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PROFITABILITY AND COMPETITIVENESS OF TECHNOLOGICAL INNOVATIONS IN CAMPESINA PRODUCTION UNITS: CASE TAHDZIU, YUCATAN

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ABSTRACT

In order to estimate the relationship of the trend towards the competitiveness of Family Units (UF), the present work was carried out in the community of Thadziú in the state of Yucatán, which according to data from the Government of Mexico, is characterized by its index of marginalization. Sixty families were selected and polled using a questionnaire as a tool. The survey was applied in two stages that were before and after the incorporation of technological innovations in corn and beekeeping. The questionnaire contained questions related to land use, animal inventory and availability of labor. Likewise, we obtained data on sales, self-consumption, salaried and family labor and operating costs of each UF. An income analysis was carried out and financial, economic and competitiveness (RC) indicators were obtained. This last indicator served to stratify UFs. The strata were negative RC (E1 <1) between 0 and 1 (E2) and> 1 (E3). Before the incorporation of technological components, 90% of the UF were not competitive after two years of evaluation, 50% of the units improved their income and increased their net added value and competitiveness.

Keywords: Income, peasant, rural poverty, technology

1. INTRODUCTION

The peasant economy in marginalized regions of Mexico is in a permanent crisis, the production they produce is generally for self-consumption and on exceptional occasions is destined to the market generating some income from their crops, to acquire goods and services that do not produce, these concepts about the economy and mode of peasant production are widely discussed in classic studies by Chayanov (1974); Wolf (1975) and later resumed by Martínez in (1987) and Galesky (1997). Rural poverty, as shown by FIDA (1999), is a multifaceted social and economic phenomenon characterized by: socio-economic exclusion and discrimination based on ethnic or gender reasons; lack or limited access to basic services (health, education, housing) and income level below the basket of basic goods and services, including food.In Mexico between 2012 and

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2014, poverty went from 45.5 to 46.2 percent; This change, although it was not statistically significant, reflected an increase in the number of people from 53.3 million to 55.3 million, that is, an increase of two million people living in poverty in a period of two years. (CONEVAL 2016).

As far as the state of Yucatan is concerned, in 2012, with respect to the country, it ranked thirteen as a percentage of the population in poverty and twelve in the deMéxico. (CONEVAL, 2011), and according to studies carried out, 4, 452 people / day join the 27.1 million in food poverty, (CONEVAL, 2011). In the Yucatan Peninsula, rural poverty is more than evident, mainly in the population living in extreme poverty. This with respect to the total population is equivalent to approximately one million people of one (3,223,862 inhabitants) of the region, being the state of Yucatan where this percentage increases up to 33% with respect to the total population of approximately two million, which means that 48.9 percent were in poverty in the state, (1'658.210 inhabitants), (CONEVAL 2013).

Another aspect that shows the level of poverty in the region is the number of municipalities with high and very high marginalization rates, which, according to CONAPO data in 2005, of a total of 125 municipalities that belong to the Peninsula of Yucatán (11 of Campeche, 8 of Quintana Roo and 106 of Yucatan), 4.8% presents a very high marginalization index (6 from Yucatan) and 61.6% high (5 from Campeche, 3 from Quintana Roo and 69 from Yucatan) .

Marginalization is understood as a multiple structural phenomenon regarding dimensions, forms and intensities of exclusion in the process of development and enjoyment of its benefits (CONAPO, 2005). Among the indicators considered by CONAPO to define levels of marginalization are the percentages of illiterate population of 15 years or more, population without complete primary education of 15 years or more, occupation in housing without drainage and without sanitary services, occupation in housing without energy electric, occupation in housing without piped water, occupation in houses with some degree of overcrowding, occupants in dwellings with dirt floor, population in localities with less than 5000 inhabitants and employed population with incomes up to two minimum wages (CONAPO 2005). Op cit.

Although poverty and marginalization is present in the three states that make up the Yucatan Peninsula, it manifests itself most intensely in the state of Yucatán, followed by Campeche and to a lesser degree in Quintana Roo. Poverty mainly affects municipalities where there is a predominance of rural population and especially Mayan indigenous, so any program focused on combating poverty and marginalization in the region must consider these inhabitants as a priority population.

Considering the above, in order to contribute to rural development and the fight against poverty, it is necessary to promote peasant self-management, to promote innovation processes, considering the organization of the actors as an axis of competitiveness and productive reconversion with a focus on business, incorporating low-cost and high-impact technologies through effective transfer-adoption processes in the production units. Cadena et al., (2009), citing Kaimowitz and Vartanian (1990), mention that in order to be competitive it is necessary to successfully face the following challenges: Increase yields, Increase value added, diversify production, reduce costs and have a sustainable production in order to reduce poverty. The

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objective was to determine the profitability and competitiveness of the family production units before and after the implementation of technological innovations in the community of Thadziú in the state of Yucatán, under the scenario of a project developed in the south-east of Mexico from 2009 to 2013 for the management of innovation and later with a project for the generation of a model for agribusiness, until 2015, both projects were complementary and supported with a multimedia training strategy for organized groups.

2.MATERIALS AND METHODS

According to the document Municipal Diagnosis of Sustainable Rural Development (2008), the municipality of Thadziú, is located in the southern region of the State of Yucatan, 160 km from Merida, the capital. It falls between the parallels 20 ° 12 'and 20 ° 15' north latitude and the meridians 88 ° 51 'and 88 ° 59' west longitude; It has an average height of 32 meters above sea level. It occupies an area of 53.65 km2 that represents 0.5% of the territory of the State. It limits to the north with the municipality of Yaxcabá, to the southeast with that of Peto and to the west with that of Chacsinkin. Regarding the most important productive activities carried out in the community, the production of corn with a traditional production system based on the slash and burn tomb and the production of honey by means of a traditional low-tech beekeeping stand out.

The work was carried out taking as unit of analysis the Family Peasant Unit (UFC) and was divided into two stages, the first was prior to the incorporation of technological innovations and is called competitiveness analysis without project and later, dimensioned in the time and evaluating the benefits of the technological components incorporated in the production units, is called competitiveness analysis with project. The technological components incorporated were, improved seeds, fertilization and pest management in milpa for the production of corn and supplementary feeding and handling of the apiary in the beekeeping activity. The transfer of technology was through the field schools model through training sessions with a practical and participatory approach according to Morales (2006), Morales and Galomo (2007), Morales et al., (2008), Orozco et al., (2008); Cadena et al., (2012); Morales, et al., (2016) and Cadena, (2016).

As an instrument to gather information, a questionnaire was used, which included 44 questions related to the background of the UFC. In them, questions were asked about land use, animal inventory, availability and use of family and contracted labor and aspects related to the assets and liabilities of the UFC, which allowed estimating net assets. The second section was used to capture the current operations of the UFC without a project in 2010 and with a project in 2011. This included the amount and value of the production generated by destination (sale and self-consumption), operating costs including the cash cost of the salaried work hand and the imputed cost of the family labor. Likewise, a section was included to estimate the investments of the UF in order to calculate its depreciation per productive year. Prior to the application of the survey, the questionnaire was submitted to a pilot test to demonstrate its congruence and effectiveness.

Calculation of the competitiveness indicator. To establish a competitive relationship, two aspects are important: the net value added, which is obtained by deducting from the gross value of UF production (VBP), cash expenses (not including wages), composed of intermediate consumption products that they are obtained from other sectors of the economy, such as seeds, agrochemicals, etc., and a concept derived from the use of capital goods called depreciation. The

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other aspect is the work used in the production process in the UF, which consists of the work of the producer and his family and the contracted work that receives a salary and that as a whole is called internal factors of production (Figure 1).

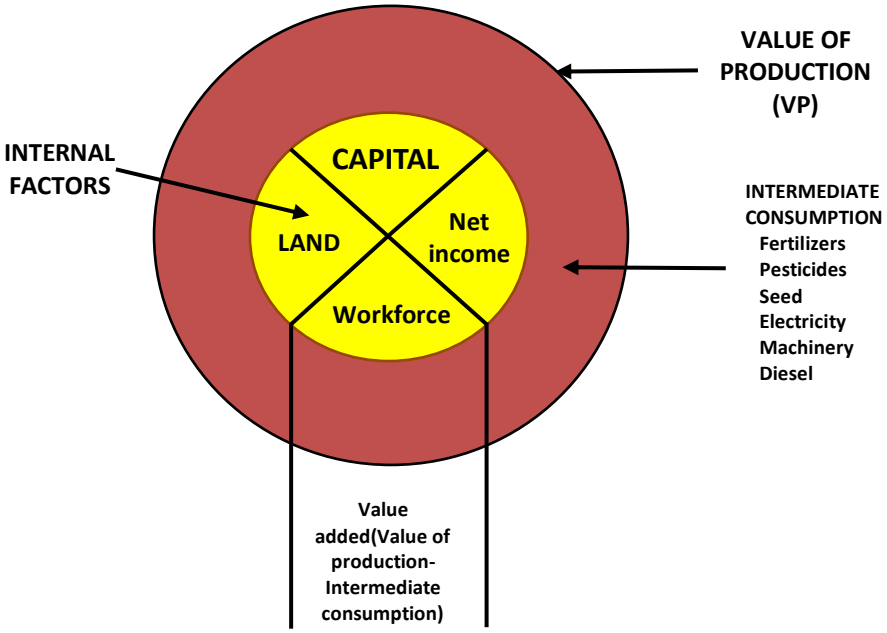

Figure 1. Structure of the value of production Source: Puente, 1995.

As mentioned, competitiveness is a complex concept, but it is intimately linked to productivity. In UFC the work is composed mostly of the work of the producer and his family and to a lesser extent of salaried work, the first, unlike the second, does not involve a cost in cash, the costs in cash are preferably related to the cost of goods. of intermediate consumption. Therefore, the human factor has the greatest capacity for the development of comparative advantages. Competitiveness depends more on human education than on investment in capital (Macmillan and Schuler, 1985). Therefore, a more specific indicator is the Competitiveness Ratio (CR), defined as the product of the quotient between the cost of internal factors and the net added value and when this relationship is closer to one the UFC tends to to be more competitive (Góngora, et al., 2012, Rodríguez et al., 2013 and Jácome et al., 2016). P.E.

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RC = CFI/VAN

Where: RC = Relationship of tendency to competitiveness

IFC = Cost of Internal factors

VAN = Net Added Value.

Case A: CFI= 6800; VAN= 10200 RC= 6800/10200 = O.67

Case B CFI= 6800; VAN= 15200 RC= 6800/15200= 0.45

Production unit B tends to be more competitive than production unit A. This is explained because at the same cost of internal factors (labor), there is a higher NPV, probably as a consequence of a reduction in intermediate consumption (cost of herbicides, seeds, etc.). In peasant economics, even if it escapes economic rationality, the CR can be negative or greater than 1, depending on the relationship established previously. In any of the cases there are explanations based on this relationship. The previous example corresponds to a CR between 0 and 1, which is expected according to the theory of neoclassical economics, for the other cases it is explained as follows:a negative RC can be obtained when in the UF, which are usually subject to the storm, inputs and labor force are applied to the production process, but due to a bad weather or any other accident, the production is practically zero, for therefore, the NPV is negative, which implies that the producer is operating with losses and does not recover its production costs.
Example:

RC = CFI/VAN

Where: RC = Relationship of tendency to competitiveness

IFC = Cost of Internal factors

NPV = Net Added Value = (Gross value of production- UF cash expenses (not including wages) -Depreciation) CFI= 6800;

VBP= 2500

Cash expenses= 4300

Depreciation= 850

VAN= 2500-8100-850= -6450

RC= (6800/-2650) = -1.05

There is no tendency to competitiveness, for this to happen, we first have to look for levels of positive profitability, increasing the VBP in such a way that it is greater than the internal factors.

A CR greater than 1 can be obtained when the cost of the internal factors is greater than the NPV, as long as it is positive. In economic terms, this situation lacks rationality, however, for the

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peasant producer whose logic of production is not to maximize his profit, but to seek family food subsistence, the productivity of his labor, is not relevant, especially when in his community the opportunity cost of their work tends to zero. The previous thing implies that the use of them in their productive process, when imputarle a value results in an overestimation that affects the CR.

Example:

RC = CFI/VAN

Where: RC = Relationship of tendency to competitiveness

IFC = Cost of Internal factors

VAN = Net Added Value CFI= 12800; VAN= 1280

RC= 10850/1280= 8.48

There is no tendency to competitiveness, family and wage labor is not productive, you have to increase your productivity by making optimal use of it.UFC for analysis and stratification. At the time of processing the information without a project and as a consequence of the lack of reliability and / or lack of consistency in the results obtained, CFUs under study were eliminated. Therefore, the total of UFC subject to the analysis were 53 and 40 without and with project respectively, the income analysis was obtained and estimated the levels of competitiveness. Then we proceeded to stratify, using the criterion of the relationship to the competitiveness trend (CR). Based on them, three strata were obtained; Stratum 1 (E1), of negative competitiveness; Stratum 2 (E2), competitiveness between 0 and 1 and Stratum 3 (E3), competitiveness greater than 1.

3.RESULTS AND DISCUSSION

Below, the average results obtained by RC stratum are presented, starting from the background of the UF, the current operations carried out by the UFs and their respective income analysis, emphasizing the main economic indicators such as the Gross Value of the Production (VBP), the Net Value Added (VAN), the Remuneration to the Production Factors and the same CR. In Table 1, the results of the UF background are presented. The average surface area of each stratum ranged between 2.6 and 3.5 ha, the most important crops being seasonal maize with relay beans in all strata and associated with pumpkin *Cucurbita pepo* (L) in E2 and bean "ib" *Phaseolus lunatus* (L), watermelon *Citrilluslanatus* (THUNB.) MATSUM. & NAKAI1916 and pumpkin at E3. In E2, 100% of the FUs have animals in the backyard in average quantities of 33 heads. The E2 stands out that with project its inventory was increased to 55 animals. Of the UFs that own animals, poultry and hives stand out and to a lesser extent other livestock species such as pigs *Sus scrofa*domestica and turkeys *Meleagris gallopavo*. It is important to highlight the importance of the use of both family and wage labor in the UF. There is a greater efficiency in the use of labor without a project in E2 than in E3 since with a larger area, less labor is used. Similarly, if the cultivated area is related to the project, with the use of labor, a greater efficiency is observed in the use of the same in E2 than in E3 since with a larger area, less labor is used.

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Table 1. Arable land, livestock inventory and labor in the community of Thadziú, Yucatán. INIFAP, 2016.Labor (months)

Stratum	Number of families		Arable area (has)		Livestockinventory(heads)		Labor (months)	
	SP	CP	SP	CP	SP	CP	SP	CP
1	15	7	2.6	2.6	25.4	13.4	13.69	12.43
2	5	20	3.5	3.0	34.1	55.4	13.62	11.61
3	33	13	2.6	2.6	37.1	32.9	14.27	17.24
Promedio	-	-	2.9	2.7	32.2	33.9	13.86	13.76

SP = Without project CP = With Project

Source: own elaboration based on fieldwork

Current operations. Given that the main crop of the UF studied is corn, these are characterized by having a logic of production aimed primarily at self-consumption with surpluses for sale. In Table 2, the percentage of UFs sold is presented. In general terms, we observe the low percentage of UF that they sell and, for the most part, products generated in the backyard. It should be noted that without a project in E1, only 7% of UFs sell their production and with a project it reaches 14%. The highlight in both cases is the sale of pigs and poultry in E2 and honey in E3.As mentioned, the base of the food of the producer and his family is corn and they try to solve their availability by producing them themselves. So it is that between 80 and 100% of the producers consume it, followed by the bean (Table 3).

Table 2. Average of production units that sell by type of product (%) in the community of Thadziú, Yucatán. INIFAP, 2015.

Strata	Stratum 1		Stratum 2		Stratum 3	
	SP	CP	SP	CP	SP	CP
Watermelon (*Citrilluslanatus*)					8	3
Corn (*Zea Mays* L.)					15	24
Pork (*Sus scrofa* domestica)			15		8	0
Poultry (*Meleagrisgallopavo*)	14	7	0	20	23	6

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Beehive (*Apis mellifera*)					15	8
Pumpkin*(Cucurbita pepo*)			0	20	0	0
Pepita (seeds of *Cucurbita* spp)					8	3

SP = Without project CP = With Project

Source: own elaboration based on fieldwork

Poultry as a source of animal protein are also present in the diet of a significant percentage of producers. In the case of producers and their families with a project, the basis of their diet is corn and they try to solve their availability by producing them themselves. So it is that between 57 and 100% of the producers consume it, followed by the beans. Poultry as a source of animal protein are also present in the diet of a significant percentage of producers.

Table 3. Average amount of self-consumption by product and stratum in the community of Thadziú, Yucatán. INIFAP, 2015.

Strata	Stratum 1		Stratum 2		Stratum 3	
	SP	CP	SP	CP	SP	CP
Corngrain(kg)	515.8	3456.0	922.7	265	2270	954.17
Turkeys (piece)			2.5			
Poultry(piece)	11.0	9.3	10.5	7.5	17.8	20
Pig (piece)		1.5	1.3		1.3	1
Lamb (piece)			1.0			
Beans (kg)	80.0	480.0	78.3	120	231	79.3
Creole cows(number)		4.0			4	
Ibes (kg)			90.0		28.7	60
Pumpkin(Kg)		50.0	70.6		36	100

SP = Without project CP = With Project

Source: own elaboration based on fieldwork

Figure 2 shows the average amount of operating costs in cash by stratum without a project in the UF. As noted, the higher cash costs are made in E3 with MX$ 7,242. For E1 and E2, these costs are lower, but similar among them. With the project we can see the average amount of cash

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operating costs per stratum in the UF, the higher cash costs are made in E3 with MX$ 4,230. For E1 and E2, these costs are lower. Within the cost structure, the use of fertilizers, pesticides and agrochemicals and the payment of salaried labor stood out equally in the three strata in both cases. To a lesser extent, the purchase of seeds and food for the backyard animals.

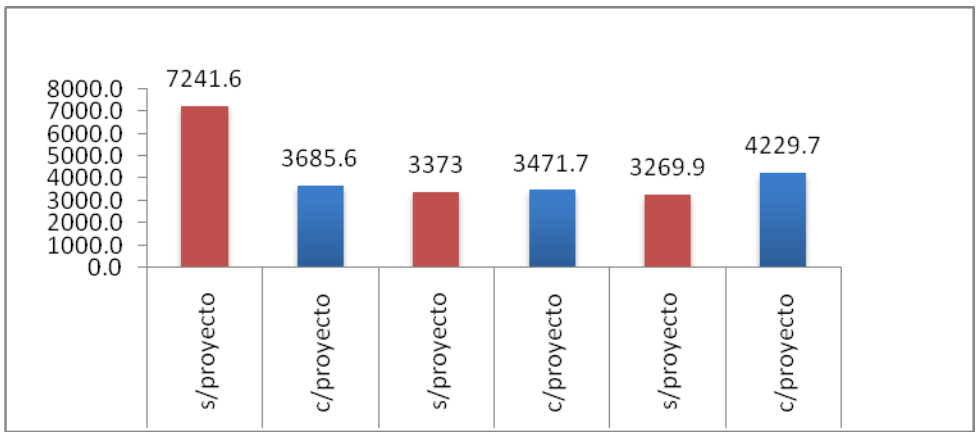

Figure 2. Average total production costs in the UF by stratum in the community of Tahdziu, Yucatán. (MX$). Source: 2015, own preparation based on field work.

Income Analysis With the information obtained, the corresponding income analysis was carried out. To obtain the averages by stratum, we considered all the UFs that make up each of them, that is to say, those that sell and self consume as well as those that do not, as well as those that even with reduced production, have a cost structure of production. Figure 3 shows the cash inflows by strata product of the sales made. In this way, it is observed that the stratum that had the highest cash inflows without project on average was E2 with MX$ 1412. As stated in E3, they were smaller and in E1 there were practically no sales. There is a difference in sales in the case where the project exists, in this way it is observed that the stratum that had the highest cash entries on average was E2 with MX$ 11,887. As stated in E3, they were smaller and in E1 there were practically no sales.

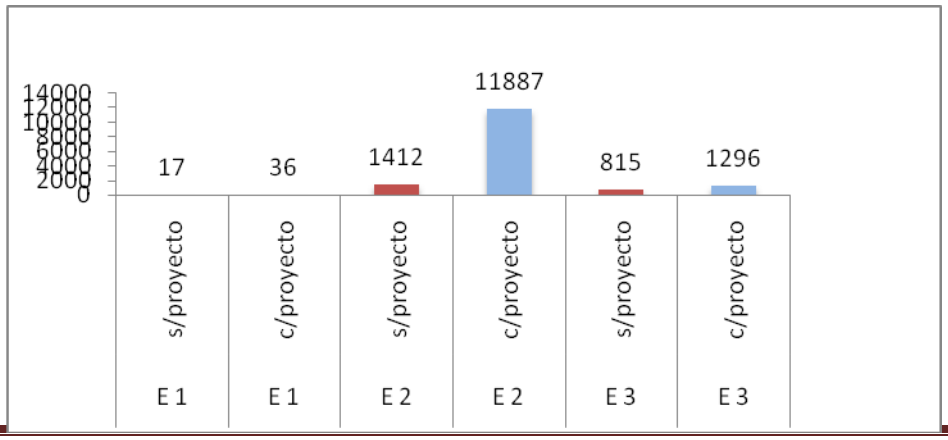

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Figure 3. Cash entries by UF stratum of the community of Tahdziu, Yucatán (MX$) Source: 2015, own preparation based on field work

The imputed value ($MX) of the consumed production is presented in Figure 4. There it is observed that the stratum that had the least self-consumption without project was the E1 with MX$ 2,154.6 on average, increasing considerably in the E2, with MX$ 20,021 this represents an increase of 927% . For E3, self-consumption reached a value of MX$ 4,499. In the case of the project, it is observed that the stratum that had the lowest self-consumption was E1 with MX$ 1,450 on average, increasing considerably in E2, with MX$ 14,076.5, which represents an increase of 970%. For E3, self-consumption reached a value of MX$ 5,508.

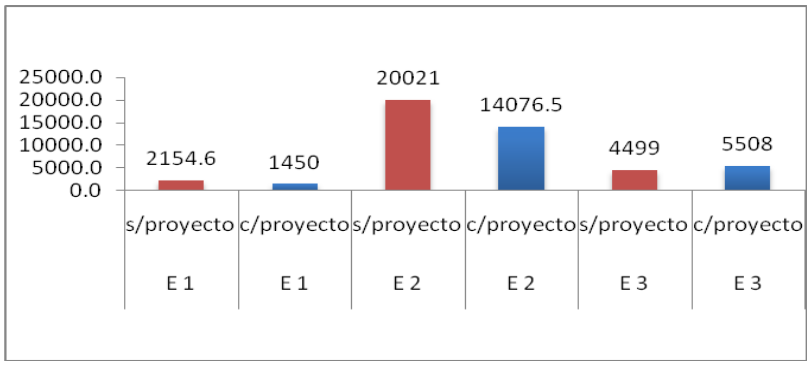

Figure 4 Imputed value of the self-consumed production by stratum of the UF of the community of Tahdziu, Yucatán. (MX$). Source: 2015, own preparation based on fieldwork

The sum of the cash inflows and the self-consumed value, make up the Gross Value of Production (VBP). This amounts on average, as shown in Figure 5, MX$ 21,433 in E2, decreasing substantially in E3 and E1 without project; and with project to MX$ 26,659 in E2, decreasing substantially in E3 and E1.

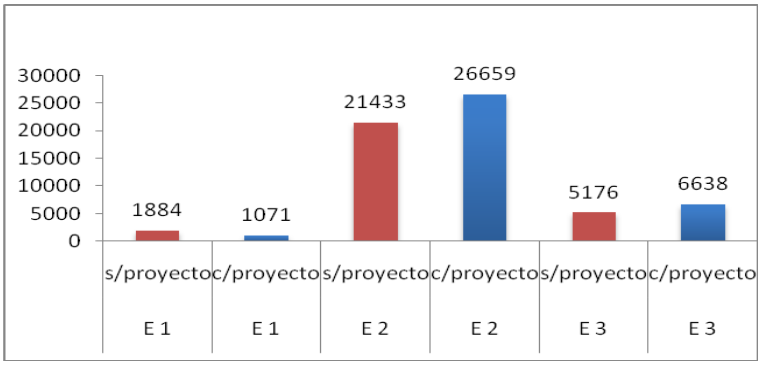

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Figure 5. Gross production value by stratum in UF of the community of Tahdziu, Yucatán. (MX $)

Source: 2015, own preparation based on fieldwork

In order to obtain the Net Added Value (NPV), we proceeded to discount the VBP, cash expenses without including wages and depreciation. These cash expenses were higher in E1 (MX$ 3,793), followed by E2 and E3 without project; these cash expenses were higher in E1 (MX$ 3,538), followed by E3 and E2 with project (Figure 6).

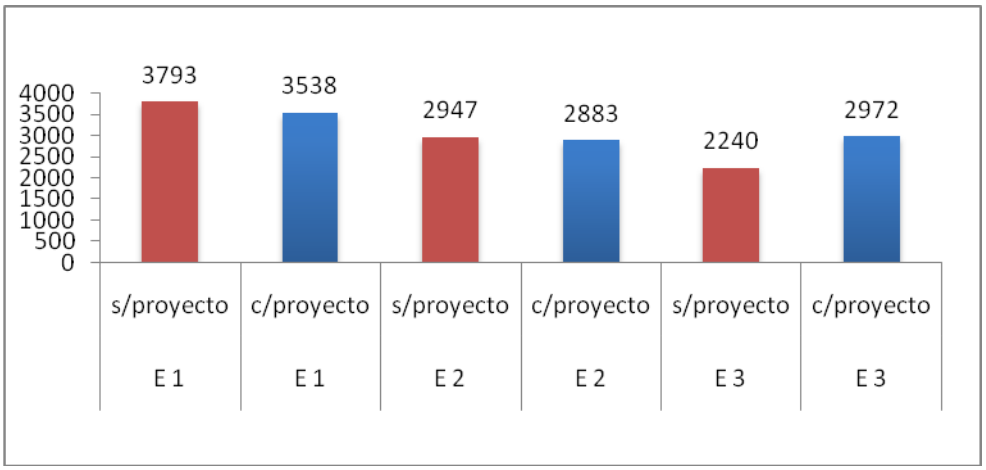

Figure 6. UF cash expenses without including salaries by stratum in the community of Tahdziu, Yucatán. (MX$). Source: 2015, own preparation based on fieldwork

The depreciation on the other hand, was calculated considering the value of the infrastructure and equipment that each UF has by stratum, without considering the house of the producers since this is not part of the production processes of the UF.

In Figure 7, the NPV is appreciated by stratum of competitiveness. As it is observed without project, E2 had a NPV of MX$ 17,633, followed by E3 with MX$ 2,672 and E1 with a negative value of MX$ -4,347. This negative amount is explained because the VBP was lower than cash expenses and depreciation, which implies that this stratum of producers had cash losses in the year of study (2009). As seen with the project, E2 had a NPV of MX$ 22,020 followed by E3 with MX$ 3,153 and E1 with a negative value of MX$ -4,891. This negative amount is explained because the VBP was lower than cash expenses and depreciation, which implies that this stratum of producers had cash losses in the year of study (2010).

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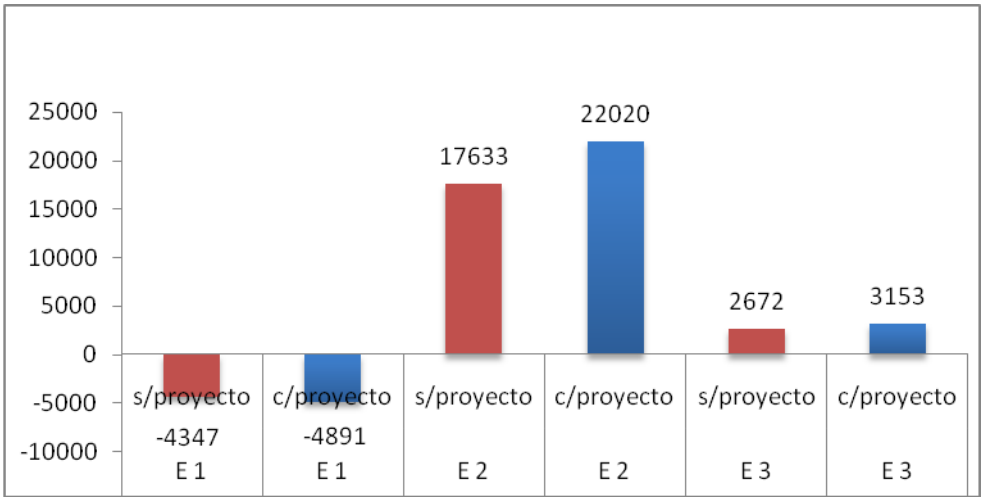

Figure 7. Net added value by stratum in the UF of the community of Tahdziu, Yucatán. (MX$). Source: 2015, own preparation based on fieldwork

As stated in the theoretical framework, to obtain the remuneration to the UF capital, the NPV deducts the internal factors constituted by the labor of the producer, his family and the hired one. In Thadziú, the average cost of salaried labor without a project amounted to MX$ 282 in E1 and MX$ 426 and MX$ 942 in E2 and E3; with project, it dropped to MX$ 148 in E1 and to MX$ 727 and MX$ 1,154 in E2 and E3 (Figure 8). The imputed family labor is the most onerous part of the production factors and amounted to MX$ 11,366, MX$ 10,800 and MX$14,545 for the E1, E2 and E3, respectively. This meant 98, 96 and 94% of the total internal factors for E1, E2 and E3.

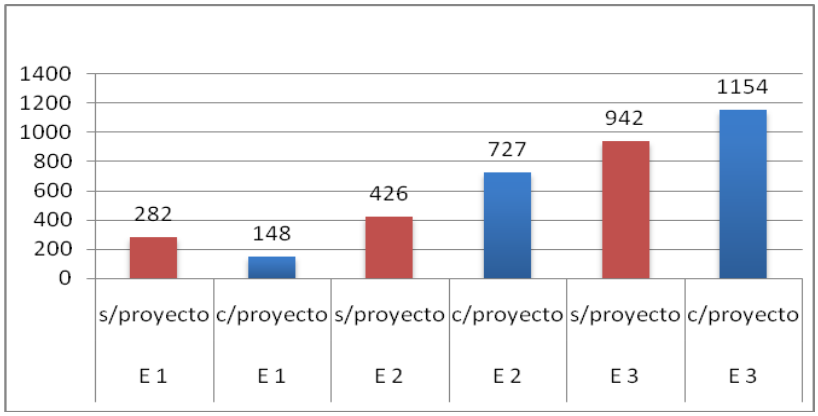

Figure 8. Cost of labor hired by stratum in the UF of the community of Tahdziu, Yucatán. (MX $). Source: 2015, own preparation based on fieldwork

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Carrying out the conducive operations, the Compensation was obtained. This was positive without a project for E2 with $ 6407, not so for E2 and 3 where negative values were obtained. With project this was positive for E2 with $ 8,627, not so for E2 and 3 where negative values were obtained (Figure 9). One of the important aspects that deserves mention is the fact that for the production obtained in the UF and its value correspondence, the use of family labor is not governed by the optimization principle, mainly because its opportunity cost is low. If in the calculation we ignore the cost of family labor and the NPV, we only deduct the actual expenses in salaries and in case there were rents and interest paid (in our study they did not exist), we obtain the net income (Figure 10)

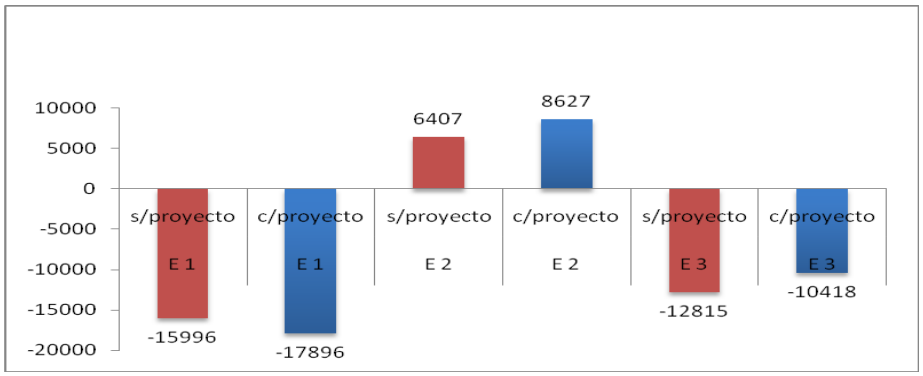

Figure 9. Remuneration to UF capital by stratum in the community of Tahdziu, Yucatán. (MX$)

Source: 2015, own preparation based on fieldwork

This indicator improves substantially with respect to the UF Capital Compensation, with E2 obtaining the best performance followed by E3 and finally E1, which is still negative.

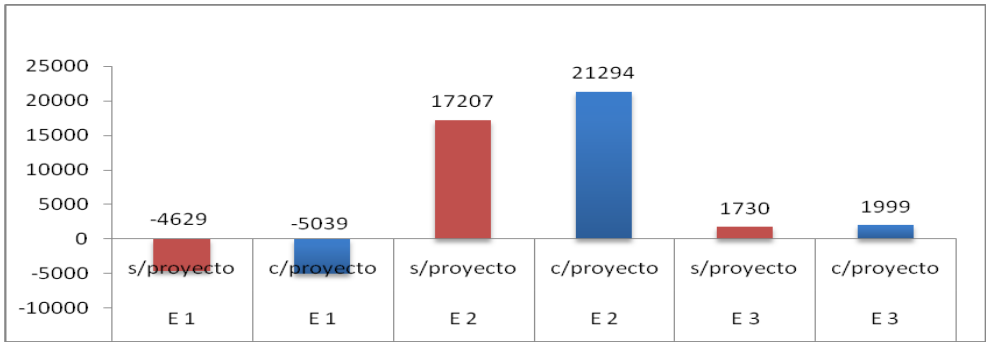

Figure 10. Net Income of the UF by stratum in the community of Tahdziu, Yucatán (MX $). Source: 2015, own preparation based on fieldwork

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The analysis that is performed allows us to obtain an indicator that relates the cost of internal factors (CFI) and NPV. This indicator, named as mentioned, Trend Ratio to Competitiveness (RC = CFI / VAN), was calculated to stratify the UF and will allow obtaining the quotient between both variables to issue recommendations for its improvement. The CR obtained in the different strata is presented in Figure 11, it is observed that on average it is the E2 that presents a relationship with a better tendency to competitiveness, not being so in the E1 whose CR is negative, which implies that the Value Gross production (VBP = cash inputs plus value of self-consumed production), does not cover the cost of intermediate consumer goods (fertilizers, herbicides, food, etc.), nor the depreciation of infrastructure and equipment of the UF of that stratum. On the other hand in E3 without a project, we have an average RC of 13.20. On the other hand in the E3 with project, we have an average RC of 8.35. This means that in the production processes of the UF, an excess of labor is used, mainly family, over the intermediate consumption goods and that this is not being productive since the VBP and consequently the VAN are reduced.

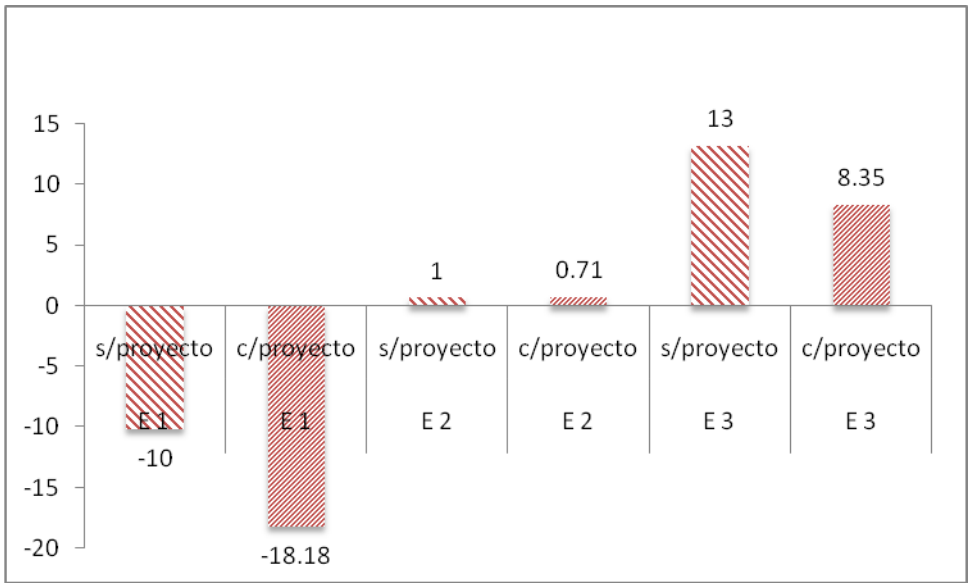

Figure 11. Relationship of competitiveness in the community of Tahdziu, Yucatán. Source: 2015 own elaboration based on field work.

4.CONCLUSIONS

A negative RC was obtained in the E1 (RC = -18), which corresponds to UF where the production indices were very low as a result of accidents in the producers' plots, so that the production costs did not recover. the NPV was negative. Although they can be related to a temporary bad weather, it is also important to highlight the importance of the attack of pests and diseases in the UF. Under the premise that there is a normal storm, the CR in this stratum can be improved by incorporating technologies aimed at combating these pests at a low cost.

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to. A more balanced CR was obtained in E2 (RC = 0.71), in UF where the cost of internal factors is lower than NPV, which indicates a more rational use of labor in relation to cash expenditures of consumer goods intermediate (fertilizers, insecticides, etc.). In this case, the CR can be further optimized if technologies that reduce cash costs are incorporated or productivity is increased at the same cost.

The RC at E3 was greater than one (RC = 8.35). This indicates that the costs of the internal factors were greater than the NPV, which implies that both family and salaried labor may be employed irrationally, which does not correspond to the VBP, or that this VBP is indicative of low levels of productivity. In this case, it should be analyzed in a specific way to each UF, to identify if the problem is of application of the labor force or of low levels of production and to issue specific recommendations tending to optimize the use of labor and / or of technologies that impact the productivity of UF production systems

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