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Confirmatory Structural Model of a Collaborative Network in Central Mexico During the COVID-19 Era

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ABSTRACT

The objective of this work was to confirm the factorial structure of collaborative networks in a university in central Mexico during the pandemic. A cross-sectional, psychometric, and confirmatory study was carried out with a sample of 300 administrators, teachers, and students from a public university in central Mexico. From a structural model, the results show that there is a dependent relationship between organizational climate and collaboration. Based on these findings, research lines related to trust as a determinant of knowledge networks and organizational collaboration.

Keywords: COVID-19, Collaboration, Knowledge, Leadership, Confirmatory Study, Institutionalism, Mexico

INTRODUCTION

Until March 2022, the pandemic has cut off the existence of eight million, although another 12 million are recognized indirectly (WHO, 2022). Anti-COVID-19 policies follow the guidelines of an epidemiological traffic light that establishes with red a scenario of high risk of contagion, disease and death and with green the least risk to health (PAHO, 2022). In the educational field, anti-COVID-19 policies translate into the transition from the face-to-face classroom to the electronic whiteboard (OECD, 2022). In other words, when the traffic light is red, virtual classroom and electronic platforms such as Zoom, Teams or Google Met are used collaboratively. The absence of a face-to-face instructor is made up for with collaborative work on platforms,

networks and digital applications. Peer self-management emerges as a teaching and learning process. In green, the traffic light forces a return to the face-to-face classroom and collaborative work facilitated by the teacher. That is, a tutor defines sources and modes of documentation and production of knowledge.

The impact of the pandemic on collaborative networks intensified after the implementation of containment and mitigation strategies that resulted in the distancing and confinement of people. The health crisis opened a dilemma to reduce or increase collaboration between the parties involved. In this sense, the instruments that measure the degree of collaboration suggest that interested parties face multiple crossroads as a risk scenario such as the pandemic intensifies. In addition, collaboration is influenced by underlying processes such as stress, exhaustion, frustration, hopelessness or depersonalization of the health crisis. Therefore, the diagnosis of the degree of collaboration allows us to infer the impact of the pandemic on the actors involved.

Therefore, the objective of this work is to corroborate the factorial structure of collaborative networks in a scenario of anti-COVID policies, distancing and confinement strategies, as well as a red traffic light that forces the use of platforms, networks and applications for communication. self-management of teaching and learning.

LITERATURE REVIEW

Collaborative networks are formed around labor climate such as relationships, tasks, props and innovation to undertake or specify knowledge that will result in innovation according to the degree of complexity concerning self-regulation, dissipation, adaptability and dynamism (see Table 1).

In a red traffic light scenario, the intensive use of technologies, networks and devices for collaborative work reflects a complex system of knowledge (Mendoza et al., 2016). This is the case for universities in strategic alliances with civil or for-profit organizations to guarantee the practice of theoretical learning (Omotayo & Adenike, 2013). This emerging, self-regulated, flexible and multidisciplinary process reflects a complex structure known as centrality or central node (see Table 2).

Anti-COVID-19 policies, the transition to the virtual classroom and collaborative work are part of a complex system (Escobar, 2014). Each of these three elements are emerging either because they generate a global crisis or because they self-organize around the health and economic crisis (Anicejevic, 2013). In other words, collaborative work is the result of an emergent and self-organizing process (Sansongu & Ngutor, 2012). In addition, they are factors of dissipation and homeostasis because they are counterweights to each other (Dugloborskyte & Petraite, 2017).

Table 1.

Structures and climates in complex organizations

	Rules	Support	Innovation	Goals
Self-regulation	Self-regulating organizations est ablish norms in order to achieve a balance between external demands and the availability of internal resources.	Self-regulating organizations esta blish forms of cooperation and solidarity in the face of a significant difference between opportunities and capabilities.	Self-regulating organizations produ ce knowledge and innovations in order to reestablish a balance between risks and objectives, uncertainty and goals.	Self-regulating organizations det ermine objectives and goals based on the balance of their expectations and needs.
Dissipation	Emerging organizations are guided by restructuring principles based on the availability of resources rather than market demands.	Emerging organizations interact with knowledge-producing nodes to generate opportunity structures in situations of unemployment.	Emerging organizations reflect the uncertainty of economic crises and their innovations are an effective response to uncertainty and entrepreneurial risks.	Emerging organizations determine objectives and goals as market demands are contingent.
Adaptation	Adaptive organizations follow unpredictable principles from which to build new opportunities and capabilities.	Adaptive organizations underlie the uncertainty of the markets in order to structure new collective knowledge.	Adaptive organizations generate the information conducive to new knowledge and innovations to face the instability of the markets.	Adaptive organizations establish objectives and goals based on the risks involved in entrepreneurship and innovation.
Dynamic	Dynamic organizations are unstable in the development of their quality processes.	Dynamic organizations through cooperation and solidarity establish the quality of their processes and products.	Dynamic organizations are flexible in the face of market instability and state demands.	Dynamic organizations set goals and targets based on economic, political, and social changes.
Complexity	Complex organizations generate knowledge networks from which they establish imbalances and stability.	Complex organizations establish strategic alliances in order to produce value in terms of opportunities and capabilities.	Complex organizations generate innovations for local positioning and transformation.	Complex organizations establish their objectives and goals based on the contingencies of the environment.

Source: Own elaboration, as adopted by Carreón (2016)

Table 2.
Temporary arrangements of complex organizations

	Austerity	Anticipation	Altruism	Effectiveness	Deliberation	Saving
Self-regulation	√	√		√	√	√
Dissipation				√	√	
Adaptation	√		√	√	√	√
Dynamic		√		√	√	
Complexity	√	√	√	√	√	√

Source: Own elaboration, as adopted by Carreón (2016)

The collaborative network, assumed as a sequence of motives, decisions and actions through an educational platform such as Zoom, Team or Google Met, suggests a transition from face-to-face tasks to asynchronous activities (Storga et al., 2013). The reasons for confinement explain the intensive use of technologies, networks and devices (Huilan et al., 2017). As users establish information traffic, their reasons for confinement are significant (Simpson, 2008).

On the other hand, decisions and intentions are determining factors in the use of platforms, networks and applications for self-learning (Garcia et al., 2017). Assumed as probabilities of carrying out a collaborative task, the decisions to use technologies or devices suggest an expected utility (Wu et al., 2015). The benefits of using an application refer to real-time access (Abar et al., 2010). The gain of using applications lies in a synthesis of represented information (Garcia, 2013). The intentions to carry out a collaborative task depend on the ease of use of the device or the application.

In the context of educational policies focused on the link between the local market and academic *curricula,* social entrepreneurship through academic networks supposes the formation of a gender identity or *habitus* that consists of the professional formation of an ethics of the collaboration (Cruz et al., 2016). It is an ethic that begins with the establishment of empathy, trust, commitment, innovation, satisfaction and happiness (García et al., 2016). In this way, collaborative networks, derived from educational institutionalism consisting of the evaluation, accreditation and certification of the quality of processes and products, show the differences between genders based on their capacities, skills and knowledge (Hernández and Valencia, 2016).

Therefore, the formation of collaborative networks implies the training or training of groups around specific objectives, tasks and goals, but the formation of collaborative networks around professional identity implies the establishment of a system of communication and motivation of the leader toward talent or among employees (Acar and Acar, 2014).

RESEARCH METHOD

The structural equation technique has been used to compare models that were designed from theoretical, conceptual and empirical frameworks (Nahuat, 2020). Collaboration networks are a phenomenon that has been approached from cross-sectional and psychometric studies (Nahuat et al., 2021). The structural equation technique allows the explanation of the relationships between factors and indicators that can be distributed normally and linearly.

A sample was selected in a simple way, considering equation (1).

$$\eta=z2x\rho(1-p)\epsilon2$$

Information was collected during the first semester of 2021 through email, the questionnaire was sent, and it was collected in a public university database.

A scale was used by Collaboration Organizational Carreon (2016), which includes four dimensions concerning the relations environment, supports, innovations and goals. Each item is answered with one of five options that go from "not at all agree" to strongly agree".

The literature from 2019 to 2022 reported a reliability of the scale between.780 and.792, although in the present study, a Cronbach's alpha of.784 and a McDougal omega of.775 were found, as well as a validity with factorial weights that ranged between.340 and.612, but a range between.342 and.621 was reported in the literature, with an explained variance of between 56% and 61%. In this study, the total variance explained reached 71%.

Participants

The study was carried out with a sample of 300 administrators (M = 25 years, SD = 2.4 years; M = 7,890.00 pesos per month, SD = 245.34 pesos per month), professors (M = 38 years, SD = 10.8 years; M = 26'443.00 pesos per month, SD = 10,865.00 pesos per month) and students (M = 21 years, SD = 3.1 years; M = 3'078.00 pesos per month, SD = 541.00 pesos per month) from the Autonomous University of the State of Mexico in a strategic alliance with knowledge-creating organizations such as the automotive company Nissan. The criteria for selecting the respondents were their relationship with the system of professional practices and social service that is established in the first semesters and is consolidated upon graduation. In the administrative economic area, students carry out their professional practices from the first semesters with the purpose of implementing the theoretical concepts. The teacher is a mediator of the implementation of theories and concepts by tutoring students. The partner organization allows professional internships as long as they are consistent with its entrepreneurial and innovation objectives.

Table 3

Description of the instrument

	Item	M	SD	S	C	A	F1	F2	F3	F4
	Subscale of relations (specifications before generalities)					0.781				
r1	Educational assessment generates indexed articles	3.24	1.25	1.02	1.32	0.743	0.632			
r2	The production of innovations is in accordance with the educational quality	3.29	1.27	1.39	1.35	0.793	0.694			
r3	Thesis advice derives from the merit contest	3.00	1.47	1.40	1.38	0.714	0.661			
r4	Research projects arise from credentialism	4.28	1.85	1.44	1.54	0.756	0.632			
	Support subscale (collaborations in the face of imponderables)					0.793				
r5	Mass education meant the weakening of trade unionism	3.05	1.04	1.05	1.47	0.742		0.631		
r6	Teacher individualism obeys educational policies	3.81	1.37	1.28	1.39	0.746		0.635		
r7	Educational neoliberalism generates collegiate works	3.21	1.21	1.38	1.27	0.784		0.563		
r8	Multidisciplinary research is a product of meritocracy	3.56	2.31	1.29	1.07	0.795		0.594		
	Innovations subscale (proposals for contingencies)					0.785				
r9	The teaching proposals underlie the	4.21	1.70	1.33	1.21	0.790			0.671	

	educational crisis									
r10	The educational dropout generated the scholarship system	4.24	1.48	1.20	1.24	0.712			0.493	
r11	Constructionism is the result of educational lag	3.91	1.31	1.25	1.36	0.774			0.614	
r12	Educacional policies fostered credentialism	3.26	1.83	1.37	1.32	0.732			0.632	
	Goals subscale (achievements against risks)					0.758				
r13	The budget cut generated absenteeism	4.34	1.83	1.09	1.30	0.795				0.381
r14	The awards are derived from mass education	4.65	1.57	1.15	1.26	0.782				0.532
r15	Multidisciplinary studies indicate technoscientific politics	4.81	1.46	1.13	1.32	0.784				0.635
r16	Educational financing is achieved with the management	4.30	1.24	1.36	1.49	0.793				0.512

Source: Elaborated with data study. M = Mean, D = Standard deviation, S = Bias, C = Kurtosis, A = Alpha removing the value of the item. Extraction method: Main components. Sphericity and adequacy ⌈$\chi 2 = 3.251$ (23gl) $p = 0.000$; KMO = 0.681⌋. F1 = Climate of Relationships (45% of the total variance explained), F2 = Climate of Supports (15% of the total variance explained), F3 = Climate of Innovations (8% of the total variance explained), F3 = Climate of goals (3% of the total variance explained). All items include the alpha value removing their estimate and include five response options: 0 = "not at all agree" to 5 = "strongly agree".

Hypotheses

The following hypotheses were proposed:

H_1: There are significant differences between the theoretical structure with respect to empirical observation.

H_2: There are no significant differences between the theoretical structure and the empirical observation.

Given that the collaborative study network is evaluated by a panel of experts who issue a rating on theoretical achievement and performance in professional practice, the Delphi technique was used. Homogenization of the words included in the statements of the instrument (Hernández et al., 201). The confidentiality of the results was guaranteed in writing, and it was

reported that these would neither negatively nor positively affect their employment-administrative status. The information was processed in the Statistical Package for Social Sciences (SPSS). The mean, standard deviation, alpha, sphericity, adequacy, factorial weights, goodness of fit and residuals were estimated.

RESULTS

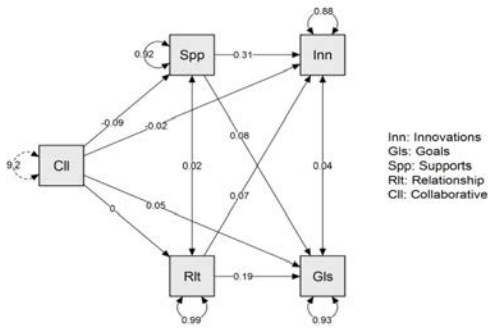
Once the four factors that explained 71% of the total variance explained were established, the relationships between the factors were estimated to establish the possible relationships of the factorial structure with respect to other variables not specified or estimated in the model. Table 4 shows the relationships between the established factors. Negative regression relationships are noted between the first-order factors with respect to the second-order factor. In other words, collaboration is not a common factor regarding the climate of relationships, support, goals and innovations.

Table 4.
Relations between the factors and the construct

			Estimate		CR	P
Relations	<---	Collaboration	0.50			
Supports	<---	Collaboration	-0.10	.586	.837	.403
Innovations	<---	Collaboration	-0.17	2.679	.911	.362
Goals	<---	Collaboration	-0.33	.667	-1.341	.180

Source: Own elaboration. Once the relationships between the factors had been established, the structural model was estimated in which the adjustment and residual parameters $\chi 2 = 3.432$ (2gl) $p = 0.180$; GFI = 0.950; RMS EA = 0.001; Bootsrap = 0.0000 suggest the acceptance of the null hypothesis regarding the fit of the theoretical explanations with respect to the empirical observations made in the case study of the public university (see Figure 1).

Figure 1.
Structural equation modeling



Source: Elaborated with data study. Extraction method: Main components. Sphericity and adequacy $\chi 2 = 3.251$ (23gl) $p = 0.000$; KMO = 0.681. F1 = Climate of Relationships (45% of the total variance explained), F2 = Climate of Supports (15% of the total variance explained), F3 = Climate of Innovations (8% of the total variance explained), F3 = Climate of goals (3% of the total variance explained).

DISCUSSION AND CONCLUSIONS

The results of this study, where the climate of support determines the climate of innovations and the climate of relationships affects the climate of goals, suggest that collaboration is not shaped by these four first-order factors. The findings of this study contravene the results published in the literature from 2019 to 2022. That is, the low regressions between collaboration and the remaining four factors seem to indicate that the pandemic had an impact on the sample surveyed. In a risk scenario, the sample surveyed seems to indicate that it was only able to organize itself around two pairs of work environments without achieving the collaboration required before the pandemic. Therefore, it is advisable to investigate the effect of COVID-19 on work collaboration to anticipate risk scenarios and their collateral effects.

The contribution of the findings of this study to ANFECA lies in the measurement of the collaborative network as a hallmark of the organization. In other words, the impact of strategic alliances between the university and organizations lies in the link between academic and professional training. That is, the formation of human capital in the system of professional practices and social service allows professional training, and it is expected that job training will be guided by this relationship.

The contribution of this work to the state of the question lies in the specification of a model for the study of complex organizations with collaborative networks oriented toward sustainability, but the type of nonexperimental study, the type of nonprobabilistic sampling and the type of exploratory factor analysis limited the findings to the study sample.

In relation to the studies of collaborative networks, which highlight isomorphism and propensity for the future, the present work has shown that four dimensions prevail relative to collaborative networks of relationships, supports, innovations and goals, but the percentage of the total variance explained supposes the inclusion of other factors that the literature identifies as a climate of tasks and trust networks.

In other words, collaborative networks distinguish complex organizations in the face of contingencies in their environment, but it is the norms and values that stand out as indicators of the organizations dedicated to the production of knowledge and the formation of intellectual capital to create intangible value in its processes.

In this way, the present work has evidenced the formation of collaborative networks from the climate of relationships to the climate of goals, which suggests that 1) in complex organizations focused on self-regulation, collaborative networks build objectives, tasks and goals based on the balance of external demands and its internal resources; 2) in sustainable organizations, collaborative networks act as dissipators of knowledge to increase the formation of intellectual capital; 3) in knowledge-producing

organizations, adaptability is an instance that will generate more knowledge to conserve the organization itself and its resources; 4) organizations that optimize their resources form collaborative networks to activate a dynamic of exchanges and transactions with their contingent environment.

Therefore, it is necessary to contrast the specified model in contexts and samples similar to the HEI under study, as well as the inclusion of a fifth factor to increase the percentage of explained variance and orient the model toward the formation of dedicated intellectual capital. to optimize resources and innovate processes.

In this way, the inclusion of the climate of empathic or trust relationships in the model will allow us to observe its link with the formation of academic and professional networks in a system of professional practices within the framework of strategic alliances between HEIs and multinationals.

In other words, the construction of an ethics of preservation and collaboration or a climate of empathic and trusting relationships between students, teachers and administrators supposes the beginning of a selective information process that, when decoded, will allow us to protect the implicit knowledge in some technology. to enhance the capacities, competencies and abilities of future users in the face of increasingly risky, contingent and threatening scenarios.

This is because the transfer of implicit knowledge in tacit knowledge is gestated from the work environment focused on empathy and trust rather than on competition. Therefore, a knowledge management model implies the inclusion and measurement of the level of trust and empathy of an organization, as well as its competencies based on the demands of the environment and the opportunities of the context.

Such a model would include 1) knowledge management based on a diagnosis of the level of empathy and trust; 2) knowledge production based on common objectives, tasks and goals between HEIs and multinationals; 3) transfer of knowledge through the system of practices and social service, as well as the academic, technological and professional training of intangible assets such as intellectual capital.

IMPLICATIONS

The objective of this work was to confirm the factorial structure of a knowledge network in a public university in central Mexico. The strategic alliance of the educational institution with for-profit organizations allows the formation of human capital that this study measured. The objectives, tasks and goals were measured as evidence of academic and professional training. The measurement of job training is recommended once students access the local market. In the process of the formation of intellectual capital, administrators and teachers are intermediaries that facilitate the application of theoretical and conceptual knowledge in the administrative economic area.

The instrument used to measure talent formation suggests the inclusion of another factor that the literature identifies as guild habitus to explain the impact of motivation on professional performance. Lines of study related to the guild habitus will explain the impact of the system of professional practices and social service.

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