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# Characteristics, diagnosis and analysis of some indicators in the agricultural sector of the Trinidad Municipality, Cuba

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**Abstract:** In the new policy established by the Cuban state for the agricultural sector, the achievement of food sovereignty and sustainability of said sector is established as a basic principle, which was endorsed in the current Law of Food Sovereignty and Food and Nutritional Security. For this reason, each municipality in the country, and under certain levels of autonomy, must guarantee compliance with the aforementioned law. For this, strict control of the structures of the territorial agricultural system and the behavior of its structures is necessary. With the completion of this work, the characterization, diagnosis and evaluation of some sustainability indicators for the agricultural sector in the Trinidad Municipality were established as objectives, in the period between 2015 and 2020, for this a work team was created that was able to collect, organize, analyze, compare and evaluate the information that appeared in the National Office of Statistics and Information of the Republic of Cuba, between the years 2015 and 2020, finding as one of the results that the workforce indicator used in this sector has suffered a drastic decrease, not guaranteeing the man-area relationship necessary to achieve food sovereignty and the sustainability of the sector at a territorial level.

**Keywords:** sovereignty; sustainability; indicators; efficiency; evaluation

## 1. Introduction

Sustainable development as a concept appeared for the first time in 1987 in a document known as the Brundtland Report. This report states that sustainable development is “development that meets current needs without endangering the ability of future generations to meet their own needs.” Sustainable local development lies in improving the quality of life for citizens [1].

The sustainability of agriculture is a necessity of the contemporary world and has become one of the premises for the well-being of large sectors of the population in developing countries. It is also recognized that its ecological, economic, and social dimensions are in conflict [2].

According to Santana and Castellanos [3], the importance of sustainability indicators in agricultural systems has been attributed to the fact that they allow us to know the state of the resources in exploitation in the agroecosystem, at the particular level of a field, a farm, a locality, or a country. Likewise, different aspects of the indicators are pointed out that make them useful in monitoring environmental, social, and economic impacts with the objective of managing human, natural, capital, and production resources. Regarding work with indicators, it is proposed that their use is of relevant importance when they are built in a participatory manner with the communities [4]. These results agree with those obtained by Beemans [5], who points out the importance of indicators not traditionally used, such as those that

reflect environmental practices, gender equity, respect for human rights, and participatory government.

Santana and Castellanos [3] themselves, based on the specific situation of the problems and alternative solutions proposed for the Community of Mantecal, State of Apure, and Bolivarian Republic of Venezuela, proposed a set of indicators for the monitoring and follow-up of sustainability in its three dimensions.

In one of the conclusions of the work carried out by the previous authors, it is stated: The set of proposed indicators allows the evaluation of the properties of the agroecosystem over time, considering the dimensions of ecological, economic, and social sustainability of the agrarian transformation in progress, from the perspective of the integration of the different sectors of production and services in correspondence with the political, social, and economic system of the country. This conclusion makes it very clear the importance of using indicators to evaluate the efficiency of any process, and specifically the sustainability of an agroecosystem.

Álvarez et al. [6] in their work entitled “Sustainability indicators in five agroecological farms with different management conditions, in the territory of Trinidad, Cuba”, obtained that: the attributes of sustainability in the three dimensions of development (economic, social, and ecological) in a general sense favor Fincas Limones, La Providencia, and La Luna, while they were unfavorable for Pitajones and Integral #2 in most indicators, but especially in productivity and stability in all its dimensions. These results are due to the fact that the last two farms are generally less efficient because they have the lowest agricultural yields, low protein and energy levels, and high costs. Dimensions and attributes of sustainability exist in the five farms in the energy study, and although Pitajones uses low levels of external inputs, it is poorly diversified, while Integral Farm #2 is a high consumer of fossil fuels, chemical fertilizers, insecticides, and herbicides.

Socorro et al. [7], which recognize that the concept of sustainability has these three dimensions (economic, ecological, and social), which, according to this author, come into conflict.

The achievement of national food security is a topic widely addressed by the leadership of the Cuban government. For this purpose, it annually allocates large sums to guarantee the basic products of the population, highlighting among them powdered milk, rice, beans, wheat, corn, and meat. Most of these are provided through the basic basket [8].

The strategic tasks of the management system of the Ministry of Agriculture are the following, which must be strategically directed in six main programs: comprehensive various crops program, comprehensive livestock program, forestry and mountain agriculture program, comprehensive tobacco program, comprehensive program for attention to human capital, management, operation, and internal control program [9].

In the Local Development Strategy of the Trinidad Municipality [10], strategic line #1 is declared as: line no. 1 productive transition with science and innovation towards sovereignty and food security, and includes, within its current situation, a municipality that lacks food sovereignty, without a productive tradition, and with a considerable increase in the floating population. The general objective is to support and promote the production of agricultural and non-agricultural foods with a

nutritional focus and achieve efficient and rational use of endogenous resources and the municipality's agricultural fund, contributing to its economic reactivation.

### **General objectives**

Characterize the agricultural sector of the Trinidad Municipality in the period between 2016 and 2020.

Diagnose the agricultural sector of the Trinidad Municipality in the period between 2016 and 2020.

Evaluate the behavior of some sustainability indicators in the agricultural sector of the Trinidad Municipality in the period between 2016 and 2020 in order to know the behavior of the same in terms of efficiency and to be able to achieve the sustainability of the sector.

## **2. Materials and methods**

### **2.1. Characterization of the agricultural sector in the Trinidad Municipality**

To characterize the agricultural sector in the Municipality of Trinidad, a compilation of information was carried out; for this, data appearing in the Local Development Strategy [10] and others appearing in the report of the National Office of Statistics and Information of the Republic of Cuba (ONEI) were taken. On the Trinidad Municipality for the period from 2016 to 2020, a report was subsequently written where a synthesis and grouping of the collected data were carried out, establishing a logical order of the information and contemplating all the agricultural systems of the municipality.

### **2.2. Diagnosis of the agricultural sector of the Municipality of Trinidad**

Information collection:

The information gathering process was carried out by the author through a diagnosis carried out in the agricultural sector of the Trinidad Municipality. The techniques to obtain the information were applied interactively: direct observation, compilation of information from the National Information and Statistics Office (ONEI) of the Republic of Cuba for the period between 2016 and 2020., checking compliance of cultural activities with crops, semi-structured interviews with partners, and analysis of documents (economic reports, field histories).

To carry out this important step, a search for information was carried out on the main strengths, weaknesses, opportunities, and threats that were influencing the agricultural sector in the Trinidad Municipality in the period between 2016 and 2020. For this purpose, the Statistical Yearbook of the National Information and Statistics Office (ONEI) [11], Trinidad Municipality, was consulted and used as an official reference source. In addition, the general diagnosis of the Trinidad Municipality, which appears in the management strategy, was consulted. Local Development of the Trinidad Municipality [10], the information appeared in the work of Valdés et al. [12], titled "Legal status until 2016 of the land fund, labor, salary and performance in the agricultural sector of the Trinidad Municipality",

published in the International Journal of Science, Technology and Society, information provided by the Municipal Delegation of Agriculture in the Trinidad Municipality.

### **2.3. Methodology used to confirm the indicators to be evaluated in the agricultural sector of the Trinidad Municipality, for the period between 2016 and 2020**

For the development of the study, the methodological aspects most appropriate to our conditions were selected, as proposed by Maqueiras [13], who validated the methodology for the evaluation of management systems incorporating sustainability indicators (MESMIS) used to evaluate productive systems, farmers belonging to the Association of Organic Coffee Growers of Colombia (ACOC), and the matrices and methodological proposals of the authors were maintained.

Once the evaluation of the agricultural sector in Trinidad Municipality was decided in the period between 2016 and 2020 and the concept of sustainability of production systems was defined, the following objectives were selected:

- Characterization of the agricultural system of the Trinidad Municipality.
- Identification of the critical points according to the evaluation areas that we addressed.

The following were addressed: productive, environmental, and socio-economic technical. Construction of the indicators, their scale, and the form of measurement. Category of analysis for the evaluation of the agricultural system of the Trinidad Municipality.

The analysis categories defined in the methodology were: For the analysis category, the criteria of Montesinos [14] were used, which allows better identification of the significance of the components, gives property criteria, and characterizes important indicators, as well as allowing the presentation of quantitative data. of the crops selected in the agricultural system of the municipality. Selection of Indicators For the selection of the indicators to be evaluated, it was kept in mind that they were a reflection of the three dimensions used systematically to evaluate sustainability in different systems: economic, environmental, and social. The indicators were:

- 1) Yield in certain crops (economic dimension).
- 2) Average annual salary of workers in the agricultural sector of the Trinidad Municipality (economic dimension).
- 3) Agricultural surface of the Trinidad Municipality (economic dimension).
- 4) Idle agricultural surface (economic dimension).
- 5) Eroded soil surface (environmental dimension).
- 6) Type I soil surface (environmental dimension).
- 7) Type II soil surface (environmental dimension).
- 8) Per capita consumption of food and vegetables per year (social dimension).
- 9) Nutritional level of the population of the municipality (social dimension).
- 10) Availability of water for irrigation of crops (environmental dimension).

A sample of the matrix for the ratings and parameters of each of the indicators is as follows (**Tables 1 and 2**).

**Table 1.** Reference list for indicators.

Critical point	Name of indicator	Concept	Parameter
Low performance of cultivation	Performance of crop	Quantity in t/ha-1	(3 values are established maximum performance up to minimum reached)

Subsequently, and in accordance with the selected methodology, a scoring scale was established for the evaluation of the previously chosen sustainability indicators, which is reflected in **Table 2**.

**Table 2.** Quantitative scoring and assessment scale of sustainability indicators.

Range	Quantitative assessment
1–1.99	Very low
2–2.99	Low
3–3.99	Half
4–4.5	High
4.6–5	Ideal

### 3. Results and discussion

#### 3.1. Characterization of the agricultural sector in the Trinidad Municipality

The Municipality has a territorial area of 116,747.37 ha and of them 60,703.72 ha are agricultural, including 13,288.2 ha of temporary crops, 14,327.5 ha of permanent crops and 44,976.99 ha of livestock. It also has a non-agricultural area of 44,154.68 ha, of which 43,151.22 ha are dedicated to forest plantations. The idle land fund available at the end of 2021 was 1787.48 ha, a figure that was higher in previous years and has decreased due to the fact that today there are a total of 1745 tenants in the territory, of which 286 are property owners and usufructuaries. by different resolutions 1459.

The economic base of this Sector in the territory is supported by: Trinidad Agroforestry Company with 4 UEB:

UEB Coffee Benefit: Felicidad, Seibabo and La 23.

UEB Valle de los Ingenios.

UEB Urban Farm.

UEB Assurance.

It also has: 7 UBPC, 8 CPA, 12 CCS, 1 twisted tobacco UEB, 1 collection establishment, 4 flora and fauna UEB, 1 integral forest UEB, 1 cigar UEB: Juan de Matas Reyes, 1 GELMA shopping center with 3 sub-headquarters: Felicidad community, La 23 community and Trinidad headquarters and 4 camps of the youth labor army: EJT Vega Grande, EJT university branch, EJT Tres Palmas and EJT Puriales. There is also a plant health ETPP, a pig establishment and an EGAME representative, which also includes soil studies, plant health and veterinary clinic services that lack technologies and other resources, which negatively impacts their quantitative and qualitative results.

The agricultural mechanization area of the municipality has an equipment park of 290 tractors, of which 199 are state-owned: 165 from MINAGRI and 34 from other organizations, the remaining 91 are in the hands of individual owners. The municipality received important support by having 7 new technology tractors, of which 5 are organized in a Land Preparation Platoon, with a favorable impact on the fulfillment of food production, but far from meeting the needs. real. Of those belonging to MINAGRI, 14 are inactive and 151 actives, according to the Technical Inspection carried out in 2019, an issue that must have worsened when their poor technical condition was observed, the lack of repaired or new tires, batteries and motors, which has a negative impact on the growth of agricultural production. The large extensions of land covered with marabou in all productive bases limit livestock production and various crops, without the municipality having mechanized or manual equipment for clearing.

Taking into account the dimensions and geographical characteristics of the territory, the development of the production of fruit trees, vegetables, root vegetables, and grains, as well as the livestock sector and the coffee sector in the mountains, is favorable.

In various crops, the average production plan for tomatoes amounts to 1200 t, for beans 40 t, for mango 900 t, and for corn 125 t. Coffee cultivation has more than 1100 hectares planted and a production of 220 t per year. As fundamental lines commissioned by the state in the 2021 plan, the production of tomato was met with 189%; mango for 184.8%; and corn for 167%, but not beans with only 32%.

Also taxed on the production of vegetables, root vegetables, medicinal plants, and ornamental plants are 16 organoponic farms, 6 farms, and 5 plots linked to the urban, suburban, and family agriculture programs and the flora and fauna company, with low yields caused by the shortage of irrigation systems and lack of technology for the exploitation of existing wells, today largely supplied by the population's aqueduct network.

As a result of the low availability of areas with irrigation systems (0.0003 ha), which means that almost all crops are grown on dry land, together with the intense drought that has affected the municipality in recent years, the levels of production and collection of agricultural products have decreased, which is why it is necessary to increase the areas under irrigation since there is potential in terms of supply sources that can be exploited with appropriate technologies, which could reverse the current results.

The UEB Forestal Integral Trinidad, in addition to the planting and exploitation of forest wealth and the production of charcoal for export, has diversified its production into various fruit crops.

In the agricultural sector, there are also units of the flora and fauna company, 4 in total: Valle de los Ingenios, Rancho Condado, Rancho San Pedro, and Rancho Los Molinos, dedicated to the development of nature tourism and the conservation of plant and animal species, essentially pure breeds; they also have a sanitary slab and obtain production of various crops intended to serve their workers and Agricultural Fairs. The facilities for raising cattle, pigs, sheep, goats, and poultry are not being fully exploited due, among other reasons, to the fact that some do not have electrical

service for the supply of water for drinking fountains and the production of animal feed.

The municipality, for the marketing of agricultural products, has a market in the city, managed by the urban agriculture farm, which also maintains 90 marketing points, a collection establishment with 3 agricultural markets (Calle Desengaño Mercado No. 45, Calle Aguacate Mercado No.8 and Calle Guaurabo Mercado No.2); 4 sales points (Chanzoneta, Casilda, San Pedro and FNTA). In addition, there are small squares subordinate to the productive bases, distributed in all the popular councils. This distribution network fails to satisfy the needs of the population due to production deficit, inadequate contracting, transportation problems, defective state of the access roads to the growing areas and insufficient marketing management actions, to which is added the lack of mini-industries that close production cycles to maintain out-of-season products.

Among the productions of the livestock sector, an annual plan of 3,126,334 liters of milk, 800 t of beef and 17.9 t of sheep and goats is recognized. At the end of 2021, the milk plans in the municipality were met at 101% in their entirety and the contracted at 100%.

There is a decrease in the number of animals in large and small livestock, which limits the development of this branch in the municipality, impacted by the lack of industrial feed, deterioration in the pasture and forage areas, non-implementation of the subprogram protein plants, low availability of water due to lack of equipment for the exploitation of existing sources, where only 18 windmills and 2 microdams are operating in this direction, the absence of breeding stock with recognized genetic values, lack of wires to quartering systems and technology for milking centers and poor mass management. In the case of cattle, at the end of 2019 there were 30,508 heads, 4215 less than in 2015, a fact related to the aforementioned causes, which highlights that for more than 10 years they have not been supplied with a protein food supplement, Likewise, pig cattle in the last five years decreased by more than 350 t in this period, since in 2016 productions of over 477 t of meat were obtained, which was reduced to only 130 t in 2019. During 2022 The municipality does not count any pork agreement, despite the extensive installed capacity in several production bases and the state sector. The current mass of the municipality is 6050 heads distributed as follows: private sector 1772, UBPC and CPA 72, Empresa Agroforestal Trinidad 91 and the Los Molinos pig farm with 4115.

The sheep-goat mass reduces from 14,017 heads in 2015 to 7939 at the end of 2019, with a contracted mass of only 5281 heads.

For all of the above, there is an urgent need for the efficient use and strengthening of existing livestock infrastructure (small and large livestock) such as: dairy farms, development and fattening centers and pigpens; the promotion of the production of native feed, pastures, forages and protein plants for animal feed; achieve the necessary breeding stock and installation of local capacities for this genetic improvement and the equipment for the Veterinary Clinic, currently not operating.

In the sphere of non-agricultural food production, the commerce and gastronomy company stand out in the town with 17 gastronomy units: 8 rural and 9 urbans; 92 commercial units: 56 rural and 36 urbans; 11 industrial markets and 2

ideal markets. The UEB Alimentaria with 21 units, including 17 bakeries, a pastry shop, a pancake factory and a mini-canning industry. The fishing activity that resides on our coastline is also present, highlighting the Casilda, La Boca and San Pedro areas, which provide an annual average production of 170 t of lobster, 100 t of Cobo, 70 t of crab teeth and 235 t of freshwater fish. scale. These productions do not pay taxes to the municipality's economy, as they constitute the national balance.

### **3.2. Diagnosis of the agricultural sector in the Trinidad Municipality in the period between the years 2016 and 2020**

#### **3.2.1. External factors**

##### *Threats*

- 1) Global crisis exacerbated by the COVID-19 pandemic and the war in Eastern Europe, which has a negative impact on all indicators of the tourism sector, the main economic activity of the municipality.
- 2) Intensification of the blockade that affects the supply of all types of inputs, with loss of purchasing capacity, little access to raw materials, materials and technologies.
- 3) Natural disasters and effects due to climate change.
- 4) Insufficient popular participation in municipal decision-making.
- 5) Population aging.
- 6) Population exodus.
- 7) Existence, in some structures, of resistance to change towards the management of local development.
- 8) Lack of motivation and agrarian culture of the workforce in the countryside.
- 9) Vertical design of statistical systems that limits the inclusion of all economic actors.
- 10) Vertical stimulation systems.
- 11) Direct actions of higher organizations on the municipality, for not facilitating the autonomy of governance.

##### *Opportunities*

- 1) Process of updating the Cuban economic model, with solid legal support for the implementation of the local development policy.
- 2) Legally instituted sources of financing for local development.
- 3) Privileged geographical location with maritime, air and land access routes.
- 4) The development of the tourism sector as a priority in the country.
- 5) Development achieved by ICTs in Cuba.
- 6) Existence of a wide river network with potential for agricultural development.
- 7) Access to universities and research centers, carriers of scientific knowledge and advanced technologies.
- 8) Presence of disused infrastructure and untapped endogenous resources.
- 9) Promotion and encouragement of new forms of non-state management.
- 10) Increase in foreign investment and collaboration.
- 11) Provincial and national addresses located in the territory.
- 12) Secure market for all agricultural production generated in the municipality.
- 13) Proximity to agricultural production centers in other provinces.



### **3.2.2. Internal factors**

#### *Strengths*

- 1) Existence of productive reserves that can be mobilized and managed at the municipal scale as viable sources of resources.
- 2) Existence of a law on food sovereignty and nutrition.
- 3) Existence of a legal basis that guarantees the proper functioning of all productive actors.
- 4) Agricultural tradition in individual producers.
- 5) Existence of water supply sources for agricultural use.
- 6) Representation in the municipal agricultural system of all productive forms officially recognized in Cuban agriculture.
- 7) Existence of forest cover that allows the establishment of agroforestry systems.
- 8) Representation of a mountainous surface that makes it possible to exploit high altitude crops.

#### *Weaknesses*

- 1) Lack of workforce in all productive forms of the municipality's agricultural sector.
  - 2) Lack of irrigation systems in the majority of the active agricultural area.
  - 3) Existence of agricultural land in an idle state.
  - 4) The average annual salary per worker in the agricultural sector in the municipality is still low.
  - 5) Lack of agricultural inputs and implements that cover the needs of the sector.
  - 6) Lack of preparation of cadres and professionals in the sector.
  - 7) There is no updated soil catalogue.
  - 8) Low quality of the soils in exploitation.
  - 9) Low yields per crop and planted surface area.
  - 10) Very low amount of machinery and technological limitations.
  - 11) Poor management of active agricultural land.
  - 12) Failure to comply with the agrotechnics required by crops.
  - 13) I don't know if there are seed banks that guarantee seed availability.
  - 14) Infrastructure with serious limitations.
  - 15) I do not know how to guarantee the minimum consumption of food and vegetables required by each person in the municipality that guarantees their calorie needs.
  - 16) I don't know if they guarantee the minimum levels of protein consumption that each person in the municipality requires.
  - 17) Insufficient projects that guarantee alternative sources of financing in the territorial agricultural sector.
  - 18) Poor treatment of the waste generated by the productive processes of the agricultural sector.
  - 19) Low productive chain.
  - 20) Structural, technical and financial imbalance between all productive forms of the agricultural sector of the territory.
  - 21) Non-compliance with collection and payment contracts with productive forms.
- Critical points found in the diagnosis carried out in the agricultural sector of the

Trinidad municipality between 2016 and 2020.

- Work force.
- Irrigation
- Performances.
- Salary.
- Use of agricultural land.

### 3.3. Behavior of the available workforce in the agricultural sector of the Trinidad Municipality in the period from 2016 to 2020

If a comparative analysis is carried out between the behavior of the employment of the workforce in the agricultural sector in the Trinidad Municipality, between the periods between the years 2011 to 2016, according to the data appearing in the ONEI, and the corresponding period between the years 2016 and 2020, see data in **Table 3**, it can be seen that there is a decrease in the employment of the workforce in the agricultural sector of this territory, keep in mind that in the informative closure presented by the ONEI for the period 2011–2016, in This last year there were 535 employed workers, which at that time, and as previously stated, constituted a decrease of 89.9% of the workforce employed in the agricultural sector of the territory in question, taking as reference the workforce that worked in said sector in the year 2012, if this same comparison is made in the period between the years 2016 and 2020, it can be seen that the decrease in the employment of the workforce in the agricultural sector of the territory continues, see **Table 3**, reaching 402 workers working in said sector in 2020, if this is compared to the 5302 workers who worked in 2012, the year taken as a reference, because it is where the greatest number of workers existed working in the agricultural sector. of the Trinidadian territory; then you can see a decrease of 97.5% of the workforce employed in this sector compared to 2012, this shows that the employment of the workforce in the agricultural sector of the Trinidad Municipality continues to decrease alarmingly, not guaranteeing not even the minimum of one man per hectare in agricultural exploitation in the territory, a very serious element in the attempts to achieve food sustainability in the territory.

**Table 3.** Workforce employed in the agricultural sector in the Trinidad Municipality, in the period between 2015 and 2020 [15].

Concept	Year					
	2015	2016	2017	2018	2019	2020
Total workers employed agriculture, livestock, hunting and forestry	301	535	483	471	Not registered	402

If a comparison is made of the behavior of employment in the agricultural sector of the Municipality and this indicator itself at the country level, according to data provided by the ONEI [15], it can be seen that in the year 2017, which is the year that is registered, At the national level there were a number of workers employed in various sectors of the economy in a quantity that amounted to 4,474,800, of which 833,300 were employed in agriculture, which meant 18.6% of all workers employed in the country, if to this we add that the Active Agricultural Surface of the country at that time was set in the order of 3,120,000.9 ha, then when

dividing the active agricultural surface of the country by the number of workers employed in the agricultural sector of the country, that will give a value of 3.74, which when applying the established rounding rules to a whole number, due to excess it is taken to 4, this according to the logic of thought allows us to say that at the level of Cuba, in the year 2017, there was an average of 4 men employed per hectare of cultivated agricultural area, if these results are compared with those obtained in the same period (2017), in the case of the Trinidad Municipality, where the active agricultural area was 106,200 ha, and the number of workers employees in the agricultural sector of the Trinidad territory, for the year 2017, was 483, if the same previous division is applied, the result would be 0.5, a value that is far from 1, so the minimum of 1 man employed per 1 hectare of active agricultural area, so it is very far from the average value shown by the country, in this same year, for the ratio of man employed per 1 hectare of cultivated area, which, as previously stated, is 4:1, this reaffirms everything stated above, in relation to the fact that the decrease in the number of workers employed per hectare of active agricultural surface in Trinidad lands today constitutes a true brake on the aspirations of achieving food sovereignty.

### **3.3.1. Behavior of the indicator: Distribution of land and its use in agriculture in the Trinidad Municipality**

In an updated analysis of this indicator, the information provided by the ONEI is taken from the period between 2016 and 2020, see **Table 4**, by observing the values that appear in this table and comparing them with those that appear reflected in the period between the years 2011 and 2016 it can be seen that the same values are maintained, this in the case of the agricultural area is justified by being an invariable value, due to the geographical location and the current political-administrative division, which makes the there are no new changes in the latter, since the area that appears declared as the agricultural surface of the municipality remains constant, and this criterion is not so absolute, since due to factors such as: population growth, industrial growth, and loss of fertility in the soil, among others, the tendency of this surface area to decrease, which is why even maintaining this constant value over a period of 5 years may even be questionable; But the great concern in maintaining the same values as 5 years ago lies fundamentally in the use made of the land declared a usable agricultural area, and precisely the same agricultural area declared idle 5 years ago is maintained. back (11,800 ha), this is contrary to all the policies established by the country and the Ministry of Agriculture, as well, and the most important thing is that it goes against the existing and unsatisfied need to deliver diverse foods, in quantities and with the quality required by the population of the territory, and finally, contrary to the aspiration of the territory to declare itself sovereign from a nutritional point of view. If we look for the possible causes of this immobility in the decrease in the surface declared as idle, and after consulting works carried out by authors such as Valdés and Suárez [16], which address the problem of management in different productive forms of the territory, finding Among the weaknesses of these productive forms is not having a management strategy that allows them to achieve the proposed objectives as an organization, the low preparation of their managers to be able to carry out an efficient management process, not having covered templates, among many. others; but these three are taken as they are considered very linked and

decisive in the solution of the problem addressed with respect to being able to reduce or completely eliminate the surface that still remains idle throughout the territory, in the case of the first two causes they are purely of direction of the processes, and that have a high influence on the solution of this problem, since much of this idle surface is within or close to each of these productive forms, and if there is no strategy that includes this problem in its diagnosis, of course that he will not have the means, time and those responsible to solve this problem, another point is the man who directs, it is clear that according to Stoner [17], in the book “Administration”, a good manager has to have adequate attitudes and skills so that he can fulfill their managerial functions and be able to efficiently conduct the management process, the accurate conjugation of these two already diagnosed weaknesses will contribute greatly to the solution of the existing problem, idle agricultural surfaces, the existing weakness has been left for last in many productive ways of not having a complete staff of workers, here all the analysis already carried out in the first indicator evaluated in the results of this work will not be carried out again, what if we want to insist again is that this weakness today, in the trinitarian territory it constitutes a great concern, and as we saw, its solution is very complicated, since it is conditioned by factors of a social, economic and political nature, which must be combined in an appropriate way for there to be a reversal in the accelerated decrease, currently existing, in the decrease in the workforce available for the agricultural sector in the municipality, and which at the same time is one of the decisive elements when it comes to being able to reduce or eliminate once and for all. surface of idle land that still exists in the agricultural area of the territory.

**Table 4.** Distribution of land and its use in the Trinidad Municipality, in 2020 [15].

Municipality	Total (Thousands ha)	Total (Thousands ha)	Cultivated (Thousands ha)	Total (Thousands ha)	Idle (Thousands ha)	Non-Agricultural (Thousands ha)
Trinidad	116.8	60.7	23.8	36.9	11.8	56.0

### 3.3.2. Behavior of the indicator: Average salary earned per agricultural worker in the Trinidad Municipality in 2020

In Cuban agriculture, the man-salary relationship has been a quite controversial issue. After the triumph of the Cuban revolution, this issue has received great interest from the country’s senior management. There have been several payment systems that have been used. have implemented, and several policies designed and put into operation, the truth is that there have been periods of bonanzas, with regard to the salary income of agricultural workers, and others of decline in salary, that is, it is an issue that has shown its ups and downs, but in a general sense, the salary has most of the time been far from fulfilling its function, generally the historical salary of a worker in the agricultural sector in the country has been one of the lowest, this is one of the factors that has directly influenced the availability of workers that the agricultural sector in the Trinidad territory has today, if you look at **Table 5**, which reflects the average annual salary earned by a worker who works in the agricultural sector of the Trinidad municipality, in the years between 2015 and 2020, where it is clearly evidenced that between the years 2015 and 2019, the average salary is in the order of \$382.42, only in the year 2020 exceeds \$1000 per worker, if this behavior is

observed and compared with that of the average salary earned by any worker in the productive sector in the municipality itself, see **Table 5**, it is an average in this same period in the order of the \$491.6, this average salary of any worker in the productive sector in the municipality is higher than that earned by a worker in the agricultural sector of the municipality, even in 2020, which is the year with the best salary performance in the agricultural sector. of Trinidad, reaching \$1010, this is much lower than that reached by any worker in the non-productive sector of the territory, which is in the order of \$1243, exceeding by \$233, the salary of an agricultural worker in the territory, this it clearly shows that the salary of an agricultural worker in the municipality is the lowest in the productive sector of the territory, in the period between 2015 and 2020.

**Table 5.** Average monthly salary in state entities by type of economic activity Trinidad Municipality [15].

Concept	Year					
	2015 (\$)	2016(\$)	2017(\$)	2018(\$)	2019(\$)	2020(\$)
Total generating wage by productive sector of the territory (\$)	632	628	413	632	765	1243
Total salary (\$) earned by workers Agriculture, livestock, hunting and forestry	441	566	571	588	643	1010

In order to have more elements in the analysis and evaluation that is being done of the behavior of this indicator, and to have a reference of the behavior in other municipalities in the country, the information provided by the ONEI, in its 2020 Yearbook, was taken regarding the behavior of the salary earned by a worker in the agricultural sector in the Municipality of Ciego de Ávila, in the period between 2016 and 2020, it can be seen that unlike what happened in the Municipality of Trinidad in relation to the average salary earned by a worker agricultural worker in 2016, it exceeds one thousand pesos, specifically \$1133.0, compared to \$566.0 which was the average annual salary of an agricultural worker in the municipality of Trinidad, which this year alone doubles The level of income of one with respect to the other, if the average salary earned by a worker in the agricultural sector in the municipality of Ciego de Ávila is calculated in the period from 2016 to 2019, is in the order of \$752.87. If this value is compared with the average salary earned by an agricultural worker in the Trinidad municipality in the same period of time, which is \$382.42, then it can be seen a difference of \$370.45 more earned on average by an agricultural worker in the Ciego de Ávila municipality compared to a worker in the same sector in Trinidad. This allows for a deduction: the salary earned by a worker in the agricultural sector of the Trinidad territory in the period between 2016 and 2020 is below the average annual salary received by a worker in the productive sector in the same country. municipality, and below the average annual salary received by a worker in the agricultural sector of the Ciego de Ávila municipality.

This salary difference, both within the municipality and in relation to another municipality in the country, is an issue that must be reviewed because, as a logical matter, nothing justifies that workers in the same sector, over the same period of time, manifest such differences. salary problems, it would be advisable to carry out a study of the causes to be able to have a starting point in the solution of this salary problem that workers in the agricultural sector in the Trinidadian territory today

express, which constitutes another element that limits the stability of the labor market in Trinidad's agricultural sector, and in the aspirations to achieve municipal food sovereignty.

It is also healthy to review the payment system that is being applied today in the agricultural sector of the Trinidad Municipality and what is established by the country. In this sense, it is to apply the payment by results system. Very favorable experiences exist with this payment system in the productive aspects of the agricultural sector, even within the same province. An example is what was proposed by González [18], in his proposal for a management strategy for the Basic Unit of Cooperative Production (UBPC) "Siguaney", where an assessment is made Regarding the application of the results-based payment system in this entity, the author states that: at the UBPC, payment based on production results is applied in all its areas, which consist of:

A payment system is defined where the administration collects its advance payment for tons of cane existing in its estimates and gives bonuses according to the production of the month.

In the lot, payment by result is from the field budget according to the activity carried out and the productivity of the work.

During the harvest, payment is made for the tons of cane harvested in the combine platoon according to the budget and the tons cut.

Results-based payments are applied to investments made in the UBPC according to the budget allocated to the investment.

In general, at the UBPC, payments for production results are applied to all activities carried out, and this results in increases in production efficiency. Payment by results favored the implementation of the development strategy since, with the increase in production, the budget increased and the worker was encouraged to obtain a higher salary with efficiency. Taking into account all of the above, production rose to 27% and the average salary by 28%.

### **3.3.3. Behavior of the indicator: Agricultural yield in the Trinidad Municipality in 2020**

To begin the analysis and evaluation of the agricultural performance indicator in the Trinidad Municipality, in the period between 2015 and 2020, a comparison was established between the yields of vegetables and bananas, between productive forms of the private sector and the state sector, first: choose vegetables and banana, because both are items that constitute one of the main sources of food for the population of the territory, both by tradition and by contribution to the daily balance that from a nutritional point of view a human being must consume, secondly: This comparison is made between the yields achieved between private and state productive forms of the agricultural sector of the territory, because it is of great interest to be able to measure the productive performance between two forms of property within the agricultural sector itself, which today includes the Constitution of the Republic of Cuba, state ownership of the means of production and private property, which by the way, the Constitution of the Republic of Cuba, recognizes state property as the main form of production; therefore, by establishing this comparison, it allows us to have results that allow us to evaluate the performance

that each form of property plays today in the agricultural performance of the municipality. This would be vital when establishing productive strategies in the region, but it could also be taken as a reference when correcting any distortion between what is endorsed in the Magna Carta of the Republic and what is actually happening in relation to what form of production today constitutes the main support for agricultural yields in the municipality. See **Tables 6** and **7**.

**Table 6.** Agricultural production by selected crops from non-cane agriculture Trinidad Municipality. State Sector [15].

Concept	2015 (Tons)	2016 (Tons)	2017 (Tons)	2018 (Tons)	2019 (Tons)	2020 (Tons)
Viands	281.1	332.8	725.2	2067.9	1773.1	1099.9
Bananas	194.3	208.2	472.4	1216.9	946.1	579.5

**Table 7.** Agricultural production by selected non-cane agriculture crops [15].

Concept	2015 (Tons)	2016 (Tons)	2017 (Tons)	2018 (Tons)	2019 (Tons)	2020 (Tons)
Viands	6899.1	8373.1	8575.3	7451.0	8412.8	5191.3
Banana	3453.2	3944.7	4370.3	3613.3	4050.7	2454.1

When a comparison is made between the agricultural yields achieved, in the period between the years 2015 and 2020, by productive forms of the non-state sector (private), and the state sector, it can be observed that in all the years mentioned, both in Viands and in Banana, the yields obtained by the productive forms of the non-state sector are much higher than those obtained by the productive forms of the state sector, for example: if we compare the results in yields obtained in 2015 in productive forms of the non-state sector, in Viands and Banana, which are 6899.1 t and 3453.2 t, respectively, against 281.1 t of Viands and 194.3 t of Banana, in the state sector, a superiority in the yields of the non-state sector with respect to those achieved by the state can be seen. Please note that in the case of root vegetables, if the total yields obtained (state and non-state sectors) are added this year, they would be in the order of 7280.2 t, meaning that the 6899.1 t contributed by the non-state sector represents 96.08% of the total production achieved during that year. In the case of plantains, if the same previous procedure is applied, that year a total yield of 3647.50 t will be obtained, representing the 3453.2 t of plantains contributed by the non-state sector, or 94.7% of the total production. As can be seen in both root vegetables and plantains, during 2015, it was the non-state sector that contributed the highest percentages in the yields of the aforementioned items at the level of the Trinidad Municipality. During the rest of the years, the same previous procedure is applied, although different values will be obtained; however, the behavior of the results is similar to the previous one, that is, the contributions to productive yields will always be greater, both in Viandas and in Plátano, in the non-state sector of the territory.

The above results coincide with the trend at the country level, according to ONEI's Statistical Yearbook of Cuba [15]. Cuba's agricultural model assigns the non-state sector a central role in national food production. In 2016, with 80.9% of the cultivated surface, the non-state sector contributed 95.4% of beans, 93.2% of

fruits, 92.8% of root vegetables, 82.7% of vegetables, and 78.1% of rice. If we take into account the total population of the Trinidad Municipality in the years 2019 and 2020, according to the ONEI Statistical Yearbook 2021, in 2019, it was 77,185 inhabitants, the floating or transit population and the tourists who visit the territory are not contemplated here, which due to its status as a World Heritage City has a large influx of foreign visitors, both figures as it appears in the Local Development Strategy [10] are around the figure of some 20,000 additional people, who make use of the territory's food, if this figure is added to the total number of inhabitants already mentioned, a total of 97,185 inhabitants would be obtained in the territory in the year 2019, if the production of viands is added, both from the state and non-state sector, in that same year, 10,185.5 t would be obtained, or what is equivalent 10,185,900 lbs, if this amount is divided among the 97,185 inhabitants, who in that year are declared in the municipality, would give a per capita consumption of 104.81 lbs, and if this value is divided between the 12 months of that year, would give a per capita monthly consumption of 8.7 lbs. If this same procedure is applied to the plantains, it would give a monthly per capita consumption of 4.28 lbs. If both monthly per capita consumptions (root vegetables and plantains) are added, it would give a total of 12.98 lbs, if it is kept in mind that these are the items that have the greatest weight in the productive yields that the territory reaches in that year. In Cuba, there is the local self-sufficiency program, which sets among its goals to reach 30 lbs of food per capita monthly, distributed in root vegetables, vegetables, grains, and fruits, and 5 kg of protein per inhabitant.

#### **3.3.4. Indicator behavior: Irrigation on the agricultural surface in the Trinidad Municipality in 2020**

This is a very depressed indicator; it is of great importance in being able to increase yields and achieve the territory's aspiration to achieve food sovereignty. It must be said that at this moment in the territory, there are only 0.0003 ha of the agricultural surface cultivated with an irrigation system, which means that almost all crops are grown on dry land. The intense drought that has affected the municipality in recent years has influenced the low yields shown by crops in the territory, so it is necessary to increase the areas under irrigation since there are potentialities in terms of supply sources that can be exploited with adequate technologies, which could reverse the current results.

## **4. Conclusions**

From 2015 to 2020, there has been a sustained tendency to decrease the availability of labor in the agricultural sector of the Trinidad municipality, reaching only 402 workers available in this sector in 2020. If we take into account that the agricultural area of the same area, suitable for cultivation, is 106,200 ha, then the man-hectare cultivated ratio does not reach 1 man/ha, which is very low.

In 2017, the man/hectare cultivated ratio at the country level was 4 men/ha cultivated; in that same year, at the level of the Trinidad Municipality, it was 1 man/ha cultivated. For the year 2020, the trend was to decrease at the municipal level



with respect to the country level, not reaching 1 man per hectare cultivated for this last year.

It is impossible to achieve high levels of production and high yields in the agricultural sector of Trinidad Municipality with such low labor force availability.

The area of agricultural land declared as idle in the Trinidad Municipality in 2020 represents 36.4% of the total area declared as idle at the level of the province of Sancti Spiritus, being a significant percentage within the total amount of idle land in the province, so maintaining the same idle agricultural area in the Trinidad Municipality for a period of approximately 10 years invariably contributes negatively to the impact of the high levels that the province still has in this regard.

The percentage of agricultural land that still remains idle conspires against the necessary increase in agricultural production in the Trinidad Municipality.

The average salary of a worker in the agricultural sector of the Trinidad Municipality is in the order of \$382.42; only in the year 2020 will it exceed \$1000 per worker, resulting in a low salary when compared to the salary received by any worker in another productive or non-productive sector within the territory itself, and it is also low when compared to that received by workers in the agricultural sector in other municipalities of Cuba.

The highest yields in vegetables and plantains are obtained at the level of the municipality of Trinidad in non-state productive forms, being much higher than those achieved by state productive forms, and these yields, as a whole, are below the average achieved in both state and non-state forms at the country level.

The productive yields currently achieved in root vegetables and plantains in the Trinidad Municipality only guarantee a monthly per capita consumption of 12.98 lbs, not meeting the 30 pounds per capita established at the country level by the local self-supply program.

Only 0.0003 ha of the cultivated agricultural surface of the Trinidad Municipality is under irrigation; most of the crops are grown on dry land, which conspires against yields.

In general, the indicators analyzed in the agricultural sector of the Trinidad Municipality in this work, for the period between 2016 and 2020, have a negative behavior, which is a great limitation in the aspiration to achieve sustainability and food sovereignty in this territory.

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