

Comparative Analyses of Honey Production Chains on the edge of Sobradinho Lake-Ba and Serra of Capivara-Pi using the Strategic Management Tool Matrix Swot 3.0

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Abstract—*The territory of the Brazilian semi-arid region has historically been the scene of great challenges and adversities, with the capacity for survival and resistance of the people living in it being represented. Within this same territory, there are also several potentialities that should be studied, developed and encouraged, one of which is the bee honey production chain with *Apis mellifera* type stingers for economic purposes, also known as European bee, which must be worked towards complementing income, as well as the diversification of the subsistence activity of the populations of these territories. The study in question intends to compare the honey production chain in two regions of the Semi-Arid Region of the Northeast. The first chain is located on the edge of the Sobradinho lake in the State of Bahia, and the second is located in Serra da Capivara, which belongs to the state of Piauí. The present study is of a qualitative-quantitative, bibliographic and documentary nature, since studies already carried out will be analyzed, starting from secondary data for a comparative analysis of the two chains, using the system called MATRIX SWOT 3.0.*

I. INTRODUCTION

The Brazilian semi-arid region is occupied by 22 million inhabitants, being the largest rural population in the country. With an area corresponding to 18.2% of the national territory, it is the most densely populated and most biodiverse semi-arid region on the planet (Baptista & Campos, 2014).

Although climatic factors cause some limitations, this region has many potentialities that must be studied and

eventually implemented with the aim of contributing to its sustainable development. Like the study of the honey production chain, which may have its economic viability assessed, to ascertain the prospects for job and income generation for populations in the Northeastern semi-arid. Thus, for this work, honey production chains were compared in two areas of this region that present the same climatic conditions, fauna and flora, showing how much

this agricultural activity can bring benefits to communities, corroborating the development of the areas surveyed.

In this sense, activities such as honey production with the western honeybee (*Apis mellifera*) have significant economic potential (Soares, Araújo and Araújo, 2019).

Apiculture represents a productive and sustainable, low-cost activity that could supplement the incomes of smallholder farmers and reduce emigration from the area (Sachs, 2009). It is also ecologically correct since it does not deforest. To the contrary, it encourages reforestation.

The active rural population in the Northeastern Semi-arid Region is currently focused primarily on raising sheep and goats. Successful honey production presents a strong potential to supplement their incomes.

For this study, we analyzed the honey production chains of two regions of the semi-arid northeast, each with similar climatic conditions, fauna and flora. The study analyzes the honey production chains in two territories. The first called Edge of lake of Sobradinho, no State of Bahia (hereinafter referred to as “Bahia case”) and Serra of Capivara in the State of Piauí (hereinafter referred to as “Piauí case”).

II. THEORETICAL REFERENCES

2.1 Production Chains

Observations of systemic and integrated steps of each production chain, can identify system shortfalls. It is essential to study every stage of each production chain. Mello and Brum (2020, p.4) state that,

[...] the study of production chains makes it possible to monitor each product, from its initial conception until it reaches the final consumer, whether in the domestic or foreign markets. It is also noted that there are different production chains around the same product, according to their organization in different regions and countries. Thus, the production chains compete in the general market for their specific product.

For a producer, any improvement in efficiency – energy, production processes and steps, or use of new materials – is innovation directly correlated to infrastructure investment. Any narrowing of the production chain can reduce costs, increase production, and consequently profitability.

In the development of a production chain, attention should also be given to economic, environmental, and social impacts (both positive and negative) arising from the exploitation of natural resources. The image and promotion of any enterprise, operated by a legal entity or

by an individual, will benefit from value-added economic, social, and environmental attributes.

To achieve sustainability, the activity must maintain a balance with the environment (Kramer, 2020). Production will be compromised without harmony with the surrounding environment.

2.2 Honey Production Chains

A production chain is understood as the set of actions that transforms raw materials into products. The various transformation processes are chosen by individual producers, organizations and institutions (Assad et al., 2018). The sales marketing of Brazilian honey has grown both nationally and internationally since the beginning of the 21st century. Analyses of production chains are vital to ensure continued market competitiveness and growth (Rego et al., 2017).

Castro et al., conceptualize production chains as follows:

“[...] production chains are sets of interactive components, such as agricultural and agroforestry production systems, service and input suppliers, processing and transformation, distribution and marketing industries, as well as final consumers of the product and by-products of the chain” (Castro et al., 1995, p. 12).

The raw material of the production chains under study are the supply of queen bees and larvae, production boxes and their various components, beehives, wax and reserve combs, food supplements, centrifuge equipment and services (Assad et al., 2018). Forage is provided by pastures of endemic and cultivated plants.

In the chains under study, marketing is carried out in four ways:

- Through regional intermediaries who purchase the honey from bulk beekeepers in buckets, cans, or drums. The intermediaries consolidate the honey into metal drums suitable for transportation. The drums are stacked and stored until the date of shipment to processing industries who in turn package the honey for domestic and international distribution and sale to wholesalers (Araújo, 2014).
- A broker is hired by the retail [JM2] entities. They broker contacts the beekeepers and makes direct purchases of the product on behalf of the retail entities (Araújo et al., 2016).
- Through direct sale by beekeepers to their community associations – usually involving smaller quantities (Araújo et al., 2016).
- Informal marketing where beekeepers sell a portion of their honey directly on the open markets to local consumers (Araújo et al., 2016).

III. THE MATRIX SWOT

In the competitive contemporary business world, it is essential that organizations be able to analyze the real market in which they operate. For this, managers/administrators use various resources and/or tools to assist in the interpretation of quantitative and qualitative information to predict uncertainties and unforeseen events (Saraiva et al., 2007; Rodrigues et al., 2015; and Massukado, 2004).

SWOT is an acronym for **S**trengths/**W**eaknesses, **O**pportunities/**T**hreats. The MATRIX SWOT, developed by Albert Humphrey between the 1960s and 1970s (Gürel; Tat, 2017), is an important methodological tool that helps the manager/administrator deepen their strategic analysis of a process so that they may optimize business decisions (Kotler; Armstrong, 2008). It is widely used by companies regardless of the level of development of their commercial size (Qehaja; Kutllovci; Pula, 2017).

In the MATRIX SWOT, **S**trengths refer to what a company does well internally, **W**eaknesses refer to what the company does not do very well, both considering the internal environment. On the hand, **O**pportunities are potential avenues to achieve greater growth and profitability, and **T**hreats are factors that can have the ability to negatively impact the company on the external environment (Martins et al., 2013; Paliwal, 2006).

IV. METHODOLOGY

To answer the research question, initially a literature review was conducted. The descriptor keywords used were “production chain”, “honey”, “apiculture”, and “semi-arid.” *Comparative analysis; SWOT 3.0 MATRIX, Management.*

In this study, a team of Master's students in the discipline called Analysis of Production Chains in the Graduate Program in Dynamics of Development of the Semi-arid - PPGDiDeS of the Federal University of Vale do São Francisco - UNIVASF, used the strategic management tool MATRIX SWOT 3.0 to analyze data gleaned from a meagre body of existing bibliographic documentation. To analyze data for two cases:

- 1) “The Bahia case” is based on “Honey production chain in the territory of the Sobradinho lake border in the State of Bahia”, published in Revista Sodebras in 2016, identified as Article 1 in Analysis 1 (AA1).
- 2) “The Piauí case” is based on “Honeybee production chain from Piauí”, presented at the 6th Piauiense Beekeeping Seminar, identified as Article under Analysis 2 (AA2).

The MATRIX SWOT 3.0 tool is based on the analysis of the internal and external factors of AA1 and AA2, where data were extracted and generated qualitative and quantitative variables, using the Likert Scale with a score from 0 to 10. The Likert Scale values in the MATRIX SWOT 3.0 are: 0 - totally unimportant, 2.5 - little importance, 5 - important, 7.5 - very important and 10 - totally important. In addition, for internal factors, the rating scale (qualitative) refers to the variables strength and weakness and for external factors, opportunities and threats.

V. RESULTS AND DISCUSSIONS

5.1 Comparative analysis between the productive chains of honey on the edge of the lake of Sobradinho-BA and Serra da Capivara-PI using the strategic management tool MATRIX SWOT 3.0

The study of the productive chains in certain regions can determine their viability or lack of viability, generating future perspectives of development, employment and income for the local populations that live in these regions of the Northeastern Semi-arid.

Castro et al (1995) conceptualize production chains as follows:

“[...] production chains are sets of interactive components, such as agricultural and agroforestry production systems, service and input suppliers, processing and transformation, distribution and marketing industries, as well as final consumers of the product and by-products of the chain” (CASTRO et al, 1995, p. 12).

In this sense, the honey production chains on the edge of Sobradinho Lake in Bahia and Serra da Capivara in the State of Piauí, object of this study, are inserted in an environment of diversity and multiplicity, in which interrelationships are each increasingly complex between man and nature. Therefore, the integration of these two actors can provide local development, increase producers' income, diversifying business within rural properties.

On the other hand, within a historical context, for Soares, Araújo and Araújo (2019), the State of Piauí started beekeeping from the year 1976 with the arrival of the Wenzel and Bendel families, in the municipality of Picos. According to the authors, the Piauí state has been developing professionally in a sustained manner in the beekeeping sector.

After inserting the variables (strengths and weaknesses) registered in the scientific article called “Honey production chain on the edge of the Sobradinho lake in the state of Bahia” and launching the strategic management tool called

MATRIX SWOT 3.0, we performed the first analysis filter based on the Likert scale method.

It is evidenced in the analysis 1.1 Internal Factors (of the honey chain on the edge of the lake of Sobradinho-BA) that within the internal structure of the chain itself, there are a number of gaps (weaknesses) that should be better addressed by beekeepers (Table 1). These are: a) The lack of health inspection (essential for the product quality process); b) Low technical qualification of beekeepers - which significantly impairs the management, in particular during periods of drought; c) Inadequate and inefficient infrastructure that impacts both quality and hygiene; d) Health inspection standards are not being met. This creates a production and quality problem, as well as a health problem for consumers; e) Quality values remain recognized. There is inadequate effort in the marketing network to improve commercialization; f) Associative or cooperative organization is lacking. This weighs on production and marketing; g) Poor or underutilized honey extraction equipment; h) Inadequate technical assistance from government agencies resulting in a culture of non-scientific “empiricism”; i) Low capitalization resulting in depreciation of equipment.

Table 1: Honey chain on the edge of the lake of Sobradinho-BA

STRENGTHS	68
Sales Marketing the product on the market	10
Beekeeping Flora	10
Production cost	10
Production outflow	10
Research and Development	10
Economic, social and environmental impacts	10
Honey sales warehouse in Remanso-BA	7,5
WEAKNESSES	85
The lack of HEALTH INSPECTION	10
Low technical qualification of beekeepers	10
INADEQUATE / INEFFICIENT production infrastructure	10
Do not meet the current sanitary standards	10
The product has low market quality for	10

consumption	
Low membership in association and/or cooperatives	10
Lack of honey extraction equipment	10
Lack of technical assistance from Government Agencies	10
Low CAPITALIZATION of beekeepers	5

Source: Prepared by the authors (2020), based on the MATRIX SWOT 3.0 tool

It is evident that the territory offers significant opportunities. One of the main challenges to further development is the lack of coordination and organization among competing honey producers.

In the analysis 1.1 Internal Factors (from the Serra da Capivara-PI honey chain), it is quite evident that the forces undoubtedly overcome the weaknesses of the chain under review (Table 2). However, it is necessary to list the weaknesses of the chain with some observations, namely:

a) Lack of state and municipal support and specialized technical assistance programs (in the article it is clear that there is a strong partnership between SEBRAE-PI and EMATER, in addition to other non-profit entities that help the chain. However, it is very incipient given the potential production of the territory and the chain as a whole). Without the partnership of government agencies (State and Municipalities) to make public policies, qualification, training and specialized and continuous technical monitoring possible, the chain may lose strength and new entrants in this market seize the opportunity to enter this market; b) Few beekeepers feed the swarms during the dry season, which leads to the loss of swarms and productivity (although the qualifications of beekeepers in the chain have access to technical assistance, handling in times of drought needs to be better worked in the supply chain. Piauí can generate an increase in productivity during the dry season); c) Lack of an organized and articulated network for the marketing of honey (this may be one of the major obstacles in the Piauí chain), as the creation of an integrated network could generate knowledge through exchanges between producers, as well as the search for new partners and new buyers of the product in the national and international honey market; d) Lack of knowledge and management tools by beekeepers and cooperatives (the lack of basic knowledge in management represents 65% of the death of micro and small companies in Brazil according to SEBRAE NACIONAL). Beekeepers in the

Piauí chain need to urgently seek this qualification within the management processes, establishing training and consulting partnerships with SEBRAE-PI to try as soon as possible to eliminate this great weakness of this chain in question.

Table 2: Honey chain from Serra of Capivara-PI

STRENGTHS	110
Quality of honey produced (competitive differential)	10
Performance of COOPARN and COOPASC cooperatives	10
Training of most beekeepers	10
Good cost / benefit ratio in honey production	10
Performance of the PVSA of the state government	10
Income generation for families through beekeeping	10
Access to beekeeping financing by BNB and BB	10
Diversity of flowering bee	10
Presence of middlemen (purchase in cash)	7,5
Existence of support entities for beekeepers such as: EMATER, CaritasDiocesana, Dom Hélder Project, Coota	7,5
Existence of technicians and private technical assistance companies specialized in beekeeping	7,5
Sufficient space for installation of future apiaries	7,5
WEAKNESSES	37,5
Lack of state and municipal development programs and specialized technical assistance	10
Few beekeepers feed the swarms during the dry season, which causes the loss of swarm and productivity	10
Lack of an organized and articulated network for the marketing of honey	10
Lack of knowledge and management tools, by beekeepers and cooperatives	7,5

Source: Prepared by the authors (2020), based on the MATRIX SWOT 3.0 system

After inserting the variables (strengths and weaknesses) registered in the scientific article called “Study of the beekeeping productive chain of the Serra ofCapivara territory in the state of Piauí” and launching in the strategic management tool called MATRIX SWOT 3.0, we performed the first filter of the analysis based on the Likert scale method.

In the analysis 1.2 External Factors (of the honey chain on the edge of the lake of Sobradinho-BA), it is clear that the opportunities in the chain under review are immense (Table 3). However, the main threat is the existence of many competitors of honey in the market and this threat is already quite worrying and should serve as an incentive to implement several improvements that have already been signaled so that the honey chain in this territory can develop further.

Table 3: External factors of the honey chain on the edge of the lake of Sobradinho-BA

OPPORTUNITIES	115
Potential for growth in honey production	10
Potential for income diversification	10
Competitive market price of honey	10
Cooperation among producers	10
Training and capacity building	10
Availability of supplementary food for dry seasons	10
New technologies for honey production	7,5
Creation of Cooperative or Association	7,5
Preservation of CAATINGA's flora	7,5
New generations to manage the chain	7,5
New beneficial public policies	5
Rural extension activities for the chain	5
Research and publication on the subject	5
Create a specific regional event (promote products)	5
Reinvestment in production equipment	5
THREATS	10

Competing of honey producers	10
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Source: Prepared by the authors (2020), based on the MATRIX SWOT 3.0 system

Regarding the analysis 1.2 External Factors (from the Serra ofCativara-PI honey chain), it is clear that, as it is better structured and positioned in the market, it generates a larger commercial relationship with suppliers, buyers and, consequently, attracts the possibility of new entrants in this market. It is extremely promising given the consumption of honey, due to the growing concern with a search for quality of life and well-being of the world population.

Table 4 presents data analysis of Piauí’s case. It indicates that the main threats to this chain are:

- a) Prolonged drought. In order to try to minimize this threat, it is necessary to establish strong partnership with technical governmental bodies that will provide specific training and new options for the management;
- b) Low price of honey compared to previous years. Without a consolidated and well-articulated commercial network, beekeepers will permanently succumb to unfair demands from middlemen and buyers;
- c) Importation of competitively-priced honey from other countries. Following market trends and diversifying could minimize this threat;
- d) Reduction of flowering during periods of drought. Irrigation options from Serra ofCativara - PI should be considered to try to mitigate loss of flora and allow bee pollination;
- e) Lack of cooperative spirit by the majority of beekeepers who are members of cooperatives. A more collaborative culture needs to be nurtured with an emphasis on the importance of joint and cooperative work;
- f) Some beekeepers do not yet have modern beekeeping skills. Governmental and non-governmental bodies need to provide specialized technical assistance.

Table 4: External factors of the honey chain of Serra da Capivara-PI

OPPORTUNITIES	70
Increasing awareness of healthy diets	10
Marketing of honey to government agencies: Small holder Farms Food and National Supply Company (CONAB)	10

Marketing of honey for school lunches through PNAE, in municipal and state schools	10
Production of other beehive products, such as: pollen, propolis, royal jelly, and apitoxin	10
Adding value to honey by the cooperatives: Improvement and fractionation of honey for the market	7,5
Conditions for setting up agricultural companies producing honey in the territory	7,5
Honey is seen to be an important dietary supplement.	7,5
Lack of access to market channels such as the National School Feeding Program (PNAE) and Education Program	7,5
THREATS	68
Prolonged droughts in the study territory	10
Imported honey from other countries at more competitive prices	10
Low flowering during droughts	10
Lack of cooperative spirit by cooperative members	10
Low market price compared to previous years	7,5
Inadequate technical proficiency	7,5
Non-acceptance of best practices (BPA)	7,5
Weak purchasing power of cooperatives: COO	5

Source: Prepared by the authors (2020), based on the MATRIX SWOT 3.0 system

In this way, the success of the managers of the honey production chains in the two studied territories, depends on the actions that should be implemented based on the various variables available contained in the internal and external factors of the MATRIX SWOT3.0 presented here.

Therefore, the analyzes are correlated with a very well-structured action plan that should allow the continuous improvement of the production process aiming at better results for all those involved in the chains.

Based on the study of honey chains in the territories of the Sobradinho lake border in the State of Bahia, as well as Serra da Capivara in the State of Piauí, it is evident that the

two chains represent a fraction, albeit a small part of the economy in agricultural products that provide these chains within their territories for products produced from bee honey.

Table 5: General analysis of the internal and external factors of the honey chain on the edge of the lake of Sobradinho-BA

Forces	67,5
Weaknesses	85
Opportunities	115
Threats	10

Source: Prepared by the authors (2020), based on the MATRIX SWOT 3.0 system

The general analysis of internal and external factors presented in MATRIX SWOT 3.0 of the “Production chain of honey in the territory of the edge of the lake of Sobradinho in the state of Bahia”, signals the following path: Producers must first take advantage of the countless opportunities for improvement existing in the chain, optimizing its forces. Weaknesses must be addressed as a matter of urgency and duly corrected, given that at the moment the threats are much smaller.

Table 6: General analysis of the internal and external factors of the honey chain of Serra ofCativara-PI

Forces	110
Weaknesses	37,5
Opportunities	70
Threats	67,5

Source: Prepared by the authors (2020), based on the MATRIX SWOT 3.0 system

The general analysis of internal and external factors presented in MATRIX SWOT 3.0 of the “Honey production chain in the Serra of Capivara territory in the state of Piauí”, signals the following path: The producers of this chain must first maintain their strength, trying to improve each day. It is important to take advantage of the countless market opportunities in this chain. The threats are quite significant, which is clear from the analysis. Although this chain has few weaknesses revealed by SWOT 3.0, it is necessary to minimize them so that they can be transformed into fortresses.

Finally, after analyzing the honey chains of the territories on the edge of the Sobradinho lake in the state of Bahia and Serra da Capivara in the state of Piauí, based on the MATRIX SWOT 3.0, the results obtained for the two chains were the following:

Table 7: Favorability index of SWOT analysis in the honey chain on the edge of the lake of Sobradinho-BA



Source: Prepared by the authors (2020), based on the MATRIX SWOT 3.0 system

Based on the analysis of MATRIX SWOT 3.0 of the “Honey production chain in the territory of the edge of the Sobradinho lake in the state of Bahia” (emphasis added), the favorability index of this chain is 55%, a course for the continuity of the business, obviously without forgetting the factors that must be developed and improved.

Table 8: Favorability index of SWOT analysis in the honey chain of Serra of Capivara-PI



Source: Prepared by the authors (2020), based on the MATRIX SWOT 3.0 system

Based on the analysis of MATRIX SWOT 3.0 of the “Honey production chain in the Serra ofCapivara territory in the state of Piauí” (emphasis added), this chain's favorability index is 47%, pointing to the path of business continuity, obviously without forgetting the factors that must be developed and improved.

Thus, in the perspective of developing the honey production chains in the territories of the Sobradinho lake border in the state of Bahia and Serra of Capivara in the state of Piauí, they need to develop several factors (internal and external) as pointed out in MATRIX SWOT 3.0, which infer the competitive advantages of this segment, aiming at obtaining a better performance in production and in meeting the increasing demands of the consumer market. To this end, considering that the entire production chain must work in a joint effort, both by the producers and the stakeholders (partners) that are around the chain, such as research institutions and public bodies, with the

perspective of raising the level of competitiveness of this company every day. productive chain in the territories where they are located. Thus, these data suggest new studies, as the remaining links in this chain are being developed.

Through this study, there was a scarcity of scientific articles that deal with the theme here under comment, within the analyzed territories, thus punctuating the relevance of this work.

In this sense, the importance of the theme for science is perceived in the perspective of having new studies on the honey production chain in the Brazilian Northeastern Semi-Arid.

VI. CONCLUSION

The development of a given region is a cumulative process, with macro, micro-regional and micro-economic needs (Elias; Rathmann; Azevedo; Dutra; Silva, 2009). Hence the importance of understanding the diversity of products produced and the components of the production processes.

In the context of the Brazilian Semiarid, the territory surrounding Lake of Sobradinho emerges as a favorable region for the development of beekeeping, since, in addition to an abundant bee pasture, a favorable climate for the development of this activity and an abundance of water (one of the largest water mirrors in the world), located within the area of influence of the largest beekeeping pole in the Northeast, which is the mesoregion of the Southwest Piauiense (ARAÚJO; CORREIA and SILVA, 2016).

The proposed objectives of this study were achieved. Using the strategic SWOT MATRIX 3.0 management tool, it was possible to analyze two productive chains of honey production, one in the State of Bahia and the other in the State of Piauí, both located in the northeastern semi-arid region of Brazil. The study identified areas needing process improvement.

Despite the growth in honey production in Brazil, beekeepers are still organized around their own associations and cooperatives, and these organizations are still relatively underdeveloped (Araújo et al., 2016). However, in both the Bahia case and the Piauí case found that the honey chains could be transformative for future development of local communities.

In both the Bahia and the Piauí regions, beekeeping represents a small fraction of the agro-industrial economy. But both the Bahia study and the Piauí studies indicate that well-structured action plans would improve the honey

production processes and make apiculture a more significant supplementary income.

Successful outcome will require strong partnerships with state and municipal government agencies to provide public policies and low-level investment, together with the nurture of awareness and provision of appropriate technical/vocational training and monitoring.

In the perspective of developing the honey production chains, both regions would benefit from measures aimed at improving production to meet market demand. To raise competitive levels, producers and partners/stakeholders, research institutions, and public bodies must work together. Areas that need to be addressed include provision of technical assistance, quality controls to honey producers, and developing a more robust marketing network.

This study also demonstrated the value of a management tool to analyze and diagnose variables in a clear and concise way.

Currently there is only a meagre body of relevant scientific articles concerning honey production in Brazil's semi-arid northeast. New studies will be required as improved production chains are developed. It is hoped that new research will follow this study and provide more insight into new strategies.

Using the strategic management tool called MATRIX SWOT 3.0, it was possible to analyze two productive chains of honey, one in the State of Bahia and the other in the State of Piauí, both located in the Brazilian Northeast Semi-arid. We suggested based on data analysis, training of producers, development of a wide network of marketing of the main products in diversified markets, improvement of product quality control. The study was based on the possibility of optimizing the information generated by the MATRIX SWOT 3.0 of the two honey chains, to improve the process of future decision making by managers. This work demonstrated the possibility of applying a management tool, more specifically to elaborate analysis and diagnosis, in a clear and concise way. The great contribution of the SWOT 3.0 MATRIX lies in the possibility of establishing connections between the various factors identified (Strengths, Weaknesses, Threats and Opportunities) in order to bring improvements in the organizational processes. It is expected that, based on our results, new studies will emerge that will deepen this theme more and more, giving continuity through the proposition of new strategies or even the application of other management tools. To analyze two production chains of honey in two territories located in the Northeastern Semi-arid. However, the research bibliographic, and, finally, the data analyses demonstrated that the tool used

provides the systematization and integration of information dispersed in a simple way, being applicable to the honey production chain in the studied territories, greatly facilitating the processes in the administration area.

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