

ROLE OF AGRICULTURAL MACHINERY IN MEXICO'S FOOD CHAINS

Jaime Cuauhtemoc Negrete

Agricultural Machinery Engineer and technical writer, Mexico.

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The situation of agricultural and livestock sectors are becoming more and more desperate, as well as decline of the sectors' gross domestic product (GDP) become more and more vertiginous in Mexico, due to prolonged challenges of political, economic and social cultural factors, these dimensions are noticed in the fact that out of 26 million Mexican of whom more than 80% (20.8 million) live in extreme poverty. An unprecedented factor to solve this situation is to use improved modern Agri- techniques such as the value chain. This is the objective of this paper to demonstrate by reviewing that in Mexico the agricultural machinery industry has not been included as a link in agro-food value chains. A situation where the country is not making progress to increase food security. It is concluded that the different studies on agri-food chains of Mexico the agricultural machinery link is considered, only for corn, rice and wheat though not emphatically. For the other value chains (Beans, Milk, Meat and coffee), the agricultural machinery link is not considered, so all the chains are not competitive internationally or sustainable, only the large monopoly companies benefit from the transformation and commercialization of each chain. Decision-makers must have the initiative to strengthen and create the agricultural machinery link of each agri-food chain within the production link, which will help integrate small producers with equipment and machinery according to their needs and thus reduce poverty, migration and food dependency.

KEYWORDS: México, foods chains, agricultural machinery.

INTRODUCTION

In Mexico, the situation of agricultural and livestock sectors have constantly depreciated. Likewise, the decline in the gross domestic product (GDP) of the sectors are ever more vertiginous, due to political, economic and social-cultural reasons, this dimension is noticed in the fact that there live 26 million Mexicans, of whom more than 80% are living in extreme poverty, 33% of households, heads of households are illiterate, young people prefer to emigrate to cities or the United States or fall into organized crime. Economically, the prospect is bleak and expresses the perversity of underdevelopment: 72% of the rural production units are worked by peasants, indigenous people and small producers with areas of less than 5 hectares produce for self-consumption, 22% is for small producers with areas of 4 to 20 Hectares, producing for self-consumption and something for the local market, only 6% of the producers are entrepreneurs who channel their goods to the local and international market. Macroeconomically, investment is insignificant, less than 1% of GDP and total agricultural production represents 3% of GDP (Mota, 2012), on the other hand the growing demand for food by a constantly growing population. Mexico is among the eleven most populous countries in the world, counting on 119 million 530 thousand 753 inhabitants in 2015. (INEGI, 2015). During 2016, the record figures reached by Mexico's agrifood import of over US \$ 2 billion, meat, cereals and dairy exceeded sales of the same products by 2 to 8 times. In fact there were deficits in 14 out of 23 food groups that included the central bank in the trade balance. (González, 2016) Thus, imports of cereals, including maize, wheat and rice, among others, together totaled \$ 309.4 million during the first month of 2016, which implies 7 times more than the exports of the same group that amounted to 44.4 millions of dollars. In terms of milk, dairy products, eggs and honey, the difference was more profound because they imported 117.7 million dollars, that is 8 times that of exports that were for 14.2 million dollars. (González, 2016) The meat produced in the country sold abroad amounted to 110 million dollars, but imports were for 249.5 million dollars, which means that these exceeded 126 percent to exports. In terms of animal and vegetable oils or fats, imports increased sixfold to exports, with the former accounting for US \$ 91.7 million and the latter accounting for US \$ 14.2 million. Foreign purchases of coffee, tea, yerba mate and spices were for 37.6 million dollars, but exports totaled 26 million. (González, 2016). A "value chain" in agriculture identifies the set of actors and activities that lead a basic agricultural product from field production to final consumption, adding value to the product at each stage. A value

chain can be vertical or a network between several independent business organizations, and can include processing, packaging, storage, transport and distribution. (FAO,2010). Some authors use the expressions " agri-food chain " and "Chain of Valor" as synonyms, while others use each word to describe different processes. The agro-food chain refers to any vertical chain of activities, from production in the agricultural establishment, through the processing stage and through wholesale and retail distribution. In other cases it is used to cover the continuum of economic processes linked to food, which start on the farm and culminate in consumption. The term "value chain" refers to a network of vertical or strategic alliances between several companies Of independent businesses within an agri-food chain (Iglesias,2002).The use of agricultural machinery to increase agricultural productivity its imperative(Negrete 2006). Agricultural mechanization has shown that this is one of the factors that contribute to improving the productivity and competitiveness of field activities, for example in maize, for manual sowing, which includes furrowing with animal traction and depositing Seed, they require eight wages of 120 pesos each, resulting in an investment of 960 mexican pesos per hectare, when with agricultural machinery the cost would be 500 mexican pesos per hectare. Therefore, given the scarcity and high cost of labor in rural areas, it is important to consider the role of agricultural machinery, as it allows for productive and profitable agriculture; But it must also be taken into account that the producer of agricultural machinery must be trained in its operation, maintenance and administration to achieve efficient and adequate use. (Reyes,2010).Increased agricultural productivity is a driving force for economic and social development. When agriculture falters, the sources of income are lost, social ties are broken and, consequently, the mobility of society increases.(IAEA). The productivity of the land can be increased as follows: 1.-Utilizing fertilization, soil management and proper cultivation procedures and practices.2.-Conducting a control of harmful herbaceous, insect and diseases.3.-Adapting soil and water conservation practices.4 Using significant agricultural machinery.5 Using populations Of correct varieties of suitable varieties.The use of significant machinery makes an important and effective contribution to the development of the agricultural activities of a farm, has a permanent place in the increase of productivity, making the required time and the efficiency to carry out a work increase, allow to replace or supplement human and animal energy with mechanical force, and thereby increasing the dignity of workers, making work more efficient and increasing work capacity. Incidence of mechanization in the production costs of the main mechanized crops is rice 70%, wheat and maize 50%.(Anonymous,2016).Appropriate use of mechanization increases productivity along the entire value chain, improving yields and reducing on-farm and post-harvest loss, all critical elements in the sustainable intensification of agriculture. By implementing the right policies, engaging the private sector, research and development, trade, and effective international development, smallholder producers can play a vital role in feeding the world. (Ziegler,2013).An unprecedented fact is the use to solve this situation of techniques such as the value chain, and the product system, failure in undeniable, has been relegated to the chain of agricultural machinery, and has not taken into account that That is precisely the importance of these approaches in considering all the links in the chain and integrating them to be successful. But without the vision enough to take into account that without mechanical technology and agricultural machinery it is impossible to reach high production levels, and the development of the sector in question. This is the objective of this paper to demonstrate that in Mexico the agricultural machinery industry has not been included as a link in agro-food value chains, a situation where the country is not making progress in increasing the productivity of basic agricultural products,by reviewing studies on the different agro-food value chains . Which leads to a deficit in their production and consequently to their importation, thus generating insecurity and food dependence from abroad.(Urquía, 2014)(Shamah, 2014).

MATERIALS AND METHODS

This study was conducted through exploratory, descriptive and bibliographic methodological process. A systematic and thorough search was conducted for data collection in printed data bases , Internet, magazines scientific, graduate and postgraduate university thesis, newspaper articles, etc.

REVIEW OF THE VALUE CHAINS OF FOOD PRODUCTS AND AGRICULTURAL MACHINERY

CORN VALUE CHAIN

In this value chain several authors (Dominguez,2014), (González,2016) when discussing the topic initiate the analysis from the production of the product, only (Moctezuma,2010) considers the agricultural machinery link in a research whose objective was to identify technological supply and demand to propose alternatives in the innovation of the agri-food chain of maize in the state of Hidalgo, Mexico. The following steps were performed: 1) characterization of the chain; 2) identification of critical factors; 3) distinction of technological demands of knowledge and politics; 4) recognition of technological supply and 5) quantification of research projects and public policy. The agri-food chains approach was applied and two consultation forums were held to capture the demands of the links in the chain. Through a bibliographical revision, the technological supply of the chain under study was integrated, later it was contrasted with the demand obtained to identify projects that drive the chain. 23 applications were identified: six training, three validation and transfer of technology, six new knowledge, three new technology and five public policy. It was detected that there is technology and knowledge to attend 10 of them, so there is a need to support 13 projects aimed at improving the

technological innovation of the maize chain in the state of Hidalgo. In relation to the links, the primary (production systems) was more demanded, since it represented 78.3% of the demands of the chain and 21.7% was represented by the link of agroindustrial transformation. (Dominguez,2014).Also in an analysis by (Secretaria de Economía,2012b) it was found that 1. There is an important lag and for many years in the yields per hectare practically the whole country, which contrasts enormously with the case of Sinaloa, which has increased yields since At least 10 years. 2. No significant efforts are being made to transfer technology to increase the productivity of primary production, including the planting of this crop with improved (genetically modified) seeds, as is already done in many regions of the world to address their productivity problems. 3. It identifies a market concentrated in very few companies in the importation, collection and commercialization of maize, which have the infrastructure of storage and distribution, which means a barrier to the entrance of new competitors.

BEANS VALUE CHAIN

In the case of beans, an analysis by the Ministry of Economy only considers the study based on production costs (Secretaria de Economía.2012a) and in an analysis it was found that despite being an important crop at the national level and having multiple programs of Support by the Federal Government, there is no significant increase in yields in recent years. It is important to concentrate the production efforts of this legume in the regions with the greatest productive potential. The industrialization and / or processing of beans is a window of opportunity to revive the consumption of this product, which has dropped significantly in the last decade. Eliminating inefficiencies in the collection and marketing link is also an opportunity to make this market more efficient. Development and application of technologies in primary production and in food products would detonate the demand and consequently the benefits along the entire value chain.

WHEAT, FLOUR AND DERIVED PRODUCTS VALUECHAIN

(Grajales ,2014)consider the back links of the chain as wheat producers need inputs and equipment, consider three links; Machinery and equipment, seed and fertilizer producers and other agrochemicals.

RICE VALUECHAIN.

In a study by (Rodriguez,2003)it was found 10 critical points in the production link were: The lack of good quality seed, the absence of varieties that substitute for the variety Milagro Filipino, the deficiencies that are had with the use and management of water, both rain and Irrigation, credit and financing, high crop costs, low rice prices, producer organization, low technology adoption, few resources dedicated to the generation and transfer of technology and machinery and equipment, as well as It proposes the mechanization of the system of production of rice by transplant that is the one that has the highest yields.The state of Morelos, México, is traditionally a rice-growing state, recognized for the quality of its production nationally and internationally. The state's area cultivated under rice has decreased in the last 15 years as the result of competition from imported rice. Because of the urgent need to deal with this displacement, this study analyzed the rice situation in the southern region of the state emphasizing the crop and the social actors, using the Chains, Dialog, and Action (CADIAC) approach, proposed by the Instituto Interamericano de Cooperación para la Agricultura (IICA) and grounded in the Policy Analysis Matrix and participative research. Application of the methodology showed that it is impossible for most of the rice farmers of the area to compete with imported rice and helped to identify the alternative strategy of differentiating production. The cooking quality of the region's rice emerged as a possibility for advantageous insertion in a segment of the domestic market. The results showed the advantages of the CADIAC methodology.(Ireta,2011).

VALUE CHAIN OF THE DAIRY SECTOR

The first link in the chain is the primary production of milk and concludes that the dairy industry needs policies that help both compete in fair and free market terms, as well as policies that promote productivity and support domestic producers as they get Along with international competition in terms of efficiency and technology. (Sagarpa,2008), (Secretaria de Economía,2012c). The current individual, isolated and untargeted programs lack direction and a common goal to develop the dairy sector, so a state policy is required in which an agency is responsible for coordinating the efforts of different institutions and actors to promote the Sector from all relevant aspects. The state policy should encompass medium and long-term actions related to issues ranging from the modernization of the infrastructure of the sector and the management of surpluses to the promotion of consumption and relation with the outside in terms of imports and exports. In conclusion, if the proposed reforms were to be carried out, Mexico would be able to produce the milk consumed in the country, which would mean an increase of more than 40% in cattle production and in domestic

production, benefiting thousands of products And consumers by improving the quality of products.(Reyes,2007) found that Critical factors in the milk chain are: technical assistance, agricultural technology, financing, organization, integration, raw material quality, proficiency in processing technology and high competition with leading brand products. In order to improve the efficiency, quality, competitiveness, equity and sustainability of the milk chain in Hidalgo, it is necessary to promote the organization of producers around the use of new technologies, access to financing, infrastructure management and equipment for the development of the sector, For marketing. It is necessary to promote the incorporation of the concepts of quality and safety, as a way to increase their efficiency and to achieve permanence, particularly in the most unprotected segments, and finally, to promote the interaction and sectoral synergy to establish policies and programs with a focus of productive chain.

BEEF VALUE CHAIN

(Calderón,2011) realice a study with the objctive of to analyze the structure and functioning of the productive chain for beef in the municipality of Tecpatan, in the state of Chiapas, Mexico. Qualitative and quantitative information oriented toward understanding and consolidating alliances among actors in the productive chain are provided. The results show the existence of distinct levels of live cattle production, marketing, and transformation, and in the sale of meat. Support services are provided by three ranchers' associations , two municipal butcher operations, and a federal inspectiontype butcher operation which includes packing and refrigeration. Four marketing circuits exist which are well-differentiated in terms of number and type of actors participating in the relationships of production-purchasesale, marketed product, and final destination market. The circuit which purchases the largest quantity of live animals is that in which weaned calves are marketed for fattening. In all circuits, the greatest profit margin is obtained by intermediaries who participate at the marketing level. The beneficiaries are principally regional and national wholesale buyers of the shortest circuit. With respect to organization, producers have three local ranchers' associations, while marketing agents do not have any type of organization The circuit which purchases the largest quantity of live animals is that in which weaned calves are marketed for fattening. In this way, the current productive chain could gradually transition toward a chain of value.

In Mexico the consumption of fodder inputs is as follows 110 million ha. In prairies, 56% of the national territory 2.5 million tons. Yellow maize, sorghum, durum wheat and forage barley, 510 thousand tons of cane molasses, 100 thousand tons of oilseeds, 2.0 million tons of fodder and agricultural fodder. (AMEG,2007). In a study carried out by (Arévalo,2015) it found that for the link chain meat production the prices of the inputs are increasing more and more hurting the producers since they do not have credit to be able to acquire all the indispensable inputs for the development of your livestock.

COFFEE VALUE CHAIN

In an analysis carried out by (Cofupro,2003), it also does not consider the productive link with its respective suppliers of agrochemicals and agricultural machinery and concludes that it should be investigated in pest control, genetic improvement, insecticides and organic fertilizers, Alternative crops, shared plantations, wastewater and solid waste management, agroindustrial technological modernization, soil protection, coffee plantation renovation, quality standards and certification, innovation in roasting, byproduct development and crop diversification.

VALUE CHAIN OF AGRICULTURAL MACHINERY

The value chain of the agricultural machinery is shown in figure 1 and figure 2 shows how this link should be inserted in

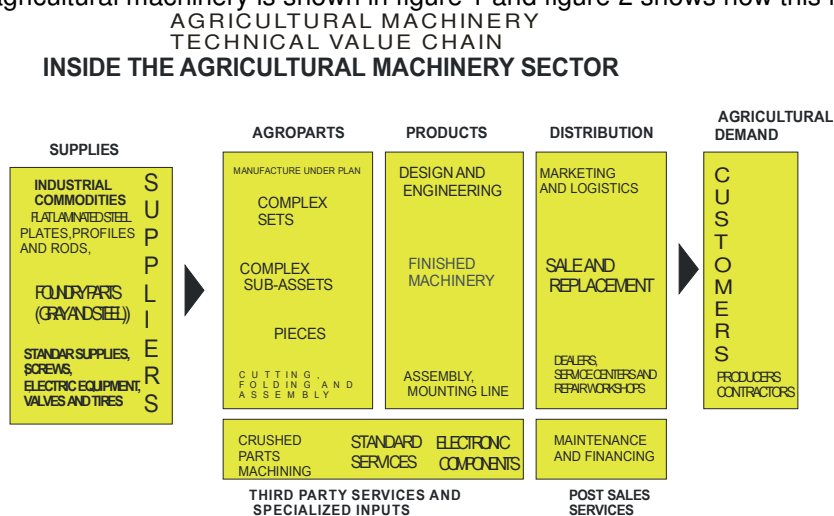


Figure 1 agricultural machinery chain Source.[2].

agro-food value chains. (Albornoz, 2010).

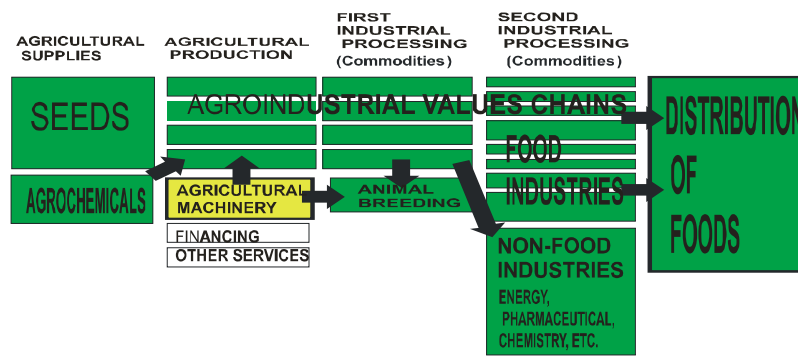


Figure 2 Integration of the agricultural machinery chain into agro-industrial value chains Source (Albornoz, 2010).

RESULTS

From the literature review on food commodity value chains only three studies take into account the link of agricultural machinery for production; for corn value chain only (Moctezuma, 2010) considers the agricultural machinery link, for Rice value chain (Rodríguez, 2003) concludes that there are few resources dedicated to the generation and transfer of technology and machinery and equipment, as well as it proposes the mechanization of the system of production of rice by transplant that is the one that has the highest yields, for wheat value chain Grajales (2014) think about wheat producers need inputs and equipment, contemplate the links; Machinery and equipment, for the others value chain (Beans, Milk, Meat and coffee) Agricultural machinery is not considered necessary. When revising the chain of agricultural machinery (Albornoz, 2010) proposes its inclusion in the chains of alimentary value.

DISCUSSION

In Argentina, the agricultural and industrial agricultural sectors have functioned as receivers of foreign innovation (to a great extent) and have not developed in depth the supply chain "forward and backward". (Langard, 2014). The same situation prevails in Mexico. In the search carried out on the agrifood chains in our country it was found that only the beginning of the chain is considered starting from the primary production and the backward integration of each agri-food chain in the country is relegated. It is not integrated to any productive chain to the small producers because their null income does not make them attractive as partners, the large companies that integrate the various agri-food chains prefer to import and not to be involved with the other actors as another of the advantages of using this philosophy of the value chains is the identification of the weak links, and strengthen them and if they do not exist to create them this is the business opportunity where the monopolistic companies of the agricultural machinery sector are integrated in their chains of their respective countries, creating profits and wealth in their Countries of origin and poverty in countries where they are not integrated into value chains. The significant case of the rice value chain in Japan where agricultural machinery companies are integrated with highly specialized equipment for their rice production system, with mechanized transplant equipment and harvesting system that can only be used in their country, situation which is the main constraint in any other rice-producing country, that scenario should prevail in our country in which the agri-food chain of maize and tortilla, basic and essential crop does not have the integration, large companies only generate profits for them, with the indifference and complacency of the decision makers and the lack of vision of the researchers that only generate investigations without real impact and the poverty of the main actors of the chain, the small producers increases every day more. In this chain if there is the link agroindustrial machinery to transform the corn into tortilla, counting on more than 6 manufacturers of equipment to elaborate tortilla of national origin (Tortilladoras automáticas, Máquinas tortilladoras Tortimaq, Celorio máquinas Tortilladoras, Máquinas tortilladoras Verduzco, Grupo Villamex, Manufacturas Lenin). This demonstrates that if there can be companies that manufacture national machinery and are integrated into the link production of agrifood chains. The same situation prevails for the other chains; Bean, meat, milk and coffee, and the consequences are the larger imports, since it is considered that with the integration of small producers to the chains will have access to technology And to increase their levels of production and productivity. (Sagarpa, 2008). The study of the meat chain does not take into account the production links for food production for livestock such as fodder and grains in addition to those necessary for the establishment and maintenance of meadows for which the agricultural machinery is necessary. In the case of the coffee chain, the same situation occurs as in rice, in which Brazil has included the agricultural machinery link in its value chain, since total mechanization guarantees the sustainability of Brazilian coffee growing. Since 1979 they have been marketing the mechanical coffee harvester. (Martin, 2013).

CONCLUSIONS AND RECOMMENDATIONS

It is concluded that the different studies on agri-food chains of Mexico on agri-food chains of Mexico, the

agricultural machinery link is considered, only for value chains of corn, rice and wheat though not emphatically. For the other value chains (Beans, Milk, Meat and coffee) is not even mentioned. And all the value chains are not competitive internationally or sustainable, only the large monopoly companies benefit from the transformation and commercialization of each chain. Decision-makers must have the initiative to strengthen and create the agricultural machinery link of each agri-food chain within the production link, which will help integrate small producers with equipment and machinery according to their needs and thus reduce poverty, migration and food dependency.

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