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Strengthening the Citrus Value Chain through Innovative Approach

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Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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ABSTRACT

Mexico has a tremendous potential in the agricultural sector to venture into international markets for its excellent environmental conditions, in addition to a high and diverse agricultural production, especially in lemon's production and exportation; unfortunately, despite the competitive advantages of the country, agricultural marketing has diminished by problems that have blocked the development of the lemon industry.

The research was conducted in the Valley of Apatzingan, integrated with ten municipalities that concentrate most of the lemon production of Michoacan. The object of the study were 4200 producers, 50 packers, 10 industries, 13 suppliers and 15 nurseries. This region is at the top in agricultural production in Michoacan, and the problems the lemon production has faced, despite its benefits, it hasn't been adequately promoted in international marketing; thereby preventing further integration of innovation networks.

Based on the above, the objective of this paper, is to describe which are the variables that drive the increase in export competitiveness. Lemon-System-Product's of Michoacan state, based on innovation networks and actors.

For the design of methodology, we propose an approach, the following hypothesis: There is a positive relationship between innovation network and the actors who compose, reflecting in the export competitiveness of Lemon-System-Product's in Michoacan's state.

This methodology puts in evidence twofold: the dynamics of technological innovation and analyzing

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innovation networks, exchanging information between both approaches to enrich the analysis. The effects of the producer group and location on variables related with the characteristic of the producer, the productive orientation of the production unit and technology adoption indices were assessed with analysis of variance.

Keywords: Innovation network; competitiveness; agriculture; system product's.

1. INTRODUCTION

Mexican Lemon System-Product in the state of Michoacan, is extremely important, since the value of its production resulted in a contribution of 44.64% to the state's economy in 2013 and thus was the fourth most important product on all crops in the state of Michoacán.

Lemon is considered a priority crop within the state, this due to the importance for having a great potential in economic activity.

According to the State Information Office for Sustainable Rural Development [1] during 2013, Michoacan's state ranked as the third largest producer of lemon in Mexico, providing a 21.08% of the national production. Municipalities that contribute to this production are thirty-one: Aguililla, Apatzingan, Aquila, Ario, Buenavista, Churumuco, Coahuayana, Cojumatlan, Zamora, La Huacana, Huetamo, Jiquilpan, Lazaro Cardenas, Múgica, Nuevo Urecho, Pajacuarán, Paracuaro, Periban, Los Reyes, San Lucas, Tepalcatepec, Tinguindin, Tiquicheo, Tumbiscatio, Turicato, Tuzantla, Tzitzio, Uruapan, Carranza, Villamar, Zamora.

The paper was developed with the goal of inferring the variables that drive the increase in export competitiveness of the lemon sector of the state of Michoacan on the basis of innovation networks and actors in order to develop a solution to increase exports competitively in the international market, which undoubtedly bring benefits together for all network members forming the product system lemon.

To achieve the objectives of the paper, the fundamentals of research and theoretical foundations are presented, which range from the definitions to theories that will be used for the development of research; both innovation networks and competitiveness.

Network is a phenomenon that has been present since the beginning of the authorities, because humans seek to live in a social environment and

therefore both are immersed in various social networks and personal.

It was during the 30s when the first formal approach to the study of networks emerged later during the theory with which network analysis was improved as an interdisciplinary field was developed [2].

The networks perform many functions, but the important thing is acquiring a time, in a perspective of a method and a horizon, which will allow to transform the way of doing things [3].

It can be considered that networks are open structures, which are able to expand without limits thus integrating new nodes, while they can communicate with each other, always say that share the same communication codes; a social structure that is based on networks, can be considered a very dynamic and open system, which is susceptible to innovate without threatening its balance; whereby the morphology of networks is also a source of reorganization to power relations [4].

Because the networks are developed through exchange of experiences emphasizing the development of attitudes and behaviors help to create a closeness despite the distance, allowing easy movement of information flows, raw materials, people and energy, hence the absence of network information just does not happen [5].

Network word comes from the Latin rete, and it is a term used to define a structure which has the general power to have a characteristic pattern.

"A network develops the exchange of experiences, but above all, develops attitudes-behavior comprising, therefore, facilitate positively evaluate the importance of being interconnected, to learn from others, to listen and respect others. The Internet is a tool to expand the innovation, network has processes or mechanisms to create, share, disseminate and use knowledge that allow networked learning" [6].

According to Schumpeter [7] an innovative entrepreneur is motivated to take the risk of introducing a new idea in the market, driven by the extraordinary benefits that it expects to receive in the future; this approach is in his Theory of Economic Development, where states that have innovation are the most important force for economic growth.

Undoubtedly the economic development of an institution, organization or country depends on the ability to invent (create ideas), innovate (apply ideas) and then spread them, which is why we are part of the creative idea that develops inside a company with a need to cover; these business improvements can even become enhancements or changes that affect an entire society [8].

This section will show some proposed concepts to define innovation, [9] mentions that among the many existing definitions of innovation, two stand out, because they allow a better idea about the concept:

"Innovation is seen as synonymous with production, assimilation and successfully exploit a novelty in the economic and social spheres, so as to provide new solutions to problems and thus allow meeting the needs of people and the society. Therefore, innovation aims to benefit society".

"An innovation is a product (good or service) new or significantly improved for introducing to the market, or a new or significantly improved process introduced in the company. The innovation is based on the results of new technology, new combinations of existing technology or utilization of other knowledge acquired by the company developments".

The innovations are the result of a scientific discovery that allows substantially modified products that perform certain functions, or may be changes in a group of products or processes by others [10].

An innovation is the implementation of new ideas, concepts, products, services and practices intended to be useful for increasing productivity. An essential element of innovation is its successful application commercially [11].

Sahin tries to find out whether there is a linear relationship among these series we have

checked each series whether they are integrated at the same order or not [12].

The networks are composed of different groups, ranging from business and academia, to producing a good or service that are related by certain factors, economic sectors or activities.

Innovation networks are by nature an evolutionary character and occur as they are developed, is why the integration of an innovation network develops capacity to accelerate learning new behaviors also provides its members surplus value derived from the organizational dynamics of the network [13].

Based on the theoretical foundations described above, it is concluded that the dependent variable for this research is the competitiveness of exports. And those variables that generate any changes or modifications on another variable which are related in some way, are: Innovation Network and Actors (Human Resources).

The hypothesis of this research:

H₁: There is a positive relationship between the innovation network and the actors that comprise it, which is reflected in the behavior of the export competitiveness of the lemon sector of the state of Michoacán.

H₂: The proper use of the connections between actors and the dimensions of the structure that forms the lemon sector of the state of Michoacán, lead to a positive impact manifested by a higher level of competitiveness in exports in this sector.

2. MATERIALS AND METHODS

2.1 Theoretical Foundation

Currently, trade develops in a highly dynamic world, which is characterized by intense competition between companies to position themselves in the international market, it is precisely for this reason that companies constantly generated and incorporates innovations, or as [13] Del Valle calls, new answers to help us to have a greater ability to deal effectively with current challenges, and further consolidated as a strategic factor in understanding the various observable trajectories in recent years.

Innovation has been transformed several areas of study, and business industry is no exception,

as the innovative processes have led growing interest among researchers, because today it is considered that the construction of enterprise networks and social together with an adequate promotion of innovation and tailored to the specific needs and possibilities of each organization become essential strategies for achieving your goals.

In this section, the concepts, definitions and theoretical bases related to innovation networks will be analyzed, which may have a view on the constitution, function, utility and importance of them in the competitiveness development.

To visually illustrate the design of this research, a methodology was developed showcase; which is basically a map where the methodological bases that were conducted in this research are shown, see Fig. 1.

Once submitted methodological continue showcase, we proceed to explain each of the steps in it.

The research was conducted based on the scientific method, also presented a quantitative approach which uses collection data analysis to answer the research questions and thus helps to the verification of the hypothesis made above.

The assumptions made in previous sections will be tested using designs appropriate research, for which a collection of numerical data will be conducted and through a series of statistical analyzes a pattern between the variables will be set to finally bring check out these hypotheses.

2.2 Methods for Obtaining Data

According to Hanneman in the study of social networks, it is essential to establish a series of links, which may consist of any number of actors and one or more kinds of relationships between elements walls [14].

Fundamentally, in the analysis of a network is considered the structure of relationships in which each actor is involved, these actors are described through their connections which are shown as relevant as themselves.

Within this network analysis, the interest is in determining the degree of connection between the actors later to make an evaluation of it, is due to the existence of a set of actors or nodes that can be found various methods by which can perform data collection, however not all methods are applicable to this investigation, for which only

two methods that help us in gathering information were selected.

In order to exploit the advantages and benefits that come with each of them and then we will provide the information necessary to conduct a Social Network Analysis (SNA) on this research; methods to be used are: the "Questionnaire" and the "Method Complete Networks".

This approach requires that accumulate information about each actor's ties with others to generate a picture of the relationship, you may do so either by carrying out a census of the bonds in a population of actors rather than sampling thereof; or collecting information through databases, which leads to full descriptions that lead to an analysis of social structures [14].

Most approaches and special methods of network analysis were designed for use with full network data, which are necessary to define properly and be able to measure many of the structural concepts of network analysis such as the degree of intermediation.

The information contained in complete networks lead us to very strong descriptions that lead to analysis of social structures; the information of each member of a population can be challenging, fortunately the task becomes more manageable asking to the actors to identify a limited number of specific actors with which they have a connection, which are grouped lists and interconnect.

Usually, the bulk of people, groups and organizations tend to have a limited number of loops or strong bonds which reduces the number of actors involved [14].

In the study of constructing a set of Ordinary Least Square (OLS) regression models to estimate the parameters and conduct yield analysis. Several methods were conducted to find the best-fitted parameters. In order to do regression analysis about the parameters, the residuals are assumed to be independent and identically distributed. Moreover, to do some statistical inference about the parameters, the residuals should be distributed as normal [12].

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It is noteworthy that each section consists of a different number of questions depending on the indicator analyzed, which is performed in order to adequately value; a brief reference to the sections of the questionnaire is show below:

1. Actors: This section attempts to identify the core attributes of the actors involved within the network and observe if they have any training; if they don't have any kind of capacitation is necessary to identify if there is any interest by the actor for training and the resulted from such training if there are any, which will lead to a better development of actor and consequently the network. This section will settle for a total of five questions.
2. Network Innovation: this section try to identify and describe the interactions and connections between actors within the network, this in order to observe and understand the dynamics of innovation and network size. This section consists of a total of twenty questions, see Table 1.

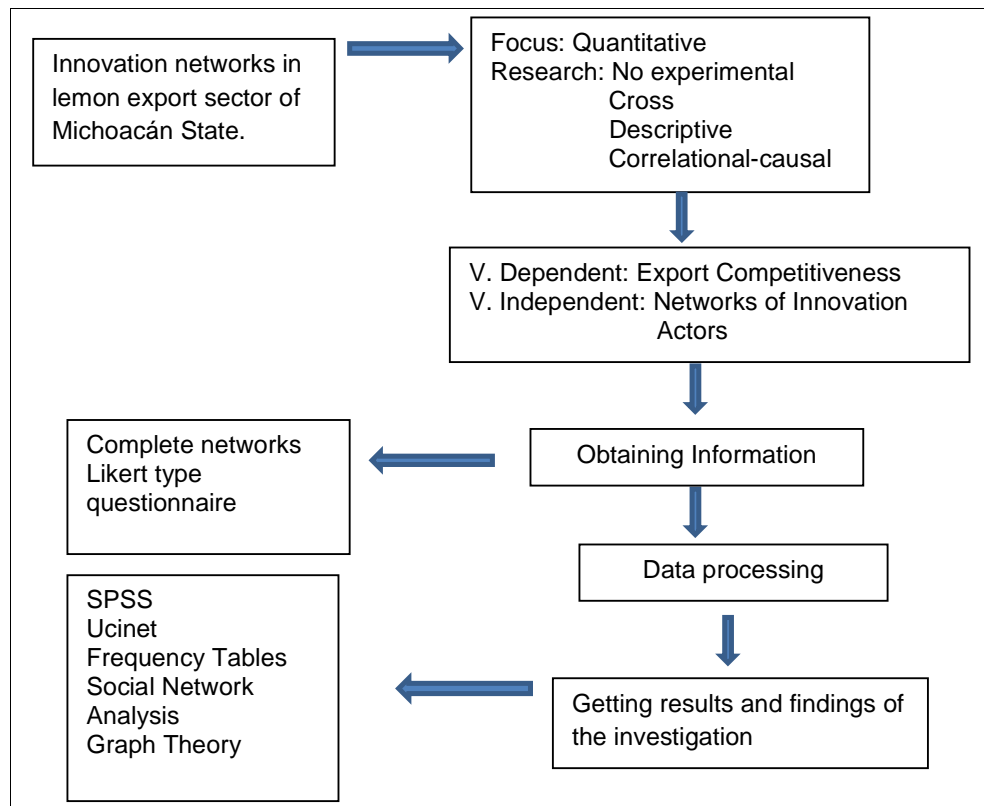


Fig. 1. Methodological showcase
 Source: Authors, based on the theoretical framework

Table 1. Operationalizing the independent variables

Variable	Dimension	Indicator	Question	
Actors	Attributes	Age	1	
		Gender	2	
		Role within the network	3	
		Access to information	4	
		Participation in the network	5	
	Capacitation	Education	7	
		Training Systems	8-9	
		Effective training	10	
		Innovation network	Conexions or interactions between actors	11-14 16-18
			Innovation Dynamics	Sources of information that foster innovation
Exports	Exports levels	Network Dimension	Centralization	25
		Diffusion	15, 27-28	
		Structuration	26	
Production Network Exports	29-31			

Source: Own calculations, based on the theoretical framework

3. RESULTS AND DISCUSSION

In order to obtain a suitable instrument collection for research, it was necessary to apply a pilot questionnaire, which in turn was modified and subsequently applied to producers; this questionnaire was structured by 18 closed questions and one open question to get a better interpretation of the results. It is noteworthy that due to the confidential treatment which was reached with the producers, not the names of those who supported us to answer the questionnaire will be reflected, and only refer to as Actor 1, Actor 2, Actor 3, etcetera.

In order to clearly present the results these were divided into three sections: actors that corresponds to the first part of the questionnaire, innovation network derived from the second section of the questionnaire and finally the section called actors and innovation networks in which you can observe the interaction of both variables of the investigation.

Following analysis of the results showed Likert type questionnaire in each of its sections and questions that involved was examined jointly variables actors and innovation networks in order to observe the degree of impact each independent variable on the dependent variable competitiveness.

At first partial scores of the variables obtained in the questionnaire are presented, then the scalograms derivatives of each variable will be observed correlations between variables of

research and finally take out the method of Cronbach's Alpha Reliability [15].

Look globally applied the results of the questionnaire, it was necessary to construct Table 4, where the number of questions is observed corresponding to each of the variables; obtained scores of variables is necessary to remember that the scale used for the questionnaire is additive and that the variables that are being used are related.

Regarding the variables related Kerlinger mentions that the dependent variable is one that is predicted, while the independent variable is the one from which it is predicted, and according to our theoretical framework was found that the independent variables drivers of competitiveness for the purposes of this research are Actors (Human Resources) and innovation networks (communication, innovation) [16].

For purposes of the table, the concept of the dependent variable Competitiveness is required, which will be seen as a chance to triumph over other bidders when, confronted with substitute products, we have high probability of being victorious, helped by the purchase consumer [17].

Returning the Table 3, the same scores are obtained by summing the values obtained in each question contained in the questionnaire, we should not forget that the number of response categories is the same for all questions.

Table 2. Data matrix derived from questionnaires

Ind	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	P11	P12	P13	P14	P15	P16	P17	P18
A1	3	5	1	3	5	5	5	5	5	5	5	5	4	5	5	5	3	2
A2	4	5	1	2	4	3	4	4	5	4	5	3	4	5	5	4	1	2
A3	4	5	1	2	3	3	3	4	5	3	4	3	4	5	5	3	1	2
A4	4	5	1	2	4	5	4	4	5	4	5	3	5	5	5	3	1	3
A5	3	5	1	3	5	5	5	5	5	5	5	4	5	5	5	5	1	1
A6	4	5	1	3	4	3	4	5	5	4	5	4	4	5	5	3	1	2
A7	4	5	1	2	3	3	3	4	5	3	4	3	3	5	5	5	1	1
A8	4	5	1	2	4	5	4	5	5	4	5	4	4	5	5	4	1	1
A9	2	5	1	3	5	5	5	5	5	5	5	4	5	5	5	5	3	3
A10	4	5	1	2	4	5	4	4	5	4	5	4	5	5	5	3	1	1
A11	5	5	1	2	5	5	5	5	5	3	5	4	5	5	5	4	1	4
A12	2	5	1	3	5	5	5	5	5	4	4	4	4	5	5	4	3	2
A13	4	5	1	3	4	3	4	3	5	3	5	2	4	5	5	3	2	3
A14	4	5	1	2	4	3	3	3	5	5	4	3	3	4	5	2	3	2
A15	3	5	1	2	5	5	5	5	5	5	5	3	4	5	5	3	2	1
A16	5	5	1	2	3	3	3	4	5	4	5	4	3	4	5	2	1	3
A17	4	5	1	2	5	5	5	5	5	3	4	3	4	5	5	3	3	2
A18	2	5	1	3	5	5	5	4	5	4	4	4	5	5	5	4	3	3

Source: Authors, based on information provided by the Representatives of Organizations Producers SIPROLIMEX

Table 3. Rating items per variable

Variable	Actors (Humans resources)	Innovation network	Competitive -ness
A1	32	44	76
A2	27	38	65
A3	25	35	60
A4	29	39	68
A5	32	41	73
A6	29	38	67
A7	25	35	60
A8	30	38	68
A9	31	45	76
A10	29	38	67
A11	33	41	74
A12	31	40	71
A13	27	37	64
A14	25	36	61
A15	31	38	69
A16	26	36	62
A17	32	37	69
A18	30	42	72

Source: Authors, based on information provided by the Representatives of Organizations Producers

On a scale type Likert as that employed in the questionnaire, the maximum score is determined by multiplying the number of items for the highest score of each alternative response, while the minimum score is the result of the number of items multiplied by the lowest score of the response alternatives [18].

It is noteworthy that the same scale for both variables used in the development of research, because each consists of the same number of items; score for each of the variables the values obtained for each question were added, then the scalograms which were developed for each variable are presented.

The score most often repeat section of actors was what was within the range of 27.2-33.6, obtaining a 71.65% success rate in the variable. Stars recall that the variable was used to observe the attributes of network members and to know if they have adequate training to perform their activities.

This indicates that it has good elements within the network SIPROLIMEX therefore need to work them properly for their attributes and qualities potentializing, and along with it the competitiveness of the entire network will increase.

In the scalogram corresponding to innovation networks scoring more repetition frequency was what stood in the range of 34-42, corresponding to the response category "almost always", indicating that innovation networks are used by

the actors and influence in 77.54%, in communications that are within the network; as well as the dynamics of innovation, since most of the participants adopt the proposed changes to the improvements of production; but much remains to be done and implemented in order to improve the communication has within the network.

Observed the scalograms corresponding to the independent variables, it is pertinent to note the amount of the dependent variable export competitiveness, where the total survey questions included overall scalogram.

Score greater repetition frequency for global scalogram was located within the range of 61.2-75.6; yielding an average score of 67.44, which corresponds to 75% effective in competitiveness variable.

The variable export competitiveness is determined by a 42.50% variable actors and a variable 57.49% for innovation network; with which it can be inferred that the variable innovation networks have a greater impact on competitiveness that the variable of the actors, but it is not enough because it has only 75% in the level of competitiveness, which reflects that there are bases and means needed to boost the lemon sector Michoacán, but is necessary to make a number of changes to increase their competitiveness.

However, another aspect to revise this section as mentioned at the beginning is the correlation between variables, for which the correlation coefficient of Pearson, which is a statistical index that measures the linear relationship between two variables was used quantitative; unlike the covariance, the Pearson correlation is independent of the measuring range of the variables.

3.1 Pearson's Correlation Coefficient

Correlation is a technique for investigating the relationship between two quantitative, continuous variables. Pearson's correlation coefficient (r) is a measure of the strength of the association between the two variables.

The first step in studying the relationship between two continuous variables is to draw a scatter plot of the variables to check for linearity. The correlation coefficient should not be calculated if the relationship is not linear. For only purposes, it does not really matter on which axis the variables are plotted. However,

conventionally, the independent (or explanatory) variable is plotted on the x-axis (horizontally) and the dependent (or response) variable is plotted on the y-axis (vertically).

The Pearson correlation coefficient (r) is measured on a scale of 0 to 1, both positive and negative direction. A value of "0" indicates no linear relationship between the variables, the value of "1" or "-1" indicates respectively a positive perfect or perfect negative correlation between two variables, finally the value located between 0 and 1 indicates a positive correlation.

The Pearson correlation coefficient (r) can be calculated in any data group, however, the validity of the hypothesis test on the correlation between the variables requires strictly, a) that the two variables come from a random sample of individuals, b) that at least one of the variables has a normal distribution in the population from which the sample proceeds. For the valid calculation of a confidence interval of the coefficient of correlation of (r) both variables must have a normal distribution.

Table 4. Matrix of Pearson correlation coefficient

Variables		I	II
I. Actors			
II. Network	Pearson Correlation	,736**	
	Sig. (bilateral)	,001	
	N	18	
III. Competitive-nees	Pearson Correlation	,926**	,937**
	Sig. (bilateral)	,000	,000
	N	18	18

**Correlation is significant at the 0.01 level (bilateral).
Source: Authors, based on information provided by the Representatives of Organizations Producers

Table 4, presents the results to carry out the correlations between the independent variables and the independent variable, where you can see that there is a positive correlation of .926 between Actors and Competitiveness; and the correlation between innovation networks and Competitiveness is also positive with an .937; which indicates that the independent variables of actors and innovation networks have a direct impact on the dependent variable Competitiveness variables are related, and therefore by the correlation can be seen which of them is the one that has greater impact on the dependent variable.

Observing that innovation networks have a greater impact on competitiveness actors indicates that in order to strengthen and boost

competitiveness, it is necessary to focus first on the connections of the actors that make up the network and work more accepting of innovations that are proposed to improve SIPROLIMEX.

4. CONCLUSION

The state of Michoacán has an important role in the production of lemon at the national level and well accepted by both domestic and international consumers; today the lemon sector has not had economic development and business momentum might be expected given its characteristics which is caused by disorganization, poor communication among its members, lack of discipline, lagging technology and deficits in the creation and use of innovations.

The Michoacan's lemon has specific features that allow you to position the taste and preference of domestic and foreign consumers, unfortunately is not reflected in the welfare of the producer population of citrus, or the economic development of the state, due to difficulties to export and market the lemon as own state of Michoacan, as a result of a lack of knowledge on strategies and marketing process.

Once observed and analyzed the lemon sector Michoacán to determine its international competitiveness, it was determined that features important factors to deal with foreign markets, referring mainly to natural resources necessary for the production of lime, and these factors are not easy to obtain, reproduce or imitate, certainly have many faults within other elements; but by the nature of them is possible to correct and improve them through effective organization, implementation and use of innovations as well as developing and implementing appropriate strategies for the proper development, organization and training sector.

Due to the lack of communication and coordination among actors that make up the lemon sector can carry out the strategies planned by industry representatives and organizers even if they have good grounds as a result of grabbing activities of representatives, which causes a failure in monitoring strategies, and therefore reflected in a decline in marketing citrus.

In the agricultural sector, competitiveness requires partnerships and business strategies to achieve better economic benefits that are reflected in the economy of their producers, which is why the lemon sector Michoacán must be prepared to compete and thus adapt to new

schemes openness, integration and trade rules, both local and international markets, facing the large number of actors competing for improving and maintaining its market position.

This research provided answers to the research question, what is the relationship between the innovation network and the actors that compose it, and how impact that relationship in the export competitiveness of the lemon sector of the state of Michoacán? Furthermore, the objective of this research was to infer the variables that drive the increase in export competitiveness of the lemon sector of the state of Michoacán on the basis of innovation networks and actors in order to develop a solution fulfilled allowing boost exports from this sector competitively in the international market.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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