

# Development analysis in the Ch'ol community from a sustainable approach

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— Abstract —

Evaluating the development of an indigenous community from a sustainable perspective, whose culture, productivity, and relationships with their natural environment are usually associated with their pre-Hispanic roots, is a complex issue, but one that needs to be addressed. This study was done using the method of hierarchical levels, sustainability indicators, and the General Sustainability Index. The results indicate a critical level of the GSI, that is, there is a negative relationship in the balance of the triad of sustainability, which puts at risk the environmental and cultural heritage that are reserved for future generations and points to the urgent need to reverse this imbalance.

**Keywords:**

*Sustainability, indigenous, community, General Sustainability Index, man-nature relationship.*

At present, the global scale on which environmental, economic, and social problems have transcended has exposed the fragility of man and the relationship he has with the environment around him; this situation has forced him to seek mechanisms that allow him to better understand the systems operating in a world that is ecologically, economically, and culturally rich and complex, as well as to perceive the interactions that arise in the structures of those systems, whose complexity requires a multidimensional analysis.

In this sense, it is necessary to understand the systems that human kind has developed to benefit from the elements that the environment offers, from a perspective of Sustainable Development (SD), from its social-cultural, economic-productive, and ecological-environmental dimensions (Gutiérrez *et al.*, 2008a: 54), a study that starts from a community level that allows recognizing the consequences of the imbalance in the relationship of the dimensional triad of sustainability: economic-social-ecological.

This premise leads us, first, to an approach to the concepts that support the present study, we refer to that of development, community, sustainability, and nature. It is possible to observe in the multiple proposals made by different authors that the common elements that have given conceptual support to these terms come, without a doubt, from the orientalist-paternalist paradigm, on the one hand, and the communalist, on the other, from the anthropomorphic or the radical environmentalism vision and economic rationalism (Palsson, 2001:80), which have had a fundamental weight in its construction.

From this, in the context of the relationship of human societies with the environment, these concepts are placed in a well-known dichotomy: either as separate entities or as something impossible to see separately. This dichotomy has resulted in various proposals to understand development, community, sustainability, and nature according to the context where they are located and who they serve, because they are also the support of the civilizational discourse that has been imposed and dominated in the world through what in our country is called "modernization", together with the public policies that have promoted it.

From the perspective of this article, it is a question of analyzing the orientation of the study community towards a type of development that derives from these concepts of "modernity" or the other, which places a different way or vision of understanding these concepts and of sustaining a differentiated civilizational discourse that arises from the 80s of the last century with the proposal of the Brundtland Commission for Sustainable Development that, without a doubt, came to stay, which contributes to clarifying that human kind's relations with the environment cannot be defined as the "use as you like (environmental resources), enrich yourself

and then see how we fix the disaster" but also that resources must remain unchanged as proposed by radical environmentalism because such a question could become an obstacle to human well-being (Gutiérrez, 1996: 205).

It should be pointed out then that the term "Development", in the context of this study, is not only a synonym for material progress or monetary enrichment (Martínez & Figueroa, 2014:15; Chirinos, 2010:296), it also means the desire, personal interests, the motivational forces behind them, as well as the mechanisms (both psychological and economic-productive), which are involved in satisfying it (Fromm & MacCoby, 1970: 171), it is, therefore, a term that has much to do with well-being and equality (Bolvinik, 2022), and with the preservation of resources for future generations.

Based on this, talking about development implies a form of progress and well-being that goes beyond the material, it is a development that from the rationally possible material benefit leads to well-being, which has as its recipient those who live in a given territory, therefore, the participation of people is considered essential and leads us to analyze it in the context that the sustainability triad proposes: achieving a balance between social benefits and human well-being with productive needs and care for the environment, applying the principles of sustainability as the opposite vision to the "modernizing" development imposed on our current societies.

On the other hand, talking about Sustainable Development is also talking about community, as an obligatory recipient of the benefit that the other brings to it and therefore we must bear in mind that this is a polysemic and complex term that can be interpreted according to the context in which it is involved, therefore, here it is used linked to the term territory, seen, beyond the geographical limitation, as a place where the diversity of the natural environment and human beings converge, considering the elements of sense of belonging, of interrelationships and common culture (Krauze, 2001:55), as a space occupied by human groups that gives them a sense of belonging or "sense of community", where they interrelate or interact, share a culture and a common history, which has a dynamic and changeable sense (Montero, 2004:100).

In other words, we speak of community in the sense of territory and the capacities of its inhabitants to decide and assume how to use it, as well as the consequences of those decisions, it also implies being clear about the ways how to use it and how to preserve it for future generations.

Another element that underpins the changes observed today, from urbanization, networks of supplies, fashions, and tastes, is the concept of improvement of the quality of life that stands as a reasoning of the "modern" civilizational discourse associated with the term nature, but, under an utilitarian vision instead of a rational and responsible relationship that leads to the progress and well-being of families without destroying the environment

(Ortiz, 2014:63). We see then that the term nature is understood according to the conveniences of the proponent and not as "that which exists and reproduces by itself" and in which the human is linked in one way or another since what happens in one sooner or later has repercussions in the other.

An example of this is that of economic rationalists that transformed the term nature into "resources", understood as goods on which the living being depended for its maintenance or supply, and therefore conveniently "capable of being exploited" which, added to the legal, support the right to privatize it ("submission"), is the conceptual justification of such appropriation and what it means in fact (destruction, looting, irrational use), only possible under a nature remote from the social world, converted into an object that can be managed according to the fluctuations of human interests at precise historical moments (Gudynas, 2014).

These concepts, viewed from the perspective of an orientation towards Sustainable Development (SD) or its inverse, are what lead us in the search for knowledge to better understand the transformations of the territorial space (Macías *et al.*, 2006:73) of the community under study, called Amado Nervo, so it involves recognizing the current characteristics of the community, the dynamics of its interactions and its relationship with the environment (Martínez & Figueroa, 2014:15), which allows evaluating the scope of its development under the criteria and principles of the SD (Moller, 2010:103).

In this sense, it is essential to recognize the abilities of its inhabitants to get goods and services from the environment, analyzing the system that it has created through indicators grouped into components placed under the magnifying glass of a scenario analysis scale and a matrix of interactions that review and analyze those goods and services that are useful to it, of its forms of conservation and/or restoration of the resources consumed, together with the fair and equitable distribution of the social-cultural benefit and others that characterize this place, whose virtue lies in the ancestral roots that distinguish it as an indigenous community of Mayan origin.

The community under study is located in the municipality of Yajalón, Chiapas, Mexico, and is composed entirely of indigenous Cho'l, which of course is not exempt from environmental problems and the exhaustion of resources that plague humanity, exposed to "modern" conversions that are very significant, especially in recent years. From this community it is known that in 1892 it was inhabited by indigenous Ch'ol and its population nucleus was expanded when in 1934, its inhabitants acquired the lands of the Colombia estate, by 1973 they were recognized and granted the title of communal assets, data recorded in the Aga file, Exp. 276.1/677 of the Ministry of Agrarian Reform.

## MATERIALS AND METHODS

### *Research area*

Amado Nervo is a community in the municipality of Yajalón, Chiapas, inhabited by speakers of the Ch'ol language and is located in the XIV Tulijá-Tseltal-Ch 'ol region at 17° 13' 45" north latitude and 92° 14'43" west longitude to the Greenwich meridian (Figure 1). The predominant climate is humid temperate with an average annual temperature of 20 °C and is located at 920 masl. The community has 1363 inhabitants according to data from the State Committee of Informatics, Statistics and Geography (CEIEG, 2021).

### *Applied methodology*

Considering that the study is based on an evaluation of complex systems from a sustainable perspective, the analysis is then made from the sociocultural, economic-productive, and ecological-environmental dimensions that give us an integral vision of the community, from the use of the resources of the environment, as well as the interactions that occur and give a dynamic to the community system, that is, they produce a behavior.

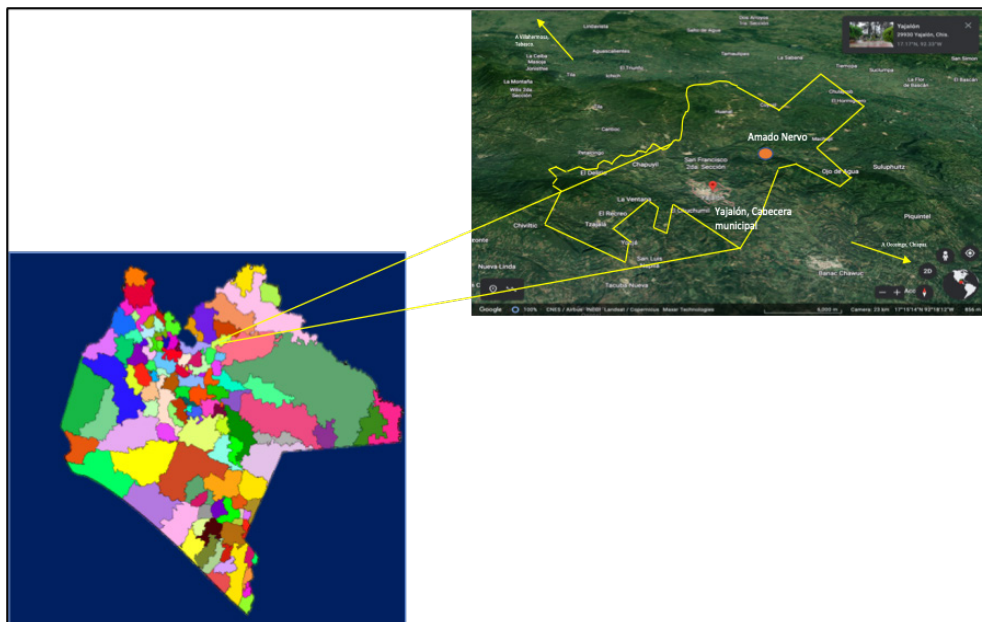


Figure 1. Location of the community of Amado Nervo municipality of Yajalón, Chiapas, Mexico

It is important to note that the purpose of this study is to recognize and evaluate the specific location of the system on a scale of values that has two extremes or maximum possible orientations; towards one extreme, an

unsustainable development is oriented, and towards the other, an orientation towards sustainable development, always bearing in mind that the most important criterion is that of the balance that the DS triad must keep. The guidelines refer to the greater or lesser degree of this reasoned balance that must exist in the triad that places human well-being and social benefit "at hand" with economic and productive activities that promote appropriate technologies for the protection of the environment to preserve resources for future generations.

For this purpose, this study used the structure of hierarchical levels (system-subsystem-component) to identify, explore, organize, and systematize information; a quantifier was used employing indicators as a measurement tool, incorporating, in turn, an analysis scale as a complementary instrument to assess the information generated.

The procedure, therefore, considers the Amado Nervo community as a system that is susceptible to disaggregation into three subsystems, and these, in turn, into various components that are combined according to the criteria and principles of sustainability. The subsystems are similar to any of the three dimensions of sustainability that link them in an essential relationship. These subsystems are the following:

- (1) Local production systems and their economic efficiency (whose similarity lies in the economic dimension). The capacity of local systems to provide goods and services to the family and community, as well as their capacity to preserve these resources are studied.
- (2) Natural resources (NR) and existing natural and induced biodiversity (like that found in the ecological dimension). Here it is proposed to analyze the use of natural resources and biodiversity to generate benefits for the community and, in turn, their efficiency to protect those resources for future generations.
- (3) Social services and cultural expressions (similar to the social dimension). The objective is to analyze their contribution to quality goods and services for the well-being and cultural identity of the community.

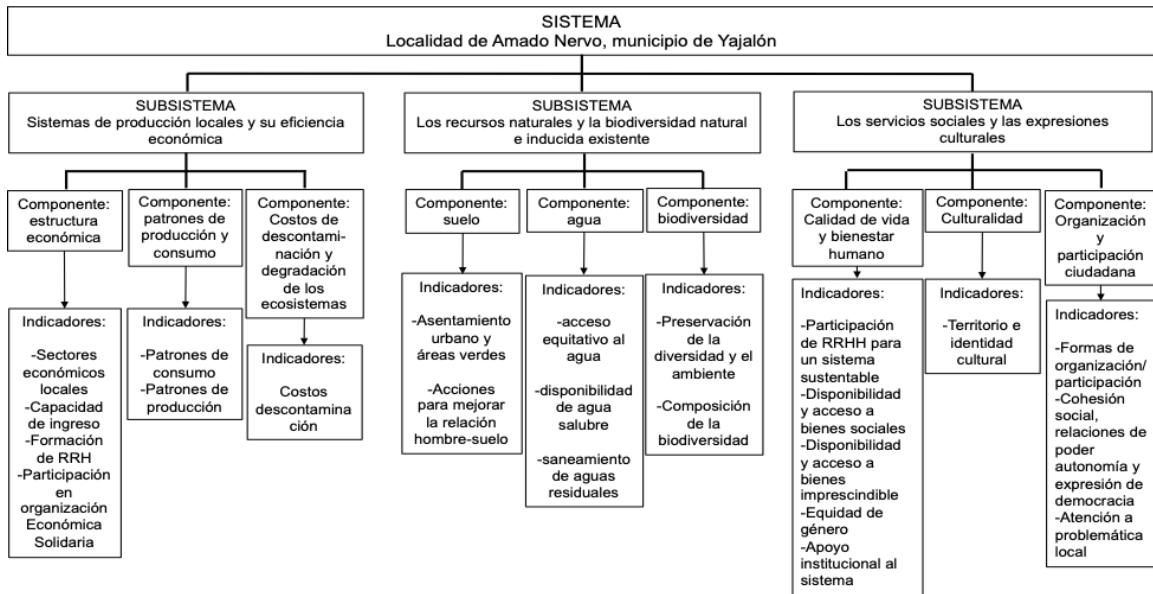


Figure 2. General outline of the structure of the hierarchical levels studied. Source: Own elaboration

From these three subsystems are derived components that were selected based on the core thematic indicator platform of the United Nations Organization (Singh *et al.*, 2008:197), as well as those proposed by similar studies, permanent observation, and personal experiences in the community under study. Thus, the components that were studied for the first subsystem are the economic structure and the patterns of production and consumption. The second were: soil, water, and biodiversity. The third: is quality of life and human well-being, cultural aspect, organization, and citizen participation. From the components derived 26 indicators that were analyzed by applying a scale of analysis as scenarios to key people in the community (Table 1).

The analysis scale used the concept of Judgment value ( $V_j$ ), which transformed, on the one hand, the original units of measurement of the indicators (percentages, weight units, length, area, etc.) to a scale value and, on the other hand, measured the value that the indicator in question has with an orientation, either towards an unsustainable development or towards a sustainable one, which can also be understood as an "undesirable" or an "ideal" scenario, using a structure of numerical categories in series of minimums and maximums, operating in the amplitude of 1 to 10 in five ranges of values, where 1 represents the "undesirable" category and 10 the "ideal" category, an example is found in Table 1.



**Table 1**  
Indicator: *Equitable access to water: (variable 1 Distance and supply capacity)*

Vj	Scenarios on the scale.
0 a 2	(1) The water source is more than a kilometer away, and people resort to it. (2) The frequency (and magnitude) of spring water is not permanent. Water is unreliable in purity and cleanliness.
3 a 4	1 + 2 + Water is clean and reliable for users (3). Families have artisanal wells to self-supply. (4)
5 a 6	3 + 4 + The frequency (and magnitude) of spring water is permanent, but limited. There is a storage tank and distribution pipeline network but in poor condition. Non-participating citizens for water conservation.
7 a 8	The frequency (and magnitude) of spring water is permanent and unlimited. Storage tank and efficient distribution piping network. Citizens are very interested but not organized in water care committees.
9 a 10	Efficient distribution network. The spring is permanent and unlimited to supply the entire population. There are citizen committees for water care.

Source: Own elaboration (2022)

The value of the indicators was obtained following the proposal of Reyes and Ammour (1997:13) but modified and adapted to the interests of this study. The procedure for analyzing the scale information was done using mathematical terms and equations that assigned a value to the indicators (Table 2), and these, in turn, determined the value of the components, of the subsystems and the overall sustainability index (GSI). A weighting factor ( $Fp$ ) was also used to visualize the level of importance of each indicator in the amplitude of 1 to 3, in which 1 is an unimportant level, 2 is moderately important, and three very important.

**Table 2**  
*Procedure for calculating indicator values by component*

Indicator	Weighting factor (FP) (a)	Indicator variables	Judgment Value (b)	Judgment value in multiple variables (c)	Indicator value (d)	Component value (e)	Subsystem value (dimension)
1	1 a 3	X	1 a 10	N/A	$(a*b)/a \text{ max}$		
2	1 a 3	x y z		1 a 10 1 a 10 1 a 10 $\Sigma 1n (Vv/s)$	$a*c/a \text{ max}$	$\Sigma 1n (d)/S$	Average of (e)
3	1 a 3	X	1 a 10	N/A	$a*b/a \text{ max}$		

N/A = not applicable a max= Maximum possible weighting factor

Source: Own elaboration

It is important to note that some indicators were disaggregated into variables and that the scale was also examined by applying the  $Vj$  and

assigning a numerical value as Variable Value ( $V_v$ ). The sum and average of the variables assign the judgment value of the indicator in question:  $VI = \sum_{1n} (V_v) / S$  (Where:  $V_v$  is the value of the variable and  $S$  is the number of variables that make up each indicator). The final value of each indicator is given by multiplying the weighting factor by the  $V_j$  and then dividing by the maximum possible weighting factor, which results in the value of the indicator. Subsequently, the value of the components was calculated by adding and averaging the value of the indicators:  $VC = \sum_{1n} (VI) / S$  ( $VI$  is the value of the indicator and  $S$  the number of indicators), and with these results, it was applied equally in the subsystems.

To recognize the orientation of the system, the General Sustainability Index (GSI) was used, which is very useful to focus attention and often simplifies the problem (Zeballos, 2016:39) since it offers a simple, coherent, and multidimensional way the situation of the study community, showing in the scale its orientation from the perspective of sustainability, clarifying which components of the system are involved and to what extent. It should be clarified that the interpretation of the value of the GSI indicator does not mark a "trend" of orientation towards one or the other end of the scale, but rather specifies where the development of the community is located in terms of balance of the sustainability triad.

The formula applied in this index was:  $IGS = \sum_n (VI) / N$  ( $VI$  is the value of the indicator and  $N$  is the number of indicators). The result of the index was interpreted following that recommended by Sepúlveda (2008:27), which estimates that an index below 2 is a state of the system with a total absence of Sustainable Development; levels between 2 and 4 indicate a critical situation in the balances of the sustainability triad; from 4 to 6 is an unstable system, while from 6 to 8 speaks of a stable system and finally from 8 to 10 is considered as the optimal situation of the system, that is, it is a system oriented to maintain a balance between cultural social well-being, with pro-environmental economic activities and the preservation of natural resources for future generations.

To recognize the relationship and interaction between indicators, an indicator interaction matrix (adapted from the Vester matrix) was used as an analysis tool, which seeks to understand the "influence" of some indicators on others with whom it relates, which provided four forms of relationship and interaction: critical, passive, active and indifferent. It should be clarified that to facilitate the study in the matrix, the initially proposed indicators were reduced to 20. Finally, from these results a prospective analysis is built considering three scenarios for the future: possible, probable, and desirable.

### *Approach Techniques and Sample Size*

To collect the information specified in the indicators, exploratory tours, interviews with key informants, and observation of the study site were carried out. For the selection of informants, the "snowball" method was applied (Arias *et al.*, 2016:206), while to weight the indicators, a survey was applied to randomly selected community residents (Morales, 2011:13). On the other hand, statistical equations applied in the analysis scale and the General Sustainability Index were used. The study period ranged from January 2019 to March 2020. The sample size followed the criteria mentioned by Morales (2011a: 13), for the construction of scales and that of Ardila and Rueda (2013: 99), with "theoretical saturation" as a criterion to delimit the sample size.

## RESULTS AND DISCUSSION

The data obtained in the results are presented from each subsystem, starting with an overview of the general aspects of the community that are of interest to know.

**a) Generalities.** Amado Nervo is a community made up of indigenous people of the Ch'ol ethnic group, who, since the nineteenth century, are recognized as having inhabited this place. In 1934 they bought an area from the then-owner Natalia Arguello of the estate known as Colombia, which allowed them to add a land of 588 hectares to those they already owned. The recognition and certification of communal property made by the Ministry of Agrarian Reform in favor of Amado Nervo in 1973 totaled 1196 hectares (López, 2015: 91).

The cultural wealth of this community is recognized in those who give rise to it, descendants of the first groups that settled here, probably coming from the area of Tumbalá and Yajalón that over time became part of the group of day laborers who worked the coffee. The main founders were those who made up the servants and waiters of the estate, according to the villagers interviewed.

The biodiversity and productivity of the ecosystem are observed in its agricultural products, mainly coffee and the fruits of the milpa such as corn, beans, squash, cassava, chayote, or herbs such as epazote and rue, in addition to banana, orange, lemon, nanchi, and multiple medicinal plants, but also in the production of birds and criollo pigs that are raised in family backyards and serve to self-supply, with the sale of supplies locally (Ruiz *et al.*, 2013:7).

Coffee continues to be the main product with which the community has access to financial resources since its commercialization is done in the regional market-based in the town of Yajalón. Cultural preservation is an

important issue that produces anxiety and restlessness as perceived among its inhabitants, for example, for the conservation of dress or language, gastronomy, and those events linked to planting and water care.

**(2) Local production systems and their economic efficiency.** This subsystem explores the capacity of the system to provide the goods and services that families require for their well-being, considering indicators that record the activities that people carry out to take from nature the resources they need and that can be transformed, but also those that promote their conservation. The indicators studied can be seen in Table 3, as well as the results in the analysis scale. From what can be seen, this is a subsystem with an IGS= 3 that places it oriented to "Unsustainable Development" and expresses a critical situation of the subsystem.

**Table 3**

*Subsystem analysis: Local production systems and their economic efficiency*

Indicator/ Result	Component/ Results	Subsystem/ Results
Local economic sectors =2.2 Income capacity=2.3 Formation of HR=3.1	Economic structure =2.4	3
Participation in Solidarity Economic Organization =2.6		
Consumption Patterns =3.0 Production Patterns =4.0	Consumption and production patterns =3.5	
Productivity index =3.7	System Productivity =3.7	
Decontamination costs =2.5	Decontamination and degradation costs =2.5	

Source: Own elaboration 2022

An approach to the indicators that contribute most to the subsystem GSI better explains the results of the scale, it should be clarified that for reasons of space, only a more detailed explanation of two indicators is made. In the indicator of income capacity (value=2.3), key interviewees perceive it and place it in this value of the scale because, although the inhabitants arrange an economic remuneration per working day according to the law, the average income per person is below the national average, even when they have public programs to support family income, they are perceived as very limited.

The income is mainly based on the primary agricultural sector (under a strategy of self-sufficiency and sale of surpluses, mainly milpa and coffee), complemented by resources that come from other activities such as masonry, public transport, commerce, and employees in education. The income capacity, quantifying only the surpluses that come from the agroecosystem, stands at 6,000 pesos per month on average, well below the national average,

which is 16,537 pesos, while that of Chiapas is 8,836 pesos (National Survey of Household Income and Expenditure, ENIGH 2018). Families who supplement their income with other activities tend to improve by up to 8,000 pesos or more, although this is a minority group.

Another indicator that adds value to the GSI is that it refers to affiliation to social economic organizations (value=2.7), approximately 80% of the members of this community said they are not members of any organization, therefore, the possibilities of promoting economic improvements to the system using this type of associations is narrow and impacts even on the development of skills and knowledge that can well be increased through the training and human resources skills that this type of organizations usually propose to improve the system, although, on the other hand, due to the formal educational level that can be observed, it is assumed that the system has people with greater skills, especially in the new generations.

(3) Natural resources and the existing biodiversity (natural and induced). This subsystem addresses the study of natural resources and biodiversity concerning man, their ability to subtract what is necessary for their benefit, and the efficiency with which it is, in turn, maintained, conserving those resources for future generations. The results of the indicators and components are shown in Table 4. This subsystem has a GSI of 4.7, which places it at scale in an unstable subsystem.

**Table 4**  
*Subsystem Analysis: Natural Resources and Biodiversity*

Indicator/ Result	Component/ Results	Subsystem/ Results
Urban Settlement and Green Areas = 6.6		
Actions to improve the man-soil relationship= 3.7	Soil= 5.2	
Even access to water= 7		
Safe water availability = 3.5	Water= 4.5	4.7
Wastewater sanitation = 3		
Preservation of diversity and the environment= 3.5	Diversity and environment= 4.4	
Biodiversity composition= 5.3		

Source: Own elaboration (2021)

The indicator Urban Settlement and its relationship with green areas (value=6.6) are analyzed as an example due to the use in agroecosystems in human settlement. Of the agroecosystem, we have already said that it is mainly dedicated to crops, which can be classified as an agricultural system with complementary activities such as cattle ranching, under a production model

in a medium with a high presence of indigenous inhabitants (Velazquez & Perezgrovas, 2017:290). As a human settlement, the community is organized into six neighborhoods, whose plots are very large and in which dwellings and large gardens are settled, having urbanized streets, for the most part, in which the action of the "human hands" in their care is also denoted.

Another important indicator is the water supply for the community, to which people assigned a value=7 which maintains a dynamics of supply from the white water stream, located to the southeast five kilometers away from the community, this is brought by pipes to the storage tank, is considered clean and reliable water (monitored every six months by the authorities), able to supply the population permanently with a volume that usually varies in the dry season, (90 liters per capita). There is a network of pipes for an equitable distribution of water. In addition, informants recognize that approximately 75% of families have artisanal wells that favor them in the self-supply. It is observed that many families have concrete tanks or two to three water tanks (capacity of 600 l) for storage. The frequency of the supply is constant except in the dry season when it is done every two or three days.

**(4) Social services and cultural expressions.** The subsystem dedicated to the social-cultural field considers three components: Quality of life and human well-being, the cultural aspect, and the organization and citizen participation component. With these, it is about understanding the generation of quality goods and services for the well-being and cultural identity of the community. The results can be seen in Table 5, where an IGS=3.8 is observed for the subsystem classified as critical.

**Table 5**  
*Subsystem Analysis: Social Services and Cultural Expressions*

Indicator/ Result	Component/ Results	Subsystem/ Results
HR contribution to a sustainable system =4		
Availability and access to social goods =4.5	Quality of life and human well-being =4.2	
Availability and access to essential goods =3.9		
Gender equity =5 Institutional support to the system=3.6		3.8
Territory and cultural identity =3.3	Culture=3.3	
Types of organization and participation=4 Social cohesion, power relations, autonomy, and expression of democracy=4.2 Attention to local problems =3.5	Organization and citizen participation =3.9	

Source: Own elaboration (2021)

The indicators that contribute the most to the system are the "contribution of HR for a sustainable system" and "availability and access to social goods". Concerning the first, the value obtained is because the judgment issued by the participants takes into account that they are reforesting with fruit trees, ornamental plants, medicinal plants, and other vegetables, but they are individual actions that are undertaken in family spaces since there is no organization on the part of citizens with which to promote training and the exchange of knowledge and awareness for the conservation of natural resources. While in the other indicator, they are perceived as comfortable homes, which cover the minimum necessary material goods, that is, houses built of concrete with all services except garbage collection, so each family manages to deal with it, which is usually burned in the backyard.

In sum, the GSI released from the subsystems studied can be seen in Table 6, where the local Production subsystem and its economic efficiency is the one that has the greatest impact on the overall evaluation, which is 3.8, to consider a community system that is at a critical level, that is, it defines a community with serious imbalances in its capacities to satisfy its well-being with social and cultural benefits due to the limited efficiency in its economic and productive activities with sustainable bases and in the conservation of resources and biodiversity for future generations.

**Table 6**

*Results of the General Sustainability Index in the subsystems analyzed*

Natural Resources and Biodiversity Subsystem	Local Production Subsystem and its economic efficiency	Social Services and Cultural Expression Subsystem
Value= 4.7	Value= 3	Value= 3.8
Overall System Sustainability Index = 3.8		

Source: Own elaboration (2022)

On the other hand, we have the results of the matrix of relationship and interaction of the indicators that yielded interesting results, which can be seen in Table 7. The dynamics that occur between the indicators and their components with the others of the system, which also include those resources that come from outside (resources outside the system that can be tangible or intangible and that the system does not have control over them), or those that come out of the components, are analyzed from the four groups formed in which those indicators that are grouped as critical standout, since they have a double characteristic, that is, they have a lot of capacity to "influence" others as well as to be sensitive to the "influence" of others, their ability to "react" is usually fast and usually contribute to the imbalances in the triad.

**Table 7**  
*Classification of the indicators of the interaction matrix*

Classification of Indicators and their Scale Value
<p>Critical indicators (they have a great ability to influence to weaken or strengthen others and, in turn, are very sensitive to the influence of others):</p> <ul style="list-style-type: none"> <li>-Participation of HR for a sustainable system: Value=4.0</li> <li>-Social cohesion, power relations, autonomy, and expression of democracy: Value=4.2</li> <li>-Territory and cultural identity (Variable 2: Current traditional practices): Value=4.2</li> <li>Territory and cultural identity (Variable 1: cultural identity preservation): Value = 2.5               <ul style="list-style-type: none"> <li>-Production patterns: Value= 4.0</li> <li>-Biodiversity and environment preservation (Variable 1: biodiversity): value= 3.7                   <ul style="list-style-type: none"> <li>-HR training: Value= 3.1</li> </ul> </li> <li>-Availability and access to social goods (Variable 1: education and health): Value= 5.5</li> </ul> </li> </ul>
<p>Active indicators (of great influence on most of the remaining indicators, but they are not influenced by the others -resist the onslaught):</p> <ul style="list-style-type: none"> <li>-Urban settlement and green areas: Value= 6.6</li> <li>-Community HR participation to conserve the soil: Value= 3.7               <ul style="list-style-type: none"> <li>-Sewage treatment: Value= 3.0</li> </ul> </li> <li>treatment-Participation in social financial solidarity organizations: Value= 2.6               <ul style="list-style-type: none"> <li>-Consumption patterns: Value= 3.0</li> </ul> </li> </ul>
<p>Passive indicators: (they do not have great capacity or influence towards others, but they are very sensitive as receivers of the influence of others).</p> <ul style="list-style-type: none"> <li>-Local economic sectors: Value= 2.2</li> <li>-Income capacity: Value= 2.3</li> </ul>
<p>Indifferent indicators (low capacity or influence towards others, are not influenced by others):</p> <ul style="list-style-type: none"> <li>-Equitable access to water (Variable 1: Distance and supply capacity): Value= 6.5               <ul style="list-style-type: none"> <li>-Availability of safe water: Value= 3.5</li> </ul> </li> <li>-Availability and access to social goods (Variable 2: food): Value= 4.0</li> <li>-Gender equity (Variable 1: Participation and decision-making): Value= 6.1</li> <li>-Institutional support to the system (Variable 1: Availability and access to institutional support programs): Value= 2.2</li> </ul>

Source: Own elaboration

As an example we can mention the component of cultural identity, which is an indicator classified as critical, that is, susceptible to influence or be influenced by others, which according to the results of the scale maintains a value= 4, and is located in it with an orientation to unsustainable development, this indicator has been very susceptible to changes brought about by "modernizing" policies (external resource to the system), which translates into replacing elements of local cultural life with those of others (for example, soft drinks and fries by pozol and chumulhua), a result of the permanent impact of "modernization" contrary to the principles of sustainability that is committed to local cultures.

Another indicator is that of urban settlement and its relationship with green areas (value= 6.6), which is classified as an active indicator, i.e. it can influence most of the remaining indicators but are not sensitive to be influenced by others (let's say they resist the onslaught to be modified). The green area observed is due, according to local sources, to the actions undertaken by each family in their own backyards or agricultural lands,



which maintain a high preservation of plant resources. The participation of public institutions is very limited in their actions, including awareness-raising, training, or promotion; it is actions undertaken by individuals, which prevent the influence of external resources such as those of "modernization" substantially modify this indicator.

In sum, it can be deduced from the interpretation of the dynamics offered by the scale and matrix that, the recurring question about how to achieve a better balance in the triad, must be considered that it depends to a large extent on the people who are sought to benefit, of the application of the principles of sustainability (say colloquially of the "spirit" of sustainability), which guide the components and their group of indicators towards sustainable development, of criteria that should "nourish" the public policies that development projects propose and their human resources as managers aimed at achieving balance, paying particular attention to the group of sensitive indicators -critical and active- that best respond to the interaction and orientation of sustainability.

On the other hand, considering different elements of reflection and analysis it is possible to visualize the system's future, from a prospective perception. The first scenario is envisioned from the resources that arrive at the system, as "modernizing" policies that contain a high dose of those concepts designed from anthropomorphic visions, of the orientalist-paternalistic paradigm, and economic rationalism, keep "the course" unchanged; it is then likely that the system is moving increasingly towards an orientation of unsustainable development, thus exacerbating the environmental tragedy that humanity lives. A second scenario is possible if these public policies are nourished by the Sustainable Development paradigm, where we have observed that there are reasons, at least at a national level, to think that there are changes in that sense, for example, the practice of participatory democracy in the decisions that are the competence of neighborhoods and communities that reach the system and influence the components strengthening them towards a sustainable development orientation.

Finally, sublimating the ideal system corresponds to a reasoned and balanced articulation in the sustainable triad, between human and cultural well-being, reconciled with appropriate economic practices and the preservation of natural resources for future generations. Achieving this scenario requires inclusion and participation of people, it is perhaps the central and essential element to achieve it, which necessarily involves the structuring of public policies that strongly encourage the construction of sustainable communities and implies the non-alignment of these to corporate interests that, so far, efforts have been made towards unsustainable development.

## CONCLUSION

Based on the observed results, it can be based that the balance of the relationship of the triad of sustainable development given by the GSI=3.8, is oriented towards unsustainable development; in other words, the participation of human beings and their activities to maintain a functional system are oriented towards a development that harms the balance that must keep the dimensional triad of Sustainable Development, in particular to maintain resources for future generations.

The community is on a critical scale that reveals, on the one hand, that the application of "modernizing" policies has contributed to the consumption of environmental resources at a faster rate than the possibilities of their preservation, whose economic activities do not allow their recovery and if they compromise the resources of the following generations, intending to support a quality of life according to what is proposed by the so-called "modernization", therefore, the reservoir of natural resources, as the social-cultural heritage are being committed to sustaining a lifestyle that this "modernity" has imposed (Gutiérrez *et al.*, 2008b: 63).

Other reflections that the present study leaves us are those that are extracted from the crossing of results of the GSI with those of the matrix, which help to explain the dynamics of interaction between the components and their indicators and the result in the orientation scale. Highly visible indicators such as cultural ones, for example, can be explained thanks to the high susceptibility to the impact of other resources that come either from other indicators or that arrive as resources external to the system and, at the same time, are of great capacity to influence others favoring modifications, because it is a critical indicator according to the matrix and when crossing with its scale value=3.3 suggest the degree of sensitivity of their responses to stimuli, we see it in the displacement of cultural traits that give identity and cultural value to the community such as gastronomy, dress, and language.

This same dynamic occurs in other indicators, such as the participation of human resources for a sustainable system (critical indicator, with value in scale=4), which has responded significantly to the effects of other external resources, changing its commitment to sustaining a sustainability-oriented system.

As well as these indicators, it is possible to see other important elements that create and recreate the community system and the measure of their actions in using the resources of their environment to satisfy a "modern" lifestyle is, in turn, the measure or condition for the environmental tragedy that is lived in a logic of the accumulation of goods and capital that, suppose,

leads to the so preciously "modern" quality of life and well-being, but subject to a very sensitive and critical loss relationship for the goods of nature.

Where is the system heading? It is a pertinent question for a prospective analysis and the crossing of results of the matrix and scale can help us to understand that future, in which we can point out at least three scenarios, as recorded above, visions that can project from anxiety, if the scenario remains the same, to the greatest optimism, if changes occur, particularly in indicators classified as critical and active.

In short, it can be said that the environment or nature is the one that suffers the most when looking to achieve a lifestyle dictated by "Western modernity" or rather, by "modern" anthropocentrism, economic rationalism, and the orientalist-paternalistic paradigm, the observed results point to the urgent need to reverse this predatory scheme and recover the resources spent on the system, for it to receive the time and attention necessary to restore itself and thus avoid a collapse of great proportions.

For the question of how to achieve the greatest balance in the triad of sustainability? It is essential that people's conscious participation be strengthened, for public policies nourished by the principles of sustainability to be reinforced, and that public projects and programs are implemented towards sustainability.

## REFERENCES

- Aguirre**, R. R., Torres, V. N., Vázquez T. E., Jiménez, G. O., Ruiz, S. A. y Velazquez, A. J.A. (2013). Caracterización del subsistema de plantas medicinales en los patios traseros (Patyotyoty) de la comunidad de Amado Nervo, Municipio de Yajalón, Chiapas; México. *Revista Espacio I+D UNACH*. <https://doi.org/10.31644/IMASD.2.2013.a06>
- Ardila**, S. E. y Rueda, A. J. (2013). La saturación teórica en la teoría fundamentada: su delimitación en el análisis de trayectorias de vida de víctimas del desplazamiento forzado en Colombia. *Revista Colombiana de sociología*. Vol. 36:93-114. Bogotá, Colombia.
- Arias**, G. J., Villasís, K. M., y Miranda, N. M. (2016). El protocolo de investigación III: la población de estudio. *Revista Alergia México*, vol. 63: 201-206. México.
- Bolvinik**, J. (2021). Renacimiento del interés en la desigualdad creciente y sus consecuencias, crítica de la ciencia económica actual y la necesidad de una ciencia social emancipatoria. *Rev. Propuestas para el desarrollo*, 5(5)
- Chirinos**, M. N. y Rincón, G. S. (2010). El concepto de desarrollo: posiciones teóricas más relevantes. *Revista Venezolana de Gerencia*, 15(50), abril-junio, 2010, pp. 294-320 Universidad del Zulia Maracaibo, Venezuela.
- Comité Estatal de Información Estadística y Geográfica (CEIEG)**. (2021). *Perfiles municipales*. Recuperado de <http://www.ceieg.chiapas.gob.mx/perfiles/Inicio>
- Espino**, A. (2011). Trabajo y género: un viejo tema ¿nuevas miradas? *Rev. Nueva Sociedad* No 232, ISSN: 0251-3552. Argentina.
- Fromm**, E., y MacCoby M. (1973). *Socio-psicoanálisis del campesino mexicano*. 1ª. Edición. Fondo de Cultura Económica. Ciudad de México.
- Gudynas**, E. (1999). Concepciones de la naturaleza y desarrollo en América Latina. *Persona y Sociedad*, 13 (1). Santiago de Chile.
- Gutiérrez**, N., R. (1996). Desarrollo Sustentable. Un camino a seguir. *Revista Espiral*, vol. II, núm. 5, pp. 197-227 Universidad de Guadalajara Guadalajara, México.
- Gutiérrez**, C. J., Aguilera, G. L., y González, E. C. (2008). Agroecología y sustentabilidad. *Revista Convergencia*, UAMEX, núm. 46. P. 51-87.
- INEGI**. (2018). *Encuesta Nacional de Ingresos y Gastos de los Hogares*. Recuperado de <https://www.inegi.org.mx/programas/enigh/nc/2018/>
- Krauze**, M. (2001). Hacia una redefinición del concepto de comunidad -cuatro ejes para un análisis crítico y una propuesta. *Revista de Psicología*, año/vol. X, número 002 Universidad de Chile. Ñuñoa Santiago, Chile pp. 49-60.
- López**, G. X. (2015). *Territorialización y cambio social en el municipio de Yajalón, durante la época del reparto agrario. Significaciones en torno al ejido*. Tesis de maestría. México. Ciesas. San Cristóbal de Las Casas, Chiapas. Pp 234.

- Macías, C. H., Téllez, V. O., Dávila, A. P., y Casas, F. A. (2006).** Los estudios de sustentabilidad. *En Ciencias UNAM*. Vol 81:23-31 México.
- Martínez, I. J. y Figueroa, C. A. (2014).** Evolución de los conceptos y paradigmas que orientan la gestión ambiental ¿cuáles son sus limitaciones desde lo glocal? *Revista Ingenierías Universidad de Medellín*, vol. 13:214 Medellín, Colombia.
- Moller, R. (2010).** Principios del desarrollo sostenible para América Latina. *Ingeniería de Recursos Naturales y del Ambiente*, núm. 9, enero-diciembre, 2010, pp. 101-110 Universidad del Valle. Cali, Colombia.
- Montero, M. (2004).** *Introducción a la psicología comunitaria. Desarrollo, conceptos y procesos*. Editorial Paidós. Buenos Aires. Argentina. ISBN 950-12-4523-3
- Morales, V. P. 2011.** *Tamaño necesario de la muestra ¿Cuántos sujetos necesitamos?* Universidad Pontificia Comillas. Madrid. Disponible en <http://www.up-comillas.es/personal/peter/investigación/Tama%F10Muestra.pdf>
- Ortiz, B., A. (2014).** La relación hombre-naturaleza. Tendencias de su filosofar en Cuba. *Revista de Ciencias Sociales*. Núm. 32:63-76. Universidad Arturo Prat. Tarapacá, Chile.
- Palsson, G. (2001).** Dominios y fronteras cuestionados. En *Naturaleza y sociedad, perspectivas antropológicas*. Pp 81-100. Editorial Siglo XXI. Ciudad de México.
- Reyes, R. R., y Ammour T. (1997).** *Sostenibilidad de los sistemas de producción en la concesión comunitaria de San Miguel Peten, Guatemala*. Centro Agronómico Tropical de Investigación y enseñanza (Catie). Pp 30.
- Sepúlveda, S. (2008).** *Metodología para estimar el nivel de desarrollo sostenible en espacios territoriales (Biograma 2008)*. IICA. San José de Costa Rica. ISBN13: 978-92-9039-872-1 Pp. 133
- Singh, R., Murty, H.R., Gupta, S.K., Dokshit, A.K. (2009).** An overview of sustainability assessment methodologies. *Ecolog Indicator*. Vol 9:189-212.
- Velazquez, A. J. (2022).** Vinculación comunitaria: contribución al concepto desde una perspectiva universitaria intercultural. En: *Vinculación comunitaria en la educación superior: Reflexiones y Aproximaciones*. Editorial Universidad de Guadalajara. Pp 12-32.
- Velazquez, A. J., y Perezgrovas, G. R. (2017).** Caracterización de Sistemas Productivos de ganado bovino en la región Indígena XIV Tulijá-Tseltal-Ch'ol, Chiapas, México. *Agrociencia*, Vol 51: 285-297.
- Zeballos, C., O. (2016).** Sustentabilidad, Desarrollo Sustentable e indicadores de sustentabilidad para agroecosistemas. *Revista Postgrado. Scientiarvm* Vol 2:37.