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Analyzing Social Networks: Unveiling the Dynamics within the Honduran Entrepreneurial Ecosystem

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Abstract*– This research addresses the prevailing gaps in our understanding of the entrepreneurial landscape in Honduras through the application of the Social Network Analysis (ARS) method, coupled with statistical mediation and multiple regression techniques. Our study delves into the intricate business ecosystem of Honduras, emphasizing the interactions among key stakeholders, including the government, private sector, academia, non-governmental organizations, and support agencies. Utilizing social network analysis, we meticulously examine the network's architecture, cohesion, reciprocity, and the strength of ties among key players. Employing statistical mediation and multiple regression techniques, we delve into how these connections among actors mediate the complex interplay between influence and the spread of business activities. Our findings uncover a bimodal nature within the entrepreneurial ecosystem of Honduras, marked by constraints in both social and material attributes. The ecosystem exhibits low-density bidirectional relationships, limited reciprocity, and constrained actor connections. The analysis further highlights that the level of connection among actors partially mediates the influence on the diffusion of business activities.

***Keywords--* Social network analysis, entrepreneurship ecosystem, mediation, dynamization.**

I. Introduction

The entrepreneurship ecosystem, characterized by the intricate web of relationships shaping national economies [1], holds significant importance in Honduras, primarily driven by Micro, Small, and Medium Enterprises (MSMEs) and entrepreneurs catalyzing economic activities. While there exist disparities among registered businesses, with over 300,000 formally registered MSMEs, a considerable number operate informally (exceeding 1,000,000) [2]. Encompassing governmental bodies, the private sector, academia, non-governmental organizations, and cooperatives, the Honduran entrepreneurship ecosystem comprises diverse stakeholders. Key entities include the Entrepreneurship Technical Board, State Secretariats, academia, Chambers of Commerce, Fedecamaras, SENPRENDE, local and territorial entrepreneurship networks, Local Development Units, and Business Development Centers [3].

However, Honduras grapples with challenges reflected in global competitiveness rankings [4-6]. The government has launched strategies [7] and regulatory initiatives focusing on industry support, financing, institutional coordination, cultural shift, and educational reform [8-9]. Stakeholders within the ecosystem contribute across various sectors, including crafts, environment, education, financial services, energy, transportation, logistics, and particularly the agricultural industry [11]. Despite these endeavors, the ecosystem exhibits sectoral isolation, resource duplication, and significant issues in rural areas [10-13]. Moreover, limited integration of academia impedes progress [14]. In Honduras, MSMEs and entrepreneurs drive the entrepreneurship ecosystem [2], which comprises not only structured organizations but also individual entrepreneurs. The nation's competitiveness hinges on the efficacy of this ecosystem, which involves the government, private sector, academia, NGOs, and cooperatives, with pivotal bodies such as the Entrepreneurship Technical Board, State Secretariats, academia, Chambers of Commerce, Fedecamaras, SENPRENDE, local and territorial entrepreneurship networks, Local Development Units, and Business Development Centers [3]. Honduras ranks poorly in global indices, such as the Doing Business report (133rd out of 190 countries in 2020) [4], the Global Competitiveness Index (101st out of 140 countries in 2019) [5], and the Global Entrepreneurship Index (107th out of 137 countries) [5]. These rankings underscore integration challenges within the Honduran entrepreneurship ecosystem, prompting governmental strategies [7], including the Government Work Plan 2018-2022. These initiatives prioritize streamlining processes, enhancing market intelligence, and fostering collaboration with the private sector through incentives for formalization [9]. Regulatory actions [3] focus on industry support, financial assistance, institutional coordination, cultural change, and educational enhancement [10]. Additionally, ecosystem actors contribute through projects, programs, and training in various sectors, emphasizing technical assistance, capacity building, and financial services, particularly in the agricultural domain [11].

Despite governmental efforts, the entrepreneurship ecosystem in Honduras exhibits several shortcomings: sectoral isolation, resource duplication, rural development disparities, legal and technological deficiencies, and limited academic integration [10-14]. Addressing these challenges necessitates deeper insights into ecosystem dynamics and actor relationships. Hence, this study aims to fill this gap by employing Social Network Analysis (SNA) to scrutinize the entrepreneurship ecosystem in Honduras. This research provides a comprehensive depiction of the ecosystem's current

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state, identifying key actors and their roles in driving ecosystem dynamics. Moreover, the application of SNA in this context is pioneering [1]. Challenges include mapping actor locations, gauging participation levels, and assessing information flow, necessitating ongoing data collection efforts. The study's research questions revolve around understanding the current state of the entrepreneurship ecosystem in Honduras through SNA, exploring the mediating role of diffusion in the relationship between connection levels and influence within the ecosystem, and examining how actor proximity and influence impact diffusion within the ecosystem. To address these questions, the study will describe the current state of the entrepreneurship ecosystem in Honduras using SNA, evaluate the mediating effect of diffusion on connection and influence levels, and analyze the impact of actor proximity and influence on diffusion within the Honduran entrepreneurship ecosystem. This research contributes to understanding the entrepreneurship ecosystem, identifying potential ecosystem leaders, and filling the research gap in Honduras, particularly by employing SNA. The remainder of the study comprises four sections: Literature Review (Section II), Methodological Process (Section III), Descriptive and Inferential Analyses (Section IV), and Conclusions and Future Research (Section V).

II. Literature Review

Entrepreneurs are the first link that generates every company and are present in all nations [15]; they are those people who generate value through the creation or expansion of economic activity, identifying new products, processes, and markets [16], mobilizing resources to ensure its operation [17]. Over time, entrepreneurs have been a force that drives the growth of nations [18]; their act in diverse ecosystems, that is, in a system with symbiotic actions, coexistence, and integrative function [12] whose purpose and framework determines the entrepreneur [19]. Also, an ecosystem from the economic-business field can be defined as a set of interconnected actors composed of business organizations, institutions, processes, and entrepreneurs that interact within an environment [20] where deficiencies in their performance lead the same actors to meet said needs [21]. Ecosystems are a product of three elements: 1) Business environment and investment climate, 2) Interaction between actors, and 3) Evolution of culture and attitudes [22]. Ecosystem actors play a biotic (e.g., entrepreneurs, educators, and bankers) and abiotic (e.g., infrastructure and culture) role [23]. The dynamics of the ecosystem can develop from the axes: 1) Politics (Leadership and government), 2) Finance (Financial capitals), 3) Culture (Social norms, Success stories), 4) Support (Support for professionals, Institutions, non-governmental and Infrastructure), 5) Human Capital (Education Institutions and Workforce) and 6) Market (Networks and Product Acceptance).

Entrepreneurship ecosystem studies have caught the eye of researchers due to their contributions to economies and competitiveness. However, the research carried out has mainly focused on the experience of researchers or previous theories rather than on studies that collect information directly from the perspective of their actors [24]. The factors that affect ecosystems are three categories: 1) Cultural attributes, norms or beliefs of a particular region or locality; 2) Social attributes, relationships between the multiple actors of the ecosystems; and 3) Material attributes, the existence of infrastructure or tangible resources [24][25][26].

Regarding ecosystem analysis, there are various methods for studying them. However, today, the application of social network analytics prevails because it allows the study of the relationships between the actors that make up a system or network [27], understanding by each network all the links between a set of actors used to analyze the connections that cross the groups [28]. The study of networks permits understanding the actor's behavior, integration, and relationships [29]. Networks contextualize phenomena between actors; the more connections an actor has, the more efficient, effective, and dynamic the ecosystem will be [29]. Networks can be: 1) Unimodal: they study a single set of actors. 2) Bimodal, the study of two sets of actors, or a set of actors and a set of events, and 3) Egocentric focuses on an individual and his immediate social environment [28], the actors with the most significant influence on the ecosystems allow effective communication, fast and bidirectional. These networks are understood from Cluster analysis, closeness, network centralization, vector centrality, accessibility, cohesion, and density, among others [29]. Networks are analyzed through levels; at the lowest level are the individual actors (ego), and at the next level, the network's properties are examined by pairs of actors (dyads). The interaction between two actors can be symmetrical or asymmetrical, direct, or indirect. The third level is represented by triads of actors with transitivity. A triad is transitive if there is a link line from actor A to actor B and from actor B to actor C, and there is also a link from actor A to actor C [28]. Nowadays, one of the most recent booming methodologies used to study ecosystems is social network analysis (SNA), which consists of analyzing social networks and evaluating formal and informal relationships to understand everything that facilitates or impedes the interaction between ecosystem actors [30]. SNA provides quantitative and objective means, using images or "maps" combined with figures, to understand relationships and dynamics, identify opportunities to improve how actors cooperate or share information, and develop network capacity. The SNA characterizes network structures as "nodes" or "actors" within systems and "connections," or the relationships and interactions that connect them [30]. Based on the information provided, the following exploratory hypotheses are proposed:

Hypothesis 1: The Honduras entrepreneurial ecosystem shows a bimodal character. Explanation: The study establishes that the entrepreneurship ecosystem in Honduras exhibits a bimodal nature, suggesting the presence of two distinct sets of actors or a set of actors and events within the ecosystem.

Hypothesis 2: The entrepreneurial ecosystem in Honduras is characterized by limitations in social and material attributes. Explanation: The study mentions that factors related to cultural norms, social relations, and tangible resources can affect the functioning of the ecosystem.

Hypothesis 3: The relationships within the entrepreneurial ecosystem in Honduras are bidirectional and low-density, with limited levels of reciprocity. Explanation: According to the paper, the ecosystem presents bidirectional and low-density relationships, which suggests that interactions between actors are rare and extensive. Furthermore, limited levels of reciprocity indicate that mutual exchanges or cooperation between actors may be lacking.

Hypothesis 4: The connection level between the entrepreneurial ecosystem of Honduras actors partially mediates the relationship between influence and diffusion of entrepreneurial activities. Explanation: The analysis carried out in the study suggests that the level of connection between actors within the ecosystem has a mediating effect on the relationship between the influence and diffusion of business activities. This hypothesis implies that more robust connections between actors can facilitate the diffusion of entrepreneurial initiatives.

III. Methodology

This study employs a descriptive approach with predictive elements to characterize the entrepreneurial ecosystem in Honduras. Through the application of Social Network Analysis (SNA), we delineate the ecosystem's actors and identify variables contributing to its enhancement. The research population comprised 177 units in Honduras, stratified probabilistically into five categories: Finance (17 banks and financial institutions, and eight financial development institutions/donors), Support (55 development and strengthening organizations, 13 Foundations, and NGOs), Politics (5 governmental agencies), Human Capital (15 academic institutions, and three training and education institutions), and Networks (14 sectoral associations). Data collection was conducted by the Transforming Market Systems project and the Institute of Economic and Social Research (IIES-UNAH). To test hypotheses, we employ statistical mediation and multiple regression techniques, following Hayes's (2021) recommendation of using the OLS method for cross-sectional data analysis. The mediation process encompasses three key elements: the total effect, the direct effect (quantified by c'), and the indirect effect (quantified by the product of coefficients a and b). The indirect effect signifies the extent to which variations in X influence Y through the mediator M. Moreover, in multiple regression analysis, we evaluate the percentage of explained variance, the significance of the data, and the coefficients describing the regression equation [32]. This comprehensive analytical approach enables us to gain deeper insights into the dynamics of the entrepreneurial ecosystem in Honduras and its determinants.

IV. Results

A. Descriptive Analysis

The cycle of the entrepreneurship ecosystem in Honduras comprises three blocks: the first is composed of actors that provide tangible and intangible inputs (Transfer and strengthening of intellectual and human capital, financing, capital, technical assistance, and formal and informal training), the second block corresponds to the interaction space influenced by Support, Infrastructure, and culture. The third block belongs to the entrepreneur market (The sale of products and services and the market to acquire inputs, capital, equipment, and non-formal training from the rest of the actors)..

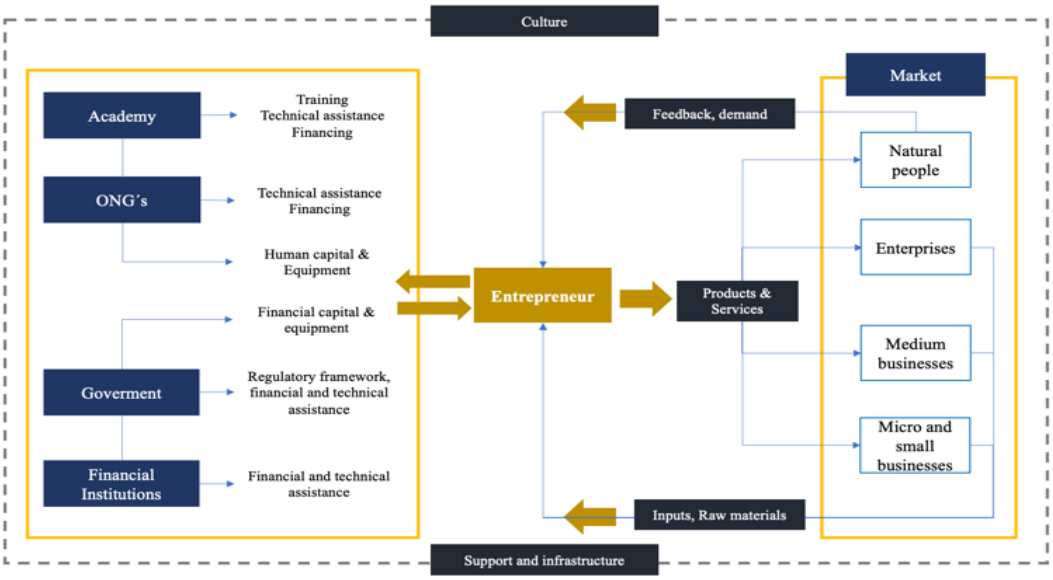

Fig. 1 Entrepreneur Cycle model in Honduras.

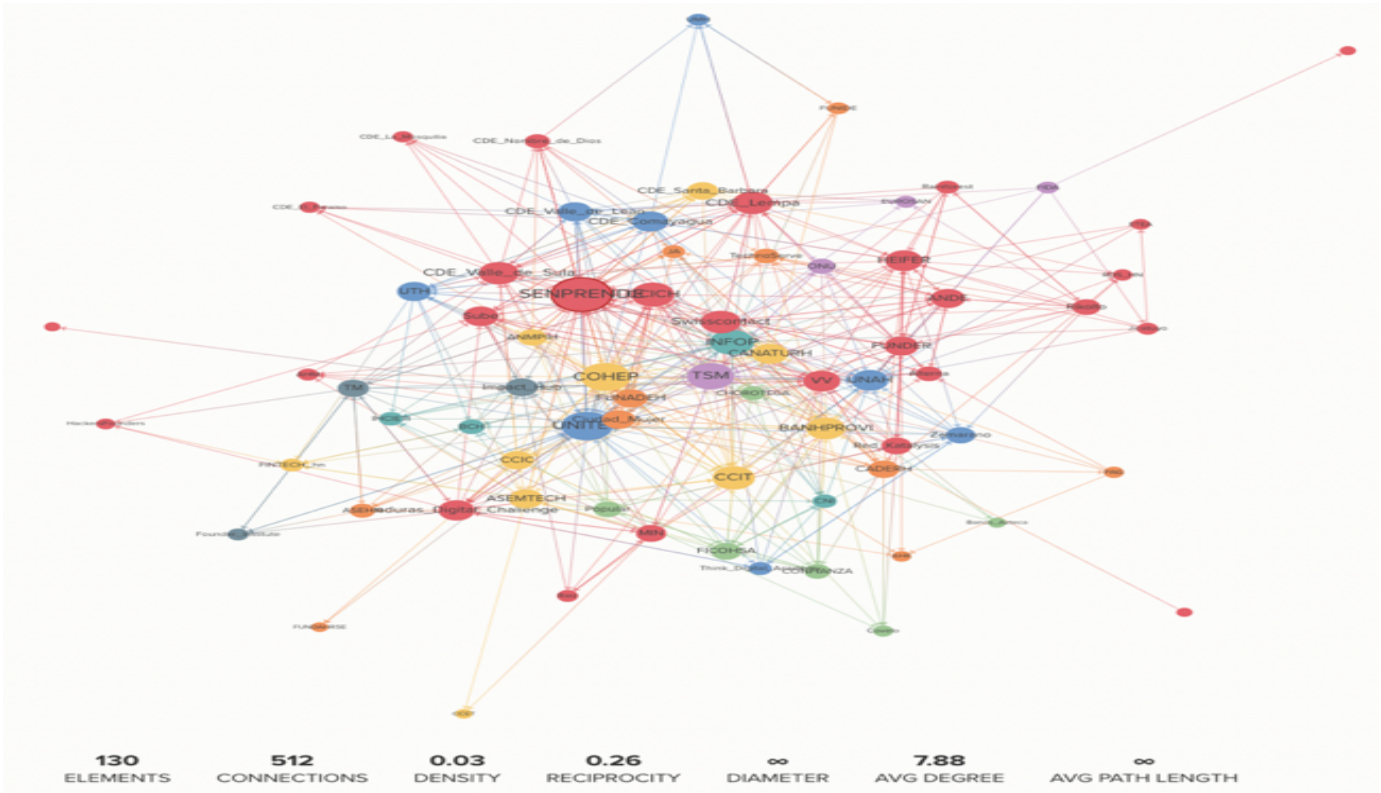

Fig. 2 a. Entrepreneurship ecosystem: connected actors.

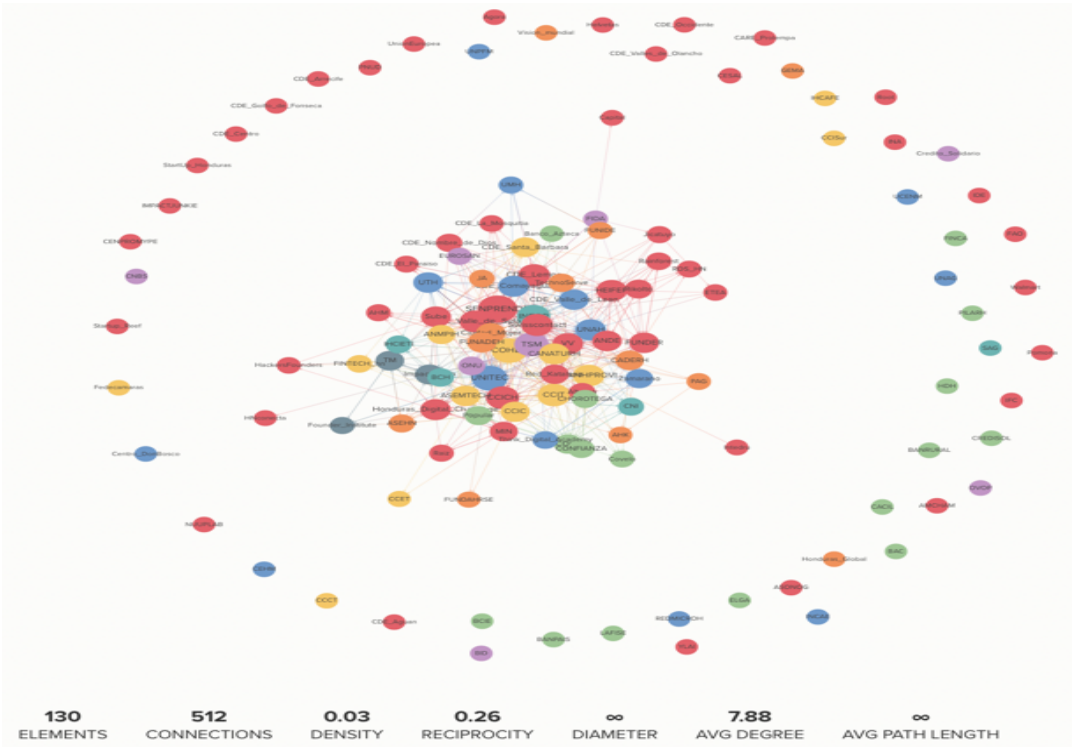

Fig. 2 b Entrepreneurship ecosystem: connected and disconnected actors.

The findings from the Social Network Analysis (SNA) reveal that the entrepreneurial ecosystem in Honduras exhibits a total of 512 connections, characterized by a density of 0.03. This density signifies a low level of interconnectedness, reflecting the presence of weak ties among actors. Notably, SENPRENDE emerges as the most connected entity, with 43 connections out of a possible 129. However, the ecosystem demonstrates limited reciprocity, as only around 30% of actors mention each other reciprocally, while 70% lack two-way relationships. On average, actors maintain eight connections out of a possible 129, underscoring the relatively sparse network structure (refer to Figure 2a). Also, Figure 2 b shows that actors with a high rate of non-relationship coexist in the ecosystem (at least 56 organizations). Table I shows actors who are connected despite working together. Their relationships and programs are weak, and the speed of information transfer is limited due to their purposes, budgets, and radius of interaction (case of INFOP, CCIT, FUNDER, ANDE, and VV).

Table I also sheds light on a promising aspect of the ecosystem. Despite having a low number of connections, certain actors, such as UNAH, UNITEC, VVy ANDE, demonstrate remarkable effectiveness in their programs. This underscores the significance of proximity to other actors within the network. These actors leverage their close ties with others to enhance their impact significantly. Even with a limited network reach, they can swiftly access resources and amplify their interactions, provided they are linked to actors with high levels of connectivity and intermediation. Notably, entities like SENPRENDE, CDE Lempa, Comayagua, UNITEC, COHEP, Swisscontact, and CCIH play pivotal roles in ensuring visibility, facilitating information flow, and extending assistance, thereby enabling actors with fewer connections to thrive and contribute meaningfully to the ecosystem's dynamics.

TABLE I
CONNECTION, CLOSENESS, AND INTERMEDIATION STATISTICS

	Closeness			Intermediation	
Pos.	Organization	Value	Pos.	Organization	Value
1	SENPRENDE	0.578	1	SENPRENDE	0.070
2	CDE_Lempa	0.536	2	UNITEC	0.047
3	CDE_Comayagua	0.534	3	CDE_Lempa	0.045
4	Swisscontact	0.531	4	BANHPROVI	0.039
5	COHEP	0.526	5	TSM	0.029
6	CCICH	0.525	6	COHEP	0.029
7	FUNDER	0.517	7	ANDE	0.027
8	UNITEC	0.516	8	Swisscontact	0.026
9	CDE_Valle_de_Sula	0.509	9	VV	0.025
10	BANHPROVI	0.501	10	CCICH	0.024
45	UNAH	0.396	23	UNAH	0.010

Table II provides a concise overview of the organizations that receive the highest mentions and are sought after by other actors within the ecosystem, particularly those specializing in financing and technical assistance, thus deemed as leaders of the ecosystem (as indicated by the indegree column). The prominence of the most mentioned institution can be attributed to its ongoing investment projects nationwide and its concerted efforts to implement actions aimed at enhancing sectoral competitiveness.

TABLE II
SIZE STATISTICS AND BIDIRECTIONAL RELATIONSHIPS OF INPUT AND OUTPUT CONNECTIONS

	Indegree			Outdegree	
Pos.	Organization	Value	Pos.	Organization	Value
1	TSM	20	1	SENPRENDE	32
2	Crédito Solidario	17	2	CDE_Lempa	25
3	COHEP	16	3	CDE_Comayagua	24
4	BANHPROVI	15	4	CCICH	23
5	CCIT	15	5	UNITEC	23
6	HEIFER	15	6	BANHPROVI	22
7	CENPROMYPE	15	7	FUNDER	22
8	Fedecámaras	14	8	Swisscontact	22
9	CANATURH	11	9	COHEP	21
10	FICOHSA	11	10	Red_Katalysis	21
57	UNAH	4	52	UNAH	5

Similarly, Table II highlights the pivotal role played by actors dedicated to enhancing network connectivity and integration, including SENPRENDE, the CDE, FUNDER, UNITEC, Swisscontact, COHEP, Red Katalysis, and CCICH. Together, they facilitate a more robust flow of information within the network, providing valuable insights that empower human capital, foster a deeper understanding of collaborative efforts, and contribute to operational enhancement. However, the efficiency of these actors remains a subject of debate. Moreover, the eigenvector values in Table III signify the leaders within the network or ecosystem. Organizations such as SENPRENDE, COHEP, Swisscontact, CDE, CCICH, HEIFER, FUNDER, and UNITEC emerge as key drivers of diffusion (Reach), focusing on strategies to bolster SMEs through human capital support, technical assistance, and financial advisory services. Additionally, organizations with heightened exposure are identified based on reach efficiency, which not only includes actors with extensive connections but also those serving as conduits to reach other actors due to their elevated visibility in direct relationships. These encompass entities like FIDA, Intedru, Think Digital Academy, FUNIDE,

Founder Institute, Banco Azteca, Raíz, ONU, Rainforest, and UMH (Refer to Table III)

TABLE III
ECOSYSTEMS STATISTICS: EIGENVALUE, REACH, EFFICIENCY REACH

Reach			Reach efficiency		
Pos.	Organization	Value	Pos.	Organization	Value
1	SENPRENDE	0.822	1	FIDA	0.068
2	COHEP	0.767	2	Intedru	0.065
3	Swisscontact	0.767	3	Think_Digital_Academy	0.060
4	CDE_Comayagua	0.744	4	FUNIDE	0.056
5	CDE_Lempa	0.729	5	Founder_Institute	0.053
6	CCICH	0.713	6	Banco Azteca	0.050
7	CDE_Valle_de_Sula	0.690	7	Raíz	0.044
8	HEIFER	0.690	8	ONU	0.044
9	FUNDER	0.682	9	Rainforest	0.043
10	UNITEC	0.667	10	UMH	0.042
45	UNAH	0.388	61	UNAH	0.018

B. Sub-ecosystems by Region and Zone

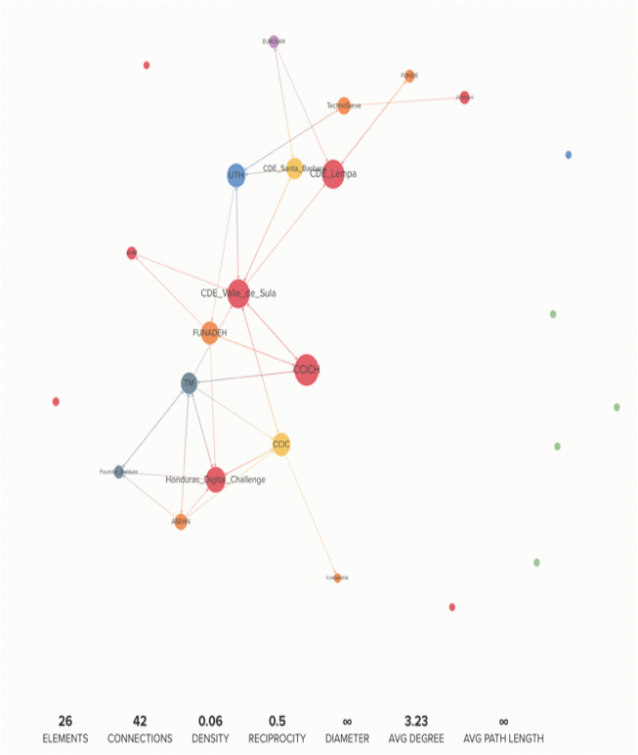

Fig. 3 a. Sub-ecosystems by region: nor-occidental region

We examine the ecosystems through the lens of four distinct sub-ecosystems, categorized by region (central-southern and north-western zones) and area (urban and rural). Focusing on the sub-ecosystem of the North-Western zone (refer to Figure. IVa), we observe a network comprising 26 actors with a total of 42 connections and a density of 6%. This density represents the ratio of actual connections to the total possible connections (26), with a recorded range of 2 connections out of a potential 26. With an average of seven connections per actor, the level of reciprocity within this sub-ecosystem is deemed satisfactory, with 50% of actors reciprocally mentioning each other. Notably, there exists a moderate level of communication among actors facilitated through organizations dedicated to supporting SMEs (See figure 3 a.).

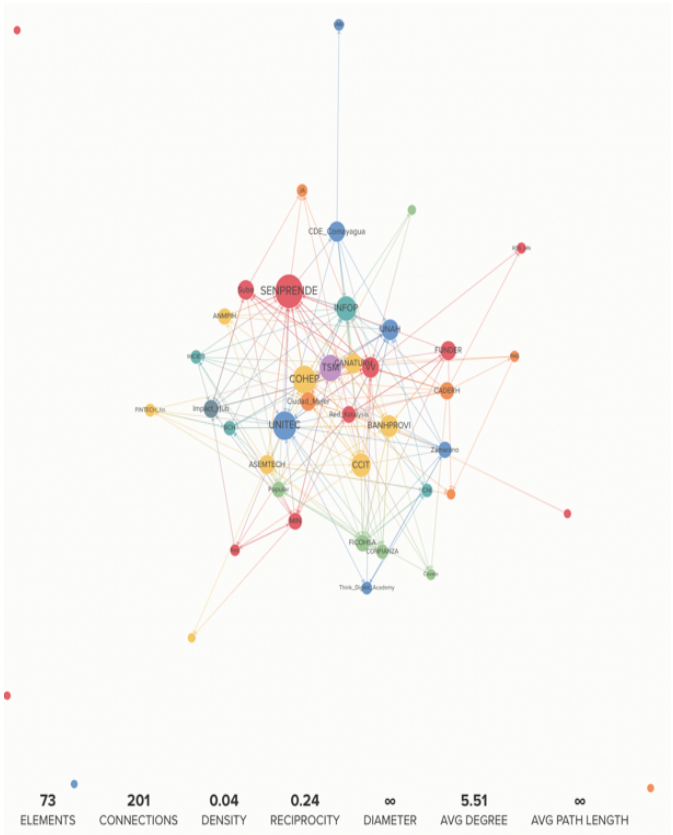

Fig. 3 b. Sub-ecosystem by region: Central Region

Central region ecosystem (See Figure 4b) shows 73 actors with a total of 201 connections out of 5,256 possible connections, generating a density of 4%, a weak level of connection between actors (Average of 5 connections per actor), at least 24% of these actors mention knowing or working with any of the 73 actors of said network, SENPRENDE has taken the role of operations center (bringing together more connections) and the weak role in the ecosystem is led by actors such as the academy.

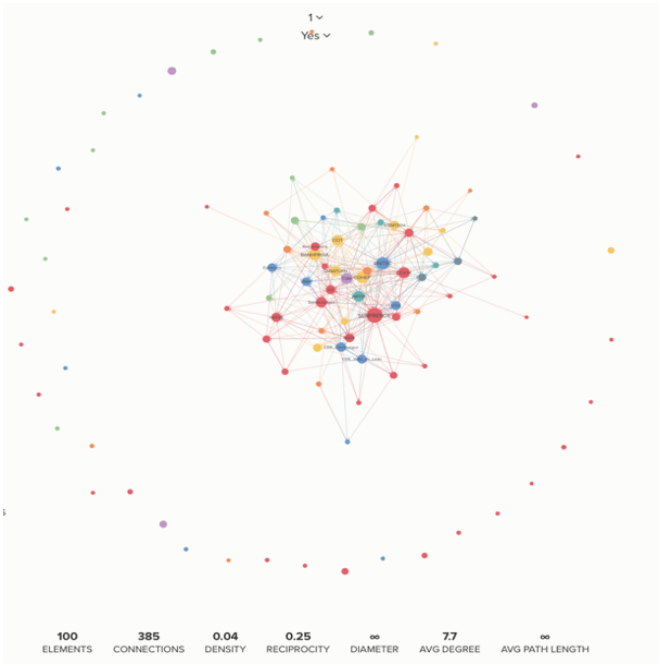

Fig. 4 a. Sub-ecosystem: urban zone

Regarding the analysis of the ecosystem by area, the entrepreneurship ecosystem of the urban area has 100 actors, with a total number of 385 connections. The average number of connections per actor is 7.7 out of a total of 99 possible connections, with a density of 4% and reciprocity of 25%; at least 25% of the actors interrelate with each other, and 75% of the remaining actors They have ever worked with different actors, they know about the programs, but there is no formal or informal relationship or link with the rest of the actors in the ecosystem, showing weakness in the bidirectional relationship between actors (See figure 4 a).

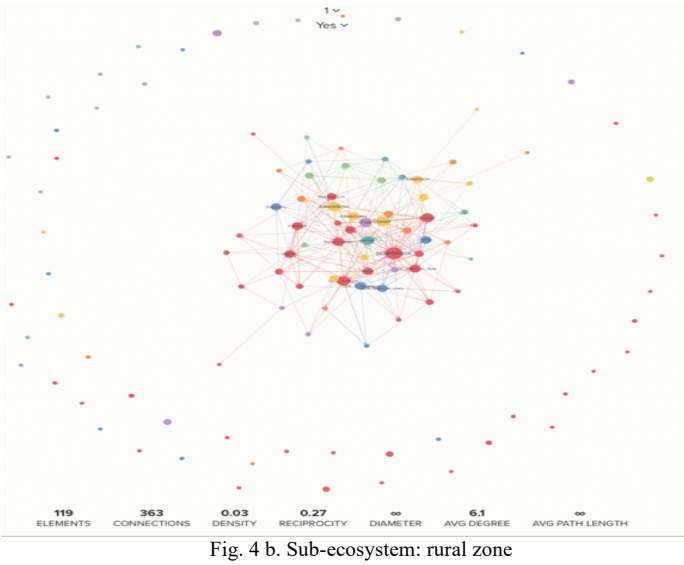

Fig. 4 b. Sub-ecosystem: rural zone

The previous sub-ecosystem shows that at least 39 actors are not connected despite being mapped (See Figure 5 a). The ecosystem of the urban area shows that: 1) an Acceptable level of competitiveness and inclusion of technology, 2) Agile information flow, 3) Accelerated mobility, 4) Larger and better places or markets, 5) Greater employability, 6) Logistics and differentiated distribution, 7) Access to a more significant number of financial products and services, 8) Lower risk and environmental contingency, 9) High level of accidents due to organized and common crime, 10) Greater portfolio of actors that enhance the business, 11) High number of substitute products and services, 12) Greater control of the supply chain, 13) Greater number of State support programs, 14) Greater access to medium and large companies, 15) Need to move from self-sustainability to growth, and 16) Transformation of matter in a specialized manner.

On the other hand, the entrepreneurship ecosystem in the rural area (see Figure 5 b) comprises 119 actors, many of whom have a presence in the urban area. The number of connections was 363 out of 14,000 possible, with a density of 3% and an average of 6.1 connections. The ecosystem reciprocity was 27%, with 3 out of 10 actors interrelated with each other.

The characteristics of the ecosystem in the rural area are: 1) Ecosystem with a more significant number of disconnected actors, focused on improving production processes, 2) Diffusion and exposure levels are affected by distance, 3) Little or no verticalization, 4) Low level of diversification, 5) Low levels of technical education, 6) Limited resource flow, 7) Weak infrastructure, 8) High levels of intermediation, 9) Low supply chain control, 10) Levels of innovation and transfer low technological, 11) Environmental control and sustainability, medium, 12) Limited place or markets, 13) Distant support, assistance, training and financing actors, 14) High level of risk and volatility, 15) Concentration of resources in the sectors medium and large, 16) Low level of fair trade, 17) Expansion and non-accelerated growth, and 18) Inclusive ecosystem with impact on poverty and human development.

C. Inferential Analysis

To test inferential analysis, first, we evaluated the internal data consistency, where Cronbach's Alpha guaranteed the reliability of the information ($a>0.887$). Data have a non-normal distribution ($p<0.05$), with deviation levels less than 0.8, indicating low variability (See Table IV). Also, we evaluated the statistical relationship between variables, where the variables closeness, degrees, MicmacE, MicmacI, Reach, and Reach Efficiency show moderate to strong relationships (values between 0.5 to 0.96). However, the eigenvector variable presented weak relationships (0.1 to 0.6). To test hypothesis H1, we applied the statistical mediation method considering X (independent variable): Influence, M (mediator variable): Connection level, and Y (dependent variable): Diffusion (See Figure 5).

TABLE IV
CORRELATION MATRIX

	Closeness	eigenvector	Grade	MICMAC (E)	MICMAC (I)	Reach	Reach efficiency
Closeness	1.000						
Eigenvector	,428**	1.000					
Grade	,873**	,570**	1.000				
MICMA Cexposición	,666**	,348**	,612**	1.000			
MICMA Cinfluencia	,726**	,277**	,547**	,559**	1.000		
Reach	,953**	,380**	,833**	,666**	,740**	1.000	
Reach efficiency	,750**	0.163	,521**	,600**	,794**	,820**	1.000

The results of the statistical mediation estimation indicate that the model was significant ($p<0.05$), the level of relationship between the variables was 0.8972, and the F value was 262.0479. We measured the direct and indirect effects and the level of mediation below.

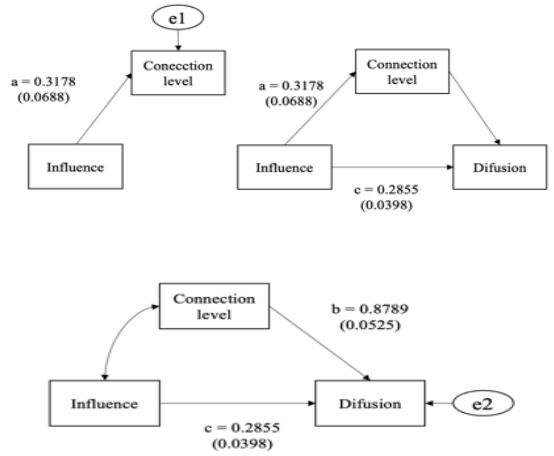

Fig. 5 Mediation estimation

TABLE V
TOTAL EFFECT, DIRECT AND INDIRECT EFFECT

Total & direct effect	*Effect*	*S. E*	*t*	*p*	*LLCI*	*ULCI*	*c_cs*
Total effect of X on Y	0.5648	0.06044	8.7647	0.00	0.4373	0.6923	0.612
Direct effect of X on Y	0.2855	0.0398	7.1706	0.00	0.2067	0.3643	0.309
Measurement of indirect effect		Boot S. E	BootLLCI	BootULCI	VF		Bootstrap (95%)
Indirect effect of X on Y	0.2793	0.05098	0.174	0.39	0.4945	49.45%	1000

Table V shows that the level of connection partially and complementarily mediates the relationship between the level of influence of the actors (X) and the dissemination capacity (Y) [33]. The partiality in the mediation is because the value of the quotient between the indirect effect and the total effect is greater than 20% but less than 80% (EI/ET: 49.5%); the mediating variable is not fully explained by the Dependent variable [34]. Also, we tested hypothesis H2, Where Y (dependent variable): Scope, X1 (independent variable); Influence of the actors, X2 (independent variable) is the closeness of the actors. The multiple regression model was estimated (see Tables VI and VII).

TABLE VI
MODEL SUMMARY

Model	R	R Square	R square adjusted	Standard error estimation
1	.939[a]	.881	.879	.32347

a. Predictors: (Constants), micmacinfluence, closeness

TABLE VII
ANOVA

Model		Sum of squares	gl	Mean square	F	Sig.
1	Regression	98.681	2	49.340	471.544	.000[b]
	Residue	13.289	127	.105		
	Total	111.969	129			

a. Dependent variable: reach, b. Predictors: (Constant), micmacinfluence, closeness

TABLE VIII
COEFFICIENTS OF THE LINEAR REGRESSION MODEL

Model		Unstandardized coefficients B	Desv. Error	Standardized coefficients Beta	t	Sig.
1	(Constant)	.142	.063		2.270	.025
	closeness	.817	.037	.853	22.054	.000
	micmacinfluence	.116	.034	.131	3.388	.001

a. Dependent Variable: reach

Finally, from the results, we determine the list of actors that maintain consistent relationships partially and directly, with a high scope and that energize the Entrepreneurship Ecosystem in Honduras; these are: 1) SENPRENDE, 2) Unitec, 3) COHEP, 4) TSM, 5) INFOP, 6) CCICH, 7) CCIT, 8) Swisscontact, 9) CDE Valle de Sula, 10) CDE Lempa, 11) Banhprovi, 12) UNAH, 13) Voces Vitales, 14) HEIFER, 15) CDE Comayagua, 16) Honduras Digital Challenge, 17) Canaturh, 18) Sube, 19) Asemtech, 20) UTH, 21) CDE Valle de Lean, 22) ANDE, 23) FUNDER, and 24) Ciudad Mujer.

V. CONCLUSION AND FUTURE RESEARCH

The entrepreneurship ecosystem in Honduras needs to be more robust due to political, social, and economic factors that generate an asymmetry and affect the levels of disconnection

between actors, affecting its competitiveness. At the same time, the ecosystem analyzed showed a low-density reciprocity that does not exceed 50% of the actors, with an average level of connections between actors that does not exceed nine connections; this indicates that evaluated actors continue to work in isolation, with low short-term incidents for the organization and the region in which it interacts. Furthermore, the ecosystem operates under the Bimodal principle (a set of actors participate in a set of events). Likewise, the ecosystem bidirectional relationship is affected since many actors have concentrated on offering a good or service rather than on the symmetrical exchange of goods or services (acquiring assistance, goods, support, or other attributes from another actor. and not just selling). The triads of actors with transitivity formed in the ecosystem are concentrated on financial organizations and government institutions like SENPRENDE. Entrepreneur-Financial Institution-Government-Academy sectors lead the triads.

Material attributes continue to be the key factors in accelerating ecosystem revitalization processes (weak infrastructure, shortages of monetary and technological resources), followed by social attributes (multiple actors but low two-way interaction between them). From tested hypotheses, we concluded that the level of connection contributes to improving diffusion. However, the latter will depend not only on the actor connection level but also on complementary actions such as efficiency in reach and the critical actors' exposure within the ecosystem. The lack of bidirectional connections or the Unidirectionality of the actors is because l) Public Policies agreed upon but lacking measurement and evaluation of their execution, 2) Duplication of functions and low interaction with the rest of the links, 3) Limited resources and oriented towards sustainability with little capital for innovation and development, 4) The purposes or objectives of the support organizations differ from the needs of the actors, 5) Assistance is aimed at guaranteeing or minimizing the risks of the actors and not to strengthen the organizations, 6) The projects and programs are not longitudinal and their sustainability over time is weak, 7) The medium and large sectors are not absorbing the rest of the actors, 9) The Formal and non-formal education encounters gaps in updating, specialization and technification, and 10) weaknesses in market control.

Finally, future research is required to investigate the magnitude of each relationship, detailing the internal and external factors that guarantee the connection, link, reciprocity, and densities between actors, which holistically explain the restrictions related to the attributes of the analyzed ecosystem. A critical analysis of network analysis will allow for establishing the factors that cause heterogeneity among them and what combination of relationships contributes to the entrepreneur's success in their ecosystem. This research recognizes limitations that can serve as proposals for future research lines. For example, future studies can delve deeper into estimating the magnitude of relationships and understanding the factors that facilitate connectivity, linkages, and reciprocity within the entrepreneurship ecosystem. The research's practical implications highlight the need to improve collaboration and cooperation between actors within the business ecosystem in Honduras. Managers can improve ecosystem competitiveness and effectiveness by addressing identified causes of weak connectivity, such as duplication of functions and misalignment of goals. Theoretical and methodological research implications are related to the application of network analysis to evaluate entrepreneurial ecosystems, identifying the factors that influence their success or failure. Also, these research results have economic and social implications because strengthening the entrepreneurship ecosystem in Honduras leads to economic growth and development. Also, by fostering connectivity and two-way interactions, the ecosystem can promote innovation, resource sharing, and knowledge transfer, ultimately driving economic progress.

Additionally, a robust business ecosystem can address social challenges by creating employment opportunities, encouraging social mobility, and addressing the needs of marginalized communities. The comprehensive network analysis developed in the study provides a unique perspective on ecosystem connectivity, bidirectional relationships, and factors that influence its competitiveness. The research directly contributes to existing knowledge on entrepreneurship ecosystems and offers a basis for future research and policy formulation in Honduras and similar international contexts. This research emphasizes improving connectivity, two-way interactions, and complementary actions within the ecosystem. By addressing the identified limitations and implications, future research can contribute to a better understanding of the ecosystem and improve its competitiveness.

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