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Factors of Competitiveness for the Bovine Livestock in Yucatan, Mexico

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Additional information is available at the end of the chapter

Abstract

This chapter's objective is to show that finance, marketing and innovation could be considered as factors of competitiveness. Owners of 30 cattle ranches were included in the state surveys, with each ranch having at least 1000 head of cattle. The study was quantitative and used a multiple linear regression model. The results were that the use of financial information, the profitability and funding are components of finance factor. The product and the process innovation are components of innovation factor and the market positioning, the knowledge of the competition and customer satisfaction are components of marketing factor, being the profitability, the market positioning, the customer satisfaction, the product and the process innovation, relatively more important.

Keywords: bovine livestock, competitiveness, finance, innovation, marketing, Mexico

1. Introduction

Meat is an important element in human nutrition and, in the world dietary context, the level of consumption is an indicator of the life of the population [1].

In Ref. [2], livestock represents 40% of the global value of agricultural production and the basis of livelihoods and food security of almost one billion people. The livestock sector, driven by the increase in income and support of technological and structural changes, is the fastest-growing in the agricultural economy. The progress and transformation of the sector offer opportunities for agricultural development, but the rapid pace of change could marginalize

small farmers; on the other hand, it must address systemic risks to the environment and human health with a view to ensuring sustainability.

In Ref. [3], mentioned that livestock activity in Mexico is carried out throughout the country; he affirmed that 56% of the national territory is dedicated to livestock, approximately 110 million hectares.

Livestock breeding takes place in four large areas: the arid and semi-arid, the humid tropics, the temperate and subhumid tropics [4].

In Ref. [5], it was indicated that in the state of Yucatan, the agricultural and fishing sector represent 6.7% of the total Gross Domestic Product in the state.

In Ref. [4], it was mentioned that the livestock is composed of the following products: cattle, sheep, horses, pigs, poultry, turkeys and bees.

Cattle ranching in the state of Yucatan constitutes a relevant economic activity because it occupies about 30% of Yucatan territory. The authors indicate that the eastern zone of the state of Yucatan has the largest concentration of cattle. The municipalities located in the eastern region are Sucilá, Espita, San Felipe, Panabá, Tizimín, Buctzotz, Cenotillo and Valladolid, with Tizimín constituting 90% of cattle production [6].

The agricultural sector in Yucatan faces several challenges: disorganization of beef producers in the region; problems in the integration of the various links in the production-consumption chain [7]; unemployment resulting from limited job opportunities, resulting in labor migration to other regions [8]; lack of effective marketing strategies to ensure higher sales, market diversification, and the use of intermediaries in marketing [9]; lack of technology, knowledge, and limited financial resources to generate innovation in production units, value-generation for all activities; and finally, market competitiveness [10].

The eastern zone has an area of 413,237 ha. It occupies 11% of Yucatan territory; in some parts, there is still vegetation rich in precious woods. It is also noted that the zone has fertile land capable of producing many kinds of tropical fruit [5].

In Ref. [5], the economically active population numbers 43,256 people, of whom 21,280 are reported as employed.

The census also reports that the income per person of the population is low. Of the total employed population, 14,111 people receive a salary between one and two minimum wages and only 3210 people receive more than five minimum wages. The latter figure corresponds to people working in the capital city of Mérida and in some other locations in the state of Quintana Roo. For this reason, the eastern region of the state of Yucatan is considered to be in extreme poverty.

In Ref. [5], the income of the employed population by sector is integrated as follows: 8205 people obtain income from the primary sector, 4114 from the secondary sector, and 8961 from the tertiary sector, which is saturated and provides less and less income to those who engage in the above activities.

An important business market to consider taking advantage of the proximity to it is the state of Quintana Roo. In Ref. [11], reports that in order to meet the rapidly increasing demand, Quintana Roo needs to obtain agricultural and livestock products from outside its borders to feed its growing tourism industry and atypical demography.

The general objective of this research is to generate a competitiveness index based on three factors: finance, innovation and marketing.

2. Literature review, methodology and results

2.1. Literature review

2.1.1. Competitiveness

In [12], it was noted that technological change could affect competition in virtually any activity. The impact of technology on competitiveness occurs because it affects differentiation or cost, the two fundamental generic strategies.

The competitiveness of a company is represented by the payment of higher wages, better jobs and greater safety for workers in the plant and the surroundings [13].

In [14], it was pointed out that it is also necessary to consider a very important factor that can cause the customer to value the product of the company more: having products to complement the main products of the company. These complementers can also become competitive products over time.

In [15], it was indicated that organizations would be competitive only to the extent that the products and services they offer have the attributes that correspond to the key purchasing criteria of a substantial number of customers.

In [16], it was remarked that companies that have managed to survive have resorted to competitiveness as a fundamental element. Competitiveness depends more and more on the way in which economic agents organize themselves into networks of companies that cooperate and compete with each other. Agricultural activity is not exempt from being immersed in today's globalization.

According to Blunck [17], competitiveness is the ability to provide products and services in a more efficient and effective way than competitors. In the commercial sector, this entails sustained success in international markets without protection or subsidies. Competitiveness at the industry level is the best indicator of the economic health of nations that compete at the enterprise level.

In [18], it was concluded in a study on competitiveness in the coffee industry in Veracruz that the factors that lead to greater incidence of it are as follows:

1. innovation,

2. marketing,

3. finances

In [19], it was established that the only way to be competitive is through maintaining advantages in innovation in the long term, and the only way to achieve this is by investing in new differentiated capacities.

According to Malhotra and Manyika [20], for companies to be competitive, it is necessary that governments at the federal, state and local levels effectively address the broad barriers that hinder productivity growth and support innovation in companies.

2.1.2. Innovation as a factor of competitiveness

According to Porter [21], companies achieve competitiveness through acts of innovation, which include both new technologies and new ways of doing things (innovation of products and processes).

Several innovations create competitive advantages by perceiving a completely new market opportunity or by serving a market segment that others have ignored. Competitive advantages are generated when competitors are slow to respond to innovations.

In international markets, the author points out that innovations that generate competitive advantage must anticipate both domestic and external needs.

Information plays an important role in the process of innovation and improvement. Sometimes this information comes from simple investments in research and development or market research.

With few exceptions, innovation is the result of an unusual effort. The company that successfully implements a new or better way to compete pursues its approach with a single-minded determination, often in the face of harsh criticism and difficult obstacles. Indeed, to be successful, innovation usually requires pressure, necessity, and sometimes adversity; the fear of losing often provides more impetus than the hope of winning.

Once the company reaches the competitive advantage through innovation, it can only sustain it with persistent, continuous improvement.

Competitors will eventually and inevitably surpass any company that stops the processes of improvement and innovation. Sometimes the advantage of being the first, for example in customer relationships, economies of scale in existing technologies or loyalty of distribution channels, is not enough to allow a stagnant company to retain its entrenched position for years or even for decades; sooner or later, more dynamic rivals will find a way to innovate around those advantages or create a better or more economical way of doing things.

Ultimately, the same author establishes that in order to sustain a competitive advantage over time, it is necessary to stay up to date.

According to Schroeder [22], innovation should be considered as a boost to the market, making what can be sold; impulse to technology, selling what can be done; and inter-functional, seeking cooperation between the different areas involved. The steps to follow in an innovation process are focused on the generation of the idea, product selection, preliminary design of the proto-type, prototype construction, testing and definitive design of the product, which will stimulate competitiveness in organizations, that is, in a continuous research and development to innovate.

In [23], the global competitiveness index assumes that, in the first stage of development, the economy of a country is driven by a series of factors such as unskilled labor and, above all, natural resources. This is when the four elements (institutions, labor, macroeconomic envi-ronment and infrastructure) play an important role in what has been called factor-driven economies.

2.1.3. Marketing as a factor of competitiveness

The competitive behavior of marketing is the rivalry between companies expressed in market strategies; that is, when a firm reacts to the marketing actions of a competitor in a certain way. There are three ways to react or competitive behavior: revengeful, cooperative and base or opportunistic. The first type of behavior is an aggressive response to an attack; the second consists of actions of the same type and in the same direction, but they are not perceived as aggressive by the competitor. The third behavior occurs when a company reduces its market-ing effort and competitors take advantage of that decision [24].

According to Galán and Vecino [25], there is a certain consensus among researchers to point out that the competitiveness of the company is determined by three types of factors or sources: those related to the country where the company is located (country effect or territory effect), derivatives of the sector to which it belongs (sector effect or industry effect) and those that have their origin in the company itself (company effect).

According to Stanton et al. [26], market positioning is the proportion of total sales of a product during a certain period in a specific market captured by a company. Similarly, it can also be considered as the potential part of the market that a company plans to achieve on the sales volume that all companies that sell a product during a certain period can expect to sell under ideal conditions.

In [27], it was pointed out that marketing implies knowledge of the competition and creates pricing policies and customer satisfaction services.

Accordingly, Fischer and Espejo [28] pointed out that the benefits that marketing brings to a company can be many and diverse: it contributes directly to sales, innovates products and services, satisfies the changing needs of the consumer, contributes to raise the profits of the company and generates great benefits in organizations.

2.1.4. Finance as a factor of competitiveness

The financial resources serve to maintain the solvency of the company in supplying necessary cash flows to satisfy the obligations and acquire the circulating assets necessary to achieve

the objectives of the company and improve the competitiveness. In order to have financial resources, it is necessary to measure profitability and financing in companies [29].

The use of financial information is indispensable in the implementation and development of strategies in organizations. This same author establishes that financial institutions are willing to lend funds for projects that are profitable and that guarantee the recovery of said funds [30].

In [31], it was pointed out that the maintenance of good financial standards through proper financial management is one of the main factors highlighted as necessary to achieve competitive success. In this sense, it is necessary to carry out short-term planning with caution, implement and control information systems, pay special attention to credit institutions, establish annual budgets, analyze the economic-financial situation and try to measure possible, use own sources of financing. To develop the aforementioned [32], comment that the level of education to be a reflection of knowledge and skills possessed, is positively related to the ability of the manager to make strategic choices according to the demands of the environment, with its propensity to generate and implement creative solutions to the problems of the entity and even with the highest level of productivity [33].

Companies have many objectives, but according to Sallenave [34], they can be reduced to three: profitability, growth and survival. Until the 1970s, emphasis was placed on profitability; in the 1970s and 1980s, growth was sought, and today survival is sought. The latter presupposes the previous two. Without profitability and growth, there is no survival.

This same author points out that there are three fundamental characteristics of profitability (ROS), profitability over assets (ROA) and financial profitability (ROE).

According to David [30], the companies that apply the most profitable and more successful management concepts than those that do not, register more sales and reach higher levels of productivity and competitiveness. The companies that do not arrive at anything tend to carry out myopic activities and do not show well the forecasts of the future activities.

2.2. Methodology

In the present investigation, a type of quantitative research was applied because a correlation was applied, for which a Pearson statistical analysis was carried out. This study is based on the temporal dimension of the cross section. It is not experimental, because it seeks to determine the processes that lead cattle producers in the state of Yucatan to improve and generate value, thereby increasing competitiveness. The study was carried out in 2014.

For the determination of the competitiveness index, the research work used information obtained by the large ranching operations (at least 1000 head of cattle) in the state of Yucatan in 2014. A survey was applied specifically to obtained needed information for this investigation.

In Ref. [35], the study population was made up of 30 large ranches in the state of Yucatan. In this case, all the observation units that make up the target population could be accessed.

The validity and reliability of the recruitment instrument was reviewed mainly through the exhaustive review of the literature, the content validity, the validity of construction, through the application of the factorial analysis and the reliability analysis of the instrument by the Cronbach alpha coefficient.

2.2.1. Validity

Content: the validity of content has been achieved by reviewing the literature on the subject that has shaped the theoretical framework of the research, as well as the review and adaptation of the recruitment instrument, after reviewing it by the experts. The uptake instrument was previously applied in a similar study in the state of Sonora [36].

Construction: the validity of the construction of the collection instrument was determined through the application of factor analysis in [37], on the content variables related to the marketing, innovation and finance sections. The results obtained for each section are presented below (see **Table 1**).

According to the results, the KMO sample adequacy coefficient is considered acceptable for all cases higher than 0.7, a value that several authors [38], consider adequate for the application of factor analysis. On the other hand, the value of the Bartlett test is based on the hypothesis of an inadequate relationship between the variables for the application of the analysis, so this relationship is considered adequate, and the application of the factor analysis is relevant. On the other hand, in all three cases, the first component explains a percentage close to 70% or greater, so that the variables can be considered to be in a group around the corresponding construct (marketing, innovation and finance). The results obtained by applying the IBM SPPP Statistics 21 statistical package.

2.2.2. Reliability measurement

Reliability can be measured by using a measuring instrument or more times with the same group of people or by applying two or more measuring instruments to the same group at different times. The split halves method requires only one application of the measurement and comparison of the parts that must be highly correlated. The Cronbach alpha coefficient requires only one measurement administration for the whole population without the need to divide it.

The method used for the characteristics of the research is the Cronbach coefficient.

$$\alpha = \frac{NP}{(1 + P(N-1))} \tag{1}$$

where α=Cronbach's alpha reliability coefficient; N = number of items; P = average of the correlations between items.

Considering that the content reagents are presented on a Likert scale, to establish the reliability of the capturing instrument, Cronbach's alpha coefficient was applied for each of the

Section	KMO coefficient	P value of the Bartlett test	Explained percentage of variance
Marketing	0.833	0.000	74.5
Innovation	0.728	0.000	80.3
Finance	0.825	0.000	68.9

Source: Own elaboration based on research data.

Table 1. Validation results of the instrument's construct.

Section	Cronbach's alpha coefficient
Marketing	0.974
Innovation	0.984
Finance	0.960
General	0.989

Source: Own elaboration based on research data.

Table 2. Reliability analysis.

sections (marketing, innovation and finance) and for the complete instrument. The results are presented in **Table 2**.

According to the results, for any of the sections, the value of the Cronbach alpha coefficient is greater than 0.95, so that once the reliability was tested per section, the value of the coefficient for the complete instrument was obtained. This turned out to be 0.983, a value which supports the affirmation that the capture instrument is reliable. The results were obtained by applying the IBM SPPP Statistics 21 statistical package.

2.3. Results

Prior to the construction of the competitiveness indicator, the possible existence of atypical data was analyzed through the construction of a box diagram [39], for the sums of the reagent ratings associated with the sections corresponding to marketing, innovation, and finance. As a result, the nonexistence of extreme values was confirmed.

Since the statistical results of the study correspond to a population, the run test [40] was applied to determine if the sums per section could be considered as random. According to the p values obtained for this test (0.593, 0.193 and 0.193) for a significance level of 0.05, the randomness hypothesis cannot be rejected, so it is confirmed that the results can be considered random. Similar results were obtained for the indices that were subsequently constructed using the threshold method (see **Tables 3** and **4**).

	Sum of Section 2	Sum of Section 3	Sum of Section 4
Median	51	181	92
Cases < median	14	15	15
Cases ≥median	16	15	15
Total cases	30	30	30
Number of streaks	14	12	12
Z value	−.535	−1.301	−1.301
P values	.593	.193	.193

Source: Own elaboration based on research data.

Table 3. Streak test by section.

	Marketing indicator	Innovation indicator	Finance indicator	Competitiveness indicator
Median	60.0	52.0	49.0	53.7
Cases < median	14	15	15	15
Cases ≥median	16	15	15	15
Total cases	30	30	30	30
Number of streaks	18	18	18	18
Z value	.585	.557	.557	.557
P value	.559	.577	.577	.577

Source: Own elaboration based on research data.

Table 4. Streak test by factor.

Likewise, the Kolmogorov–Smirnov goodness-of-fit test was applied to establish whether the results of the indicators could be considered to have a normal distribution. According to the p-values obtained for this test (0.06, 0.180, 0.595 and 0.114), for a level of significance of 0.05, the normality hypothesis cannot be rejected, so it is confirmed that the values of the indicators have this distribution (see **Table 5**).

To establish the competitiveness index of the observation units under study, the Marketing, Innovation and Finance indices were previously obtained, considering that the response to the reagents is presented on an additive Likert scale, using the threshold method [41], according to which the value of the index in scale from 0 to 100 for the ith observation is obtained by the expression:

$$Ind_i = \left(\frac{x_i - x_{min}}{x_{máx} - x_{mín}} \right) \times 100 \tag{2}$$

		Marketing indicator	Innovation indicator	Finance indicator	Competitiveness indicator
N		30	30	30	30
Descriptive measures	Mean	49.444	38.026	37.949	41.999
	Standard deviation	26.3099	25.8404	21.9028	24.2776
More extreme differences	Absolute	.241	.200	.140	.218
	Positive	.140	.150	.140	.161
	Negative	−.241	−.200	−.130	−.218
Z value		1.323	1.097	.769	1.196
P values		.060	.180	.595	.114

Source: Own elaboration based on research data.

Table 5. Kolmogorov-Smirnov test for a simple.

where Ind_i It is the value of the Indicator (marketing, innovation, finance) for the ith observation unit; x_i It is the sum of the rating awarded for the items that make up the corresponding section for the ith observation unit; x_{min} It is the minimum value observed of the sum of the rating granted for the items that make up the corresponding section for the ith observation unit; $x_{máx}$ It is the minimum value observed of the sum of the rating granted for the items that make up the corresponding section for the ith observation unit.

Based on these results, the competitiveness index (IndComp) is obtained as the weighted average of the marketing, innovation and finance indexes, by means of the expression:

$$IndComp_i = (0.35)\ IndMer_i + (0.35)\ IndInnov_i + (0.3)\ IndFnz_i \qquad (3)$$

The weights assigned to the marketing, innovation and finance factors are the result of the analysis of the literature, the opinion of the owners, and the representatives of the livestock associations, with respect to the relative importance of said factors in the competitiveness of the production units. As can be seen, the value reflects a similar importance for the three factors with a greater relative importance of marketing and innovation, with respect to finance.

Nine subthemes based on the same number of reagent subgroups (three for each section of the survey) were previously established to identify the relationship between the sub-themes and the competitiveness index. For each subtheme, an indicator was constructed from the corresponding subgroup of reagents using the threshold method. The subthemes and indicators by section are the following:

- Marketing:
  - Market positioning.
  - Knowledge of the competition.
  - Customer satisfaction.
- Innovation:
  - Innovation in processes.
  - Innovation in products.
  - Investigation and development.
- Finance:
  - Use of information.
  - Cost effectiveness.
  - Sources of financing.

To analyze the relationship between subtopics and the competitiveness index, three models of multiple linear regression were performed, reviewing in addition to compliance with

the assumptions of the constructed models, the standardized regression coefficients and the p-values associated with said coefficients in said models. The general results of the analyses are presented in **Table 6**.

In accordance with the above, considering the value of the standardized regression coefficients as a measure of the relative importance that the aspects of each section (marketing, innovation and finance) have in relation to the competitiveness of the observation units, as well as the values p of the tests of statistical significance for the regression coefficients under study, the results are the following.

In relation to marketing, the aspects most related to competitiveness are market positioning and customer satisfaction, which coincides with [26–28] who consider the competitiveness factor to include these variables as the real generators of competitiveness. Regarding innovation, the most closely related aspects are innovation in products and innovation in processes; this coincides with what was pointed out by [21], who states that the variables of innovation of process and innovation of product are indispensable for the competitiveness of the organizations. Finally, regarding finances, the most closely related aspects are the sources of financing, the use of financial information and profitability; this coincides with principles established by [31, 34].

Concept	Marketing	Innovation	Finance
Model	$y = 0.378\,x_1 + 0.152\,x_2 + 0.329\,x_3 + 1.829$	$y = 0.306\,x_1 + 0.578\,x_2 + 0.001\,x_3 + 7.798$	$y = 0.269\,x_1 + 0.515\,x_2 + 0.461\,x_3 - 7.609$
Standardized coefficient B1	0.463	0.334	0.328
Standardized coefficient B2	0.166	0.671	0.309
Standardized coefficient B3	0.375	0.001	0.408
R^2 adjusted	0.956 (95.6%)	0.973 (97.3%)	0.943 (94.3%)
Durbin Watson coefficient	2.081	2.201	1.545
P value (ANOVA)	0.000	0.000	0.000
P value (B1)	0.006	0.001	0.003
P value (B2)	0.220	0.000	0.000
P value (B3)	0.007	0.988	0.000
P values (B0)	0.481	0.000	0.058
P value of the test of Kolmogorov-Smirnov	0.995	0.996	0.960
Homoscedasticity	ok	ok	ok

Source: Own elaboration based on research data.

Table 6. Results of multiple linear regression analysis.

The other aspects were not statistically significant in relation to the built models, that is, their relative importance is minimal.

3. Conclusions and recommendations

3.1. Conclusions

The population studied was made up of 18 cattle ranches in the municipality of Tizimín (60%), 5 cattle ranches in the municipality of Panabá (16.7%), 3 in the municipality of Sucilá (10%) and the rest in the municipalities of Buctzotz, Cenotillo, Dzilam González and Sotuta, each of these, with only one ranch.

Ranching operations are, on the average, 31 years old. They have an average of 27 full-time workers working in them, with an average of 1120 head of cattle and a territorial extension of 1306 ha. It was found that the owners are on average 57 years of age.

The competitiveness index model (IndComp) is obtained as the weighted average of the marketing, innovation and finance indexes.

The finance indicator has the lowest maximum value as compared to the other two indicators related to marketing and innovation and the competitiveness index itself.

The competitiveness of most of the observation units at a medium level could be qualified.

There is a statistically significant negative correlation with the years of foundation and the age of the owner; that is, it seems that the seniority of the ranch or greater age of the owner is associated with lower competitiveness. On the other hand, a larger-sized observation unit (according to the heads of livestock or hectares it has) is more competitive. The generation of the competitiveness index as well as the importance of the factors analyzed in the study (finance, marketing and innovation), allows all those involved in the sector to develop strategies to boost their competitiveness.

3.2. Recommendations

It will be necessary to have qualified workers in order to use the most sophisticated technology in the breeding and fattening of cattle. Bearing in mind that there are many small cattle producers that produce independently of the largest cattle farmers, the smaller producers should consider working together in order to create outsourcing alliances to obtain cost advantages in the acquisition of raw material.

Cattle meat producers could benefit more from production if they could further exploit economies of scale in the production and distribution of new food products. They could also increase the production of high-end products. Finally, they should focus the growth of their external sales to the countries of high consumption and high growth and with which there are trade agreements, such as China and Vietnam.

Farmers and related industries should invest in research in order to develop local technology, in relation to biotechnology as well as equipment. Although some progress has been made in this regard, there is an opportunity to develop the machinery that can be tested and improved locally. When the results are positive, the machinery can be easily exported later to other beef producers in the world. The development of more suppliers and support for industries would be very beneficial, as it increases competition and innovation among suppliers. This gives companies more opportunities to improve costs.

It is necessary to improve local competition and cooperation abroad. Because there are high fixed costs to enter new world markets, strategic alliances could be made between producers entering foreign markets.

Some of the limitations that could be mentioned are the context in which it can be applicable, as well as the lack of vision and the ingrained organizational culture that hinders innovation.

As a contribution for future studies, this work offers a strategic model and a methodology to boost competitiveness and the generation of added value. However, there could be, in addition to the factors analyzed in this study, other factors that could have an important effect on competitiveness of the sector. This study can also be replicated in other states to identify the competitiveness index of the livestock sector as well as in other sectors to assess their competitiveness. In Mexico, there are few studies related to the generation of the competitiveness index of the different sectors. In the specific case of the beef sector, the information obtained is generated by government entities such as SAGARPA, the Ministry of Economy as well as local secretariats, which are based on data on production, exports, and so on. This information is important, but the lack of an index of competitiveness of the different productive sectors of each federative entity impedes comparison among the sectors in order to develop strategies to boost their competitiveness.

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