Exploratory Factor Model of Technology Adoption in the COVID-19 Era

Lidia Amalia Zallas Esquer[1], Héctor Daniel Molina Ruíz[2], Arturo Sánchez Sanchez[3], Cruz García Lirios[4] & Tirso Javier Hernández Gracia[2]

[1] Universidad de Sonora
[2] Universidad Autónoma del Estado de Hidalgo
[3] Universidad Autónoma de Tlaxcala
[4] Universidad Autónoma del Estado de México
Correspondence: Cruz García Lirios, Universidad Autónoma del Estado de México.

Abstract

The pandemic was mitigated and controlled through distancing and confinement policies, but the stigma towards anti-COVID-19 devices opened the discussion about trust and adoption towards preventive technology. The aim of this paper was to explore the dimensions of trust and adoption of anti-pandemic technology. A cross-sectional, psychometric and correlational study was carried out with a sample of 186 students selected for the use of anti-COVID-19 technology in their professional practices and social service. The results show three dimensions related to the usefulness, efficiency and use of anti-pandemic technology. In relation to the state of the art, the scope and limits of the study are highlighted to propose the extension of the model.

Keywords: adoption technology, COVID-19, factorial model, agenda

1. Introduction

In 1987 the Technology Adoption Model was published with the purpose of explaining the impact of the information age on private economic spheres (Bustos, Juarez & Garcia, 2022). Meanwhile, in the public sphere, the Innovation Diffusion Model explained knowledge transfer as an extension of users' daily activities, but without considering the conflict of non-computational skills with Internet skills.

In this way, the innovation diffusion model explained the use of technology in public spheres as an externality to institutional or organizational relations (Sanchez & Rivera, 2020). In contrast, the private spheres moved towards predicting decisions and actions through the technology acceptance model.

However, the prediction of the use of the technology was established from the perceived ease of the technology in interaction with the perception of the usefulness of the technology (Espinoza, Sanchez & Garcia, 2022). Both variables, ease and usefulness, were translated as trust in the technology and generated an explanatory construct for training with devices or informational networks.

Precisely, trust towards technology, or

interactive utility and ease of use, revealed trust towards the organization and towards technology-based training. In this sense, trust as a determining factor is predicted by the diffusion of innovations (Garcia, Bermudez & Juarez, 2022). In other words, an increase in beliefs about the importance of technology in the media or electronic networks, typical of a systematic diffusion of innovations, but with high degrees of confidence in the opportunities, ventures, and achievements through the intensive use of the technology.

In addition, trust towards technology is the result of the accumulation of information and computational practice (Garcia et al., 2021). In fact, distrust in the technological process highlights the perception of risks. The Technology Adoption Model highlighted the importance of utility and ease but ignored the perception of risk in the use of technology.

Perceived risks complement perceived control and perceived self-efficacy, both antecedents of the usefulness and ease of use of the technology (Jacinto & Lirios, 2022). Trust towards technology is shaped by perceptions of efficiency, efficacy and effectiveness. Mistrust of technology is shaped by expectations of risk such as failure. If trust prevails, perceived control and self-efficacy towards technology emerges. If there is underlying distrust, the perceived risk is appreciated. Both trust and mistrust are determined by the diffusion of prior innovations in the media and sociodigital networks.

However, the utility and efficiency as predictors of risk behaviors have not been appreciated in a scenario such as the pandemic (Garcia et al., 2020). In other words, the stigma that explains the distrust towards the use of anti-COVID-19 devices can be explained by the degree of efficiency and usefulness. As the pandemic intensifies, stigma translates into confidence that anti-COVID-19 technology is the only alternative for prevention.

Therefore, the objective of the study lies in establishing the factorial dimensions of the adoption of technology in situations of risk of contagion, illness and death from COVID-19 (Garcia & Bustos, 2021). In other words, the confidence towards anti-COVID-19 technology can be appreciated in the access to innovations such as masks, oximeters or fans.

Are there significant differences between the structure of dimensions reported in the literature on the trust and adoption of anti-COVID-19 technology with respect to the observations made in this work?

The premises that explain the trust and adoption of anti-COVID-19 technology indicate that differences among users prevail (Garcia, 2021). If stigma polarizes the perception of technology, then mistrust or trust towards anti-COVID-19 devices will be predicted from utility and efficiency levels.

2. Method

There were 186 students selected from the Metropolitan Autonomous University. 65 men (M= 24.3 SD = 3.2 age; M = 9'897.23 SD = 546.57 income) and 121 women (M = 21.34 SD = 3.54 age; M = 8'967.00 SD = 657.34 income).

The validity was carried out in a first phase with the exploratory factorial analysis technique of main axes with promax rotation (Campas et al., 2021). In the first phase, the reliability and validity of the instruments that measured the five variables was built and established. In the second phase, the likelihood of adjusting indirect and direct, negative and positive, and significant causal relationships between the study variables was modeled and demonstrated.

From the Mobile Consumption Theory, twelve indicators were established that configured three dimensions for the five variables of the measurement model that were subjected to an exploratory factor analysis of the main components with promax rotation (Lirios et al., 2020). The results reject the hypothesis of factorial unidimensionality for three variables of the measurement model.

Scale of the perception of the level of utility. 12 items with response options from "strongly disagree" to "strongly agree". The table shows the convergence (indicated by the factor weight) of the reagents with respect to the factor.

Scale of the perception of the degree of efficiency. 12 items with response options from "never" to "always". Considering the factor weights of the perceptual variable of self-efficiency, the convergence of four reagents is demonstrated.

Scale of the level of use. 12 items with response options from "less than ten minutes" to "more than twenty minutes."

Because the three scales have interval levels, their equivalence was not necessary, but if there were any asymmetry, it was cleared by

multiplying it by a constant (Lirios, 2022). The psychometric properties of the instruments that measure the study variables are detailed in the table where they meet the requirements for multivariable analysis. During the first week of the spring quarter of 2023 at the UAM-I library, students were asked how often they used their phone to download images, sounds and speeches to select the ideal sample. Subsequently, the questionnaire was provided indicating a response time of 30 minutes to answer it.

3. Results

From the Innovation Theory, a new model was designed with the variables that met the criteria of reliability and validity (see Table 1).

Table 1. Kaiser Meyer Olkin test

	MSA
Overall MSA	0.783
r1	0.769
r2	0.824
r3	0.782
r4	0.907
r5	0.829
r6	0.725
r7	0.778
r8	0.866
r9	0.742
r10	0.840
r11	0.827
r12	0.804
r13	0.798
r14	0.640
r15	0.485

Source: Elaborated with data study, Barttlett's test 1783.936 (105 df) p < .001.

Multiple linear regression was calculated to establish the determinants of the dependent variable and the non-linear relationship between independent variables. The scheme shows that the perception factor of academic utility is the main determinant of the level factor of Internet use for academic purposes (see Table 2).

Table 2. Factor loadings

	Factor 1	Factor 2	Factor 3	Uniqueness
r1			0.857	0.353
r2	0.521	-0.581		0.407
r3	-0.952			0.153
r4	0.564	-0.587		0.311
r5		-0.481	0.453	0.313
r6		0.605		0.531
r7		-0.966		0.106
r8	0.917			0.194
r9			-0.710	0.312
r10		0.838		0.155
r11	1.023			0.021
r12	-0.887			0.102
r13	0.789	0.573		0.051
r14		0.617		0.427
r15			0.829	0.367

Source: Elaborated with data study,

Note: Applied rotation method is Promax. RC1 = Efficiency, RC2 = Utility, RC3 = Use. $\chi2$ 411.837 (63 df) p < .001; TLI = 0,646; RMSEA = 0.248.

These findings indicate a modification of the TCM measurement model by proposing a direct, positive and significant effect of the utility factor on the use for academic purposes. That is, a person looking to buy, for example, a book, could get it if there was a virtual library connected to the mobile phone (see Table 3).

Table 3. Factor correlations

	Factor 1	Factor 2	Factor 3
Factor 1	1.000	0.031	-0.261
Factor 2	0.031	1.000	-0.264
Factor 3	-0.261	-0.264	1.000

Source: Elaborated with data study. RC1 = Efficiency, RC2 = Utility, RC3 = Use.

Similar reasoning would imply the perception factor of self-efficiency as a determinant of academic mobile use. An individual looking for academic information could find it through his mobile phone. However, the causal relationship lacking the required significance suggests the exclusion of the variable.

The strength of association between independent variables indicates its spurious implication. Finally, the level of mobile Internet use for academic purposes is explained by the two independent variables in percent of their variability. From the original measurement model only two variables maintain a causal relationship that selects them for inclusion in another measurement model. These consequences and implications are discussed below.

4. Discussion

The objective of the present work was to specify a model for the study of the perception of utility, considering the dimensions reported in the literature, as well as those established in the present work, but its design limited the contributions to the analyzed sample, suggesting the extension of work towards other scenarios and other study samples (Aguayo et al., 2020).

In relation to the perception of utility that literature identifies as concomitant to the perceived ease of use (Gracia, Sanchez & Lirios, 2020). The present work has shown that it affects, together with the perception of efficiency, the intensive use of electronic technologies, devices and networks.

Regarding the perception of effectiveness that literature links to the perception of control (Lirios, Guillen & Valdes, 2020). The present study has shown that when interrelated with the perception of utility generates a predictive structure of Internet use.

In relation to the use of the Internet, literature stands out because of the interrelationship between perceptions of utility, ease, efficiency and control (Lirios, 2020). The present work has shown that the perception of utility associated with the perception of effectiveness generates a structure that determines the use of the Internet.

Research lines concerning the associative structure of the perception of utility with the perception of efficiency and these as determinants of the use of the Internet will explain the rational, deliberate, planned and systematic process of acceptance of technology.

References

Aguayo, J. M. B., Nájera, M. J., Lirios, C. G., Mojica, E. B., & Campas, C. Y. Q. (2020). Reliability and Validity of Scale of Studies of the Perception of Internet Use. *Zona Próxima*, (33), 27-41.https://www.redalyc.org/journal/853/85369305003/85369305003.pdf.

Bustos-Aguayo, J. M., Juárez-Nájera, M., & García Lirios, C. (2022). Review of entrepreneurship in the COVID-19 era. *Revista Ingenio*, *19*(1), 60–66. https://doi.org/10.22463/2011642X.3173.

Campas, C. Y. Q., Barreras, I. G. M., Morales, F. E., Lirios, C. G., Félix, C. A. M., & Mellado, E. I. A. (2021). Diseño y validación de un instrumento para medir la calidad de vida laboral en trabajadores de instituciones de educación superior del sur de Sonora, México. *Interciencia*, *46*(11), 423-430. https://www.redalyc.org/journal/339/33969826004/33969826004.pdf.

Espinoza-Morales, F., Sánchez-Sánchez, A., & García Lirios, C. (2022). Reputación corporativa en una universidad pública formadora de trabajadores sociales de la salud pública. *Revista GEON (Gestión, Organizaciones Y Negocios)*, *9*(1), e-747. https://doi.org/10.22579/23463910.747.

García Lirios, C., & Bustos-Aguayo, J. M. (2021). Diseño y evaluación de un instrumento para medir el uso de internet en la era

COVID-19 (Design and Evaluation of an Instrument to Measure Internet Use During the COVID-19 Era). *Revista CEA*, *7*(14). https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3878991.

García Lirios, C., Bermúdez-Ruíz, G., & Juárez-Nájera, M. (2022). Dimensiones de emprendimiento de la reactivación de la economía basada en el turismo en México central. *Ara: Revista De Investigación En Turismo*, *11*(1), 100-114. Recuperado a partir de https://revistes.ub.edu/index.php/ara/article/view/34526.

García Lirios, C., Bolivar Mojica, E., Blaness Ugarte, A., Coronado Rincón, O., & Molina González, M. (2021). CONTRASTE UN MODELO DE VIOLENCIA DOMÉSTICA EN LA ERA DEL COVID-19 . *Revista De Investigación Académica Sin Frontera: División De Ciencias Económicas Y Sociales*, (35), 13. https://doi.org/10.46589/rdiasf.vi35.379.

García Lirios, C., Carreón Guillén, J., Bustos Aguayo, J. M., & Hernández Valdés, J. (2020). Percepción del emprendimiento caficultor en la región Huasteca, centro de México: Array. *Revista Activos*, *18*(1), 235-266. https://doi.org/10.15332/25005278/6164.

García-Lirios, C. (2021). Redes tutoriales en la elaboración del protocolo de investigación. *Comunicación, Cultura Y Política*, *12*. https://doi.org/10.21158/21451494.v12.2021.3083.

Gracia, T. J. H., Sanchez, A. S., & Lirios, C. G. (2020). Specification of a Voting Intention Model Based on Coexisting Expectations. *Himalayan Journal of Humanities and Cultural Studies*, *1*(2). https://himjournals.com/articles/96_Specification_of_a_Voting_Intention_Model_Based_On_Coexisting_Expectations.

Jacinto, O. A. D., & Lirios, C. G. (2022). Digital Activism in the COVID-19 era. *Jurnal Bisnis, Manajemen, Dan Ekonomi*, *3*(3), 147-155. https://doi.org/10.47747/jbme.v3i3.768.

Lirios, C. G. (2020). Intensive Use of Internet Technologies, Devices and Networks in The Post COVID-19. *Gl J Neu Psy Bra Dis: GJNPBD-104*. https://www.researchgate.net/profile/Cruz-Garcia-Lirios/publication/351441647_2020_3_1-9/links/6097ee2692851c490fca0aed/2020-3-1-9.pdf.

Lirios, C. G. (2022). Factorial Structure Determining the Intention to Vote Ecology. *Malikussaleh Social and Political Reviews*, *3*(1), 21-25. https://ojs.unimal.ac.id/mspr/article/view/7275.

Lirios, C. G., Aguayo, J. M. B., Nájera, M. J., Mojica, E. B., & Campas, C. Y. Q. (2020). Fiabilidad y validez de la escala de estudios de la percepción del uso de Internet. *Zona Próxima*, (33), 27-41. https://rcientificas.uninorte.edu.co/index.php/zona/article/view/11670.

Lirios, C. G., Guillén, J. C., & Valdés, J. H. (2020). Governance of electoral preferences: consensus expectations and voting intention in students of a public university. *Revista Interamericana de Investigación, Educación y Pedagogía, RIIEP*, *13*(1), 89-100. https://www.researchgate.net/profile/Cruz-Garcia-Lirios/publication/342937244_Governance_of_electoral_preferences_consensus_expectations_and_voting_intention_in_students_of_a_public_university/links/62aa688fe1193368baa01772/Governance-of-electoral-preferences-consensus-expectations-and-voting-intention-in-students-of-a-public-university.pdf.

Sánchez Sánchez A., & Rivera Varela, B. L. (2020). Governance of in a coffee industry. *Revista De Investigación Académica Sin Frontera: División De Ciencias Económicas Y Sociales*, (30), 28. https://doi.org/10.46589/rdiasf.v0i30.302.