

Green Innovation Business (GIB) as a Comprehensive Entrepreneurship Model for Internationalization. The Case Study of BIO-FOM in the Urban Area of Guadalajara

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Abstract

This paper aims to analyze the functioning of an integral model of entrepreneurship in green innovation business (GIB) that is currently emerging and in the process of internationalization. Therefore, this work aims to study the central perspectives of technology based on entrepreneurship and develop a strategy that adapts to companies with an ecological basis to achieve internationalization. This article analyzes a particular company specializing in environmental bio- mineral organic fertilizer, where no chemical product is used to produce the composition. Instead, everything marketed is made up of a base of organic minerals and other organic compounds.

Key Words: *Integral model, eco-efficiency, internationalization.*

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1. Introduction

Currently, there is a new business model which has as the objective to be eco-efficient. Eco-efficiency is defined as producing products and services at competitive prices that meet human needs and provide quality life. In contrast, the ecological consequences and the use of numerous resources during the life cycle are progressively reduced. Level equivalent, at least, to the estimated capacity of the planet (World Business Council for Sustainable Development, 1991).

On the other hand, it is mentioned that eco-efficiency has the purpose of establishing production of manufactured products of high durability, reducing the intensity in the application of energy for the production of goods and services, maximizing the use of raw materials, managing and disposing of hazardous materials and waste in an efficient and environmentally acceptable manner, have management systems and environmental quality, as well as procedures in occupational safety and health, among other provisions, that will bring them financial benefits and competitiveness (Cantú, 2008, page 78).

In both definitions, the authors agree that eco-efficient companies should have as their primary objective to develop quality products at competitive prices and reduce the environmental impact of producing or offering their products and services. Castro (1998) mentions that eco-efficiency aims to address three relevant aspects that correspond to 1) the total quality, which involves productivity and quality in the company, 2) the preservation of the environment, which is related to the sustainable development; 3) occupational health and safety (Castro, 1998).

2. Background of the Problem and Assumption

Green innovation in urban areas is a neglected issue in terms of urban planning and policing. Still more ignored is a concern for changes in urban green areas toward implementing green innovation initiatives to revitalize the cities, increase economic growth, improve social justice and inclusiveness, and improve the environmentally sustainable development of the biodiversity and socio-ecosystems. For achieving these goals, it is necessary to implement some actions following the design and implementation of a comprehensive entrepreneurship model.

This new eco-efficient business entrepreneurship model will be analyzed in the context of the integral model, analyzing the tripod of the strategy, which integrates considerations based on industry, resources, and institutions. This paper begins with the assumption that the companies of ecological base present significant difficulty when wanting to internationalize, compared to the industrial base companies.

3. Use of fertilizers in Mexico

The National Development Plan 2019-2024 establishes among the priority actions for food self-sufficiency and the rescue of the Fertilizer Program's field to benefit agricultural producers.

The Mexican Government's National Fertilizer Program aims to address the low availability of national fertilizers at competitive prices for small producers includes chemical fertilizers and bio-fertilizers. In addition, this National Fertilizer Plan aims to reduce dependence on the import of these fertilizers. For achieving this, the Cosoleacaque Petrochemical Complex plants and the Pajaritos plant are reactivated for the production of ammonia, an input to produce urea, which Mexico imports mainly from Ukraine. In the case of phosphates, in the Pacific, the Lázaro Cárdenas plant is operational and is the largest in Latin America.

The National Bio Fertilizer Program shows incipient progress. The fertilizer production in Mexico estimated for 2019 was 1.85 million tons, reflecting an annual reduction of 2%, while demand continues to rise, with a record estimate of around 5.5 million mt. However, by July 2020, the production volume of nitrogen fertilizers in Mexico almost reaches 48,800 metric tons, representing a decrease of 32.7% compared to that reported during the same month in 2019. Likewise, the production volume of phosphate fertilizers in Mexico exceeded 75,600 metric tons, representing a decrease of 29.1% compared to that reported during the same month in 2019 (Burgueño Salas, 2020).

4. Fertilizer Demand in Mexico

A recent analysis of the fertilizer market in Mexico has pointed out that the consumption of fertilizers has changed the structure in favor of consumers with the highest concentration and diversification (UACH). This situation has contributed to a drop in the consumption of fertilizers since the farmer's real income has fallen.

On the change in the consumption pattern (sources), I have no complex information about it. However, from experience in the field, it can be stated that there has been a growth in the use of physical fertilizer mixtures where the distributor makes specific formulations, mixing fertilizers. Thus the producer only buys one product. Regarding those of high concentration, it is well understood, if possible, because there has been significant growth in protected agriculture and in the area of strawberries and high-value vegetables where drip irrigation is used, and fertilizers are applied through it. Thus, highly soluble sources with minimal impurities are usually used, which are not ordinarily traditional sources.

However, with more recent data reported by Instituted Trusts concerning Agriculture (FIRA 2020), in the agricultural year 2019, 71.8% of the sown area was fertilized, representing the seventh consecutive year with increases in the percentage of fertilized area. According to this report, the consumption of fertilizers in Mexico grew by 5.8%.

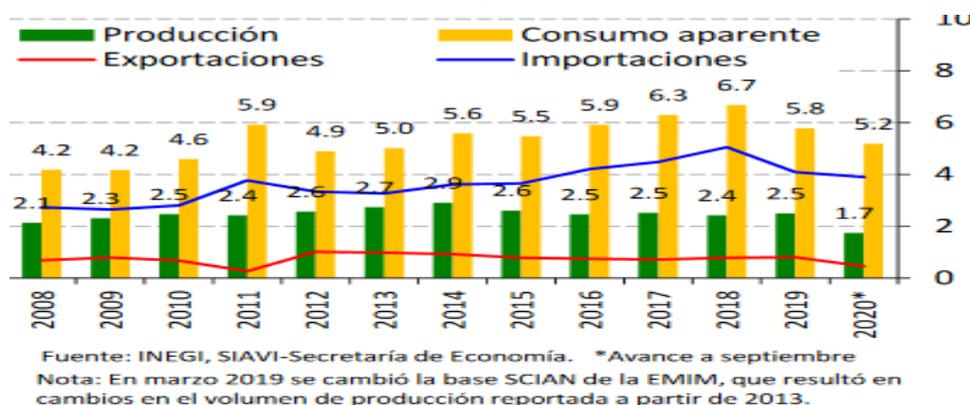


Figure 1: Production and consumption of fertilizer in México (Millions of tons)

In an interview with a FIRA fertilizer specialist analyst, Gallegos Cedillo (2021), asking about fertilizer consumption trends and asking about the demand and supply of fertilizers in Mexico, he warned that the lack of complex data does not always support directions in which the market

moves. Regarding the consumption of fertilizers, the production information indicates that production has fallen: 15.4% from 2013 (2.06 million tons) to 2020 (1.75 million tons) for January-September. On the other hand, although in 2014 and 2019, it increased compared to the previous year and the same period.

If we consider the fertilized area, it has increased as a percentage of the sown area. This proportion has increased from 2013 to 2019, the last reported year, going from 65.3% in 2012 to 71.8% in 2019. However, if we look at the apparent consumption, it increased from 5 million tons in 2013 to 6.7 in 2018, in 2019 (January-December), it does drop to 5.8, and in September 2020, it is 5.2 (Graph in the quarterly report). Therefore, there are no elements to attribute the drop in consumption from 2018 to 2019 to decrease producers' income, but it is not easy to prove otherwise if someone affirms this.

5. Fertilizer Production in Mexico

During the last years, the increase in Mexican fertilizer production is attributed to the reforms made to the Pemex Law since 2008. These had the objective of promoting the production and productivity of the Mexican fertilizer industry through the supply of raw materials, such as ammonia, at competitive prices for national manufacturers. In 2018, national production contributed 30.7% of apparent national consumption, estimated at 6.2 million dollars, representing an annual increase of 7.9%. On the other hand, the preceding shows the country's high dependence on fertilizer imports.

With data from 2019, the national production of fertilizers is mainly composed of Phosphate fertilizers (diammonium and others) with 55.7%. Nitrogen fertilizers (ammonium sulfate and nitrate, and others) with 32.2%. Acidic fertilizers (phosphoric, sulfuric, and nitric) with 10.9%. The estimated value of the fertilizer industry in Mexico in 2019 is 13,616.4 million pesos, 2% lower than that registered in 2018.

Fertilizer production processes in Mexico are not integrated, impacting domestic producers, mainly urea and nitrate, at a disadvantage compared to producers of international competition (UACH). According to data from the latest Quarterly Report on Fertilizers from the Directorate of Research and Economic Evaluation of the Instituted Trusts concerning Agriculture (FIRA, 2020), the production of fertilizers in Mexico decreased at an annual rate of 8.4% in the first nine months of the year compared to the same period in 2019.

The national producers of urea and ammonium nitrate are at a disadvantage with the international competition due to the lack of integration of their production processes. Suppose the statement is well understood, especially the reason manifested by the lack of integration of their production processes. In general, it would be expected that greater integration greater profitability, but this is not considered the main reason for the disadvantage of domestic producers. It can affect but is not the main reason.

More weight would be given to the characteristics of the Mexican farmer, small areas, and little specialized. He grows various products and the dependence to a large extent on the import of fertilizers that expose him to have fertilizers without due quality control, lack of weight in the containers (49 kg bags instead of 50, for example), exchange rate, and exchange rate, etc. Gallegos Cedillo, 2021).

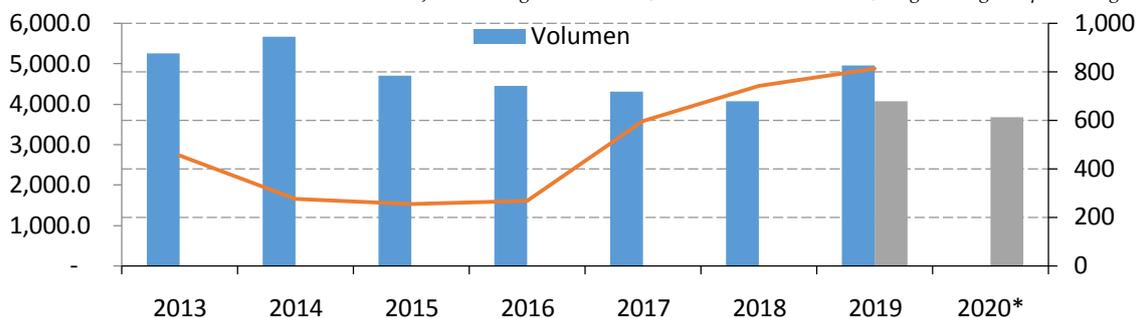


Figure 2: Acid fertilizer production in Mexico, 2013-2020 * (Thousands of tons)

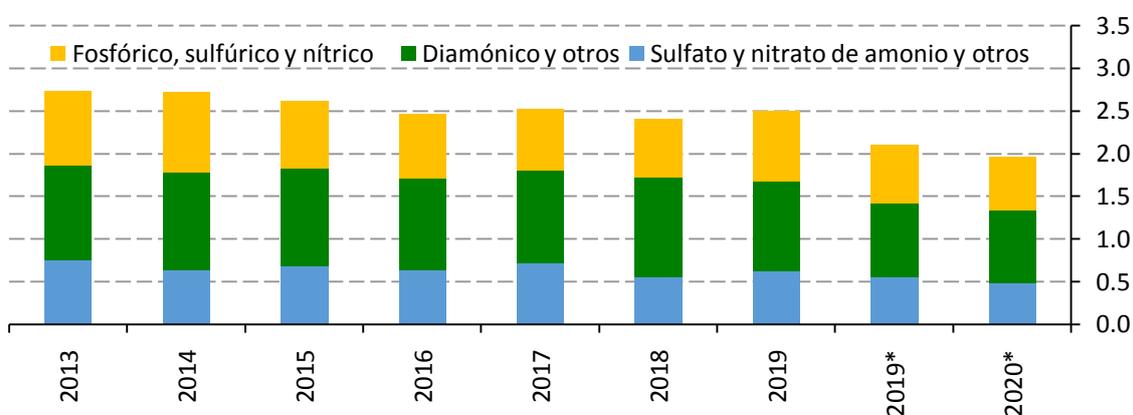


Figure 3: Fertilizer production in Mexico, 2013-2020 * (Millions of tons)

6. Fertilizer Exports and Imports in Mexico

In this regard, with information from the Ministry of Economy, imports of fertilizers in Mexico during 2018 registered a volume of 5.06 million dollars and represented an annual increase of 12.6 percent. In said year, imports came from Russia (30.9%), the United States (14.3%), Norway (12.1%), and China (11.1%) mainly. In the last five years, these countries participated with 69.5% of the national fertilizer imports. In exports, these stood at 0.79 million pesos and registered an annual growth of 10.5%. Between 2008 and 2018, consumption and imports grew on average at an annual rate of 6.3 percent.

Imports in 2019 are estimated at around 2.9 million tons, of which an advance of 92% was recorded as of November. Of the total imported, 67.2% corresponded to nitrogenous, 15.5% to phosphate, 12.5% to potash, and others with 4.8%. The commercial value of these imports was 807.8 million dollars, reflecting a reduction of 14.3% concerning the record of 943.1 million dollars registered in 2018. The main supplying countries were: Russia 30.6%, China 16.9%, United States 11.3%, Algeria 7.9%, Malaysia 3.8%, Chile 2.9%, Canada 2.1%, Egypt 1.4% and others 23.1%.

Between January and September 2020, Mexican fertilizer imports grew 9.9%, while exports decreased 16.6% at an annual rate, totaling 3.9 and 0.46 million dollars, respectively.

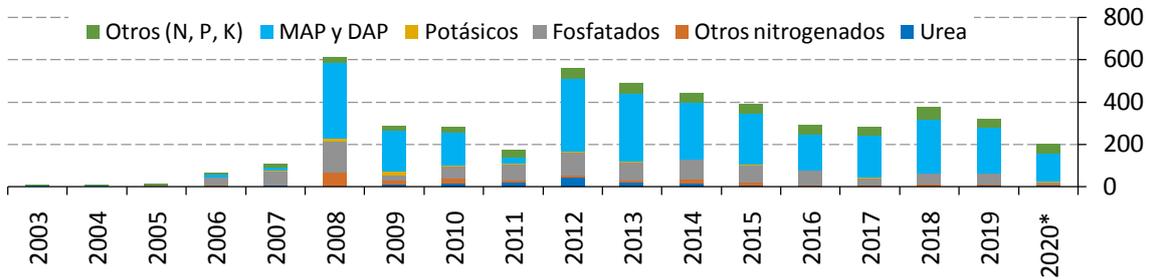


Figure 4: Mexican Fertilizer Exports, 2003-2020 * (Millions of dollars)

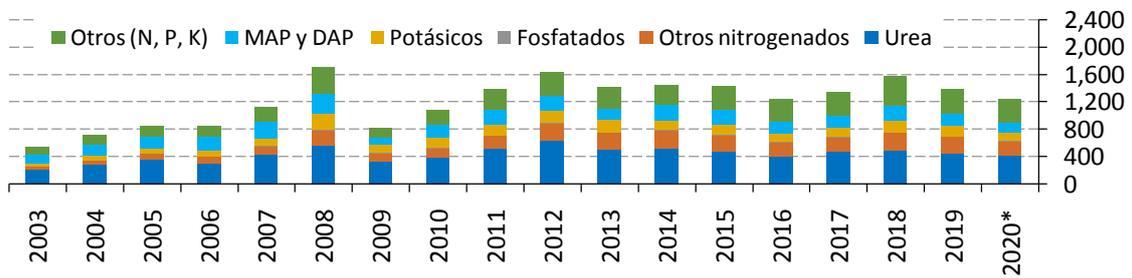


Figure 5: Mexican fertilizer imports, 2003-2020 * (Millions of dollars)

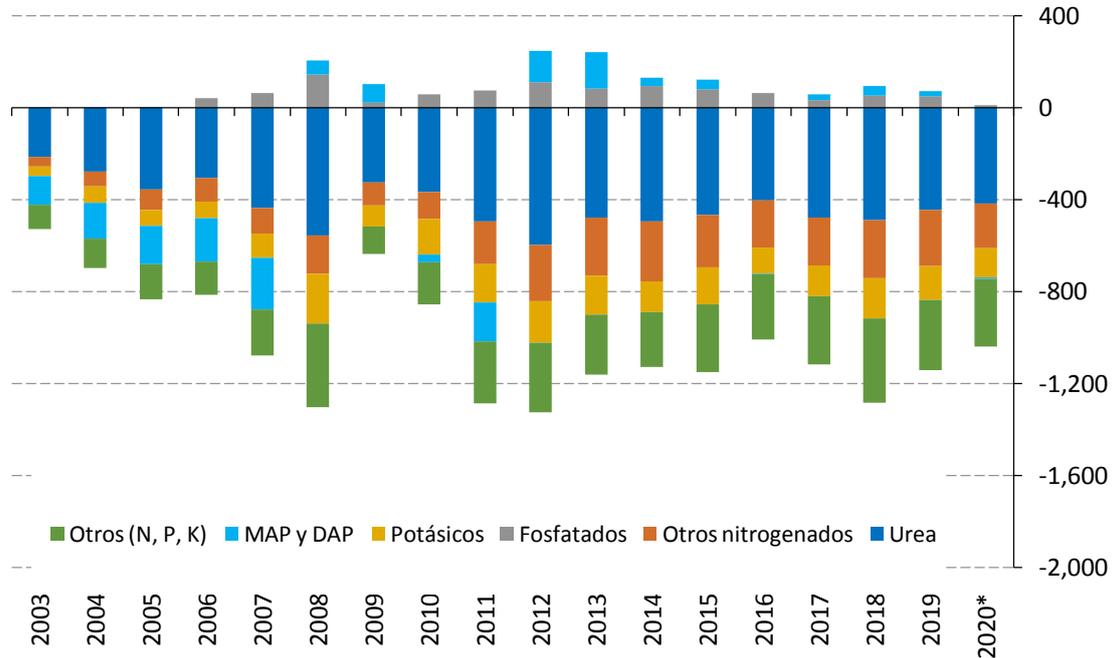


Figure 6: Balance of the fertilizer trade balance, 2003-2020 * (Millions of dollars)



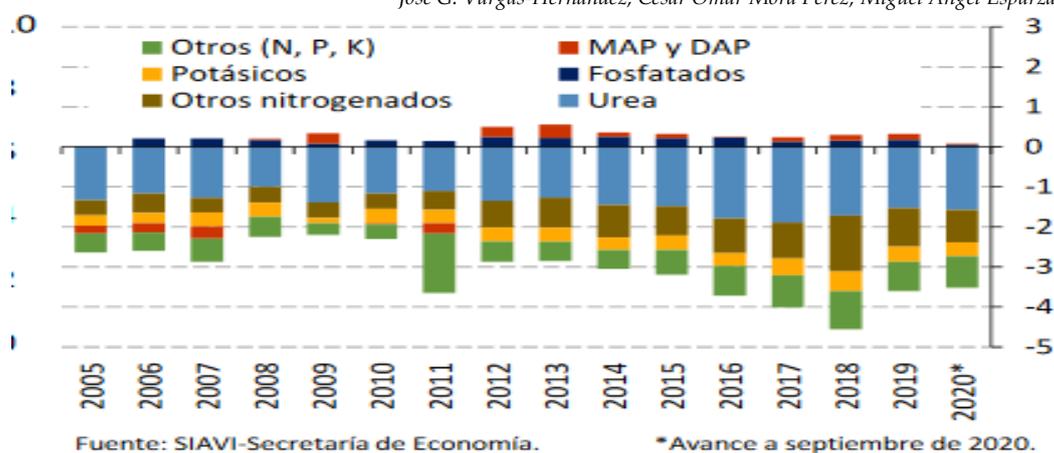


Figure 7: Trade balance (Millions of tons)

7. The Fertilizer Market

The implicit price of fertilizer imports in Mexico in 2018 was \$ 322.3 per ton and represented an annual increase of 6.7%. The assumed cost of imports from Russia was 283.4 dollars per ton, 387.2 for those from China and 416.1 for those from the United States. It showed an annual growth of 10.8, 24.2, and 9.7%, respectively. Regarding the average price level of fertilizers in Mexico, since 2014, the behavior has been on the rise. In 2018, a ton of fertilizer in distribution centers was quoted on average at 10,254 pesos, representing an increase of 3.5% compared to 2017.

The fertilizers with the highest annual increases in prices were diammonium phosphate (DAP) (10.4%), Triple 17 (10%), and potassium nitrate (9.4 percent). In January and February 2019, the average price was reduced by 2.0 and 1.3% compared to December 2018, so it would be expected that the average price in 2019 will be at levels similar to those registered during 2018. In the domestic market, urea prices increased 7.3% from 2018 to 2019, while those of diammonium phosphate rose 4.8%.

The average price of fertilizers in the country maintains an upward trend. In November 2020, it registered a growth of 2.7% at an annual rate and 3.3% from December 2019 to date. As of November, the price increases of triple 17 (12.2% annually), ammonia (9.9%), ammonium sulfate (8.3%), and ammonium nitrate (7.9%) stand out. The prices of simple superphosphate and potassium chloride were the ones that showed the most significant annual decrease, at rates of 7.1 and 4.6%, respectively.

8. Bioorganic Fertilizers in México

The use of organic fertilizers in Mexico is not very common; industrial-based companies need chemical products that make plants grow faster due to market demand. But these fertilizers damage the soil, causing them to become unusable after a time for the harvest; in turn, the food absorbs these fertilizers that are harmful to the human being in the long run.

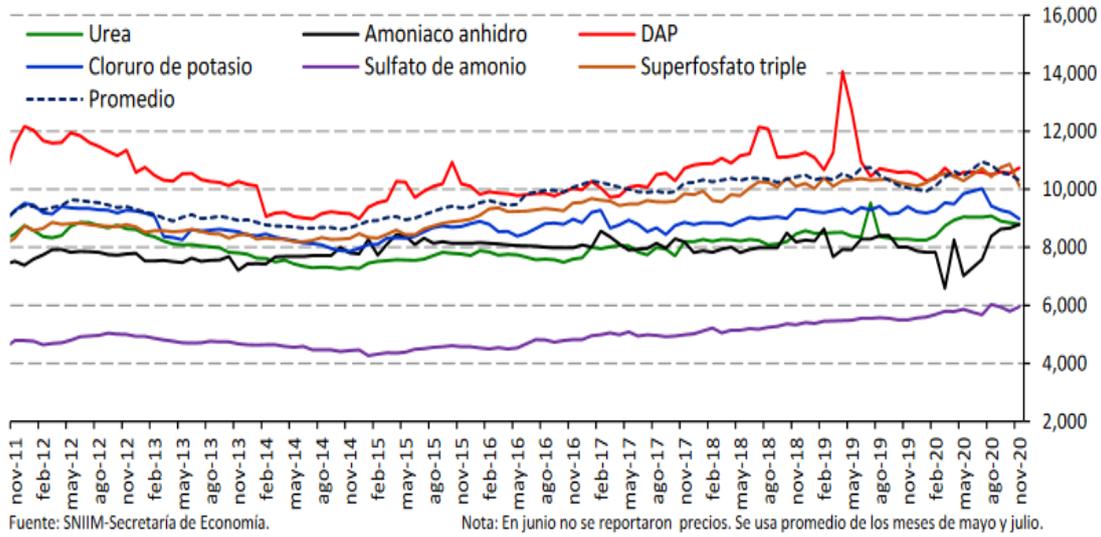


Figure 8: Prices in the national market (In Mexican pesos per ton)

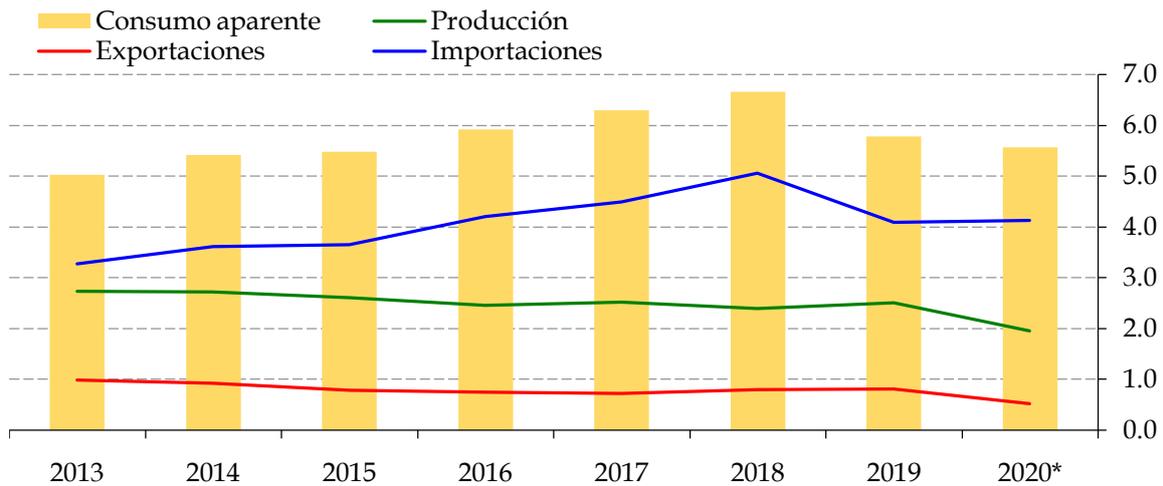


Figure 9: Production, foreign trade and apparent consumption of fertilizers in Mexico, 2013-2020 * (Millions of tons)

On the other hand, organic fertilizers bring many benefits for the soil and plants, and food; according to a study carried out by SAGARPA, organic fertilizers favorably influence the physical characteristics of the earth (biological fertility). These characteristics are structure porosity, air action, water retention capacity, infiltration, hydraulic conductivity, and stability of aggregates. The following table 1 shows a comparison made by the National Agricultural Survey (ENA). There is an increase in the use of chemical fertilizers in Mexico and a decrease in organic fertilizers.

**Table 1: Comparison of the use of chemical and organic fertilizers in Mexico
National Agricultural Survey
Agricultural Technology (First part)
86% of Agricultural Production Units Carry Out Agriculture**

Employed technology	Percentage	
	ENA 2012	ENA 2014
Type of seed	60.9%	82.2%
Creole	29.7%	29.2%
Improved	Na	Na
Certified	Na	Na
Transgenic	Na	Na
Seedling	Na	21.0%
Chemical fertilizers	65.5%	68.8%
Natural fertilizers	40.4%	27.5%
Herbicides	61.7%	62.7%
Insecticides	45.3%	48.2%

The sum does not give 100 because each production unit can use more than one technology

Na Not available

Source: INEGI; National Agricultural Survey (ENA 2014)

9. Theoretical-Conceptual Framework

The theoretical framework applied in this study is based on the analysis of the coefficient company using the main three theories of strategic design and implementation: The industry-based considerations, the resource and capabilities considerations, and the institutions-based considerations, as shown below in figures 10 and 11.

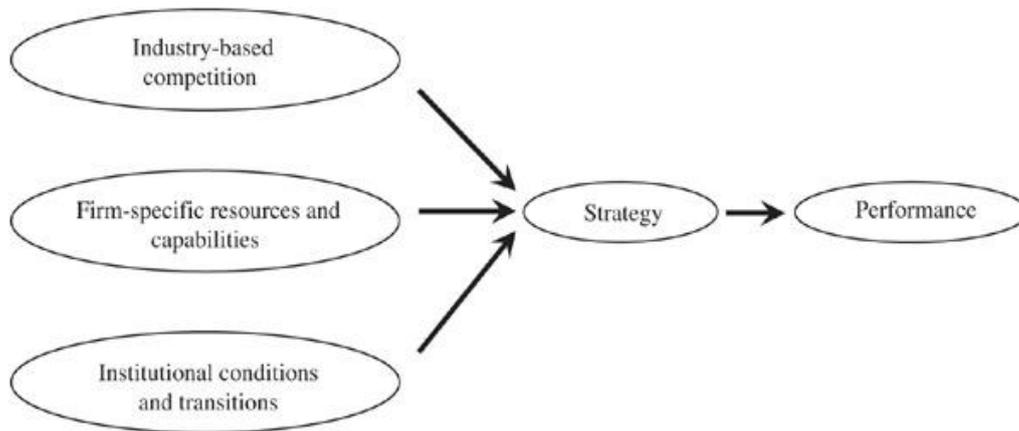


Figure 10: Model of strategic analysis
Source: Own elaboration based on Peng (2012).

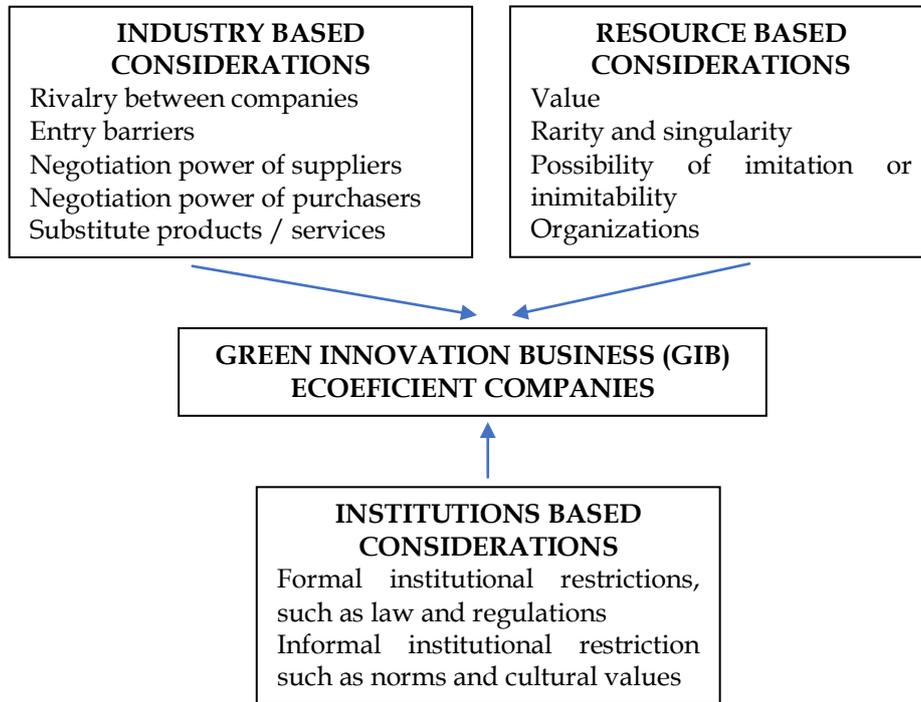


Figure 11: A comprehensive entrepreneurship model for the internationalization of green innovation business (GIB) and eco-efficient companies

10. The Green Innovation Business (GIB): BIO-FOM

BIO-FOM is a green innovation business (GIB), also characterized as an eco-efficient company that promotes sustainable, profitable, and inclusive development through highly competitive Mexican seeds with fair prices. Organic mineral bio-fertilizers healthily increased the profitability of the producers. It is located in the metropolitan area of Guadalajara (Figure 12).



Figure 12: Localization of BIO-FOM, a green innovation business (GIB).
 Source: Web page of the company.

BIO-FOM is a complete Organic Mineral Bio-fertilizer available on the market, comprising the interaction of elements: biological, organic, and mineral. It is a mineral organic Bio-fertilizer for plant nutrition. The interaction of the BIO-FOM factors forms a: Functional Plant Nutrition System, whose results are reflected in: improved seed germination and initiation, healthy and adequate growth, more extensive roots, more incredible flowering, and tie, increase in the quality of the fruits, and provide resistance to pests and diseases. BIO-FOM increases soil fertility and contributes to the decontamination and regeneration of the soil.

BIO-FOM bases its functionality on the interaction of the biological, organic, and mineral elements that compose it: A Poly-Functional Consortium of Microorganisms, among them: antagonists to pests and diseases, nitrogen fixers, and; mycorrhizal fungi; that help release the nutrients provided by the BIO-FOM blend itself. The 17 Basic Mineral Elements of plant nutrition (nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, boron, copper, manganese, silicon, zinc, iodine, sodium, cobalt, molybdenum, selenium) Organic Matter, Amino Acids, Acids Humic, and Fulvi.

BIO-FOM contains live microorganisms: 8 bacteria and mycorrhizal fungi that help unblock the chemical components that exist in the soil allowing their absorption, in addition to an essential contribution of organic matter, amino acids, humic and fulvic acids, this, together with its content of 16 mineral elements (nitrogen, phosphorus, potassium, magnesium, calcium, iron, boron, copper, manganese, silica, zinc, iodine, sulfur, sodium, cobalt and chlorine) together give rise to a molecular dialogue that results in a functional plant nutrition system, fertile soil, larger root size and helps improve pH, which is essential for proper and healthy plant growth.

Among other benefits, it potentiates the chemical fertilizers that complement the application of BIO FOM as:

- a) It recovers the soil fertility, unlocking mineral nutrients present but not available, favoring their absorption due to its bio-organic profile.
- b) Increases the specific weight of grains, resulting in higher production.
- c) Increases the Brix degrees of the fruit, having better sales possibilities.
- d) Stimulates the immune system, so healthy, vigorous, and productive plants are achieved. They are strengthening the plant's root system, thereby improving water and mineral nutrients available in the soil.
- e) Respect the ecosystem, avoiding the contamination of the water table.
- f) 100% assimilable, achieving a greater expression of the genetic potential of plants.
- g) Retains and conserves moisture in soils.

11. Method

This analysis is based on the specific case study of an eco-efficient company using the methodological tools proposed for each of the theoretical approaches.

For the analysis, industry-based considerations are employed in the five forces model, also called the diamond model proposed by Porter (1980). The resource and capabilities analysis of the eco-efficient company is used the model proposed by Barney (2001), complemented with the SWOT analysis. Finally, the eco-efficient company is also analyzed in terms of the institutional considerations considered the "rules of the game." Formal and informal, that frame the

entrepreneurial activities and the creation and development of companies according to the territorial environment.

12. Empirical results and conclusions

Industry-based considerations

When analyzing industry-based considerations, Porter's five forces framework is used, which considers factors such as rivalry between firms, barriers to entry, the power to negotiate with suppliers and buyers, and substitute products.

The rivalry between companies

When talking about companies' rivalry, it is referred to the struggle that companies face every day to obtain a position before consumers. These battles can be for prices, quality in products, advertising battles, etc. On the other hand, the author Huyghebaert mentions that the rivalry between firms directly impacts the likelihood that a business will be successfully undertaken and has an effect on the existence of barriers to entry. Since fewer firms exist in one industry, more complicated will be the entry of new firms (Huyghebaert, 2004).

The company to analyze is dedicated to organic fertilizers made from organic minerals, as it is an innovative product. It does not have much competition, but if there is a competition about the substitute products, that would be all chemical fertilizers, due to the great variety of substitute products available in the market. It isn't easy to compete for price in the same way as being a medium-sized company is not even positioned in the consumer's mind when thinking of organic fertilizer.

Entry barriers

As already mentioned before, BIO-FOM faces competition from large chemical and organic fertilizer companies. Due to this, there are difficulties in wanting to enter the foreign markets, as the big brands are doing well positioned in the market. It would not be straightforward to unseat them or compete for prices so that the company, in this case, could compete for product quality, innovation, and the benefits that its product provides.

It is also essential to consider the transaction cost and the transportation cost if working with foreign currencies. If the costs become too high, BIO-FOM products would be less competitive in the foreign market. An alternative to export is the franchise, which allows local business units to produce BIO-FOM products for a fee.

Substitute products or services

More specifically, in the global marketplace and, more specifically, North America, large, medium-sized, and small competitors produce similar products. Geographically, most production plants are located in rural areas and seem to serve only local markets. The competitive advantage of BIO-FOM is that it is the company with the highest social awareness among all its competitors. And although its product is easy to imitate, it gives it a plus by mixing it with some other ingredients that make the compost a better quality. It is also easy to use as they pack the product inside disposable pod-made biodegradable materials that only have to be deposited in a container with water waiting for it to dissolve. It starts to water in a usual way.

Bargaining power with buyers

According to Porter, at this point, it is defined as the ability of customers to impose prices and conditions of sale (Porter, 1980). This force can be established by customers directly, whether negotiating a discount or financing model, demanding delivery forms, or indirectly which is summarized with competitive purchases.

The bargaining power of buyers may depend on some variables, such as a high supply of products and services and low demand for them. Another may be that the products offered have no differentiation among themselves, etc. At this point, the customer can choose any product or service that is presented to them and that they consider to be the best and meet their expectations. As well as defining the maximum price customers are willing to pay for a product or service and some other requirements that could be delivery times, product quality, etc. All this has an impact on the company's profits.

Bargaining power with suppliers

In one of his writings, Peng mentions that "when the bargaining power of suppliers becomes too great, business solutions must be found that can reduce it" (Peng, 2012, page 127). It is because many options must be available to the purchase of inputs at reasonable prices.

The organic fertilizer based on organic minerals requires many inputs because a lot of raw materials are used for its elaboration, so it is necessary to have a large number of suppliers. The few suppliers that have contact must make and establish the negotiation agreements and delivery times, among many other things. This way can reduce and, to a certain extent, eliminate transaction costs.

Considerations based on resources and capabilities

The resources are any input in a productive system in which an output is generated. These can be classified as financial, physical, human, technological, organizational, knowledge, management team experience, and customer service. On the other hand, Barney dogmatizes that the heterogeneity of organizations is due to the possession of resources: i) valuable, which must respond to environmental threats and take advantage of their opportunities; ii) scarce, those that cannot allow obtaining competitive advantages with competitors; iii) complex resources to imitate, without substitutes and organizational, which means that the company has aspects of order (Barney, 2001, page 41).

The company BIO-FOM offers the market an innovative product because it takes the most significant benefit to a product that people see as waste and transforms it into a product with added value. The strengths with which this product provides are that they are organic, have a higher performance compared to other fertilizers, are favorable to the environment, are not expensive to produce. Something that gives a more excellent value is that the packaging is biodegradable. The whole product itself is ecological. There is no waste of plastic or any other material that is difficult to decompose; the product is safe for children and pets so that anyone can use it.

Therefore, for the considerations based on resources, a SWOT analysis was carried out to analyze both the internal and external factors that provide added value to the firm and the positive and negative factors that can cause the company not to overgrow, what was expected.

Table 2: SWOT Analysis

Strengths	Opportunities
Organic products/products without chemicals Excellent performance compared to other inorganic fertilizers environment friendly It is not expensive to produce The packaging is biodegradable No toxic, safe for children and pets It is not easy to imitate	The growing trend in organic products Market development Product development Product differentiation
Weaknesses	Threats
Lack of advertising + visibility Small production capacity-challenge for the company at scale The products have limited functions The products are not standardized Hard to forecast production Limited capital and strategic partners Don't go alone Expensive compared to inorganic fertilizers	Regulations that exist for exports Animal diseases Environmental factors may affect the production Breach of demand levels Low market level

Source: Prepared by the Authors

In this table, it can be seen that the firm has many strengths that make its product different but also has many threats. It is due to the same rarity of the product, which makes it somewhat complicated for sale. Likewise, the product is easy to imitate, so it could have a lot of competition, which can quickly get to the market firm.

Considerations based on institutions

When talking about considerations based on institutions, we are talking about the rules of the game of these. The behavior of the company is determined and how they are developed around the world. Peng points out five strategies for an entrepreneurial company to be successful, which can be applied together, and they are growth, innovation, networks, financing/government, and harvest/output (Peng, 2012).

The BIO-FOM company integrates some of these strategies, such as innovation in their products and networks since they try to have a comprehensive web to get known and obtain advice. And keep growing as the company participates in a program called X-culture where companies are assigned a group of people from different parts of the world, advising companies to expand or internationalize when the company uses all the possible networks to be able to grow.

Instead, McDougall notes that network analysis builds an excellent foundation and helps identify international opportunities, as well as establish credibility, provide access to critical resources, as well as knowledge, and lead strategic and cooperative partnerships (McDougall, 2000).

13. Challenges and Opportunities

Green innovation business (GIB) is in the field of organic fertilizers are contributing with an input of fundamental importance in primary agricultural activity. The rehabilitation of organic



fertilizer-producing plants in the country is not economically viable in the short term because the reactivation of activities in the plants takes time. Besides, it is not common to find this kind of producer unit in urban areas.

It is necessary to invest more resources for the qualification and reduce the import of organic inputs and other ingredients essential in the production of fertilizers. The importation of chemical and organic fertilizers will continue since the national output of 2020 only covers 33.7% of the total demand, and the remaining 66.3% is brought from the foreign market.

14. Conclusions

When analyzing the green innovation business (GIB) and eco-efficient company through the comprehensive method of entrepreneurship, it is observed that just as the company has some advantages in the product. Also, with many threats are the large companies that are already positioned and compete with competitive prices. It is also determined that although the green innovation business (GIB) has a vast network that uses the best way possible, it is necessary to increase the international network of contacts to overgrow. Although BIO-FOM has been positioned in the local, regional and national market for a short time and has grown steadily, it has the challenge to enter the international markets in a very competitive position.

Likewise, it can be seen that due to the culture of planting in Mexico, this company faces problems to become highly competitive in the country. Since most farmers prefer chemical fertilizers and thus produce more in less time than caring for the land and having a higher quality product with organic fertilizers.

It is necessary to implement a culture of conscience in Mexico when we talk about caring for the land since the use of organic fertilizers would help the environment and people. It is because the foods that are consumed will have better nutrients. They would not be contaminated with pesticides. Today some people started to make their gardens at home, so they grow their food; this is a good technique because they can be sure that food consumption is one hundred percent organic. Here is the importance of the topic for green innovation urban areas.

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