Revista Iberoamericana para la Investigación y el Desarrollo Educativo
ISSN 2007 - 7467

https://doi.org/10.23913/ride.v15i29.2143

Scientific articles

Jardines Etnobiológicos: Desafíos de Gobernanza Universitaria en el marco de la Agenda 2030

Ethnobiological Gardens: University Governance Challenges within the framework of the 2030 Agenda

Hortas Etnobiológicas: Desafios da Governança Universitária no âmbito da Agenda 2030

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Resumen

La Agenda 2030 propone que las instituciones educativas lideren el cambio hacia un futuro más sostenible para enfrentar desafíos ambientales, económicos y sociales de las generaciones presentes y futuras. Esta investigación articula un análisis de la gobernanza y la sustentabilidad universitaria, como variables que pueden facilitar u obstaculizar el proceso para la creación de un Jardín Etnobiológico (JE), como una ruta que impulse la conservación de la biodiversidad y del patrimonio cultural. Los resultados obtenidos mediante el abordaje metodológico mixto -cuantitativo y cualitativo- muestran los siguientes desafíos: 1) Relevancia de la acreditación "Institución 2030" en el proceso de construcción de relaciones mutuamente beneficiosas que sirven de sustento para generar mayores sinergias entre la comunidad universitaria. 2)Participación integral de autoridades, maestros y alumnos para que, en conjunto con los sectores gubernamental, empresarial y social, puedan consolidar acciones, programas y proyectos sustentables. 3) Importancia de la gran riqueza de especies de flora como la ceiba (*ceiba pentandra*), framboyán (*delonix regia*) y maculí (*tabebuia pentaphila*) que se encuentran en las áreas naturales de la Universidad Tecnológica de Tabasco (UTTAB). Finalmente, se propone valorar al Jardín Etnobiológico como un laboratorio innovador para la sustentabilidad y nuevo escenario para la enseñanza-

aprendizaje, vinculado a la preservación de saberes tradicionales de los pueblos originarios de Tabasco.

Palabras clave: Biodiversidad, Cambio Climático, Desarrollo Sostenible, Institución 2030, Millenials.

Abstract

The 2030 Agenda proposes that educational institutions lead the change towards a more sustainable future to face environmental, economic and social challenges of present and future generations. This research articulates an analysis of university governance and sustainability, as variables that can facilitate or hinder the process for the creation of an Ethnobiological Garden, as a route that promotes the conservation of biodiversity and cultural heritage. The results obtained through the mixed methodological approach -quantitative and qualitative- show the following challenges: 1) Relevance of the "Institution 2030" accreditation in the process of building mutually beneficial relationships that serve as a basis to generate greater synergies among the university community. 2) Comprehensive participation of authorities, teachers and students so that, together with the governmental, business and social sectors, they can consolidate their sustainable actions, programs and projects. 3) Importance of the great richness of flora species such as the ceiba (ceiba pentandra), framboyán (Delonix regia) and macuilí (tabebuia pentaphila) found in the natural areas of the Universidad Tecnológica de Tabasco (UTTAB). Finally, it is proposed to value the Ethnobiological Garden as an innovative sustainable laboratory for teaching-learning, linked to the preservation of traditional knowledge of rural communities and native peoples of Tabasco.

Key Words: Biodiversity, Climate Change, Sustainable Development, Institution 2030, Millenials

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Resumo

A Agenda 2030 propõe que as instituições educativas liderem a mudança para um futuro mais sustentável para enfrentar os desafios ambientais, económicos e sociais das gerações presentes e futuras. Esta pesquisa articula uma análise da governança universitária e da sustentabilidade, como variáveis que podem facilitar ou dificultar o processo de criação de um Jardim Etnobiológico (JE), como rota que promove a conservação da biodiversidade e do patrimônio cultural. Os resultados obtidos através da abordagem metodológica mista – quantitativa e qualitativa – evidenciam os seguintes desafios: 1) Relevância da acreditação "Instituição 2030" no processo de construção de relações mutuamente benéficas que sirvam de apoio para gerar maiores sinergias entre a comunidade universitária. 2) Participação integral de autoridades, professores e estudantes para que, em conjunto com o governo, os setores empresariais e sociais, possam consolidar ações, programas e projetos sustentáveis. 3) Importância da grande riqueza de espécies de flora como ceiba (ceiba pentandra), framboyán (delonix regia) e macuilí (tabebuia pentaphila) que se encontram nas áreas naturais da Universidade Tecnológica de Tabasco (UTTAB). Por fim, propõe-se valorizar o Jardim Etnobiológico como um laboratório inovador de sustentabilidade e um novo cenário de ensino-aprendizagem, ligado à preservação dos conhecimentos tradicionais dos povos originários de Tabasco.

Palavras-chave: Biodiversidade, Mudanças Climáticas, Desenvolvimento Sustentável, Instituição 2030, Millenials.

Reception Date: November 2023 **Acceptance Date:** July 2024

Introduction

Mexico is among the first places worldwide for its biocultural diversity. The state of Tabasco, nestled in the tropics in the southeast of the country, has the presence of at least 3 indigenous peoples, in terms of cultural diversity (INEGI, 2021). In the Tabasco territory, the presence of 149 mammals (Hidalgo, *et al.* , 2019), 495 species of birds (Arriaga, *et al.* , 2019), 106 reptiles (Barragán *et al.* , 2019), 31 amphibians (Barragán, 2019), 246 algae (Rivas and Cruz, 2019) and 429 species of fungi (Rosique and Cappello, 2019) has been documented. The interaction that has occurred for generations between different cultures and biological diversity generated biocultural heritage, which is now threatened due to the speed at which socio-environmental changes have occurred in recent decades. For this reason, in 2015, the member countries of the United Nations signed the 2030 Agenda, which represents a valuable

strategic planning instrument to guide countries towards sustainable, inclusive and harmonious development of their ecosystems through environmental public policies (UN, 2020). A cross-cutting objective of the Sustainable Development Goals (SDG) is the one that refers to quality education, which allows safeguarding present biocultural resources without deteriorating them for future generations (ECLAC, 2018).

In this context, proposals have been generated by higher education institutions (HEIs) to contribute to the conservation and sustainable use of plant species diversity and towards the development of environmental and tourism practices that encourage the participation of the population in the care and preservation of natural resources and collective cultural heritage in conjunction with educational institutions, the business sector and the government sector (Nieto and Medellín, 2007; Cantú, 2021; Bosmenier *et al.* , 2020). Currently, Mexican Universities are immersed in these changes, making their study plans relevant; mainly considering the new global challenges that require an inclusive vision in higher education. Faced with these challenges to address environmental problems, HEIs require a paradigm shift to promote a sustainable organizational culture for the benefit of caring for natural and cultural ecosystems (Higuera-Sánchez and Pacheco-Borbón, 2021).

This is how the National Council of Humanities, Sciences and Technologies in Mexico (CONAHCYT) has promoted a new national strategy for the protection of Mexico's biocultural heritage, inviting HEIs to participate in the Network of Ethnobiological Gardens of Mexico (RENAJEB), which are spaces for research, the dissemination of bioculturality and the management of sustainable development projects (Ramírez, 2021). Faced with these scenarios, the Technological University of Tabasco (UTTAB) intends to create an Ethnobiological Garden (JE), which would enhance knowledge of the cultural biodiversity of Tabasco, from a socio-ecological and environmental affectivity approach, bringing together indigenous peoples to share their traditions and knowledge with students. Thus, the Tabasco Science and Technology Council is currently financing the research project *Network of Ethnobiological Gardens: an alternative for sustainable tourism management and biodiversity conservation in the territories of the Mayan Train* , which proposes, in a first stage, the elaboration of a Master Plan to promote the creation, development and consolidation of a JE on the UTTAB university campus as a valuable laboratory for environmental linkage and; in the second stage of the project, the model will be replicated in the municipalities that make up the state of Tabasco as a strategy for the conservation of

Tabasco's biocultural heritage (these results will not be part of the analysis carried out in this article because the research phase is still in development).

In the first part of this article, the context of biodiversity will be analyzed, focusing on Mexico and mainly on the state of Tabasco. Subsequently, a review of the literature regarding the importance of Ethnobiological Gardens as instruments of environmental conservation will be carried out. The importance of accreditation of Higher Education Institutions to promote sustainable projects with an emphasis on social responsibility and that have a positive impact on the conservation of the biocultural heritage of rural communities and indigenous peoples will also be examined, as well as an analysis of governance and institutional leadership to achieve a university culture of sustainability based on organizational change and strategic management. In the third part, quantitative and qualitative data will be analyzed, obtained through the instruments developed to collect pertinent information regarding the biodiversity of the university campus. On the other hand, the criteria of environmental governance and university sustainability were selected, grouped into four categories: 1) educational 2) institutional 3) environmental and 4) cultural. The participating actors, who are the primary source of information, correspond to a representative sample of the university community of UTTAB. In the fourth section, the results obtained will be discussed, contrasting them with the scientific literature and conclusions supported by the research will be based. Finally, future lines will be proposed to be developed in later stages of the project .

National Network of Ethnobiological Gardens

In 2019, the federal government, interested in recognizing the great value of Mexico's indigenous peoples, issued a call to promote the creation of a National Network of Ethnobiological Gardens. Currently, 24 states in Mexico are part of this network and have ethnobiological gardens aimed at the knowledge and conservation of their biodiversity, most of them based in higher education institutions and others, on a smaller scale, established in protected natural areas. Tabasco is one of the eight Mexican states that does not have an Ethnobiological Garden. It is necessary to emphasize that ethnobiology is the science that studies the use of plants, animals and other natural resources to meet cultural needs and practices (Pulido-Silva and Cuevas-Cardona, 2021). This science examines traditional knowledge about medicinal uses of plants, agricultural techniques, spiritual beliefs related to nature, among other aspects (Ríos *et al.,* 2017). Ethnobiology explicitly studies the ancestral

and current interrelations of indigenous peoples with respect to animals, plants and fungi, in a cultural, spatial and temporal context (Pérez and Argueta, 2020). On the other hand, according to Juárez (2014), ethnobiology is the science that promotes understanding and collaboration between cultures and science for the benefit of biodiversity conservation and sustainable development.

The ethnobiological garden is a place that highlights the relationship between local communities and nature, promoting ancestral knowledge about the use of flora, fauna and fungi and their value in different aspects of human life. In this type of gardens, artistic, cultural and scientific activities are promoted to provide universal access to this great biocultural wealth (Martin *et al.,* 2020). The JE represent a source of inspiration and learning about the interaction between people and the natural environment; they also recognize and value the ancestral knowledge of indigenous communities on the use of plants, animals and natural resources (Díaz-Toribio and Piedra-Malagón, 2022). Conceptually, it is broader than a botanical garden, since it not only focuses on the conservation of plants and organisms from other kingdoms, but also promotes and fosters knowledge about the use and maintenance of that biodiversity (Viccon *et al.,* 2023). Traditional knowledge faces strong threats, as it is exposed to phenomena such as migration, globalization and undervaluation (Cuevas-Cardona and Pulido Silva, 2021). In addition to being educational spaces, JE promote scientific research and the exchange of knowledge between different actors, such as scientists, local communities and visitors interested in learning about the relationships between people and plants (Dalmau-Rovira, 2022). The social responsibility of a JE is manifested in the conservation of biodiversity, the protection of traditional knowledge and the promotion of equity and inclusion in the interaction between the university community, local communities and nature (Olalla-Reyes, 2020). Likewise, social responsibility is related to the recognition and appreciation of local knowledge and practices, the promotion of community participation, and the search for collective solutions for the conservation of biodiversity and the well-being of communities (Ramírez, 2021).

According to the literature review presented in the previous paragraphs, most of these spaces are considered laboratories for the conservation of sustainability. Five years have passed since CONAHCYT launched the first call to expand the horizons of botanical gardens to ethnobiological gardens and thus in 2024 it issues a new call to add the eight states that have yet to join RENAJEB.

Leadership and environmental governance

In this context, higher education institutions (HEIs) have promoted actions for environmental conservation with innovative projects that seek to positively impact student learning, from theoretical knowledge to sustainable practices – such as school gardens – with an impact on the communities in their area of influence (Fontalvo-Buelvas, 2024). The paradigm shift includes that subjects related to environmental care and sustainable development are being included in the curricular plans of the various degrees taught at HEIs. This has required sustainable actions for financing and competitiveness that drive institutional change to carry out innovations with university social responsibility (Díaz-Herrera *et al.,* 2021). Historically, educational organizations incorporate new methods, projects and new technologies that facilitate learning about environmental care, producing changes in the organizational culture and the university community (Rueda *et al.* , 2018). Globalization and new sustainable technologies invite educational organizations to generate constant change processes in order to face environmental transformations in the environment. In the case of higher education organizations, organizational change processes in their management enable university governance and sustainability (Lizama-Pérez, 2024).

Environmental governance (Chávez and Cardona, 2019) refers to the set of transformations that are expressed in the new organizational culture for decision-making and resource allocation to environmental projects, whose new quality will generate an impact on the HEIs themselves and on the communities in their area of influence. This governance is introduced mainly by senior management and administrative staff, who visualize the opportune moment in which an institutional change is required. The capacity of HEIs to adapt to the demands of the environment is the result of rational actions by the actors involved in university life (professors, students, researchers, administrators and authorities of the institution). Forces external to HEIs (companies, civil society, the government) put pressure on institutional changes in favor of caring for a healthy environment, converging in social transformations that emerge as a result of the innovations introduced in the HEI (Guevara *et al.* 2021).

Organizational leadership in the field of HEI sustainability is essential for organizations to maintain their relevance and competitive profile in the market (Pedraja-Rejas *et al.,* 2018). However, resistance to change is shown to be a frequent process that hinders the implementation of new systems, mainly those related to aspects of governance, decision-making, organizational culture and environmental culture (Martínez-Bustos *et al.,*

2018). University governance allows improving the quality of strategic planning and management in HEI processes, as well as the policies, strategies and tools that allow their autonomy. Despite this, one of the greatest challenges, at a national and international level, is to develop a close link between the university and the business, government and society sectors, all in close connection with Objective 4 of the 2030 Agenda (Bosmenier et al., 2020).

Therefore, the universality of HEIs is seen as pluriversal and with a perspective of global citizenship, through education for SD. Thus, sustainability requires the renewal of programs taught in universities for the generation of experiences and knowledge from a horizontal perspective (Botero, 2020). The university community of HEIs must take advantage of the synergies that arise from the connection with other entities, which would allow innovation, taking up the challenges of the 21st century with environmental governance strategies (Vivas-Rodríguez and Lizama-Pérez, 2023).

Given this scenario, UTTAB envisioned the possibility of introducing an innovation in university governance and sustainability, applying as a candidate to form part of the National Network of Ethnobiological Gardens of CONAHCYT and is currently working on a research project funded by the Council of Science and Technology of Tabasco, called *Network of Ethnobiological Gardens: alternative for sustainable tourism management and biodiversity conservation in territories of the Mayan Train.*

"Institution 2030" Accreditation

As mentioned in the previous section, it is essential that institutional leaders support changes in organizational culture to promote university governance and sustainability. SDG number 4 of A2030 seeks to guarantee inclusive, quality education and promote lifelong learning opportunities; therefore, it is shown as the most powerful tool for sustainable progress, which allows building more prosperous societies (UN, 2020). In this context, the accreditation of HEIs is a new reference for the substantive functions of the university, so it is necessary to reflect on the articulation of this dimension in the institutional, economic, social and environmental impacts taking into account university governance and sustainability within the framework of A2030 (Cantú, 2021). Strategic management in Higher Education Institutions (HEIs) is an indispensable element within the 2030 Educational Agenda to achieve Sustainable Development. Therefore, evaluation and accreditation processes are vital to manage the quality of institutions, in view of the needs of university activities and their quality (UNESCO 2017).

Gutiérrez *et al.* (2022) emphasize that educational processes in HEIs that offer the tourism and gastronomy profession must promote the quality of educational programs, from a universal perspective that favors learning and facilitates students' integration into a competitive labor dynamic in the field of their profession. Therefore, it is essential that through educational programs HEIs are linked to society and contribute to social well-being. According to Huerta-Estévez *et al.* (2023) emphasize that in education issues in the context of A2030, important progress has been made through the implementation of public policies with support programs for students at all educational levels. HEIs need to strengthen inter-university networks and links with other associations and institutions in the public, private and social sectors, to achieve comprehensive sustainability and extend actions that promote community projects and strategic alliances; This requires a comprehensive self-assessment that identifies areas of opportunity in institutional plans to improve for the benefit of biocultural heritage (Bohne *et al.,* 2019). To advance towards the consolidation of the environmental perspective and sustainability in HEIs, it is essential to promote public policies that guide planning, evaluation and accountability efforts, in addition to leadership and the will of the governing bodies. The knowledge built in Mexican HEIs will allow the training of critical and creative professionals to generate concrete proposals for change towards the construction of a sustainable future (Nieto and Medellin, 2007).

For this reason, in 2020, the formal authorities of the UTTAB (Rector and Board of Directors) promoted the accreditation of the “Institution 2030”, with the mission of training human capital of excellence that develops professional skills, emphasizing the use of innovative technological tools; In addition, social responsibility actions have been proposed, forging a culture of sustainable development and promoting strategic links with the business, government and social sectors (Martínez, 2021). One of the fundamental actions of the “Institution 2030” accreditation at UTTAB, under a triple economic, social and environmental aspect, was the creation of the Master's Degree in Sustainable Tourism Development (Lizama-Pérez, 2024), and as part of its priority actions related to A2030, the research project on the creation of an Ethnobiological Garden as a reservoir of the biocultural diversity of the state of Tabasco was proposed, which includes species of flora, fauna and fungi that are native and culturally important for rural communities and indigenous peoples. The aim is to document ancestral ecological knowledge, as well as develop sustainable projects that promote the conservation of biodiversity, its ecological restoration and the dissemination of ethnobiological knowledge of the state of Tabasco, implementing

innovative teaching-learning models with an emphasis on university governance and sustainability.

Methodology

The *general question* that forms the backbone of the work is:

Are ethnobiological gardens laboratories for the conservation of biocultural diversity that foster significant learning about environmental affectivity in the university community or are they a limited route to promote sustainable development and social responsibility from the spheres of higher education within the framework of A2030?

To answer this question, three specific objectives have been raised:

1. Identify the natural resources available to UTTAB for the creation, development and consolidation of an Ethnobiological Garden (JE) that serves as a reservoir for fungi, flora and fauna of Tabasco.
2. Collect information through interviews with experts to develop an analysis of the strengths and challenges of the UTTAB for the implementation of a JE as an innovative teaching -learning and university social responsibility strategy.
3. Conduct a survey among students to measure the dimensions of environmental governance and university sustainability that will allow the creation of a JE on the UTTAB campus, based on the criteria of the “Institution 2030” Certification.

Materials and methods

The methodological approach used in this research was based on a mixed focus, since it involved the collection and analysis of qualitative and quantitative information. The procedure was concentrated in two phases: in the first, documentary information regarding the topic of ethnobiology, botany and environmental education programs was collected, classified and analyzed, which was obtained from sources such as theses, scientific journals, books and bulletins, as well as electronic sites of official organizations such as the UN and UNESCO. And in a second phase, field work was carried out, which has combined survey and interview techniques. It was developed through the DEXPLOS Sequential Exploratory Design, which integrates in a first stage the collection of qualitative analysis and later another where quantitative data is collected and analyzed (Hernández-Sampieri *et al.,* 2016). To obtain qualitative information, interviews were conducted with seven key informants from the Technological University of Tabasco, who are recognized teachers with 20 or more years

of seniority at UTTAB, have experience in the environmental area and leadership in research projects (See Table 1). For the design of the interview guide, models of questionnaires-guides generated and tested in previous works with similar thematic axes were considered (Manzano and Martínez, 2017) and were conducted during the month of June 2023. The interviews were recorded and uploaded to a YouTube channel created for this purpose, called "University Leadership and Governance" (See Table 2).

Table 1. Interviewed experts attached to the UTTAB.

Interviewee	Academic Division	Activities
Full-time teacher. Belongs to the State System of Researchers	Administration and Business	Teaching Projects
Full-time teacher and SNI 1	Industrial Processes	Investigation Teaching Projects
Full-time teacher Conductor Belongs to the State System of Researchers	Information Technology	Teaching University promotion Hosting UTTAB radio and official events
Full-time teacher Postgraduate Coordinator Belongs to the State System of Researchers	Tourism and Gastronomy	Teaching Investigation Coordination of Master's Degree in Sustainable Development
Teaching Full time	Environmental engineering and petroleum chemistry	Teaching Environmental projects Union leader
Full-time teacher	Environmental engineering and petroleum chemistry	Head of the “Earth Charter” Club. Investigation.
Full-time teacher	Environmental engineering and petroleum chemistry	Investigation Teaching

Fountain: Own elaboration (2023).

Table 2. Instrument for the interview with experts.

Variable	Categories	Items
Environmental Governance	1) Educational	1.- What leadership and social responsibility strategies should teachers and students implement to promote the 2030 agenda in the study plans and programs and to allow the creation of an ethnobiological garden at UTTAB?
Environmental Governance	2) Institutional	2.- How do you think institutional authorities could support activities related to the creation of an ethnobiological garden, as part of the activities related to Institution 2030 Certification in the field of social responsibility?
University Sustainability	3) Environmental	3.- What flora and fauna of the UTTAB has allowed environmental sustainability and could promote the creation of an ethnobiological garden? 4.- What environmental management practices has UTTAB implemented and what environmental action plan could be developed for the creation of an ethnobiological garden?
University Sustainability	4) Cultural	5.- Why is it important to promote community participation networks for the creation of an ethnobiological garden at UTTAB as a laboratory for scientific knowledge of biodiversity that allows the preservation of the biocultural heritage of indigenous peoples?

Source: Own elaboration (2023).

In the quantitative methodological approach, the population is made up of the student community of UTTAB (See Table 3) and the subjects were students between the ages of 20 and 27, who by sharing similar cultural characteristics belong to a generation called Millennials; this generation is aware of environmental problems and is motivated towards projects based on the principles of sustainability. For sampling, the considerations and peculiarities of exploratory social studies were followed, which seek to obtain a broad data collection for subsequent in-depth investigations into the aspects of interest. In this way, a non-probabilistic sampling was carried out, in which the following stages were considered: opportunity, intentional or convenience sampling, and seeking to obtain a diversity of points of view and actors for the areas of study (Hernández-Sampieri *et al.,* 2016). The sample size was statistically obtained with a margin of error of 6% and a confidence level of 95%, resulting in a sample of 152 students, studying different semesters and careers at the time of applying the instrument during the months of April and May 2023. As the Tourism and Gastronomy Division is the academic area that concentrates the largest part of the student population, it was the place where, in proportion, the largest number of these were carried

out (40 in Tourism and Gastronomy, 28 in Administration and Business, 28 in Information Technologies, 28 in Industrial Processes, 28 in Environmental Engineering and Petroleum Chemistry). Regarding the research instruments for the interviews and surveys, various topics were addressed regarding environmental governance, social responsibility, the 2030 Agenda and university sustainability. The design is non-experimental and cross-sectional, since the variables used were not manipulated and the data were recorded at a single point in time, revealing the phenomenon as it occurs in that space. It has an explanatory scope in seeking to answer how environmental governance influences university sustainability.

Table 3. Survey participant data

Variable	Worth	Frequency	Percentage
Sex	Man	75	49.3
	Women	77	50.7
Age	20-22	52	34.2
	23-25	50	32.9
	26-27	50	32.9
Academic Division	1.-Tourism and Gastronomy	40	26.4
	2.-Industrial Processes	28	18.4
	3.-Chemistry and Environmental	28	18.4
	Engineering	28	18.4
	4.-Information Technologies	28	18.4
	5.-Administration and Business		
Semester	First	27	17.8
	Second	25	16.4
	Third	25	16.4
	Room	25	16.4
	Fifth	25	16.4
	Sixth	25	16.4

Source: Own elaboration (2023).

The technique for collecting statistical data was a self-administered survey. The instrument is a questionnaire designed based on a review of scientific literature and an analysis of expert judgment. A pilot test with eight observations was applied, and the final items that measure the variables of environmental governance and university sustainability were subsequently determined. Thus, the instrument was made up of four categories analyzed during the research , where the 12 items (See Table 4) were evaluated through a five-point Likert-type scale, whose values range from (1) totally disagree to (5) totally agree respectively. The questionnaire was captured in digital format (online) on the Google Forms platform, where it was sufficient to have the link to the questionnaire and an electronic device with an Internet connection . The application was carried out during the first semester of 2023; for this, the

authorization of the UTTAB directors was requested, guaranteeing the confidentiality, anonymity and good use of the information.

Table 4. Operationalization of the variables of the quantitative study

Variable	Categories	Authors	Items
Environmental Governance	Educational	Perez and Argueta (2019); Martin *et al.,* (2020); Cuevas-Cardona and Pulido-Silva (2021)	1. Authorities promote university consultation to carry out educational actions of sustainable social responsibility. 2. Authorities introduce mechanisms to facilitate the implementation of a JE as a laboratory for research and sustainable practices. 3. Authorities involve the university community in environmental education activities.
Environmental Governance	Institutional	Cantú (2021); Gutiérrez *et al.,* (2022); Viccon *et al.,* (2023)	4. UTTAB offers educational programs that contain sustainable actions of university social responsibility. 5. UTTAB takes action to ensure that JE is a strategy for the formation of scientific communities from childhood. 6. UTTAB promotes activities to disseminate Institutional Accreditation 2030.
University Sustainability	Environmental	Rios *et al.,* (2017); Olalla (2020); Pulido-Silva and Cuevas-Cardona (2020)	7. The JE promotes strategic actions for the conservation of university biodiversity. 8. JE is sustainable in the long term 9. The JE plays an important role in the conservation of flora, fauna and fungal species.
University Sustainability	Cultural	Damon and Sánchez (2022); Dalmau-Rovira (2022); Reyes *et al.,* (2023)	10. The JE is a space that allows activities to enrich knowledge about Tabasco culture. 11. The beauty of a JE's design attracts external visitors and promotes cultural tourism. 12. The university community would be willing to participate in cultural and ethnobiological programs of a JE.

Source: Own elaboration (2023).

Results

In order to respond to objective number 1, regarding the identification of the natural resources available to the UTTAB, the following three tables (5, 6 and 7) were prepared, based on the information collected during the interviews conducted with the experts.

Table 5. Floristic list of tree, shrub and palm species **(** With information collected from question 3 corresponding to the interview applied to the experts. See table 2).

Common name	Scientific name	Family	Biological form	Use
Round guano	*Mexican sabal*	AREACEAE	Palm	Construction
Licuala	*Licuala grandis*	AREACEAE	Palm	Ornamental
Royal Palm	*Roystonea dunlapiana*	AREACEAE	Ornamental palm	Construction
Willow	*Salix humboldtiana*	SALICACEAE	Tree	Timber
Amate	*Ficus insipida*	MORACEAE	Tree	Shade
Indian laurel	*Ficus benjamina*	MORACEAE	Tree	Ornamental
Ramon	*Brosimum alicastrum*	MORACEAE	Tree	Forage
Flamboyan	*Delonix regia*	FABACEAE	Tree	Ornamental
Golden shower	*Senna fistula*	FABACEAE	Tree	Medicinal
Red	*Haematoxylum campechianum*	FABACEAE	Tree	Timber
Mahogany	*Swietenia macrophylla*	MELIACEAE	Tree	Timber
Cedar	*Cedrela odorata*	MELIACEAE	Tree	Timber
Ceiba	*Ceiba pentandra*	MALVACEAE	Tree	Timber
Cocoa	*Theobroma cacao*	MALVACEAE	Tree	Edible
Guava	*Psidium guajava*	MYRTACEAE	Tree	Edible
Guayacan	*Tabebuia chrysantha*	BIGNONACEAE	Tree	Timber
Macuilis	*Tabebuia rosea*	BIGNONACEAE	Tree	Timber
Cannon	*Averrhoa carambola*	OXALIDACEAE	Tree	Edible

Source: Prepared by the authors using data from interviews with experts (2023).

Table 6. List of mammal and amphibian species of the UTTAB and its surroundings

Gender	Species	Gender	Species
Incillus (Toads)	Valliceps	Rhinella (Toads)	Marine
Staurotypus (Turtles)	Triporcatus	Trachemys (Turtles)	Venusta
Kinosternon (Turtles)	Leucostomum	Dermatemys (Turtles)	Mawii
Boa (Snakes)	Constrictor	Iguana (Lizards)	Iguana
Glossophaga (bat)	Soricin	Choeroniscus (bat)	Godmani
Didelphis (opossum)	Virginiana	*Crocodylus acutus (crocodile)*	Crocodylus

Source: Prepared by the authors using data from interviews with experts (2023).

Table 7. List of bird species observed in the UTTAB and its surroundings.

Order and Family	Scientific name	Common name
Apodiformes		
Trochilidae	*Anthracothorax prevostii*	Black-throated Hummingbird
Piciformes		
Picidae	*Melanerpes aurifrons*	Chejé carpenter
Psittaciformes		
Psittacidae	*Eupsittula nana*	Dirty-breasted Parrot
Passeriformes		
Icteridae	*Icterus gularis*	Greater dorsal calandria
Cardinalidae	*Piranga rubra*	Blue black colorin

Source: Prepared by the authors using data from teacher interviews (2023).

In order to respond to objective number 2, the results of the interview with the experts gave us the following insights into the implementation of the Ethnobiological Garden at UTTAB.

Table 8. Results of the interview applied to UTTAB experts (E=Interviewee. P1=Question 1. P2=Question 2. P4=Question 4. P5=Question 5. See Table 2)

AND	P1	P2	P4	P5
E1	It is essential to establish clear objectives and goals, which must be shared and socialized with all members of the school community.	The University has undergone major changes that have triggered innovative trends and a rethinking of its substantive functions, such as its management and evaluation, in relation to social responsibility, and a JE would be an excellent example to benefit society.	Have a clear and explicit commitment to sustainability in its mission, vision and policies. This involves integrating sustainability into all areas of the institution, including strategic planning, governance and decision-making.	Students perceive the value of having a space dedicated to the conservation of biodiversity and the promotion of local culture as a JE, therefore it is necessary to create synergies with the participation of community networks.
E2	It is the leader's responsibility to generate, develop and promote group goals for the creation of the JE and to include those who make up the organization.	Accreditation in social responsibility tangibly demonstrates the institution's commitment to the values and principles it upholds. It would be very interesting to develop a Master Plan for the creation of the JE at UTTAB.	Offer academic programs that integrate sustainability into their curriculum. This is demonstrated by the inclusion of courses on sustainability-related topics, the promotion of research in sustainable areas, and the integration of sustainable practices into teaching and learning.	Students have a genuine interest in biodiversity and the conservation of native species. This interest shows that the student community values the importance of biodiversity in the local and global environment. With some subjects, networks have been established with the social fabric. Therefore, the JE would be an excellent opportunity to promote these actions.
E3	The main focus must be on the teaching-learning process in the creation of the JE.	Creating a JE could improve the reputation and image of the university. This is especially relevant in a context where social	The university has implemented environmental management practices that minimize the negative impact on the environment.	The university community has a positive environmental awareness and a commitment to sustainability. In this sense, the

		responsibility and sustainability are increasingly valued by students, parents, employers and society in general.		creation of a JE requires the collaboration of institutional, academic, societal and government authorities.
E 4	Ensure that all components and actions within the educational system support student learning.	Accreditation can be seen as objective proof that the university is meeting high standards of social responsibility. And a JE would be an environmental standard that could position UTTAB as a leading institution in the environmental field.	Adoption of measures to reduce the consumption of natural resources, such as water and energy, proper waste management, promotion of the use of renewable energy and conservation of biodiversity on campus.	Students who are part of the Earth Charter Club are always involved in community participation activities and have brought artisans to activities held at UTTAB.
E5	Ability to deal with complex and everyday situations considering axis 4 of the A2030	Respond to the expectations and demands of the local community, demonstrating the university's commitment to improving the quality of life of people and the environment in which it operates.	The university has involved the academic community and society at large in promoting sustainability.	The JE can enrich your educational experience by providing a hands-on learning space and an opportunity to gain knowledge about native flora and local culture. I consider it of utmost importance to establish ties with communities to create environmental synergies.
E6	Make judgments and take assertive decisions for the creation of the ethnobiological garden.	It is necessary to ensure that the university is offering quality education, preparing students to be responsible citizens committed to social and environmental well-being. The JE	Creating student engagement programs, collaborating with local organizations, and disseminating sustainable practices in the community.	Preserve and celebrate local culture, including traditional knowledge related to biodiversity. This perspective shows how the project can contribute to the promotion of regional culture

		could support these causes.		and identity and therefore requires the collaboration of society at large.
E7	Willingness to improve, dedication, interest, study and resolution to carry out SR actions	Social responsibility involves a process of continuous evaluation and improvement of institutional practices. This can stimulate innovation and the adoption of good practices in various aspects, such as environmental management, community participation, social inclusion	The University has established monitoring and evaluation systems to measure and improve its sustainability performance by setting clear goals and objectives, conducting regular audits and using sustainability indicators to assess progress.	Institutional support is required for these activities, both in terms of resources and administrative support. And of course, attracting artisan communities to participate in events that would need to be held in the JE.

Source: Prepared by the authors using interview data (2023).

The following information obtained from data collected during the survey of young university students will allow us to respond to the statement of objective number three.

Table 9. Results of the survey applied to the community of young university students .

Items	5	4	3	2	1
1. Authorities promote university consultation to carry out educational actions of sustainable social responsibility.	57.2 % (87 R)	36.2 % (55 R)	6.6 % (10 R)	0	0
2. Authorities would introduce mechanisms to facilitate the implementation of a JE as a laboratory for research and sustainable practices.	61.8 % (94 R)	31.6 % (48 R)	3.3 % (5 R)	1.3 % (2 R)	2 % (3 R)
3. Authorities involve the university community in environmental education activities.	55.9 % (85 R)	34.2 % (52 R)	9.2 % (14 R)	0.7 % (1 R)	0
4. UTTAB promotes educational programs that contain cross-cutting themes of sustainable actions.	39.5 % (60 R)	34.2 % (52 R)	23 % (35 R)	2.6 % (4 R)	0.7 % (1 R)
5. UTTAB takes action to ensure that JE is a strategy for the formation of scientific communities from childhood.	37.5 % (57 R)	44.1 % (67 R)	17.1 % (26 R)	1.3 % (2 R)	0
6. UTTAB promotes activities to disseminate the 2030 Agenda.	45.4 % (69 R)	40.1 % (61 R)	11.9 % (18 R)	2.6 % (4 R)	0
7. The JE will promote strategic actions for the conservation of university biodiversity.	51.3 % (78 R)	39.5 % (60 R)	9.2 % (14 R)	0	0
8. The JE will be created based on a master plan that will allow for its long-term sustainability.	39.5 % (60 R)	40.1 % (61 R)	17.1 % (26 R)	3.3. % (5 R)	0
9. The JE will play an important role in the sustainable use of flora, fauna and fungi species for the conservation of ancestral knowledge.	55.3 % (84 R)	36.1 % (55 R)	5.3 % (8 R)	3.3. % (5 R)	0
10. The JE is a space that would allow activities to enrich knowledge about Tabasco culture.	46 % (70 R)	43.4 % (66 R)	9.9 % (15 R)	0	0.7 % (1 R)
11. The beauty of a JE design would attract external visitors and promote cultural tourism.	40.8 % (62 R)	37.5 % (57 R)	21 % (32 R)	0.7 % (1 R)	0
12. The university community would be willing to participate in JE cultural and ethnobiological programs .	34.4 % (53 R)	39.1 % (59 R)	22.5 % (34 R)	3.3. % (5 R)	0.7 % (1 R)

Source: Prepared by the authors using survey data (2023).

R = Number of responses

In summary, the positive results of the surveys and interviews indicate that the implementation of the Ethnobiological Garden has strong support from the university community. These results not only validate the viability of the project, but also provide a solid basis for continuing with the planning and implementation, knowing that there is an enthusiastic and committed group willing to contribute to the success of the garden. A significant number of students have indicated their willingness to participate in the creation and maintenance of the Ethnobiological Garden. This willingness to get directly involved shows a high degree of commitment and enthusiasm on the part of the students to contribute to the project. However, according to the results of the interviews, institutional actions are required in the context of the 2030 Agenda to promote an organizational change that favorably impacts the institutional culture and environmental governance.

Discussion

1.-Environmental governance variable

a) Educational Category

The answers to questions 1, 2 and 3 of the survey and the answers to question 1 of the expert interviews show that a high percentage of the university community is willing to actively participate in activities related to environmental education and conservation. The answers reflect the recognition of the educational value that an Ethnobiological Garden can bring. Students and experts consider that this project can enrich their educational experience by providing a practical learning space and an opportunity to acquire knowledge about native flora and local culture. In this context, Fontalvo-Buelvas (2024) has collected research on university school gardens, showing that sustainable practices positively influence student learning and have an impact on the surrounding communities. UTTAB has taken measures, such as the creation of the 'Earth Charter Club', integrating students into sustainable projects. In addition, a group of academics has carried out the inventory of the university's flora and fauna. However, the dissemination of these actions is sporadic, without research and documentation of the impact and scope of these strategies. Chávez and Cardona (2019) state that the paradigm shift for an organizational change with an impact on a sustainable university culture includes that the subjects related to environmental care and sustainable development be included transversally in the curricular plans of the various degrees. Currently, the UTTAB offers university programs that transversally include actions for

environmental care. Therefore, it is of utmost importance to analyze the educational benefits of the implementation of a JE, considering its potential for scientific research, the teaching of ethnobiology, environmental education and the strengthening of cultural awareness. In this context, the research results agree with the arguments of the United Nations Educational, Scientific and Cultural Organization (UNESCO, 2017) which states that Education for Sustainable Development is a holistic and transformative education that concerns the content, learning outcomes, pedagogy and learning environment for sustainability with actions that benefit rural communities and indigenous peoples. Following this line, although Díaz-Herrera *et al.* (2021) mention that USR is essential to achieve an impact on SD, the UTTAB promotes an education that trains ethical professionals committed to society and the environment, but sustainable actions for financing and competitiveness that drive institutional change to carry out innovations with USR are only incipient . Díaz-Toribio and Piedra-Malagón (2022) state that the Ethnobiological Garden is a learning environment in which species of flora, fauna and fungi are preserved, which favor the social interaction of the community and allow its actors to exchange knowledge to build and integrate new learning into their existing knowledge structures. In this sense and derived from the present research, it is shown that the UTTAB has an inventory of flora and fauna that would favor the implementation of a JE in its facilities, in order to have a learning environment that favors social interaction and offers meaningful learning and collaborative work.

b) Institutional Category

The answers to questions 4, 5 and 6 show a high percentage of the university community to strongly support the initiative in this category. Cantú (2021) affirms the relevance of higher education and A2030 for the promotion of SD. This implies integrating sustainability in all areas of the institution, including strategic planning, governance and decision-making. Since its creation, UTTAB has demonstrated a clear and explicit commitment to sustainability in its mission, vision and policies. The University has undergone major changes that trigger innovative trends and a rethinking of its substantive functions, such as its management and evaluation, regarding social responsibility, which has implied an organizational change, university culture and leadership. Coinciding with Pedraja-Rejas *et al.* who mention that leadership and sustainable academic culture are essential requirements for achieving the SDGs in HEIs, UTTAB has offered academic programs that integrate sustainability into its curriculum. This is demonstrated by the inclusion of courses on topics related to

sustainability and the integration of sustainable practices in teaching and learning. UTTAB has involved the university community in environmental management practices that minimize the negative impact on the environment. Therefore, the most relevant SDGs for the context of the JE must be defined and a system for evaluating the achievements that can be reached must be proposed, as well as the establishment of indicators that allow measuring the economic, social and environmental impact of each action. The results of this research agree with Lizama-Pérez (2024), who states that the creation of the master's degree in Sustainable Tourism Development has encouraged the participation of graduate students in research projects in the context of A2030, which includes the collaboration of local organizations and the dissemination of sustainable practices with the community. Finally, in this category, the university community considers that ethnobiological gardens enhance the development of skills, knowledge and values related to conservation, biodiversity, local culture and the Sustainable Development Goals of the 2030 Agenda. In this sense, we agree with Olalla-Reyes (2020), who states that the implementation of the 2030 Agenda has allowed Ethnobiological Gardens to adapt their strategies to achieve the SDGs but that it is necessary to design a strategic plan that covers the challenges for sustainable development, with local actions and global impacts.

2.- University Sustainability Variable

a) Environmental Category

The answers to questions 7, 8 and 9 indicate that students perceive the value of having a space dedicated to biodiversity conservation. The results reveal that many students have a genuine interest in biodiversity and the conservation of native species. This interest demonstrates that the student community values the importance of biodiversity in the local and global environment. The data indicate that there is a positive environmental awareness and commitment to sustainability among the students surveyed. According to Gutiérrez *et. al* (2022), the accreditation of a university as sustainable implies complying with certain criteria and standards established by recognized organizations. In this context, UTTAB has established monitoring and evaluation systems to measure and improve its performance in sustainability. This has involved setting clear goals and objectives, conducting regular audits, and using sustainability indicators to assess progress and take corrective action when necessary. Cuevas-Cardona and Pulido-Silva (2021) are the designers of the ethnobiological garden at the Autonomous University of the State of Hidalgo and consider the participation

of the university community to be of utmost importance for the long-term sustainability of the garden, through students who do their professional internships, the giving of environmental talks to students and the organization of tours of the garden, inviting students from basic and secondary education levels. Considering this premise and with the results of the research, the UTTAB has conducted tours of the university facilities for children and has given talks related to caring for the environment, in addition to the fact that students are carrying out sustainable projects in connection with the tourism sector and for the benefit of local communities and indigenous peoples of Tabasco. Viccon *et al.* (2023) INECOL JE researchers affirm that it is important to evaluate the positive impacts of ethnobiological gardens on the conservation of local biodiversity, the protection of endangered species and the restoration of ecosystems and to assess their effects on society with actions such as the dissemination of science, environmental education and biocultural knowledge, involving all types of public. In this vein, sustainable linkage activities have been carried out with the Science and Technology Council of Tabasco and other HEIs to promote university DS. Ramírez (2021) affirms that in the JE of Durango, ethnobiological environmental education favors strategic planning processes, and designs pedagogical and/or didactic proposals, based on the dialogue of knowledge, feelings, identifications, realities and uses that from the local are linked to the global; such as sustainable workshops, training and accompaniments. At UTTAB, reforestation actions, environmental forums and webinars have been carried out to showcase sustainable university actions.

b) Cultural Category

The results of questions 10, 11 and 12 indicate that students see the JE as a way to preserve and celebrate local culture, including traditional knowledge related to biodiversity. This perspective shows how the project can contribute to the promotion of regional culture and identity. This is especially relevant in a context in which social responsibility in the field of culture and sustainability are increasingly valued by students, parents, employers and society in general. Martin *et al.* (2020) argue that it is essential that ethnobiological gardens are recognized as living cultural spaces that favor the generation of affective and respectful links with the elements of nature. Dalmau-Rovira (2022) states that JE, in addition to being educational-cultural spaces, promote scientific research and the exchange of knowledge between different actors, such as scientists, local communities and visitors interested in learning about the relationships between people and plants in relation to cultural use and ancestral knowledge. Cuevas-Cardona and Pulido-Silva (2021) state that the JE is a place

that highlights the relationship between local communities and nature, promoting ancestral knowledge about the use of flora, fauna and fungi and their value in different aspects of human life. Ramírez (2021) argues that botanical gardens (antecedents of the JE) promote artistic, cultural and scientific activities to provide universal access to this great biocultural wealth. The UTTAB proposes that the investigative and educational mission of the JE should not be forgotten and their cultural, leisure, recreation and education potential should be recognized. The Technological University of Tabasco has, on some occasions, carried out activities with artisans from the region, who have attended the University facilities to exhibit their products and give cultural talks to the university community; however, these have been sporadic actions that need to be institutionalized to improve extramural links and have an impact on rural communities and indigenous peoples.

Conclusions

Based on the research results, it can be concluded that implementing an Ethnobiological Garden at the university is feasible and has a strong potential for success. The data obtained offer a solid basis for presenting compelling arguments to stakeholders and making informed decisions about project planning and execution. The implementation of an Ethnobiological Garden at the Technological University of Tabasco, in line with the 2030 Agenda for Sustainable Development, represents a significant step towards promoting biodiversity conservation, environmental education and community awareness. Through this work, a solid, action-oriented methodology has been explored and proposed that will guide the materialization of this comprehensive project. The theoretical analysis and literature review have demonstrated the importance of addressing environmental and social challenges in a holistic manner, recognizing the interconnection between the different Sustainable Development Goals. The Ethnobiological Garden is not only conceived as a physical space, but as a catalyst for interdisciplinary research, the promotion of traditional knowledge, and the strengthening of the relationship between the university and the community. The proposed methodology offers a structured and flexible approach to understanding the driving factors for the successful implementation of the Ethnobiological Garden. The inclusion of community participation and broad outreach will ensure that this project not only benefits the academic community, but also has a broader reach in society, promoting environmental awareness and commitment to sustainability. Ultimately, the creation of an Ethnobiological Garden at UTTAB will contribute to the achievement of multiple SDGs, including quality

education, climate action, life on land, and partnership to achieve common goals. This project represents an exemplary model for other educational institutions and organizations interested in fostering the connection between academia, biodiversity, and local communities. As we move towards the horizon of the 2030 Agenda, it is imperative that academic institutions lead the change towards a more sustainable and equitable future.

Future Lines of Research

Some key recommendations are presented to consider as future lines of research.

- Evaluate collaboration with other institutions and organizations.
- Design a sustainable plan, its ecological interaction and seasonality.
- Design spaces in the garden that reflect and celebrate cultural diversity and the relationship of the community and its traditional knowledge with its natural environment.
- Analyze educational, environmental and social benefits that the implementation of the Ethnobiological Garden could bring to the university and the community in general.

Acknowledgements

We would like to thank the Science and Technology Council of the State of Tabasco for funding the project *Network of Ethnobiological Gardens: an alternative for sustainable tourism management and biodiversity conservation in the territories of the Mayan Train;* and the Technological University of Tabasco for the support and facilities provided for this research.

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