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Measuring the Economic Cost of Hydrated Ethanol by the EVA®: A Case Study in the São Martinho Mill, in Brazil

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Abstract

The aim of this paper is to evaluate and measure the economic costs of hydrated ethanol during the periods from 2004 to 2012 in the São Martinho Mill (a large Brazilian company) by the EVA® (Economic Value Added) approach. We adopted as initial conception the economic costs of hydrated ethanol towards their respective sectoral economic aspects, so as to clarify the EVA® among the levels of investment versus the capital cost employed. For this, it was applied a quantitative metric within of an exploratory approach adopted in the studies by Saito, Savoia and Angelo (2011). Results offer reflections that the São Martinho Mill is in a situation of economic value aggregation and emphasize the importance of adequacy of capital costs from the year 2012 in order to align the metric and also allow the assessment of investments and achieve economies of scale by the optimizing of the production cost, enabling the real perception of the assessment by the shareholders on an analysis of the next cycle of the EVA® performance. Results also allow us to infer the importance of parametric consideration of the capital cost, and moreover, in parallel, reinforce the need to understand the structure of the operational cost, hence the need for a new approach to the opportunity capital cost.

Keywords: economic cost, EVA®, hydrated ethanol, São Martinho Mill, Brazil

1. Introduction

With the globalization and technological growth, the competition among businesses has increased worldwide, being necessary to increase their competitiveness to ensure its place in the market (Sánchez, Vijande, & Gutiérrez, 2010; Souza, Milito, & Pontes Jr., 2011; Islam & Meade, 2012). So to remain in the competitive market, companies need to acquire more knowledge about the sector which they operate, and also, seek to use the management tools available for measure the values that an organization has acquired in a determinate period (Kim, 2006; Hu, 2010).

One of the tools available to assess in a useful way the value number that an organization acquires in a determinate period is the Economic Value Added—EVA® (Altendorfer & Jodlbauer, 2011; Ismail, 2011; Sobue & Pimenta Jr., 2012). According to Sobue and Pimenta Jr. (2012), the EVA® is used to measure the companies' performance, because is an indicator that showing parameters which the high management and investors can use to check the evolution of the companies' economic value. That is, it represents a measure of economic profit in which subtracts the capital cost from operating profits in a company.

Thus, the EVA® is also considered as a management tool, which according to Wet (2005), Lee and Kim (2009) and Kryzanowski and Mohsni (2010), yonder to measuring the company's performance, this index allows the setting of targets and improves the communication between investors, also defining the capital value; Which makes it a great usability tool for companies that looking to increase its value and its competitiveness in the market.

This tool will be used in the present study which is focused in the Brazilian hydrated ethanol industry. Currently, according to Lima et al. (2012), this is one of the sectors in Brazil which has been growing and excelling

substantially, presenting technological developments in its complex cluster of sugarcane power. However, a reduction in production costs and increased productivity is expected, seeking to answer to a market fuel that goes on besides of competitively and alternative or green energy.

With the growth of hydrated ethanol industry and the importance of using of EVA® to verify the companies' performance, this study presents the following problem: what is the economic cost of hydrated ethanol in the parameterizations of EVA®. Defined the problem, the aim of this study is to evaluate and measure the economic cost of hydrated ethanol during the period 2004 to 2012 at São Martinho Mill (a large Brazilian company) with the approach of EVA®. The theme is justified due to the growth of the hydrated ethanol sector in Brazil and in worldwide industry, as well as to consolidate the organizational valuation to the parameterizations brought by EVA® as a management tool to improving the companies' earnings. Also, the relevance of this study is to assist in the discussions about analysis of organizational performance regarding to its valuation, as well as in the guidelines that drive the profitability of the operations.

In the following sections, we will discuss the conceits of economic costs of hydrated ethanol, evidencing the growth of the sector, and the conceptual bases on the EVA® which establish the results, adopting also the comprehension of opportunity cost under the accounting slope. Also, based on those propositions, we seek to evaluate and measure the EVA® to identify parametric reflections that enables new advances in the methodological procedures used.

2. Theoretical Review

2.1 Economic Costs of Hydrated Ethanol

Based on the conceptual considerations of costs associated to the production, Souza and Clemente (2007) associate the concept of cost of production with the total cost of the production process. For the authors, the production cost is, in a certain period, the value of all goods and services consumed in the process of transformation of raw materials into finished products i.e., an accounting definition that also is based by total cost.

Still, in the conception of costs, to understand its distinction related to the economic costs, has in the approach of Bacic (2008, p. 28), that the total cost should "add certain profit margin due to be associated within a reality of operation level and volume of sales considered consistent with the structure of the company". In addition to exploring relationships between unit costs, volumes of production and sales prices per product, the author also points out in his reasoning about cost of production that, front to the competitiveness challenges, the cost management should be considered in the competitive and strategic aspects while preserving an approach to the economic sphere. This occurs because this perspective acknowledges that the cost is not only a phenomenon of accounting, but also marketing, resembling with the economic cost.

On the other hand, the economists admit that the approach of the economic cost can be defined in two equivalent ways: first is that the market value of all inputs used in production; and second is that also the market price in the most efficient use of inputs in the production process (Binger & Hoffman, 1998).

Still, under this economic approach, Binger and Hoffman (1998) complement the understanding of the production cost, associating it with another definition: opportunity cost (which represents the best alternative for the use of inputs); on this aspect is that it characterizes the economic cost. That is, the economic cost includes the cost of production and the opportunity cost. It is worth noting that the production cost of an organization should be related to the intended goals of production and its respective restrictions. Thus, starting from the assumption that an organization, among its objectives, also maximizes the profit, then it should necessarily produce the lowest possible cost.

It is understood that technological advances in the productive chain of hydrated ethanol directly impact on reducing the costs of ethanol production and in increased productivity, being achieved through the efforts of the agricultural efficiency of cultivars, varieties of sugarcane and improvement in turbidity of the broth. These technological efforts emerge at the expense of an opportunistic fuels market which focus on the alternative use of fuels, since ethanol also provides the technology for the manufacture of ethylene which is the raw material for the plastics industry, as well as the farnesene that serving to the diesel production (Lima et al., 2012).

Particularly, the hydrated ethanol is associated with a flex-fuel vehicle market in high booming. According to Goldemberg et al. (2008), the technology of flex-fuel vehicles was effectively launched in 2003, and reached in less than five years, a share of over 90% of light vehicles produced.

To this, Brazil still has the conventional production platform in the ethanol production (in which prevails ethanol production by the first generation) made by the fermentation of rich materials on starch or sucrose, which can

still add the generation of electricity through cogeneration with steam cycles (one currently commercial option) (Lima et al., 2012; Lima et al., 2013).

Once observed that the ethanol production is feasible by the first generation, it could be emphasized that the efforts in productivity gains and cost savings should be concentrated in the agricultural sector through the harvest and the genetic improvement of sugarcane. And only part of the efforts should be promoted in the industrial area which currently is revealed through technology of dosage with polymer that provides increased sedimentation rate, compression and reducing the volume of sludge with increased filterability, loss reduction of sucrose, and especially, improvement in the turbidity of the broth. That is, in the agricultural stage there is a greater possibility of production range and therefore reduction in the ethanol production costs (Bernardo, 2009; Lima et al., 2012).

Thus, it is evident in the use of hydrated ethanol, paths that theorizing the opportunity in a marketing view of add value to the industry/mill, in relation to the possibilities of alternative uses in parallel to efforts to optimize production costs (Lima et al., 2012; Lima et al., 2013).

2.2 Economic Value Added—EVA®

With the globalization there has been a growing increase in the competition, thus, to maintain their competitive edge the companies need to maintain competitively (Islam & Meade, 2012; Pangarkar & Wu, 2012). For this, the companies need to acquire more knowledge and to use the management tools available to measure the value that is being added to the business and verify the feasibility of new projects (Kim, 2006; Hu, 2010).

The organizations generally seek results, which is an unquestionable truth. To this, the big challenge is in the form in which this will be possible, as the market environment has scarce resources and limited. Thus, the decision process becomes important, since it contributes directly in the income of companies i.e., correct or incorrect decisions directly influence the profit or loss of the companies (Santos & Watanabe, 2005; Basso, Oliveira, & Kayo, 2008).

There are several ways to measure the economic performance of an organization. According to some authors, the value of the organization and its practices is an important parameter for decision-making (Stewart, 1990; Copeland, Koller, & Murrin, 1995; Knight, 1997). For Shinohara (2003), the company's value is maximized when it is possible to maximize both the value of the company's operations and its growth expectations.

Thus, the EVA® (also known as Economic Value Added) developed by Stern Stewart & Co. arises in the 80s, to assist the companies in conducting their activities (Stern Stewart & Co., 2013). Studies indicate that this management tool allows the organization to make decisions based on adding value to the company itself, i.e., plan and decide actions that increase the company's value (Stewart, 1991; Carvalho, 2000; Shinohara, 2003; Kim, 2006; Medeiros, 2009; Hu, 2010; Altendorfer & Jodlbauer, 2011; Ismail, 2011; Sobue & Pimenta Jr., 2012).

Used to measure the performance of companies, the EVA® is an indicator that displays parameters by which the high management and investors can use to check the evolution of the company's economic value (Sobue & Pimenta Jr., 2012).

However, the existence of this indicator is not as recent as the issue of globalization. According to Carvalho (2000), the first use of the term Residual Income which is a measure of the net gain less interest on own capital invested at the current rate, was responsibility of Alfred Marshall I in 1890. Already in the 1960s in the United States, this concept was then introduced into the financial management literature due to studies by Joel Stern and G. Bennett Stewart III, who became partners and founders of audit and consulting firm Stern Stewart & Co. which patented the term Economic Value Added. The growth of this company was due to increased use and disclosure of EVA®.

The EVA® is also known as Economic Profit (EP), Residual Income (RI), and Economic Value Management (EVM) (Carvalho, 2000). Thus, according to the definition created by Stern Stewart & Co. (2013) for this method, the value added is found by deducting all costs including the opportunity cost.

For Sobue and Pimenta Jr. (2012), this method can be applied even in different business units. In this sense, according to the authors, the EVA® is defined as the measure of economic profit that is subtracted from the capital cost of operating profits. Still, one of the advantages of this indicator is to enable the relationship between internal performance measures and evaluation carried by the capital market.

Also, according to Shinohara (2003), Medeiros (2009) and Ismail (2011), the EVA® is a measure of performance in which all operating costs, even the opportunity, are considered i.e., this index is the operating income of the organization after the rates less the tributary burden on the capital provided by third parties and shareholders. In

this way, it will be shown how much was generated more than the minimum return required by the suppliers of capital for the company.

Therefore, the EVA® is a way of measuring the operating performance, evaluating the actuation of the company and enabling an evolution in their financial management through the planning activities. This makes the company more attractive to shareholders, since the company is preoccupied with its performance and its value, increasing its competitiveness. In this regard, besides being an indicator of performance, the EVA® is also a management tool, since it allows: to measure the company's performance; to mark the targets and the bonuses payable; to improve the communication between investors; and, set the capital value (Wet, 2005; Lee & Kim, 2009; Kryzanowski & Mohsni, 2010; Girão, Machado & Callado, 2013).

Shinohara (2012, p. 29) presents four characteristics that make the EVA® more advantageous than other management tools:

> ***1*** *- It is a complete measure – the EVA® is superior to the traditional measures of income (such as net income, EBIT, EBITDA, etc.), because it balances properly the invested capital to generate profit, considering all costs including the capital cost of shareholders;* ***2*** *- It is an absolute value, and not percentage – investors are interested in absolute gains and not percentage: you win more with a 10% return on invested capital of $ 1000 than a 100% return on capital invested of $ 100. Accordingly, the EVA® is greater than the return measures;* ***3*** *- The EVA® can be tracked period to period over time– unlike what happens with the discounted cash flow method, is the fact of the EVA® "married" the investments with the benefits that they generate, makes it comparable between periods;* ***4*** *- The EVA® minimizes accounting distortions – the adjustments made in the calculation of EVA® correct various distortions that exist in traditional accounting: non-operating income, amortization of goodwill, etc.*

For Kyriazis and Anastassis (2007) and Sharma and Kumar (2010), the EVA® is a measure of organizational performance of aid to business management, therefore, its calculation can be performed in divisions or independent business units of the organization as a whole; considering the flows and not the prices of stocks and allowing the realization of computations in periods of time; and also, providing the wealth creation for shareholders of the organization.

Thus, according to Stewart (1991), the calculating of the EVA® is obtained by using the following formula:

$$EVA® = NOPAT - Capital\ Charge$$

In which:

NOPAT = *Net Operating Profit after Taxes*.

Capital Charge = Capital Employed *x* Capital Cost.

Obviously there are a number of criticisms about the EVA®. Telaranta (1997) affirms that the EVA® has a correlation with the share quotations, but with levels of clarity lower than other indicators. Other authors (Uyemura, Kantor & Pettit 1996; Milunovich & Tsuei, 1996; Grant, 1996) also bring studies that show the method related to the existing stock return, but with a bland format and with low frequency.

From these discussions, Medeiros (2011) sought to examine whether the EVA® really was not an effective analysis tool or if some adjustments could be made to determine the stock return more efficiently than previous authors. The conclusions found were that the EVA® historic is extremely important for check the stock return. The author further states that the possible causes for that the others have not found such correlation between the method and the stock price is due to non-use of past data. In the same view, O'Byrne (1996) identified that the EVA® contributes about 33% for the measurement of market value, but that EVA® historic is also very important for this measurement and contributes about 55% of the shares value.

Unquestionably, the EVA® is a good method of management which is consolidated both in business and in the academic world, known by investors and the market in general (due to the easy applicability of this method and its easy comprehension for extensive use) (Ehrbar 1998; Oliveira et al., 2012). Complementary to this idea, Shinohara (2003) commented that EVA® could be the only administrative metric to be used as managerial tools for companies due to their level of control and their wide use.

Still, from the perspective of benefits of EVA®, can be said that it: stimulates the employees of the organization; provides distinctive capabilities of competitiveness; awareness from management; entrepreneurial management for formation of value; segmented evaluation by business opportunity of decisions taken; facilitates the creation and tracking of targets in the short, medium and long term; and, favors the securities brokers (Stewart, 1991; Shinohara, 2003; Wet, 2005; Lee & Kim, 2009; Kyriazis & Anastassis, 2007; Sharma & Kumar, 2010; Kumar &

Sharma, 2011a, 2011b).

Shinohara (2003) also argues that the EVA® is the best of all methods of management due to four main factors:

1) Correct contraposition of invested capital in order to generate profit;
2) The value found it is an absolute value and not percentage;
3) Can be monitored periodically and progressively;
4) Minimization of the accounting distortions.

2.3 Opportunity Cost

In turn, the opportunity cost is defined by the remuneration that would have been obtained if the money used in the project had been invested in another project with the same level of risk. This concept has generated discussions regarding the "economic cost" and "accounting of cost" (Ambrozini, 2011).

Thus, Beuren (1993) supports the concept of opportunity cost in economic view, determining it as the value of production factors (i.e., net income applied as the best alternative use). The author states that in the economic approach, the value of production factors that define the opportunity cost are found in the market.

Another factor of the opportunity cost is that the choice of an alternative involves the sacrifice of the alternatives not chosen. So, Panarella (2010) affirms that the opportunity cost expresses the relationship between choice and scarcity, because when any shortage arises, not all demands will be met. Therefore, it is necessary to choose the best alternative use of net profit, creating and selecting the alternatives rejected.

In an accounting view, the opportunity cost is defined by Beuren (1993), as the value of the benefit that is not gained when choosing a path over another in the decision-making process. That is, the profit that could have been generated if it had been applied to other alternative, or the value that the company sacrificed for having applied the resources given to other alternative. The author further explains that the opportunity cost can be understood as the profit that could have been achieved.

3. Methodology

This is a quantitative research, according to the classification of Silva (2006), that is based on specific measurements and is treated by mathematical procedures in which the results lead to a conclusion about a phenomenon or relationship.

Oliveira et al. (2012) state that the quantitative research uses statistical methods as basis to prove or disprove hypotheses, numbering and measuring units for define goals. That is, the quantitative research translates the information into numbers to classify them and analyze more objectively.

The study has also an explanatory nature, since according to Silva (2006), it aims to make something more understandable, explaining its main reasons. Thus, it deepens the knowledge of reality, explaining the reason of things and identifying the factors that determine or contribute to the occurrence of the phenomena.

Still, the survey refers to a case study which is a way to organize data around a chosen unit. So, it is considered that from this definition that the study can be composed by a research on the financial statements of a company, as such statements are organized data in around an organization. Thus, this study requires planning with the following protocols to be presented: the scope of the study, structuration, and techniques for data collection and data analysis (Oliveira et al., 2012).

For perform the research were collected the financial information of the company Sao Martinho S/A which operates in sugarcane power industry, listed in the Stock Exchange of São Paulo (BM&FBovespa), in order to assess and measure the Economic Costs of hydrous ethanol for the periods 2007 to 2012 through the EVA® approach. Therefore, the data used in this study are classified as secondary because they have been collected for purposes other than not the problem of the paper in question.

So, the study presents the measurement of EVA® in the Sao Martinho Mill. As discussed previously, the EVA® is the result of deducting all operating costs of the company's revenues, treating of the economic measure of the company i.e., the measurement of the wealth generated in a given time.

The measuring of EVA® was conducted from the studies of Saito, Savoia and Angelo (2011), which it considered the result of the deduction of all operating costs of revenues in order to identify the ROE (Return on Equity). And in this study, the opportunity cost was parameterized by the Interbank Deposit Certificate (IDC). The value object for analysis, the EVA®, will reflect an economic measure capable of measuring the wealth created among the period from 2004 to 2012. For this parameterization of EVA®, it will start from the following formula:

$$EVA^{®} = (ROE – ke) \times Equity$$

In which:

$EVA^{®}$: is the economic profit;

ROE: is the return on equity. In this paper, is computed by dividing net income and shareholders' equity, listed on financial statements ended each year studied;

ke: is the equity cost. In this study, we considered the value defined as the opportunity cost of the IDC;

Equity: is the equity invested in the company. In this paper, it is represented by net equity accounted in the year-end.

The parameters in this study adopt the metrics of ROE, equity and cost of equity, which in accordance with Saito, Savoia and Angelo (2011, p. 106):

> *ROE indicates the profitability calculated by the company on the funds invested by shareholders and, when subtracted from the opportunity cost of these investors – ke –, we obtain the so-called economic spread of the shareholder, which multiplied by the Equity, it results in the wealth provided by the risk involved in the investment made by shareholders. The EVA® is based on the intuitive notion that firms should generate more wealth than the cost of capital employed in its activity. Once obtained the EVA® and collecting the amount of revenues calculated in a year, it is can calculate the total cost of a company that embraces the opportunity costs, in contraposition to the accounting metrics.*

4. The Case Study: São Martinho Mill

The São Martinho Group is among the largest Brazilian organization of sugarcane power. The organization has three mills operating in Brazil: São Martinho located in Pradópolis, Ribeirão Preto/SP; Iracema located in Limeira/SP; and Boa Vista located in Quirinopolis/GO. Beyond them, the group still holds 32.2% of Santa Cruz mill, also located in the region of Ribeirão Preto/SP (São Martinho, 2013).

According to data from São Martinho Mill (2013), the production is segmented between ethanol and sugar. The Mills of São Martinho and Iracema produce both ethanol and sugar; meanwhile Boa Vista mill produces only ethanol. The mills of the group have energy generation technologies produced through the burning of cane bagasse, this ensures to the company energy self-sufficiency and selling surplus energy.

The production capacity of the Mills in the 2012/2013 harvest was 12.9 million tons of sugarcane, besides 969 tons of sugar and approximately 451,000 tons of ethanol. Moreover, the average level of mechanization of the harvest was 88.8% (São Martinho, 2013).

According to Table 1, the company has the vast majority of its shares distributed among LJN Participações S/A (56.12%) and Free Float (37.16%) besides having no preferred shares distributed.

Table 1. Distribution of shares of São Martinho mill

Shareholder	Common Shares	%	Preferred Shares	%	Total	%
LJN Participações S/A	63,414,288	56.12	-	-	63,414,288	56.12
Indirect Controlling	5,389,224	4.77	-	-	5,389,224	4.77
Administrators	1,401,510	1.24	-	-	1,401,510	1.24
Audit Committee	-	-	-	-	-	-
Treasury Shares	807,600	0.71	-	-	807.600	0.71
Free Float	41,987,378	37.16	-	-	41,987,378	37.16
Total	113,000,000	100.00	-	-	113,000,000	100.00

Source: São Martinho (2013).

In addition the São Martinho Group produced in the harvest concerned 176 megawatts hour (MWh) and accounted for 3.04% of all ethanol produced in Brazil, 2.41% of all sugar produced in Brazil, and 2.20% of all sugarcane produced in Brazil. The acreage of the Group is 110,000 hectares.

5. Results from EVA®

In the results from Table 2 there are evolution bands of 2004 until 2012 of the EVA® value of São Martinho Group:

Table 2. Calculation of EVA®

Date	EVA® (R$)	Net Equity (R$)	ROE	IDC (%)
2004	- 1,031.66	356,205.00	- 0.0179	16.150
2005	1,890.07	362,863.00	0.0274	18.990
2006	3,139.47	363,328.00	0.0575	15.030
2007	7,913.29	1,671,480.00	0.0401	11.810
2008	6,039.92	1,648,965.00	- 0.0296	12.378
2009	6,949.22	1,576,702.00	- 0.0446	9.876
2010	12,344.95	1,909,391.00	0.0663	9.750
2011	16,497.58	1,953,486.00	0.0728	11.595
2012	8,705.82	2,024,678.00	0.0512	8.397

Source: From authors.

It is observed that EVA® only in 2004 was negative regardless of ROE. The net equity was increased in almost every year and the rate used as a benchmark for the cost of capital formation was the Interbank Deposit Certificate—IDC which over the years has fluctuated in fall, contributing to the hypothesis that EVA® (in 2004) is variable to the extent that rated their positive relationship with the IDC.

Such fluctuating in the economic aggregates can be understood as opportunity cost. Also, considering the level of economic activity in the heated sector of hydrated ethanol resulting from the alternative uses of sugarcane and technologies that promote productivity and optimization of production costs, there are signs that the Mill is in a situation of aggregation of economic values over the years 2004 to 2011, and in 2012 the slowdown is reflected in the condition of aggregate diseconomies to the variable opportunity cost (ICD), since this kind of parametric reduces about 16% in 2004 to 8% in 2012. This effect is related to the importance of parametric consideration on the capital cost, and moreover it reinforces the need to understand the operational cost structure in parallel with the need for a new approach to the opportunity cost of equity.

6. Final Considerations

The analysis from 2004 to 2012 at the economy sectoral level, initially, revealed the technological employ in the different uses of the feedstock ethanol production to be hydrated, but also useful in producing of ethanol fuel, plastic and even diesel. And this fact, while revealing a heating sector (related to the aggregation of values incorporated into the Mill), the study object showed that the sectoral monitoring in parallel to the performance of EVA® reveals considerable discussions.

Once the EVA® was reduced only at the instant that the capital cost (understood as IDC, in this study) decreased by 100%, based on 2004; which demonstrating that the parametric of capital cost of or opportunity cost to the sugarcane power market also needs of reflective parameters about the opportunity cost from businesses. And analogously, observing only the contents of the EVA® over the period, you will not notice that his fall also resembles the levels of investment, so it is also important assess the amounts invested together with the capital cost.

Also, the adoption of the opportunity cost with the IDC in Brazil for evaluate the economic performance of a company by the EVA® method, revealed analysis distortions in understanding their real economic measurement. Although the EVA® represents a tool that can measure the difference between the operating profit and the cost of all capital employed, such method does not validate its performance analysis when one has a significantly oscillating of the ICD, demonstrating that if this is volatile, the opportunity cost is also. However, parameterize

returns over a period considering the effects of the IDC equivalent to the weighted average cost of capital, it does not corroborate with the opportunity cost of capital, and also with the debt capital of long-term. The oscillation of the year from 2004 to 2012, gives a variation in the IDC of 92.33% drop, which is not to say that this parameter corresponds to an expectation that the investment in 2004 would suffer such an economic perspective. Although the value of EVA® is positive from 2005, the company has not obtained a higher profitability of capital cost employed under the actual prospects of the opportunity cost, due to the large variation of the IDC.

The results offer reflections under the sectoral considerations regarding to the investment decisions and capital cost. That is, it is need suit to the determining of the equity cost, so that it is possible to obtain not only the merged evaluations and parameterized by EVA®, as also the measures that stimulate investment and economies of scale, in which the benefits can be reflected from the interests of shareholders.

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