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Economic profile of two species of Genus Euterpe, producers of açaí fruits, from the Pará and Amazonas States - Brazil

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***Abstract*—** *This study deals with an analysis of the production of the two assaih species (Euterpe precatoria Martius & Euterpe Oleracea) occurring in the states of Amazonas and Pará, respectively. In subject to delineate the economic behavior of two açaí pulp producing species, estimates were made based on temporal observations of the secondary data of produced amounts, prices practiced and respect analyses of growth market. The study made it possible to understand the market dynamics of the açaí economic activity from both species of the genus Euterpe. Analyzing data on the quantities produced and several studies on management, production and commercialization, it was possible to trace the apparent profile of the market structure of açaí fruit, where it was verified the strategic importance of investing in plantations of Euterpe precatoria species, because this species besides having higher anthocyanin contents, has its fruit production in the off-season months of E. oleracea. The harvest in alternate periods, adjust the annual supply and, certainly, will contribute to reduce the variation in prices. Over this perspective, was can perceive the social, political, technological, cultural, market and environmental transformations that need to be implemented and taken into account so that this activity may be able to follow an expansion of its demand and in an environment of perfect competition, find its point of balance, within the formats of the economic sustainability.*

***Keywords*—Assaih, Açaí Market, E. precatoria, E. oleraceae, production.**

I. INTRODUCTION

The Amazon has been a source of inspiration for several sectors of the world market, certainly due to the richness of its biodiversity and the exotic nature of its products. Therefore, it is considered a green reserve capable of providing innovative ingredients for the cosmetic, pharmaceutical or food & beverage industry, which are the main consumers of non-timber forest producers – NTFP [1]. Extraction of non-timber forest products (NTFPs) can provide important income for the inhabitants of tropical developing countries. The growth in the market for healthy products points to the need to obtain natural raw materials instead of synthetic or chemical components. In this consumption trend, "açaí", a native species of Amazonian biodiversity, has the potential to generate great business. Açaí is historically important for the survival of the native populations and capitalization of the northern region of Brazil. However, there is no standardization of data recorded in official bodies on production, marketing, among others, which are sometimes confusing and / or not reflecting reality. This negatively interferes with the creation of adequate marketing strategies, the concession of public incentives, necessary to subsidize the attraction of new ventures and job creation, being indirectly responsible for a repressed demand and consequent increase of prices of the final product.

Especially in the Amazon, the açaí is the fruit of the present and has a promising future. The market for this fruit began to conquer other regions of Brazil from the 1990s and its products are present on five continents [2]. In less than two decades, açaí pulp went through a process of expanding demand, conquering new markets, both geographically and in terms of target audience, reaching consumers with higher income. This change in demand occurred after the disclosure of its energy and nutritional properties, which resulted in the demand for the product by people interested in healthy foods [3].We have listed 22 different uses for all parts of the plant, from leaves to roots[4]. However, the main use is the preparation of a dark purple thick pulp called açaí wine obtained by maceration of the mature fruits of both species *E. oleracea* and *E. precatoria* [5]. From its pulp a great variety of products of market and of subsistence can be

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produced, being, therefore, a growing demand that according to experts, is far from being met.

In 2011, data from the Brazilian Institute of Geography and Statistics (IBGE) showed that the State of Pará is the largest national producer of açaí, with an annual production of about 850 thousand tons of the fruit, generating for the state economy an approximate value of R $ 677 million. According to the Secretary of State for Agriculture - SAGRI, more than 6 thousand tons of açaí pulp were exported from Pará in the previous year, which corresponds to an amount of more than U$D 17 million [6]. It should be noted that this market was established practically around the product extracted from a species, *Euterpe Oleraceae* Martius. However, the worldwide consumption trend and the growing demand for açaí indicate that there is room for the introduction of *E. precatoria* Martius, since it produces similar pulp and an increase in its supply, it may complement national production, Excellent option to supply the market's lack.Economic analysis studies for NTFPs generally present a partial approach, with emphasis on productive chains (processes and actors), rather than on the main input [7]. Contrary to this logic, we sought to trace the economic profile of açaí (fruit) production, analyzing the data of two species: *Euterpe precatoria* Martius. (Central Amazon) and *Euterpe oleracea* Martius. (Eastern Amazon).

II. METHODS

2.1 Description

2.1.1Gender

The genus Euterpe Martius. Is widely distributed in South and Central America [8]. The plants of this genus have great genetic variability, comprising seven species, five of which are native to Brazil [9]. The species *Euterpe edulis, Euterpe oleracea* and *Euterpe precatoria*, are considered as the most important of the genus due to their wide commercial usage [10].

2.1.2 Species

- *E. oleracea* Mart., Predominantly occurring in the eastern Amazon (Pará, Amapá, Tocantins and Maranhão), has as main characteristic, tillering, forming clumps and occurring in flooded floodplain areas.It is a palm tree with up to 25 strains per clump in differentdevelopment. The açaí flora and fruit practically all year round.However, the peaks of flowering and fruiting occur more frequently, duringJanuary to May and September to December [11].

- *Euterpe precatoria* Martius (açaí upland), is a palm widely distributed by Central America and north of South America, especially in Central and Western Amazonia [5, 12]. It is a common species in the forests of the Western Amazon, with a large occurrence in the states of Amazonas, Acre, Rondônia and Roraima [13]. Occurring naturally on the banks of rivers and lakes, in a non-flooded area of high várzea or upland / plateau. It is a solitary, monocaule palm, considered the most abundant palm tree in the Amazon [14].

2.2 Uses

From the fruits of the açaí palm is extracted wine, pulp or simply acai, as it is known in the Amazon region. Açaí is usually consumed with cassava flour associated with protein derived from fish, shrimp or meat, being the staple food for populations of riverside origin. Açaí berries are made with ice cream, liqueurs, jams, nectars and jellies, and can also be used to extract dyes and anthocyanins. The latest research shows the new organization chart of the use of the fruit of the açaí tree. The pulp represents 15% and the core corresponds to 85% of the total weight, from which the pulp is used in the production of cosmetics; The fibers in furniture, acoustic plates, xaxim, plywood, automobile industry, among others[15].

In addition, it is important to understand the role of organic matter in the generation of steam, charcoal and organic fertilizer. The “açaizeiro” has significantly impacted the commercial market. In addition to the uses described above, it may be a source of material for the manufacture of paper and cellulose [16]. It also presents ornamental potential [17, 18], in view of its morphological aspects. Highlights the therapeutic use[19]; The medicinal use[20]; Food use[21,22];Bioenergetic potential[23];High antioxidant activity [24,25,26].

2.4 Main differences

Taking as an example the State of Pará, where there are small orchards of Amazonian açai, implanted in areas of upland, without additional irrigation in the period of less precipitation of rains. It is possible to compare the behavior in the field of the two species *E. Oleracea* and *E.precatoria*, simultaneously submitted to the same edaphoclimatic conditions and it was observed that: The productivity is good, not being rare to obtain up to 50 kg of fruits / plant / year. The industrial yield of the fruits of *E. precatoria* is 30% to 40% higher than those of *E. oleracea* fruits and the production occurs in the first half of the year, ie in the off season of *E. oleracea*. As an alternative to complement the volume for export, due to its functional properties. The first studies have shown the superiority, in terms of the anthocyanin content of the fruits of *E. precatoria*, when compared to the fruits of *E. oleracea*[27].

2.5 Pulp production

Both species are producers of "açaí wine", name which is given to the pulp produced from its fruits. After processing the fruit consists basically of the addition of water and filtration, the pulp extracted from açaí receives the classification of type A, B or C, according to the amount of total solids (QST) present. Being considered respectively: Acai thick or special one that presents QST above 14% and a very dense appearance; Medium or regular acai berry is the one that presents QST above 11 to 14% and a dense appearance and, fine or popular acai berry that presents QST of 8 to 11% and a little dense appearance [28].

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2.6 Economic and biological importance

Euterpe oleraceae and *E. precatoria* produce products that have been presented at international fairs in Europe and North America, arousing the interest of the general public. Samples of pulp and by-products have been constantly shipped to Australia, Germany, USA, Italy and Japan [29].

Exports have been increasing significantly with annual rates of over 30% [30]. With the açaí export values coming from these two species of *Euterpe*, from 2004 this product reached the position of main fruit of the State of Pará in terms of income, employment and occupation of labor [31].

One of the great attractions for the drink commercialization is the presence of anthocyanins. Anthocyanins due to their anti-free radical, delay aging, extend cell life, increase immune defenses, promote better blood circulation and protect the body against lipid accumulation in Arteries. They also have the ability to delay vision loss and decrease the effects of Alzheimer's disease [32].

In a recent review, was presented comparative results of biological studies between the species *E. precatoria* and *E. oleraceae* that showed the antioxidant activities of the fruit pulp of *E. precatoria* are superior to those of the fruit pulp in *E. oleracea*. The results suggest that *E. precatoria* contains strongly water soluble antioxidants that can enter living cells and inhibit ROS (Reactive Oxygen Species) formation, with greater efficacy than those produced by *E. oleracea*[33].

Import data show that açaí, once totally destined for local consumption, has conquered new markets and become an important source of income and employment. The sale of frozen pulp to other Brazilian states has been increasing significantly. However, there are no consistent statistics on the amount of açaí exported to other regions of Brazil and abroad, but it is probable that something around 10% of production will be destined to these markets [34]

For the federal government, the extractive activity presents great potential in the generation and distribution of income, mainly in the rural and forest regions of the country, since it is still practiced by a large number of families. Therefore, the stimulus of this activity is seen as something important to [35].

III. DELIMITATION OF THE STUDY

In order to outline the economic profile of açaí productive activity, the study was based on secondary data from the following official bodies: Brazilian Institute of Geography and Statistics (IBGE); Sustainable Agriculture and Forestry Institute of the State of Amazonas (IDAM); Secretariat of Agriculture of the State of Pará (SAGRI); Brazilian Forest Service (SFB), National Supply Company (CONAB), Institute of Applied Economic Research (IPEA). Import and export data were collected from the Brazilian Export and Investment Promotion Agency, Aliceweb System and Secex / MDIC yearbooks.

3.1 Data processing

In this work, the IPA-DI-M, maintained by the Getúlio Vargas Foundation (FGV), was chosen. The estimates were made from the data [35,36, 37, 38]. The variables analyzed were: quantity produced by the extractivism, quantity produced by the plantation, total quantity exported, total quantity imported and respective prices, from 2005 to 2013, since, for one of the species object of this study, available data, prior to 2005, are inexpressive.

3.1 Data series

The Spearman coefficient was used to verify if the series of temporal data have constant mean and to evaluate if the trend movement is stationary or non-stationary. Spearman is a correlation of rankings and therefore is a non-parametric test, ie it does not require any assumption of normal distribution and can be used for ordinal variables. When the relationship between the variables is not linear but a monotonic function, Spearman may result in a higher coefficient than the Pearson correlation. This is good, but the downside is that Spearman's correlation coefficient is less sensitive to outliers.

IV. RESULTS AND DISCUSSION

The results obtained allowed comparisons between the economic activities of Acai in two states: Pará and Amazonas. Fig. 1 shows extractive production in all Brazilian Amazon states, where it is observed that Pará, the main producer, participates with 54.9% of this production and Amazonas with 35.5%. The largest variation in absolute values occurred in Acre. The production of açaí does not only come from extractivism and its cultivation is increasing.

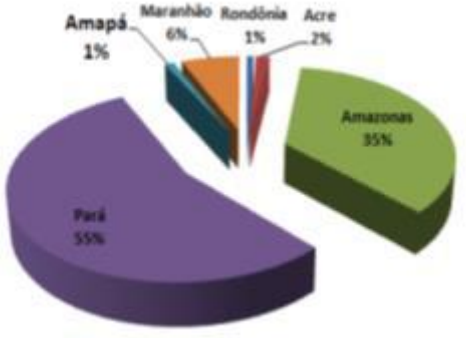

Fig.1: Production of Açaí (fruit) Extractivist in Brazil by States. Elaboration [39].

State of Pará is the largest producer of açaí (fruit) with a extrativist production of 111,073 tons, followed by the State of Amazonas with 71,783 tons, as shown in Fig. 2.

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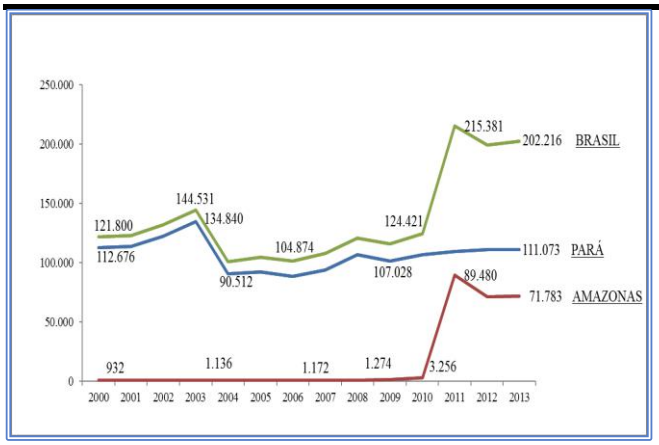

Fig.2: Production Evolution (ton) of Açaí (fruit) Extractivist in the States of Amazonas and Pará in 2013. Data Source: [36].

Analyzing the production data for the State of Pará (Figure 3), it is observed that in 2008 most of the production (in tons) was destined for domestic consumption, followed by consumption in the country and finally for export. This pattern of consumption continues to be followed, since the unofficial data of 2015, also show no signs of change.

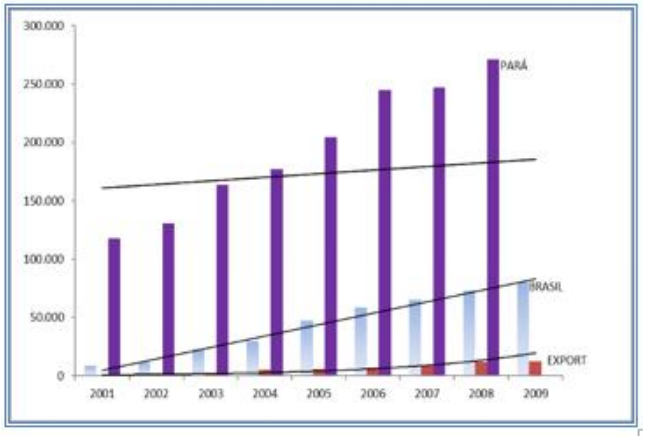

Fig.3 - Consumption (ton) of extractive açaí fruit in the State of Pará, Brazil and export. Data Source: [40]

Comparing the growth rate of the two states, Figure 4, it can be observed that for Pará it is below 20% pa, with negative peaks, indicating a severe fall in production in 1996 and 2004. In Amazonas, Variation is reversed, with the majority of the analyzed period remaining below 15%. However, it is observed that in 1996 and 2013, there was a significant ncrease in production.

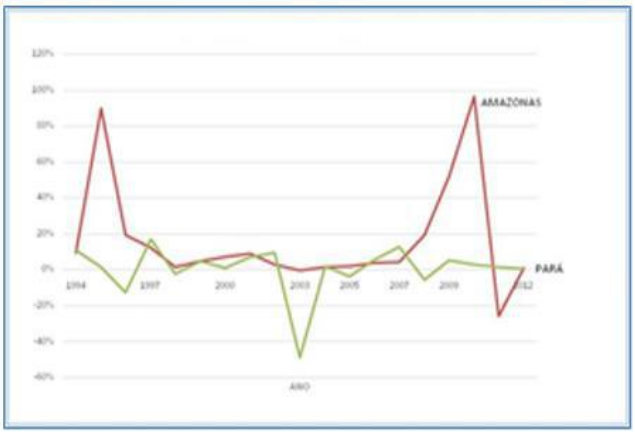

Fig.4 - Rate of production growth in tons of açaí between 1994 and 2012. - Production ofVegetable Extraction and Silviculture.Data Source: [41].

Calculating the Spearman coefficient for açaí production separately for the States of Pará and Amazonas (figure 5 e 6), the respective values were 0.96541 and 0.99098. The positive coefficients indicate that both sites have NON-STATIONARY series, that is, the production has very significant trend movements, not having a constant mean.

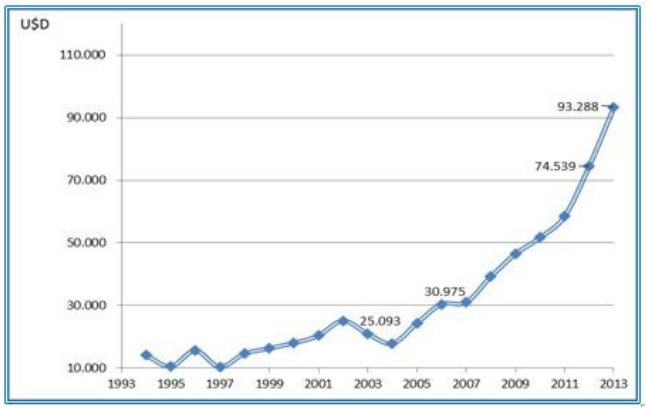

Fig. 5: Spearman coefficient of açaí production in (ton) x value (USD) in the State of Pará. Period analyzed 1994 - 2013. Data Source: [41].

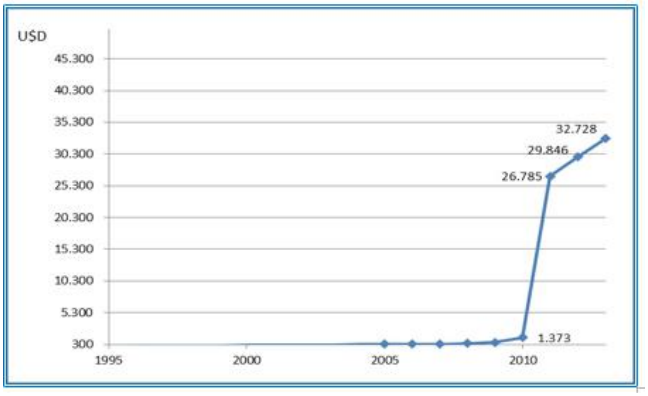

Fig. 6: Spearman coefficient of the production of açaí in (ton) x value (USD) in the State of Amazonas. Period analyzed 1994-2013. Data Source: [41].

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In terms of prices, the total production of açaí in Brazil, although it has undergone great variation during the studied period, presents visually a steady trend, with peaks and valleys around a central value. However, comparing the results presented for the two States, it is noticed that despite presenting series with non-stationary trends, the behavior of the means is quite different [42].

Evaluating the total production of açaí for the State of Pará (Table 1), we can see a change in production patterns. It is noted that the State produced 928 tons of fruit, being 817 tons from cultivation and 122 tons from extractivism. In the state of Amazonas, the State Department of Production SEPROR, empirically considers that 15% of the volume announced is from crop.

Table 1 *- Total production in the states of Pará and Amazonas (Cultivation / Extraction) * Estimated value.*

Production	***2012 (Ton)***		
	Total	***Cultivated***	***Extraction***
PARÁ	*928. 183*	*817.246*	*111.073*
AMAZONAS	*80.306*	*9.16**	*71.146*

Data Source: [40,42].

Pará remains the largest producer of the fruit, according to data from the Systematic Survey of Agricultural Production (LSPA), provided by the Brazilian Institute of Geography and Statistics (IBGE) and published by the State Department of Agriculture (SAGRI). Fig. 7 shows that in 2012, the municipalities of Paráina had reached a total of 817,246 tons of açaí, in an area of 91,426 hectares (planted and managed fruit), with an increase of area and production in relation to the interior year. SAGRI estimates that Pará is responsible for 80% to 90% of national production. Pará supremacy can be attributed to large-scale planted / managed açaí, an option that is not used in the same proportion in other states.

By associating total açaí production data for Amazonas and Pará in the same graph, it is possible to observe the real difference between the two places (Fig. 7).

Between 1994 and 2004, the data on extractive production in Amazonas are inexpressive, since they reach 1,000 tons only from 2005. It is also observed that in 2010 there was a peak of production around 90% (figure 7). However, it cannot be stated whether this situation was caused by increases in production or more likely by errors or omissions of public agencies in the collection of data from previous years.

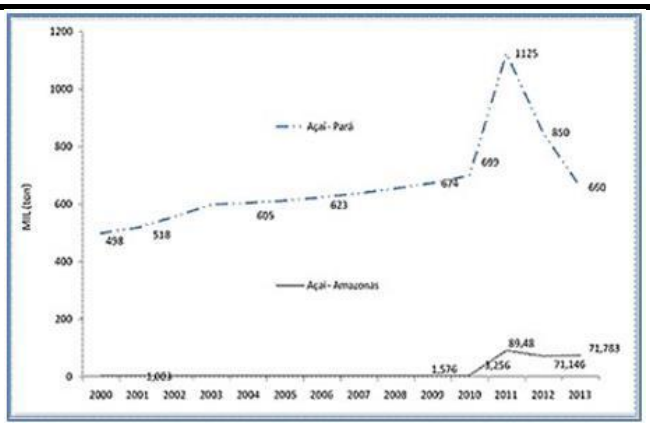

Fig. 7: Total production in tons the states of Pará and Amazonas (Cultivation / Extraction). Data Source: [40,42].

By making a parallel between the cultivated and extractivist quantities produced in Amazonas and Pará (figure 8), it can be verified that the percentage of participation of each State in the total production of açaí, differs from the situation shown in figure 8.

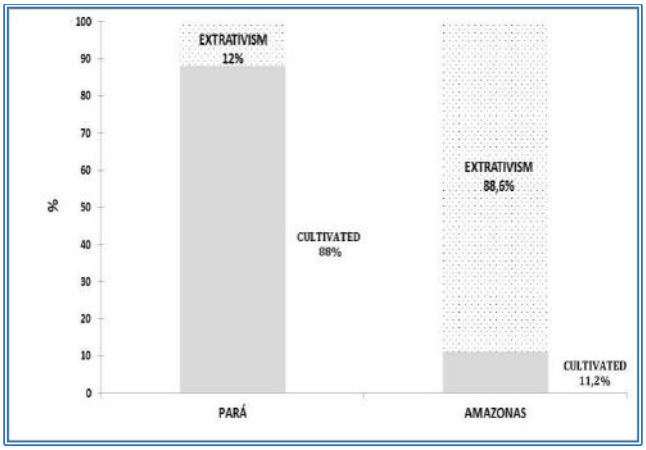

Fig. 8: Effective participation in the açaí market in 2012. Data Source: [36,40].

The results obtained by the State of Pará may be related to the investments in research for new cultivars, early and adapted to the upland, with high productivity. From the agreement signed with Embrapa Amazônia Oriental, the cultivar BRS Pará appeared in 2004. In 2013, it was the launch of the new cultivar that has as main characteristics the highest yield of pulp and production in the first semester, that is, in the off-season. Since 2008, according to the Secretariat's survey, about 19 tons of selected seeds of BRS Pará were distributed, which produced at least 9 million seedlings. "This development, coupled with the prospect of good business by private initiative, probably increased the area planted. Even with this initiative "Demand will still not be fully met, because it will take some years for the new plantations with technology (irrigation and new cultivars) to go into production."[44].

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V. CONCLUSIONS

Analyzing the quantities produced, the production methods and the marketing studies, it was possible to trace the apparent profile of the market structure of the açaí fruit where the following characteristics are perceived:The regional market revolves around the in natura consumption of pulp. The major consumer centers in Brazil, such as São Paulo and Rio de Janeiro, receive pulp processed and frozen, as well as ready-made beverages, with components such as guarana syrup and other fruits. The international market requires strict control, processes and analyzes, and it is necessary for the supplier to have agroindustry and technology.The product is homogeneous, but the seasonality of the extractive production causes great price variation. However, the commercialization of the fruit in natura (in the field) and pulp (in the cities) operates in perfect competition.The supply of açaí (*Euterpe oleracea*) has been shown in several studies as inelastic to the price, but it can not be said that it occurs for *Euterpe precatoria*, since the secondary data for this species are insufficient.It is strategic to invest in plantations of *Euterpe precatoria* species, because currently the volume produced in the state of Amazonas, represents about 1% of the national production and the fact that this species occurs in the off season of *E. oleracea*, will certainly contribute to maintain the supply of matter the whole year and consequently to reduce the variation in prices.

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