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The Influence of Technology Support, Digital Literacy, and Virtual Team Leadership on Maya Team Collaboration

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Abstract: In these lately years, teamwork already got considered to be matters more for every kind of organization. Working in teams helps people to be more flexible, productive, and creative than working alone, as well as to keep their jobs and be happier at work. This research was done on purpose to help defining the influence of digital literacy, technology support, and virtual team leadership toward virtual team collaboration in tertiary institutions in influencing the way virtual teams work together. In this study, the questionnaire used a Google Form, which was sent via email to the appropriate email address. The findings reveal that the three antecedent variables significantly influence virtual cooperation by 62.3%. This research theoretically has offered a virtual collaboration model that has been evaluated empirically in the field. In addition, this model has enlarged the elements that influence virtual team collaboration from several previous studies. The findings of this study apply to administrators in tertiary institutions who seek to increase collaboration between lecturers, especially in the fields of teaching, research, and publication. In this context, the antecedents of this virtual collaboration model can be considered.

Keywords: Digital literacy; Technology support; Virtual team collaboration; Virtual team leadership

Introduction

In these recent years, teamwork already got claimed as the key used to obtaining fruitful and economical results in various corporate setting (Nijstad et al., 2014). Productivity at work and effective communication between employees depend heavily on teamwork. Every team is defined as a group of people that get involved in working together in order to reach the same purposes and also objectives and help providing such a high-caliber services (Gilson et al., 2015).

The introduction of digital technology has enabled businesses to migrate to virtual work environments where tasks can be completed with a high degree of flexibility and responsiveness. To comply with laws and government restrictions imposed in response to the COVID-19 epidemic, digital transformation, and virtual team functions have taken on an increasingly vital position (Meyer et al., 2022). At the time COVID-19 was not occurred yet, researchers and also practitioners winder hoy the remote working can be useful enough to apply in virtual teams by gaining its advantages and also disadvantages. Thus, after COVID-19 occurred, remote working had been considered as normal standard.

Nowadays, virtual teams are an integral element of companies (Benazir & Iqbal, 2015). Virtual teams have become part of the resent environment of business, and they get divided by the information and communication technologies (ICTs) uses, radical changes in companies design, and the spread of a multicultural workforce (Bhat et al., 2017); the ability to respond to market demands more quickly and agilely (Ibrahim, 2015).

Virtual teams or partnerships rely on the support of technology for doing communication and also involved in some collaboration (Han et al., 2017). They are getting cooperated through virtual teams commonly get related into synchronous and also asynchronous interactions

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and also jobs to achieve purposes, it is the same as co-located teams (Wickramasinghe & Widyaratne, 2012).

Several studies have examined the collaboration and application of technology in various settings. However, unlike co-located teams, the people in virtual teams must get engaged in a various activities, of collaboration including formal and also informal meetings applying the technologies s example by video conferencing (e.g., Zoom or Microsoft Teams), text (email, Whatsapp) file transfers, and also sharing of application (Gheni et al., 2016). Consequently, virtual teams try to do collaborate, encountering various obstacles that make them hard to reach the same level of success as they become such a co-located teams (Dulebohn & Hoch, 2017). Therefore, virtual teams take a lot of time and also money transferring members of team to specific projects to remove the distance-related hurdles of cooperation (Puiia, 2015).

Previous research has recognized team communication as one of the main constraints of virtuality (Großer & Baumöl, 2017). Communication within virtual teams can be claimed as significant predictor of many kinds of outcomes, including increased performance and also improved commitment (Choi & Cho, 2019). Due to the additional work needed to interact via computer-mediated tools (eg. e-mail), virtual teams should exert additional ways in order to help manage very large messages volumes, which may hinder performance (Alsharo et al., 2017).

Several other researchers have also pointed out the challenges organizations face when implementing virtual teams. This includes the virtual teamwork strategies and processes' formalization (Ebrahim et al., 2009); the technology role in environments of virtual team (Gibbs et al., 2017); virtual team's problems of communication (Dulebohn & Hoch, 2017). Appropriate organizational structures's creation for virtual team operations (Alkhatib & Al-Humaidi, 2018); challenges of leadership (Malhotra et al., 2007; Mattarelli et al., 2017); cultural, physical, and also temporal dispersion; and personnel interactions of getting in virtual teams and the supporters (Lim, 2018).

This study was different from several research that were done before from the model applied to see the performance of virtual teams. This study aims to examine the influence of technology support, digital literacy, and also virtual team leadership toward virtual team collaboration in tertiary institutions (Amorim & Sousa, 2014).

Method

This research uses a quantitative approach on purpose to investigate the influence of independent variables toward dependent variable through giving a self-administered set of questionnaire. The analysis used is defined as an individual that has worked in a team before. Respondents were the lecturers from 15 universities known to be located in Central Java with a total sample of 216 experienced lecturers. The sample selection used a purposive sampling method because it was based on the specified criteria. While distributing the questionnaire using Google Forms through direct contact with the Management Lecturer Association for the Central Java region.

All the variable were measured and also they get adopted from the prior references of studies. Table 1 indicates the items measurement. All variables were judged by applying a five-point Likert scale in order to help knowing the respondent consensus' level (1–Strongly Disagree to 5–Strongly Agree). To analyze the model of research, the partial least squares-structural equation modeling (PLS-SEM) approach was chosen.

According to the theoretical review defined, the hypothetical model was developed for this research model as shown in Figure 1.

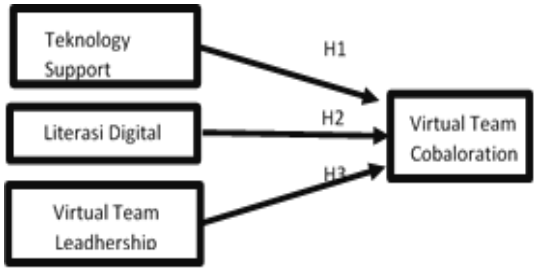

Figure 1. The hypothetical model in this research

Table 1. Measurement Items in Questionnaire

Variables	Measurement Items	References
Technology Support (X1)	Compatibility The system of information used is by specifications of computer. Hardware that is up to date based on the facilitates and times the operation of information systems. The software is easy to understand and lightens the workload. Rights to information systems are limited according to the authorization of the leadership. Supported by a communication network to expedite the operation of information systems and there are almost no interruptions.	Venkatesh et al., 2003
Literacy Digital (X2)	Easy-to-understand information content and an evaluation of information content to support virtual team performance. There is an institution that manages information data in virtual teams. There is team collaboration in supporting science in an integrated manner.	UNESCO, 2005
Virtual Team Leadership (X3)	How to communicate well so that it can inspire and motivate others. There is innovation and experimentation, to find new or better ways. To broaden the support of others who share the same interests and vision. There are other attractions, interests, hopes, and dreams. Lead by example by behaving in a way consistent with his stated values. There is confidence in the technical competence of the members	Northouse, 2013
Virtual Team Cobaloration (Y)	Belief among the members, in individual, the belief becomes the member's motivation Tendencies toward believe that affect a person's trust intention, trustworthiness, and institution-based trust (McKnight et al., 1998) The ability to work in teams in overcoming problems with the right solution Having the capability to work under pressure according to the data and facts Not manipulating data and also facts	Liedtka, 1996

Result and Discussion

This research applied the PLS-SEM to help analyzing the data, where testing through a path model which consists of two parts: a model of measurement or external model that shows the indicators and their correlation to constructs, and also a structural model or can be called as inner model that is consisted of constructs and path relationships between constructs. The inner model also reflects the theoretical component of the path model (Hair et al., 2014).

There were 216 participants in the survey who answered the research questions. 39.4% of the sample as a whole are female, while 60.6% are male. 98.6% of people with this level of education have a master's degree, and 1.4% have a Ph.D. This shows that respondents have a very high level of literacy because they can understand the questionnaire clearly.

Respondents' academic positions ranged from expert assistant (71.3%), to lector (19.9%), to associate professor (8.80%). Respondents with low academic positions, such as expert assistants, dominate, as evidenced by the composition of the respondents. However, in terms of length of service, 43.52% had less than five years, 25% had six to ten years, 20.37% had eleven to fifteen years, and 10.19% had more than twenty-one years. A rather even distribution is evident here (Gonçalves et al., 2014). Demonstrating a significant level of confidence in the accuracy of the data provided by those who answered the questionnaire, 56.48% of respondents had work experience of more than five years (Malhotra et al., 2007).

Measurement model (Outer Model)

Confirmation factor analysis (CFA) was conducted to help assessing the result of validity and reliability of the support constructs of Technology, Culture Intelligence, Digital Literacy, Virtual Team Leadership, and also Virtual Team Collaboration. Following (Hair et al., 2014), is a model of measurement test according to the validity of discriminant, convergent validity, reliability of indicator, and also composite reliability (Jackson et al., 2012).

Table 1 is the result of the test of discriminant validity. Discriminant validity relates to the term claimed that different sizes of construct is not always highly correlated. This test was done by using the value of cross-loading of every indicator of the variables. This research used the value of reference is above 0.7 (Hair et al., 2014). The results indicate that the cross-loading indicator value of a construct is higher compared to the value of cross-loading indicator from the construct used. So that, we can claim that the discriminant validity of every variable used already suitable and fulfilled (Ryan, 2020).

The test of convergent validity was done on purpose to help determining the result of validity to every correlation between indicators and also constructs. A convergent validity test was applied by method of Average Variance Extract. The value of AVE

value should be exceeding 0.50 to become sufficient for validity of convergent (Nixon et al., 2012). In Table 1, the value of AVE of every variable is higher than 0.5. Due to the reason that the test of Discriminant Validity and also Convergent Validity test have been fulfilled, it is able to be considered that this model of research is known to be valid (Ibrahim, 2014).

Table 2 shows the test of discriminant validity. Discriminant validity testing is able to be shown from the value of cross-loading value. In this research, the value of reference applied was above 0.7 (Al-Waeli et al., 2020). In Table 1 it can be seen that the value of cross-loading for indicator is higher compared to the value ofcross-loading of construct indicator to another, so it can be meant that the discriminant validity for every indicator become fulfilled (Hair et al., 2014).

Table 2. Discriminant Validity Based on Cross-Loading Value

	Technology Support	Virtual Team Leadership	Virtual Team Cobaloration	Literacy Digital
dt1	0.759	0.669	0.579	0.682
dt2	0.817	0.668	0.568	0.657
dt3	0.806	0.709	0.538	0.650
dt4	0.778	0.653	0.588	0.636
dt5	0.797	0.699	0.568	0.665
dt6	0.766	0.643	0.578	0.644
dt7	0.821	0.713	0.681	0.718
dt8	0.839	0.689	0.594	0.671
dt9	0.786	0.682	0.565	0.631
ld1	0.668	0.659	0.541	0.801
ld2	0.642	0.630	0.563	0.802
ld3	0.679	0.656	0.589	0.821
ld4	0.710	0.663	0.595	0.799
ld5	0.659	0.606	0.610	0.816
vtc1	0.610	0.596	0.752	0.569
vtc2	0.598	0.591	0.785	0.612
vtc3	0.536	0.548	0.772	0.528
vtc4	0.586	0.566	0.757	0.538
vtc5	0.561	0.543	0.784	0.531
vtc6	0.515	0.525	0.755	0.570
vtc7	0.543	0.500	0.773	0.516
vtc8	0.576	0.558	0.776	0.553
vtl1	0.720	0.781	0.626	0.643
vtl2	0.699	0.818	0.610	0.620
vtl3	0.724	0.822	0.570	0.653
vtl4	0.618	0.794	0.601	0.604
vtl5	0.647	0.784	0.500	0.577
vtl6	0.648	0.773	0.543	0.621
vtl7	0.660	0.799	0.505	0.594
vtl8	0.711	0.797	0.639	0.699
vtl9	0.727	0.853	0.573	0.712

Structure Models

The path coefficient's result of test can be known from the Table 2. Due to for every independent variable, the value of significance (p values) is under 0.05, it is able to be considered that every independent variable gives such a significant and also positive influence toward dependent variable. Table 3 indicates the value of R-Square is 0.623. This shows that the variables of Digital Literacy, Technology Support, Culture Intelligence, and also Technology Virtual Team Leadership are able to help predict Virtual Team Collaboration by 62.3%. While the rest is getting influenced by factors out of this study.

Table 3. Value of R-square

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

Hypothesis Test

This study discusses the factors that influence Virtual Team Collaboration. The analysis results help support the theoretical model and the entire hypothesized correlations

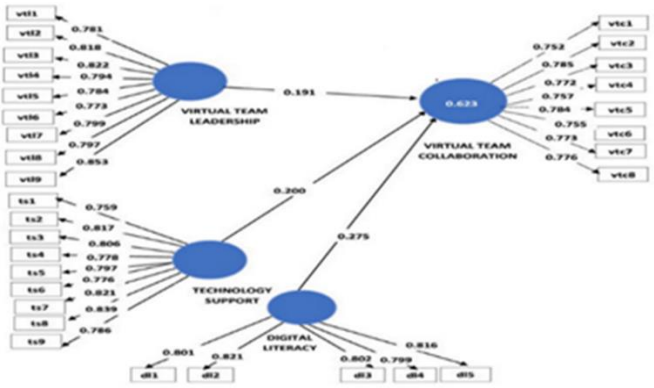

Figure 2. The analysis results and the entire hypothesized correlations

The Results of Hypothesis Testing

The results of H1 Technology Support have a positive and also significant influence toward virtual team collaboration. This result indicates that if the technology support is getting better, it becomes easier to support the collaboration of virtual team. On the other side, if technical support is getting lower, virtual team collaboration can be difficult and also less frequent to do. The results of H2 Digital Literacy have a positive and significant effect on virtual team collaboration. These findings indicate that the higher the digital literacy, the more virtual team collaboration will increase.

The results of H4 Virtual Team Leadership have a positive and significant effect toward virtual team collaboration. The results reflect that if the virtual team leadership is getting better, so the virtual team collaboration will also improve. But when the virtual team leadership is lower, so the virtual team collaboration is also getting decreased.

Conclusion

This research empirically examines the antecedents of the model of virtual team collaboration. Theoretically, research has contributed in the form of virtual collaboration models that have been tested empirically in the field. Practically, the results of this research can be useful for higher education administrators who want to improve collaboration between lecturers, especially in the fields of teaching, research, and publication. At present, higher education institutions in Indonesia are commonly tending to improve the work performance, especially in several ways as like teaching, research, and also publication. These demands rely heavily on virtual team collaboration. Although, because of the pandemic, this collaboration is not able to be applied in face-to-face but heavily done by doing virtual team collaboration. So that the findings of this research is applied as input for the universities to have focosed to the four antecedent variables which can help support the action in doing virtual team collaboration.

Author Contributions

Kustiyono conceptualized the research idea, designed of methodology, management and coordination responsibility, analyzed data, conducted a research and investigation process; Daniel Manongga conducted literature review and provided critical feedback on the manuscript.

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Conflicts of Interest

The authors declare no conflict of interest.

References

Alkhatib, G., & Al-Humaidi, O. (2018). Innovative Virtual Teams on Demand: HBDI-Based Paradigm. *Procedia Computer Science, 131*, 139–147. https://doi.org/10.1016/j.procs.2018.04.196

Alsharo, M., Gregg, D., & Ramirez, R. (2017). Virtual Team Effectiveness: The Role of Knowledge Sharing and Trust. *Information and Management, 54*(4), 479–490. https://doi.org/10.1016/j.im.2016.10.005

Al-Waeli, A. J., Hanoon, R., Geeb, H., & Hairidan, H. (2020). Impact of Accounting Information System on Financial Performance with the Moderating Role of Internal Control in Iraqi Industrial Companies: An Analytical Study. *Journal of Advanced Research in Dynamical and Control Systems, 12*(8), 246–261. https://doi.org/10.5373/jardcs/v12i8/20202471

Amorim, B. S. R., & Sousa, J. L. R. (2014). Information System Conceptualization Drive of Unique Business Process through Virtual Organizations. *Procedia Technology, 16*, 867–875. https://doi.org/10.1016/j.protcy.2014.10.037

Benazir, B., & Iqbal, N. (2015). Impact of Rewards and Leadership on the Employee Engagement in Conventional Banking Sector of Southern Punjab. *International Letters of Social and Humanistic Sciences, 57*, 30–34. https://doi.org/10.18052/www.scipress.com/ilshs.57.30

Bhat, S. K., Pande, N., & Ahuja, V. (2017). Virtual Team Effectiveness: An Empirical Study Using SEM. *Procedia Computer Science, 122*, 33–41. https://doi.org/10.1016/j.procs.2017.11.338

Choi, O. K., & Cho, E. (2019). The Mechanism of Trust Affecting Collaboration in Virtual Teams and the Moderating Roles of the Culture of Autonomy and Task Complexity. *Computers in Human Behavior, 91*,

305–315. https://doi.org/10.1016/j.chb.2018.09.032

Dulebohn, J. H., & Hoch, J. E. (2017). Virtual Teams in Organizations. *Human Resource Management Review, 27*(4), 569–574. https://doi.org/10.1016/j.hrmr.2016.12.004

Ebrahim, N. A., Ahmed, S., & Taha, Z. (2009). Virtual Teams: a Literature Review. *Australian Journal of Basic and Applied Sciences, 3*(3), 2653-2669. https://doi.org/10.6084/M9.FIGSHARE.103369

Gheni, A. Y., Jusoh, Y. Y., Jabar, M. A., & Ali, N. M. (2016). Factors Affecting Global Virtual Teams' Performance in Software Projects. *Journal of Theoretical and Applied Information Technology, 92*(1), 90–97. Retrieved from http://www.jatit.org/volumes/Vol92No1/12Vol92No1.pdf

Gibbs, J. L., Sivunen, A., & Boyraz, M. (2017). Investigating the Impacts of Team Type and Design on Virtual Team Processes. *Human Resource Management Review, 27*(4), 590–603. https://doi.org/10.1016/j.hrmr.2016.12.006

Gilson, L. L., Maynard, M. T., Young, N. C. J., Vartiainen, M., & Hakonen, M. (2015). Virtual Teams Research: 10 Years, 10 Themes, and 10 Opportunities. *Journal of Management, 41*(5), 1313–1337. https://doi.org/10.1177/0149206314559946

Gonçalves, P., Ferreira, L., Gonçalves, J., Putnik, G. D., & Cruz-Cunha, M. M. (2014). Direct Communication versus Virtual Communication in Virtual Teams. *Procedia Technology, 16*, 3–10. https://doi.org/10.1016/j.protcy.2014.10.062

Großer, B., & Baumöl, U. (2017). Virtual Teamwork in the Context of Technological and Cultural Transformation. *International Journal of Information Systems and Project Management, 5*(4), 21–35. https://doi.org/10.12821/ijispm050402

Hair, J. F., Sarstedt, M., Hopkins, L., & Kuppelwieser, V. G. (2014). Partial Least Squares Structural Equation Modeling (PLS-SEM): An Emerging Tool in Business Research. *European Business Review, 26*(2), 106–121. https://doi.org/10.1108/EBR-10-2013-0128

Han, S. J., Chae, C., Macko, P., Park, W., & Beyerlein, M. (2017). How Virtual Team Leaders Cope with Creativity Challenges. *European Journal of Training and Development, 41*(3), 261–276. https://doi.org/10.1108/EJTD-10-2016-0073

Ibrahim, M. Y. (2014). Model of E–leadership, Intra–Team Communication and Job Satisfaction among School Leaders in Malaysia. *Mediterranean Journal of Social Sciences, 5*(23), 1927–1931. https://doi.org/10.5901/mjss.2014.v5n23p1927

Ibrahim, M. Y. (2015). Model of Virtual Leadership, Intra-Team Communication and Job Performance Among School Leaders in Malaysia. *Procedia-Social and Behavioral Sciences, 186*, 674–680. https://doi.org/10.1016/j.sbspro.2015.04.126

Jackson, E. M., Rossi, M. E., Hoover, E. R., & Johnson, R. E. (2012). Relationships of Leader Reward Behavior with Employee Behavior: Fairness and Morale As Key Mediators. *Leadership and Organization Development Journal, 33*(7), 646–661. https://doi.org/10.1108/01437731211265232

Liedtka, J. M. (1996). Feminist Morality and Competitive Reality: A Role for an Ethic of Care? *Business Ethics Quarterly, 6*, 179-200. http://dx.doi.org/10.2307/3857622

Lim, J. A. Y. K. (2018). IT-Enabled Awareness and Self-Directed Leadership Behaviors in Virtual Teams. *Information and Organization, 28*(2), 71–88. https://doi.org/10.1016/j.infoandorg.2018.02.001

Malhotra, A., Majchrzak, A., & Rosen, B. (2007). Leading Virtual Teams. *Academy of Management Perspectives, 21*(1), 60–70. https://doi.org/10.5465/AMP.2007.24286164

Mattarelli, E., Tagliaventi, M. R., Carli, G., & Gupta, A. (2017). The Role of Brokers and Social Identities in the Development of Capabilities in Global Virtual Teams. *Journal of International Management, 23*(4), 382–398. https://doi.org/10.1016/j.intman.2017.01.003

Meyer, B. H., Prescott, B., & Sheng, X. S. (2022). The Impact of the COVID-19 Pandemic on Business Expectations. *International Journal of Forecasting, 38*(2), 529-544. https://doi.org/10.1016/j.ijforecast.2021.02.009

Nijstad, B. A., Berger-Selman, F., & De Dreu, C. K. W. (2014). Innovation in Top Management Teams: Minority Dissent, Transformational Leadership, and Radical Innovations. *European Journal of Work and Organizational Psychology, 23*(2), 310-322. https://doi.org/10.1080/1359432X.2012.734038

Nixon, P., Harrington, M., & Parker, D. (2012). Leadership Performance is Significant to Project Success or Failure: A Critical Analysis. *International Journal of Productivity and Performance Management, 61*(2), 204–216. https://doi.org/10.1108/17410401211194699

Northouse, P. G. (2013). *Leadership: Theory and Practice* (6th ed). New York: Sage Publications, Inc.

Puiia, L. (2015). *Virtual Team Interactions: Do They Help or Hinder Interpersonal Communication?* (Thesis). University of Southern Maine. Retrieved from https://digitalcommons.usm.maine.edu/etd/57/

Ryan, C. (2020). Refereeing Articles Including SEM–What Should Referees Look for? *Tourism Critiques:*

Practice and Theory, 1(1), 47–61. https://doi.org/10.1108/trc-03-2020-0002

UNESCO. (2005). *Education for All: Literacy for Life; EFA Global Monitoring Report, 2006*. https://doi.org/10.54676/HFRH4626

Venkatesh, V., Morris, M. G., Davis, G. B., & Davis, F. D. (2003). User Acceptance of Information Technology: Toward a Unified View. *MIS Quarterly, 27*(3), 425–478. https://doi.org/10.54676/HFRH4626

Wickramasinghe, V., & Widyaratne, R. (2012). Effects of Interpersonal Trust, Team Leader Support, Rewards, and Knowledge Sharing Mechanisms on Knowledge Sharing in Project Teams. *Vine, 42*(2), 214–236. https://doi.org/10.1108/03055721211227255