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The Influence of Technology Support, Digital Literacy, Culture Intelligence, and Leadership on Virtual Collaboration in University Settings

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Abstract. Collaboration is a very important factor in doing a task. Due to the COVID-19 pandemic, face-to-face collaboration has turned into virtual collaboration, but its implementation has encountered many obstacles in the field. This study aims to examine the influence of factors that support virtual collaboration (VC), including technology support (DT), digital literacy (DL), cultural intelligence (CQ), and virtual leadership (VL), as antecedents of VC in the world of High Education. Respondents consisted of 216 universities with a total sample of 216 lecturers who were selected using the purposive sampling method. The research questionnaire was sent to the relevant email address using Google Form. The results showed that the four antecedent variables had a significant influence with the ability to explain 62.3% of the VC. Theoretically, the research has contributed in the form of a virtual collaboration model that has been empirically tested in the field. In addition, this model has expanded the factors that influence VC from several previous studies. Practically, the results of this research can be useful for university administrators who want to increase collaboration between their lecturers, especially in the fields of teaching, research and publications. In this context, the antecedent factors of this virtual collaboration model can be taken into consideration.

Keywords: culture intelligence, digital literacy, higher education sector, leadership, technology support, virtual collaboration; virtual team.

1. Introduction

Recently, teamwork has emerged as one of the most important facilitators of achieving positive and cost-effective outcomes in various organizational settings (Procter & Currie, 2004). Teamwork is very important for good output and good communication between staff in the company (Hersey et al., 2007). A team can be defined as a group of individuals who work collectively to achieve common goals and objectives to provide excellent service quality (Askari et al., 2020). Advances in ICT have provided opportunities for organizations to turn to virtual teams. Virtual teams enable companies to coordinate activities that span geographical, cultural, temporal and organizational boundaries Kedia and Mukherjee, 2009; Purvanova and Bono, 2009; Mesmer-Magnus et al., 2011).

Today the virtual team has become an important part of the organization (Zimmermann, 2011). Virtual teams have become part of the contemporary business environment, and are characterized by the use of information and communication technologies (ICTs), radical changes in organizational design, and the spread of a multicultural workforce (Gilson et al, 2014; Greenberg et al., 2007); the ability to react more agilely and flexibly to market demands (Algesheimer et al., 2011; Derosa et al., 2004, Gressgard, 2011); accessibility to various intellectual resources (Altschuller & Benbunan-Fich, 2010; Maznevski & Chudoba, 200); the involvement of various activities of large and strategic projects simultaneously and sequentially by team members in various geographical locations (Lee-Kelley & Sankey, 2008); and cost savings in travel activities and speed up the process (May & Carter, 2001). Currently, as a result of the impact of the coronavirus crisis, more than 80% of enterprises are turning to virtual forms and mixed virtual team collaboration (Meluso et al., 2020). Meanwhile, 62% of employees worldwide say they want to switch to a company that offers remote work (GitLab 2021).

Virtual teams have various definitions. Some definitions of virtual teams include virtual teams as work arrangements in which team members are geographically dispersed, have limited face-to-face contact, and work interdependently through the use of electronic communication media to achieve common goals (Dulebohn & Hoch, 2017); various activities and forms of teamwork that use information technology for communication and collaboration (Anderson et al., 2007; Shen et al., 2015); working groups whose members come from different geographical locations and/or organizations but are connected through computers and communication technology (Clear & MacDonell, 2011); a team of members from different organizations, time zones, geographic locations, and cultures who communicate using technology (Huang et al, 2010; Bhat et al., 2017); a team characterized by age and membership that is not fixed and partially dispersed, and the use of computer-based communication (Purvanova & Bono, 2009). Nevertheless, this article follows the definition of a virtual team as a group of individuals who work interdependently from different locations, share responsibility for team outcomes, and significantly rely on

technology to support their communications (Gibson & Cohen, 2003). Of such definitions, the most common dimensions are geographic dispersion and dependence on technology (Hanebuth, 2015; Shameem, 2022).

This study is designed to explore virtual teams in academic circles. The main issue to be explored is the effect of virtual collaboration and reward systems as moderating variables on virtual team performance in the context of an online learning environment in an academic setting. In this 21st century, students must be exposed to the experience of virtual collaboration and virtual teams. They must be able to communicate using ICT with people from different cultural and organizational backgrounds (Karpova, 2009). In addition, maintaining academic performance during the Covid-19 Pandemic situation requires a good understanding of the virtual team. Universities are required to be able to adapt and at the same time make a real contribution to society in dealing with the pandemic. Teachers or lecturers in many countries around the world are facing educational reform in their careers. The reform required them to improve the quality of their teaching through the implementation of various innovative teaching strategies. Besides, all learning activities must be done online (Wunong et al., 2020). In this environment, students can be anywhere to learn and interact with instructors and other students (Singh and Thurman, 2019). Collaborating is considered a viable approach to change the traditional teaching philosophy of teachers (Liu and Tsai, 2017). Universities in Indonesia are not much different from universities around the world. Pressure from the Ministry of Higher Education on higher education management has resulted in increasing challenges for academics (Alwaheeb et al., 2020). Globally, universities in the new millennium are facing more challenging problems. For example, in addition to academic work, academics are required to excel in undergraduate and postgraduate academic consulting or supervision, all of which must be done online. Team effectiveness is a development function of a climate of trust among virtual team members (Martin et al., 2018).

Most virtual team literature assumes that collaborative networks bring clear benefits to their members. However, despite these assumptions, some researchers point out the challenges that organizations face in implementing virtual teams, such as standardization of processes and virtual teamwork strategies (Lee, 2009; Carter et al., 2015); the role of technology in virtual team work environments (Clear & MacDonell, 2011; Bryant et al., 2009); communication problems in virtual teams (Rosen et al., 2007; Riopelle et al., 2003); appropriate organizational forms for virtual team operations (Bryant et al., 2009; Johnson et al.,2001); leadership challenge (Malhotra et al., 2007; Serrat, 2009; Mukherjee et al., 2012); physical, cultural, and temporal distribution (Martin et al., 2018); personal interactions of virtual teams and their supporters (Hill et al., 2014; Shu et al, 2011), criteria in analyzing and selecting collaborative partners in logistics (Correia-Alves and Rabelo, 2011), strategies of information sharing and collaboration on supply chain performance (Nazifa &

Ramachandran, 2019), and the quality of collaboration that facilitates the integration and exchange of knowledge, decision making, and resource sharing (Aws et al., 2021).

In contrast to co-located teams, virtual teams engage in a variety of collaborative activities, both formal and informal, using technologies such as video conferencing, for example Zoom (Inc ZC (2020), Whatsapp (whatsapp.com, 2021) and Microsoft Teams (2021), file transfer and app sharing (Correia-Alves and Rabelo, 2011). As a result, virtual team members often face obstacles in collaborating which make them less successful than co-located teams (Olson & Olson, 2000; Dub´e and Robey, 2009; Lipnack and Stamps, 1997).

Some researchers who have conducted research related to virtual collaboration are as follows (Gressgård, 2011) discussed how the use of ICT in team collaboration impacts the creation of shared understanding and knowledge development within teams, and how these factors are important for capability of organization's innovation. (Li and Skulason, 2013) examined how depth of relationship, trust, and shared understanding among team members feed the team's collaborative capabilities, based on a thorough literature review. It also examines the interrelationships between these factors.

(Godin et al., 2017) identified the factors that influence the use of electronic collaboration technology. The UTAUT model was modified for use in this study. The dependent variable for the model is User Intention to Use Collaborative Technology of the three independent variables in the model that are Performance Expectations, Effort Expectations, and Social Influence. This research differs from previous research in terms of the model used to see the factors that influence virtual collaboration. Some of the specific factors that are considered to influence virtual collaboration are technology supports, digital literacy, cultural intelligence and leadership.

The following sections of this paper are organized as follows: Section 2 discusses the literature and hypotheses development about virtual team collaboration and the four factors that affecting it. Section 3 will discuss the methodology used in this study. Section 4 shows the analysis and results. Section 5 discusses the results and discussion. Section 6 describes the theoretical implications. Section 7 shows the practical implications. Section 8 describes the limitations and directions of future research, while Section 9 provides conclusions and suggestions.

2. Literature Review and Hypothesis Development

2.1. Factors affecting VT collaboration

In their article to measure the degree of virtual team collaboration, Peters and Manz (2007) used three factors as antecedents for their virtual collaboration model, namely trust, shared understanding, and relationship depth. In this article, we take a different perspective from them by proposing factors, among others, technology support,

digital literacy, cultural intelligence, and virtual leadership as antecedents in researching virtual team collaboration. The following sections will describe these four factors in detail.

2.1.1. Technology supports

The current digital era makes almost all organizations utilize information and communication technology (ICT). Likewise with the role of ICT in virtual teams. Coordination and performance of virtual teams is highly dependent on the use of ICT. Team members use various ICT facilities to collaborate with each other. Managers are required to set strategies and utilize technology that supports trust, collaboration, and effective communication in virtual teams (Chang et al, 2011; Desper, 2013). Advances in ICT have enabled virtual team members to communicate important and inclusive information (Hu,2015; Laitinen and Valo, 2018). Inclusive communication that encourages teamwork and enhances social connections can only happen through the sharing of information that everyone can understand (Han et al., 2017).

In addition, ICT advances also provide various technological collaboration facilities, which support communication between virtual team members. There are various terms regarding collaboration technology, such as group decision support systems, electronic meeting systems, and groupware (Brown et al., 2010; Kapogiannis and Sherratt, 2018). With the various facilities offered by technology, managers need to set strategies and utilize technology that supports trust, collaboration, and effective communication in virtual teams (Chang et al., 2011; Desper, 2013; Walsh, 2019). Based on this explanation, the following hypothesis is proposed:

Hypotheses 1**:** Technology Support has an influence on Virtual Team Collaboration

2.1.2. Digital literacy

Communication is the core of every process in a virtual team (Powell, 2004). The virtual team structure should build on the team's ability to communicate and collaborate using technology (Driskell, et al., 2018; Bordia, 2017; Brown et al., 2010).

The use of multiple communication tools is an integral part of enabling virtual teams to communicate smoothly and effectively to support teamwork (Schulze and Krumm, 2016). Virtual environments pose challenges for effective communication due to several differences, such as the timing of receiving feedback, common terms of reference, and understanding (Mukherjee and Natrajan, 2017). These challenges require virtual team members to develop new approaches, and acquire new knowledge and skills. In other words, employees must develop their competence in digital literacy (Ligurgoet al., 2019; Almenara et al., 2021; Tomczyk, 2021.

(Gilster, 1997) was the first to introduce the concept of digital literacy, but did not provide a list of skills, competencies, or attitudes that define digital literacy.

Instead, he only describes it in general terms, as the ability to understand and apply information from various digital sources and regard it only as literacy in the digital age (Bawden, 2008). On the other hand, (Buckingham, 2015) defines digital literacy as a means of cultural understanding. According to him, digital literacy is more than just people who use computers and keyboards, or how to search online, but they must also be able to critically evaluate and apply information to become knowledge.

Digital technology will continue to influence virtual team collaboration; therefore, digital literacy is needed to support virtual team members using digital technology, consuming critically, but at the same time being producers of various content. The emphasis on digital literacy focuses on basic technology or computer literacy skills, a set of critical thinking and creative abilities, as well as critical engagement with identity, ethics, and citizenship in digital contexts (Alexander et al., 2016; Hague & Payton, 2011). Based on this explanation, the second hypothesis is proposed as follows:

Hypothesis 2: Digital Literacy has an influence on Virtual Team Collaboration.

2.1.3. Culture intelligence (CQ)

Thomas et al., (2008) defines cultural intelligence as an important cross-cultural competency that enables individuals to "adapt, choose, and shape the cultural aspects of their environment". CQ is very important in virtual team collaboration, where members come from different locations and different cultural backgrounds. Collaboration can be a very challenging process because it demands a very intense way of working, and requires new ways of thinking, behaving, and operating.

Several previous studies related to cultural intelligence and its relationship to virtual team collaboration, including research by (Ahmadi et al., 2013) who conducted a study investigating the relationship between managers' CQ and employee collaboration. The results showed a significant and positive relationship between CQ managers and their employee collaboration. (Li and Skulason, 2013) conducted a study to investigate the effects of CQ on the process of cross-cultural virtual collaboration. Their findings showed that individuals with higher CQ exhibit more positive reactions and responses. Based on this explanation, the third hypotheses can be proposed as follows:

Hypotheses 3: Cultural Intelligence has an influence on Virtual Team Maya Collaboration

2.1.4. Virtual leadership

Rapid technological advances have generated a new working paradigm. Collaborative work can be started anytime, and from anywhere (Cascio & Shurygailo, 2003). Technology has radically revolutionized the way people think, behave, work and get paid. This technology uses a global communications infrastructure and is

highly active, enabling 24-hour interaction between individuals, groups and organizations both synchronously and asynchronously (Lee, 2002).

In the current situation, the task of leadership becomes much more difficult when the team members of the led are in separate locations and only meet through virtual channels. In addition, understanding the leadership function in virtual teams is important as organizations increasingly use multiple teams (Liao, 2017). Managing conflicts in virtual teams becomes more difficult when only some members use remote communication while others do not. These different ways of communicating can result in different norms of interaction within the team and increase the gap between team members who physically separated (Cheshin et al., 2013).

Previous studies have shown that virtual team leaders have an influence on virtual collaboration and therefore also on virtual team performance (Gilson, 2015; Liao, 2017; Hill et al., 2014; Bell & Kozlowski, 2002; Malhotra et al., 2007; Martin et al., 2018). (Cheshin et al., 2013) demonstrated that different communication patterns can result in different norms of interaction within teams and widen the gap between team members who physically divided. (Han et al., 2017) provides five main barriers to the success of virtual teams, namely distrust, personality differences, generation gaps, scheduling problems, and technology. While (Sedrine et al., 2020) shows that leadership style affects cohesiveness and trust. Based on the discussion above, the fourth hypotheses can be proposed as follows:

Hypothesis 4: Virtual Team Leadership has an influence on Virtual Team Collaboration

2.2. Research model

Based on the theoretical review above, a hypothetical model can be constructed in this study as presented in Figure 1.

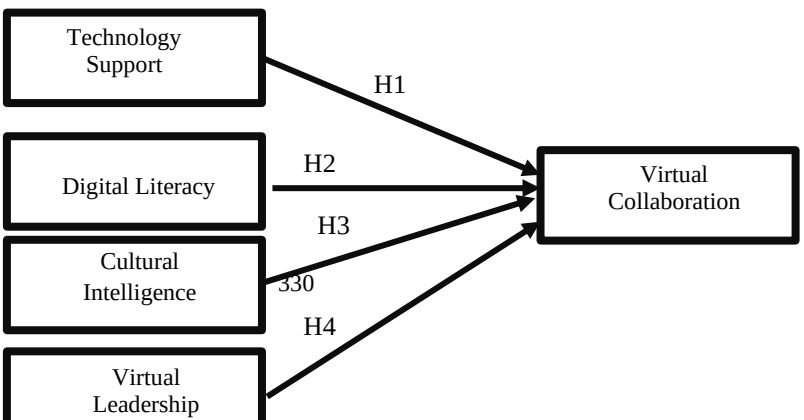

Fig. 1: Hypothesis model.

3. Research methods

This study adopted a quantitative approach to analyze the relationship between the independent variable and the dependent variable using a self-administered questionnaire. The analysis unit of this research is individuals who have experience working in teams. The respondents are lecturers at 15 universities in Central Java. The sample size is 216 lecturers who are experienced in virtual teams. The sampling technique used is a purposive sampling because the sample in this study has certain criteria. Dissemination of questionnaires using Google Forms through the Central Java Regional Management Lecturer Association.

All variable measurements were adapted from previous literature. Table 1 shows the Measurement Items in the Questionnaire. All variables were measured using a Likert five point scale to indicate the level of respondents' consensus (1 {Strongly Disagree to 5 {Strongly Agree). While the analysis for this research model uses the partial least squares-structural equation modelling method (PLSSEM).

4. Analysis and Results

This study uses PLS-SEM for data analysis, where the test uses a path model consisting of two parts, namely a measurement model or outer model that displays indicators and their relationship to the construct, and a structural model or inner model that contains constructs and paths of relationships between constructs. The structural model also represents the theoretical elements of the path model (Hair et al., 2014).

Table 1 Measurement Items in Questionnaire

Variables	Measurement Items	References
Technology Support (X1)	• The information system has been operated using the right computer specifications • *The Hardware* is up to date according to the times	(Venkatesh et al., 2003)

	• *The Hardware* used makes it easier to operate the information system • *The Software* of operational information system is easy to understand • *The Software* of operational information system is lightening the workload • Access to computer operations is limited only to lecturers who have received authorization from the leadership • The communication that has been established is going well • Communication networks support accelerates the operational information system Almost no communication network interruptions	
Digital Literacy(X2)	• Information content in the field simplify the work of team • Evaluation of content • Information that supports the virtual team performance • There are institutions that manage information data in virtual teams • Virtual team integration is affected by knowledge assembly • Collaboration between teams supported by Knowledge Assembly	(UNESCO, 2006) (Gilster, 1997)
Culture Intelligence (X3)	• Be aware of the cultural knowledge used when interacting with people from different cultural backgrounds. • Adapting cultural knowledge when interacting with people from unfamiliar cultures. • Understanding that cultural differences affect work behaviour • Respect the different characters in a team • Be aware of cultural knowledge applied in cross-cultural interactions.	(Brislin, 2006) (Earley & Peterson, 2004) (MacNab ,& Worthley, 2012)
Virtual Leadership (X4)	• Talk about the principles or values behind the decisions made. • Communicate in a way that inspires and motivates others. • It takes time to fully explain what he is thinking. • Experiment, innovate and take risks to find new or better ways. • Enlarge the support and assistance of others who have an interest in the vision. • Draw on values, interests, hopes and other dreams.	(Rowold, 2005)

	• Set an example by behaving in a consistent manner in accordance with the stated values. • Have a clear future image. • Have a desire to realize something. • Believe in the technical competence of other members	
Virtual Collaboration (Y)	• Believe in the motives and intentions of other members, in particular, trust in one's motivations • Tendency towards trust that influences an intention of person's trustworthiness, trust, and institutional-based trust (Mcknight et al., 1998) • Ability to work in a team • Ability to solve problems with appropriate solutions • Ability to work under pressure • Work based on data and facts • Do not manipulate data and facts	(Schrage, 1990) (Bititci et al., 2003)

The demographic data of respondents in this study are as follows; The number of respondents who took the research questionnaire was 216 people. Of this total sample, 60.6% are male & 39.4% are female. At the Education Level, 98.6% hold masters & 1.4% hold doctorates. This shows that the literacy level of the respondents is very high to understand & answer the questionnaire well. In terms of the academic ranking of the respondents in their organization, it was found that 91.2 were assistant professors, and 8.80% were Associate Professor. The composition of respondents indicates that they are dominated by assistant professors. However, in terms of tenors, 43.52% is 0 { 5 years, 25% is 6 { 10 years, 20.37% is 11-15 years, and 10.19% is > 21 years. This shows a fairly balanced distribution. A total of 56.48% of respondents have work experience of more than five years which shows support for the reliability of the information they provide.

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4.1. Measurement model (The Outer Model)

Confirmation factor analysis (CFA) was conducted to assess the construct reliability and validity of Tech Support, Digital Literacy, Culture Intelligence, Cyber Team Leadership, and Cyber Team Collaboration. Following (Hair et al., 2014), is test of the measurement model based on discriminant validity, convergent validity, indicator reliability, and composite reliability.

Table 2 shows the discriminant validity test. Discriminant validity relates to the principle that measures of different constructs should not be highly correlated. The discriminant validity test uses the cross-loading value of each indicator for each variable. In this study, the reference value used should be above 0.7 (Hair et al., 2014). The test results show that the cross loading indicator value of a construct is greater than the cross loading indicator value of a construct to another construct. Thus, it can be concluded that the discriminant validity for each variable has been met.

Convergent validity test aims to determine the validity of each relationship between indicators and their latent constructs or variables. Convergent validity test was carried out using the Average Variance Extract (AVE) method. The AVE value must exceed 0.50 to be sufficient for convergent validity (Bagozzi & Yi, 1988; Henseler et al., 2009; Hair et al., 2014). In Table 2, the AVE value for each variable is greater than 0.5. Because the Discriminant Validity test and the Convergent Validity test have been met, it can be concluded that this research model is valid.

Table 2: Discriminant validity based on cross loading value.

	TS	DL	CI	VTL	VTC		CA	CR	AVE
ci1	0.564	0.479	0.890	0.518	0.507	TS	0.928	**0.940**	**0.635**

ci2	0.551	0.497	0.899	0.520	0.565	DL	0.927	**0.945**	**0.773**
ci3	0.509	0.453	0.867	0.515	0.470	CI	0.931	**0.942**	**0.644**
ci4	0.584	0.510	0.869	0.579	0.581	VTL	0.901	**0.921**	**0.592**
ci5	0.598	0.500	0.871	0.588	0.602	VTC	0.867	**0.904**	**0.653**
dt1	0.759	0.682	0.510	0.669	0.579				
dt2	0.817	0.657	0.516	0.668	0.568				
dt3	0.806	0.650	0.498	0.709	0.538				
dt4	0.778	0.636	0.510	0.653	0.588				
dt5	0.797	0.665	0.493	0.699	0.568				
dt6	0.766	0.644	0.506	0.643	0.578				
dt7	0.821	0.718	0.513	0.713	0.681				
dt8	0.839	0.671	0.552	0.689	0.594				
dt9	0.786	0.631	0.499	0.682	0.565				
ld1	0.668	0.801	0.432	0.659	0.541				
ld2	0.642	0.802	0.446	0.630	0.563				
ld3	0.679	0.821	0.477	0.656	0.589				
ld4	0.710	0.799	0.431	0.663	0.595				
ld5	0.659	0.816	0.461	0.606	0.610				
vtc 1	0.610	0.569	0.434	0.596	0.752				
vtc 2	0.598	0.612	0.445	0.591	0.785				
vtc 3	0.536	0.528	0.472	0.548	0.772				
vtc 4	0.586	0.538	0.504	0.566	0.757				
vtc 5	0.561	0.531	0.472	0.543	0.784				
vtc 6	0.515	0.570	0.470	0.525	0.755				
vtc 7	0.543	0.516	0.508	0.500	0.773				
vtc 8	0.576	0.553	0.540	0.558	0.776				
vtl1	0.720	0.643	0.539	0.781	0.626				
vtl2	0.699	0.620	0.540	0.818	0.610				
vtl3	0.724	0.653	0.530	0.822	0.570				
vtl4	0.618	0.604	0.436	0.794	0.601				
vtl5	0.647	0.577	0.450	0.784	0.500				
vtl6	0.648	0.621	0.497	0.773	0.543				
vtl7	0.660	0.594	0.521	0.799	0.505				
vtl8	0.711	0.699	0.451	0.797	0.639				
vtl9	0.727	0.712	0.523	0.853	0.573				

Note: TS= Technology Support; DL=Digital Literacy; CI= Culture Intelligence; VTL = Virtual Team Leadership; VTC= Virtual Team Collaboration; CA= Cronbach Alpha; CR = Composite Reliability; AVE = Average Variance Extracted

The next test is a reliability test which aims to determine the extent to which the measuring instrument is reliable or trustworthy. A questionnaire is said to be reliable if a person's answers are consistent and stable from time to time. In this test, Cronbach Alpha and CR values above 0.7 were used (Hair et al., 2014; Esposito Vinzi, 2010). From Table 2, both the Cronbach Alpha and CR values are above 0.7. Because the results have met the Cronbach Alpha and composite reliability values, this study is declared reliable.

4.2. The structural model (Inner Model)

Figure 2 shows the results of the Structural Equation Model based on the Path Coefficient test. The path coefficient test results are shown in Table 2. Because for each independent variable of the significance value (p Values) is below 0.05, it can be concluded that each independent variable has a significant and positive effect on the dependent variable.

Table 3 shows the R-Square value of 0.623. This shows that the Technology Support, Digital Literacy, Culture Intelligence and Technology Virtual Team Leadership variables are able to predict Virtual Team Collaboration by 62.3%. While the rest is influenced by other factors.

Table 3: Value of R-square.

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values
VTC	0.623	0.631	0.042	14.976	0.000

5. Discussion

This study investigates the influence of Technology Support, Digital Literacy, Cultural Intelligence and Virtual Team Leadership on Virtual Team Collaboration. The results of the analysis provide support for the theoretical model and all hypothesized relationships.

H1 results confirm the positive and significant effect of technology support on virtual team collaboration. This finding shows that the better the technology support, the easier it is for virtual team collaboration. On the other hand, if technology support is low, virtual team collaboration will also be more difficult and less. These results are in accordance with the literature which states that collaboration in virtual teams is highly dependent on the use of ICT. Advances in ICT have greatly helped virtual team members communicate important and inclusive information (Hu, 2015; Laitinen

and Valo, 2018). In addition, information that is shared and understood by everyone can encourage teamwork (Han et al., 2017).

H2 results confirm the positive and significant effect of digital literacy on virtual team collaboration. This finding shows that the higher the digital literacy, the virtual team collaboration will increase. On the other hand, if digital literacy is low, virtual team collaboration will also be more difficult and decrease. This is understandable because digital technology has been used in various fields both at the office and at home. Advances in digital technology, such as ICT, have enabled the use of mobile devices, multimedia content, groupware, cloud computing, and big data technologies (Holtgrewe, 2014).

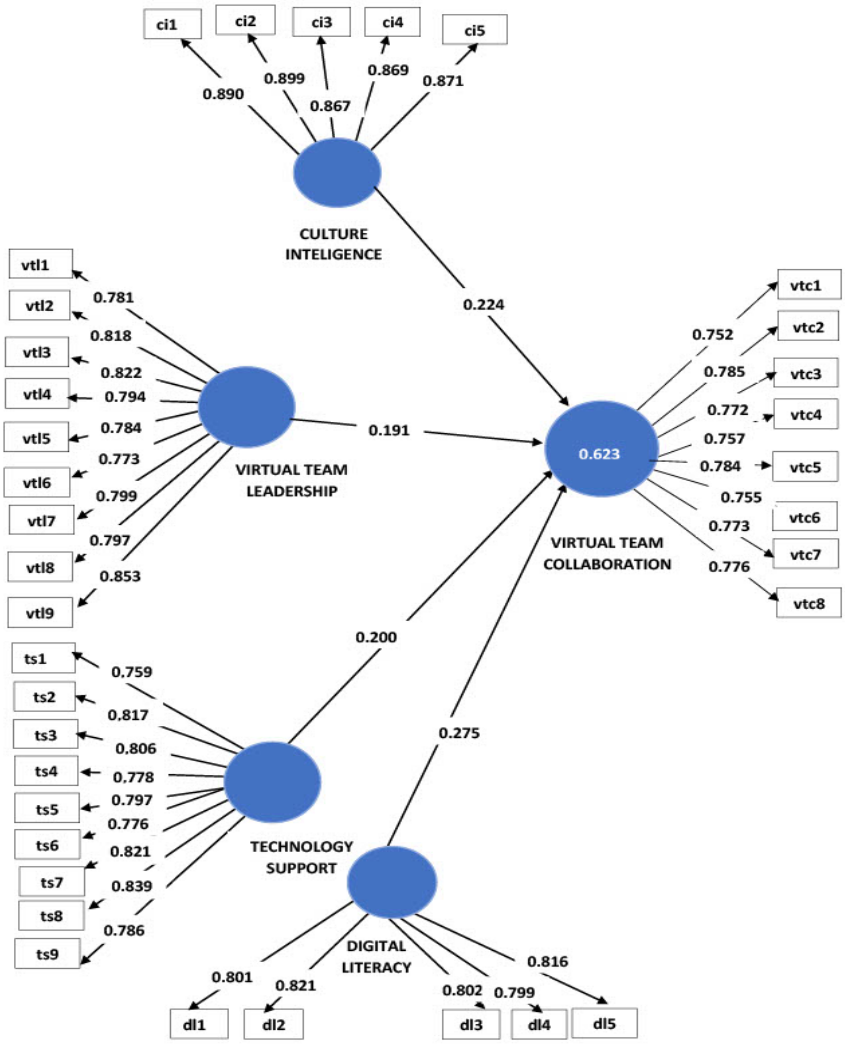

Fig. 2: Structural model as a result of testing the path coefficient.

H2 results confirm the positive and significant influence of culture intelligence on virtual team collaboration. These results indicate that the higher the cultural intelligence, the virtual teamwork will increase; on the other hand, if the cultural intelligence is lower, the virtual team collaboration will decrease. This finding supports previous research which states that cultural intelligence has a positive effect on virtual team collaboration (Li and Skulason, 2013; Ahmadi et al., 2013).

H2 results confirm the positive and significant influence of virtual team leadership on virtual team collaboration. These results show that the better the virtual team leadership, the better the virtual team collaboration. On the other hand, the weaker the virtual team leadership, the lower the virtual team collaboration. This finding supports several previous studies (Malhotra et al., 2007; Cheshin et al.,2013; Sedrine et al., 2020).

6. Conclusive Remarks

This study empirically examines the antecedents of the virtual team collaboration model. Theoretically, research has contributed in the form of a virtual collaboration model that has been empirically tested in the field. In addition, the research is different from previous research (Peters and Manz, 2007; Gressgård, 2011). This research has expanded on the antecedent factors influencing virtual team collaboration, including technology support, digital literacy, cultural intelligence, and virtual leadership as antecedents in researching virtual team collaboration.

Practically, the results of this research can be useful for university administrators who want to increase collaboration between their lecturers, especially in the fields of teaching, research and publications. Currently, universities in Indonesia are highly demanded to improve their performance, especially in the fields of teaching, research, and publications. This demand relies heavily on team collaboration. However, due to the COVID-19 pandemic, this collaboration cannot be done face-to-face, but relies heavily on virtual team collaboration. Therefore, the results of this study can be used as input for private universities to pay more attention to the four antecedent variables that support virtual team collaboration.

There are some weaknesses in the research. First, in filling out the questionnaire, this study used a Google form, because it was conducted during a pandemic. This method opens the possibility of questions that are not understood by the respondent, thus causing the filling to be inconsistent with the facts. Second, this research is limited to the field of education, so the conclusions cannot be generalized to a wider field.

Future research can add new variables, such as organizational support, and individual trust, to increase the explanation level of virtual team collaboration antecedent variables.

This research has examined the factors of Technology Support, Digital Literacy, Culture Intelligence and Virtual Team Leadership as antecedents of virtual team collaboration. The test results using the Structural Equation Modeling model show that there is a positive and significant effect of the four variables on virtual team collaboration.

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