importance of all types of expertise. Satisfaction in the hospitality community is based on the perceptions and knowledge of each group member. The scope of future research could be expanded to include these factors. Researchers could discuss the high-efficiency and high innovation professional knowledge communities associated with professional catering equipment, facilities, and systems. This study was limited by its use of the innovative technology factor, dually regulated learning, and community members' perceptions of themselves and society. Through the concept of social exchange theory, we explored the benefits and competitiveness of the dual model. This approach could be extended to other factors in the future, such as trust and forms of knowledge. Researchers should explore which factors are used in individual judgments and social influences to create trends in a dually normative learning model. They could also explore the continued adoption of behavioral theories and related external influences and theories by new and highly knowledge-rich professional communities.

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