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THE IMPACT OF THE INVESTMENT CLIMATE ON TOTAL FACTOR PRODUCTIVITY (TFP) IN THE AGRICULTURAL SECTOR: THE CASE OF HANOI, VIETNAM

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ABSTRACT

This study measures the impact of investment climate factors on the total factor productivity (TFP) of agricultural manufacturing firms in Hanoi, Vietnam. Endogeneity of the production function and of the investment climate variables is addressed by using econometric models, based on individual firm information, and by aggregating investment climate factors by various business lines. Specifically, the analysis is conducted in two steps: first, an econometric production function is estimated to produce a measure of TFP at the firm level; in the second step, variation in TFP across firms is statistically related to indicators of the investment climate as well as firm characteristics. The result yields a number of insights on the factors that underlie productivity. In a variety of business lines, indicators of poor investment climate, especially the *administrative clearance time* variable which has significant negative effects on total factor productivity. Decreasing by one hour in administrative clearance time could increase TFP by 1.7 - 5.7%. Indicators such as *time of land rent, certification of clean production, market competition, age of the firm,* and *educated labor* have positive effects on TFP. However, levels of effects from investment climate factors on TFP are different among business lines.

Key words: agriculture, impact factors, firm level

INTRODUCTION

As a developing country, Vietnam has to face pressure and impact of globalization. In order to address these problems, it seeks ways to stimulate growth and employment within the context of increased openness. Vietnam is now focusing on issues of competitiveness and productivity through micro-economic reform programs after having a reasonable level of macro-economic stability over the past twenty years.

The economic performance of a firm is influenced by two types of factors. The first type is composed of internal factors such as the technology embodied in the firm's capital stock, its management practices and its marketing strategies. The second factor type may be referred to collectively as the investment climate: the policy and institutional environment in which the firm functions. Even the best-managed firms have difficulty flourishing in a bad investment climate.

Many conceptual and empirical researches show that the investment climate can significantly and adversely impact productivity, growth and economic activity (Mendes *et. al*, 2009; Bosworth and Collins, 2003; McMillan, 2004; He et al., 2003; World Bank, 2002 and World Bank, 2004 a, b). Prescott (1998) argues that to understand large international income differences, it is necessary to explain differences in productivity (TFP). His main candidate to explain those gaps is the resistance to

the adoption of new technologies and to the efficient use of current operating technologies, which in turn are conditioned by the institutional and policy arrangements a society employs (investment climate factors). Thus, investment climate assessments have become a standard instrument for identifying key obstacles to country competitiveness and imputing their impact on productivity, in order to prioritize policy reforms for enhancing competitiveness.

In this paper, the impact of investment climate factors on the total factor productivity of agricultural manufacturing firms was examined. Methodologically, a two-step analysis of agricultural manufacturing firms surveyed in Hanoi is conducted. In the first step, we estimate a measure of total factor productivity for each firm in the survey. In the second step, we test for a statistical relationship between the productivity measure and indicators of both types of factors: those internal to the firm and those related to the investment climate.

Previously, some studies examined the impact of investment climate factors on the total factor productivity. With main objective of the productivity impact of the investment climate variables in order to improving country competitiveness and productivity in Guatemala, Honduras and Nicaragua, Escribano and Guasch (2005) developed a methodology to estimate appropriately using the two-step analysis.

Uma and co-authors (2005) measured the impact of the investment climate factors on the total factor productivity (TFP) of firms in China and Brazil by estimating TFP base on production function at the firm level and then, testing TFP across firms with indicators of the investment climate as well as firm characteristics. Mendes and co-authors (2009) also used the two-step analysis to evaluate the effects of infrastructure investments on total factor productivity in Brazilian agriculture.

Analytical Model

Measuring Total Factor Productivity

Productivity refers to the effects of any factor different from the inputs affecting the production process. Measuring TFP generally requires an empirical specification of the production function (1). Because of data restrictions, it is often more practical to specify a value added production function of the form, where Y represents value added, K represents capital services, M represents intermediate materials, and L represents labor inputs.

$$Y = f(K, L, M) \quad (1)$$

Measurement is usually based either on time-series data or on cross-sectional data. While aggregate or firm-level data can be used for either type of analysis, time-series analysis generally employs data on aggregates of firms and cross-sectional analysis usually employs data on individual firms.

Growth accounting methods are used to identify the rate of growth in TFP in time series data by subtracting the effect of growth in inputs from growth in output. The residual is the growth rate of TFP:

$$\Delta TFP = \Delta \ln Y + \alpha_1 \ln K + \alpha_2 \ln L + \alpha_3 \ln M \quad (2)$$

where $\alpha_{1,2,3}$ are the cost shares of *L, M* and *K* respectively. This type of measure is used by national statistical agencies to track productivity improvements through time. It does not permit a quantitative partition of TFP into technology and efficiency improvements, since both types of improvements occur over the course of the time-series and contribute to growth in TFP.

Cross-sectional analysis generally defines some index of relative TFP for each firm *i* defined

as follow:

$$\phi_i = \frac{Y_i}{f(K_i, L_i, M_i)} \quad (3)$$

such that $\Phi = 1$ indicates the central tendency of TFP in the cross section. A value of Φ above 1 indicates high TFP relative to the firms in the cross section, while a value below 1 indicates low TFP.

Rearranging (3):

$$Y_i = f(K_i, L_i, M_i)\phi_i \quad (4)$$

If we assume Cobb-Douglas production technology and that the TFP index can be written $\Phi_i = v_i$, (4) is specified as,

$$Y_i = AK_i^{\alpha 1} L_i^{\alpha 2} M_i^{\alpha 3} e^{v_i} \quad (5)$$

which can be transformed into a linear expression amenable to regression methods:

$$\ln Y_i = \ln A + \alpha_1 \ln K_i + \alpha_2 \ln L_i + \alpha_3 \ln M_i + v_i \quad (6)$$

In the equation (6), the natural logarithm of the TFP index is equal to the residual term in the econometric production function. However, interpretation of the residual term in this way should be done with caution. Measurement error is also likely to have an effect on the size and distribution of the residuals. A more conservative conclusion is that firm level variations in TFP account for a substantial component, but not all, of the residual values.

The TFP analysis in this paper is based on cross-sectional data at the firm level. It is important to bear in mind that in a cross section collected in one year or over a relatively short interval, all firms have access to the same level of technology. Thus variations in TFP may be attributed principally to variations in efficiency rather than variations in technology. Recent improvements in technology, however, may increase the level of variance across firms as some are more successful than others in moving toward the new productivity frontier (Alvaro and Luis Guasch, 2005)

TFP and Investment Climate

While measurements of TFP are informative in themselves, from a policy perspective it is much more valuable to relate these measures to factors that underlie the environment in which the firm operates. Therefore, we are not only measure TFP for individual firms in the survey, but also try to identify factors that explain a significant proportion of the variability in TFP. The purpose of this section is to evaluate the productivity impact of investment climate factors at different levels of aggregation of firms' characteristics.

In general, a firm's TFP depends on characteristics of the firm itself and on characteristics of its external environment that affect its economic performance (Alvaro and Guasch, 2005; Uma *et. al*., 2005). Relevant characteristics of the firm may include its size, age, ownership, location and various proxies for its innovativeness or the quality of its management (Trung *et. al.*, 2009).

Investment climate refers to the external environment of the firm. Mendes (2005), Zhang and Fan (2004) showed the factors that affect agricultural TFP such as electricity, telecommunications, storage capacity of warehouses, transportation, irrigation, and macroeconomic policies. When assessing the situation of attracting FDI in agriculture and rural development in

Vietnam, Hung (2006) indicated that land ownership is fully not recognized and renting agricultural land has many difficulties because of urbanization. Instability of renting time results in the decrease in economic performance. He argues that unstable situation of land use results in limited investment and then, reduces TFP. Classical input of production function, both of the quantity and quality of labor resources available to the firm, influence its TFP. More skilled employees improve their efficiency more rapidly with experience, move more easily from one task to another and allow the firm to embrace technological improvements more rapidly. Transaction costs associated with regulations and bureaucracy are resources diverted from productive and effective uses of scarce resources and have significant implications for economic performance (World Bank, 2004). Bureaucratic delays and poor institutions have a similar effect on access to markets and trade performance (Hung 2006; Groot, *et. al,* 2004). Martin (1998), Cuong (2005), and Hung (2006) proved the ability to move goods from the production site to markets is critical to efficient production. Poor logistics result in excess costs and delays that reduce TFP. Unreliable logistics services may require the firm to maintain excess inventories, which again divert resources from production. The quality of logistics services depends on a number of factors, including the quality of public infrastructure, (Limao and Venables 2001), the presence of high quality service providers and, especially in the case of import and export logistics, the efficiency of institutions and bureaucracy such as customs (Subramanian and Arnold, 2001; Subramanian, 2001). The level of competition in the domestic market may have a positive impact on productivity (Cuong, 2005; Uma, *et. al*., 2005). In the study entitled "Opportunities and constraints for safe and sustainable food production in Hanoi", Anh and co-authors (2004) showed that effects of food security on TFP are enormous.

Given a set of indicators for both the characteristics of firms and the characteristics of their business environment, we hypothesize that TFP for firm *i* can be defined as:

$$\phi_i = \prod_k F_{ik}^{\gamma_k} \prod_j E_{ij}^{\beta_j} e^{\varepsilon_i} \qquad (7)$$

where the *F* are characteristics of the firm, the *E* are characteristics of the firm's external environment, the γ and β are statistical parameters and ε is a "white noise" stochastic term (Uma et al. 2005). Taking logarithms of both sides of Equation (7) yields Equation (8):

$$v_i = \sum_k \gamma_k \ln F_{ik} + \sum_j \beta_j \ln E_{ij} + \varepsilon_i \qquad (8)$$

Data Description

A survey was conducted in Hanoi for two main reasons. Firstly, Hanoi has much potential for developing agricultural production because of having many research institutions and universities, good infrastructure, large market, and other favorable natural conditions. Secondly, the urbanizing process results in situations of agricultural land losses that characterizes the situation in Hanoi. Primary data were gathered through personal interviews of individual firms. Additional information related to the research problem was also collected from various agricultural institutions and local municipalities. The information gathered included: (1) characteristics of firm such as general information, agricultural production, operating capital, firm's incomes; and (2) characteristics of investment climate such as policies applied, public utilities, labor resources, land allocation, regulation and bureaucracy. One hundred and sixty agricultural firms consisting of companies, cooperatives and farms were chosen through stratified random sampling.

The survey data in Hanoi includes 160 usable observations that are about evenly distributed across suburban districts of Hanoi which focus on agricultural production: Tu Liem, Thanh Tri, Gia Lam, Dong Anh, and Soc Son. They are also roughly distributed across five business lines (Table 1).

Table 1. Observations by district and business lines.

District	Planting	Animal	Aqua-culture	Mixed production	Processing	Total
Dong Anh	11	10	7	5	5	38
Gia Lam	7	6	3	5	7	28
Soc Son	9	8	8	7	9	41
Thanh Tri	6	9	6	5	3	29
Tu Liem	4	7	6	5	2	24
Total	***37***	***40***	***30***	***27***	***26***	***160***

Source: survey data

Tables 2 indicates that processing firms' TFP is the highest, the average TFP is 1044.85 million VND. Positive skewness value means that the TFP that is obtained by processing firms mainly contains low TFP. The survey data also shows the average TFP of planting firms is 279.72 million VND. The TFP of planting firms varies largely across planting firms because its standard deviation is relatively large as compared to its mean. A positive skewness of 1.51 and kurtosis of 0.92 mean that the TFP of planting firm distribution has a short right tail: some planting firms have small size of TFP.

Table 2. Descriptive statistics for TFP by business lines.

Business lines	Mean	Standard Deviation	Skewness	Kurtosis
Planting	279.72	379.98	1.5109	0.9179
Animal	93.68	135.58	2.3821	5.4360
Aquaculture	158.48	194.32	2.3279	6.5469
Mixed	181.55	317.83	3.3024	11.8473
Processing	1044.85	1952.15	3.2405	11.5366

Source: survey data

The average TFPs of animal, aquaculture and mixed firms also have positive skewness and great values of kurtosis mean that distributions of these firm's TFP have long right tails: many firms have small size of TFP.

RESULTS AND DISCUSSION

Estimating TFP

The first step in the analysis is to estimate the production function (6). The variables *Y, K, L* and *M* are derived from the survey data as follows:

- Value added (*Y*) is calculated by subtracting materials and energy costs from the total value of sales;
- Capital *(K)* is defined as the total book value of assets;
- Labor *(L)* is defined as the total number of employees (including contractual employees) working at the firm's main production facility at a given time; and
- Intermediate material *(M)* is defined as the material costs.

Table 3 present the GLS parameter estimates for equation (6). As the results shown in Table

3, the capital, labor and material factors have positive effects on TFP by five producing lines.

Table 3. Value added production function OLS parameter estimates.

Variables	Planting	Animal	Aquaculture	Mixed	Processing
capital	0.2697	0.2057	0.3298	0.2743	0.2348
	(0.093)	*(0.042)*	*(0.075)*	*(0.030)*	*(0.025)*
labor	0.5302	0.4026	0.2760	0.8047	0.4794
	(0.003)	*(0.084)*	*(0.092)*	*(0.001)*	*(0.004)*
material	0.1596	0.2244	0.1998	0.2242	0.2594
	(0.089)	*(0.011)*	*(0.065)*	*(0.036)*	*(0.037)*
No. observation	37	40	30	27	26
R squared	0.650	0.667	0.526	0.647	0.719
Pro > F	0.000	0.000	0.000	0.000	0.000

Note: P-values (t-test) are shown below parameter estimates (in brackets)
Estimates significantly different from zero at the .01 level are shown in italic.

Estimating the Effects of the Factors on TFP

Based on the definition of TFP and the residual terms estimated from the production functions described above (equation 8), the next step in the analysis is to identify factors, including firm-level factors and characteristics of the investment climate, that explain variations in TFP across agricultural firms.

Educated labor (*edulab*): Factors relating to labor quality are also somewhat ambiguous as to whether they reflect the firm or its environment. Labor skills are naturally limited by the skills in the local labor force, but within the same labor market some firms may choose to hire the highly skilled workers while another chooses the lowest cost workers. From a number of different measures of labor quality we found that measures of formal education were important for *edulab* (including years of education and proportion of college graduates).

Age of the firm (*age*): This firm characteristic included was age, defined as the number of years since the firm went into business. Expectations on age are ambiguous. Learning by doing would suggest that productivity increases with age, but there may also be a negative vintage effect if the age of capital is correlated with the age of the firm.

Time of land rent (*rentime*): Since the firms have to rend land for their operating, we examined this factor, *rentime* that measure of the length of time of land rent (year). The effect of *rentime* is expected to be positive for TFP because of reducing the land rent.

Administrative clearance time (*adtime*): Factors relating to administrative clearance time, *adtime* include time of checking quality of products (poultry, pork, etc.) before they are sold and regulation of market opening time (hour). Learning by doing would suggest that productivity declines with administrative clearance time.

Infrastructure and utility services (*lostirr*): Many variables reflecting the quality of infrastructure and services were examined. These included measures of the reliability of phone, irrigation and electricity services; measures of the length of time needed to get a phone installed or for a check to clear; measures of the quality of transportation services, etc. The variable that proved most consistently important was the loss of sales due to poor irrigation system: *lostirr*, electric failure, etc.

The respondents mark the contribution of infrastructure and utility services to firm's operations that random from zero to ten. This variable is also expected to be positive effect on TFP.

Market competition (*acompe*): Unless the firms are only interest international market, we examined the level of competition in domestic market through firm's assessment. The respondents mark the ability of firms, *acompe* to enhance productivity through access to the domestic market with higher point if the firm access to this market easier. The respondents mark the enhance productivity through access to the domestic market also random from zero to ten.

Certification of clean production (*cerpro*): This factor is defined as a dummy variable, *cerpro* whose value is 1 if the firm is engaged certificate and 0 otherwise. The effect of *cerpro* on TFP is ambiguous.

Table 4 shows the results of estimating equation (8). With the exception of the ambiguous effect of *rentime* for planting, all estimates have expected signs and are significant for remain business lines. Age of the firm, *age* is significant for all business lines. The lack of significance of *lostirr* for three business lines of Animal production, Processing, and Mixed production may be explained by the argument that these business lines relate to industrial production. It also means that effects of irrigation on them are not so large. In general, labor-related variables are highly significant as are administrative clearance time, and market competition. The *cerpro* dummy variable is significant and positive in three of the five business lines, suggesting that there are productivity advantages if firms enhance the certificate of clean production.

The econometric results in Tables 4 allow us to derive some simple results about the effect that the various factors have on TFP. In what follows, we report the result of some simple counterfactual exercises in which the value of one independent variable is altered while holding all others constant in order to estimate the magnitude of its effects on TFP. We limit this analysis to variables whose impact is shown to be statistically significant at the 0.1 level or better.

Educated labor: Table 4 shows the magnitude of the effect of increasing educated labor by one person in three business lines in Hanoi. Employees in the Planting have lower years of education compared to employees in other groups. If the average number of years of education in the planting was increased by 1 year, our results indicate that the TFP of the planting would increase by 3.62%. This is 2.61% for mixed and 3.2% for processing

Age of the firm: Older firms have higher productivity in all business lines. This result may be driven by the greater experience and the long-term, established customer relationships that older firms have. Because of production in agriculture is not rapid change in technology and customer demand; thus younger firms have not many advantages compared to the older ones. In average, one year increase in age of the firm yields a nearly 3.75% increase in TFP for Aquaculture, while for other groups the effect is much smaller.

Time of land rent: The results indicate that *rentime* has positive effects on TFP in four of the five business lines. In average, increase one year in time of land rent would result to TFP increase by 2.4% for animal firms, 2.19% for aquaculture firms, 1.46% for mixed firms, and 0.37% for processing firms. With the exception of the ambiguous effect of *rentime* for Planting, the firms in remain business lines need to stability of land using because of long-time investments such as processing factories, breeding facilities, etc.

Administrative clearance time: The results seen in Table 4 indicate that the number of hours to administrative clearance significantly impacts TFP. For example, a one-hour increase in administrative clearance would result in a 5.7% increase in TFP for Animal, 2.9% for Planting, 2.6%

for Mixed, and more than a 1.7% increase for processing. These results may be taken to mean that slack clearance is a major problem of selling agricultural products in Hanoi. This may be the least efficient firms that suffer the greatest reduction in sales therefore the result should be treated with caution as there may be some issue with endogeneity. For example, food security is always a big problem and quality examination is necessary and effects of this regulation may be negative on TFP.

Infrastructure and utility services: Consistent with the expected, the results in Table 4 and Figure 1 indicate that the increase of a one-point in this infrastructure and utility services increased TFP by 2.43% on average for planting, and 2.32% for aquaculture. These results show that planting and aquaculture production are heavily dependent on irrigation systems which are also very dependent on electricity for operation.

Table 4. Effect of factors on TFP

Variables	Planting	Animal	Aquaculture	Mixed	Processing
edulab	0.5439	0.1075	0.0466	0.3650	0.5279
	(0.0007)	(0.3284)	(0.3899)	*(0.0733)*	*(0.0072)*
age	0.1922	0.5982	0.4492	0.2057	0.2012
	(0.0698)	*(0.0000)*	*(0.0005)*	*(0.0980)*	*(0,0530)*
rentime	0.2150	0.4638	0.3296	0.2845	0.1833
	(0.2573)	*(0.0738)*	*(0.0407)*	*(0.0033)*	*(0.0675)*
adtime	-0.2619	-0.5739	-0.0420	-0.9648	-1.5043
	(0.0021)	*(0.0762)*	(0.6936)	*(0.0139)*	*(0.0295)*
lostirr	0.1700	0.2039	0.1681	0.5424	0.6137
	(0.0035)	(0.5724)	*(0.0146)*	(0.3909)	(0,1596)
acompe	0.4793	0.3479	0.7931	0.6916	0.8783
	(0.3450)	*(0.0075)*	*(0.0535)*	*(0.0957)*	*(0.0718)*
cerpro	0.9736	0.6831	1.1083	-0.0478	0.2054
	(0.0308)	*(0.0161)*	*(0.0051)*	(0.9008)	(0.6246)
Observations	37	40	30	27	26
R-square	0.371	0.398	0.358	0.407	0.438
F-test	35.57	23.09	14.00	16.55	11.08
Prob>F	0.000	0.000	0.000	0.000	0.000

Note: P-values (t-test) are shown below parameter estimates (in brackets)
Estimates significantly different from zero at the .01 level are shown in italic.

Market competition: Ability of the firms in accessing to domestic market has a strong effect, especially in processing. The results suggest that if a one-point in ability of firm was increased, average TFP in processing would increase by 10.97%. The impact is smaller in other business lines. This impact probably reflects more than just the productivity-winning in the domestic market as an advantage, but rather it could serve as a proxy for accessing to international market.

Certification of clean production: The results indicate that TFP for firms that have certificate of clean production in planting is 23% higher than for those have not. The corresponding difference is 21% for animal firms, and 18% for aquaculture. The implications of these differences in terms of the relative food security and business efficiency of the firm in agriculture are obvious.

CONCLUSIONS

The results of our analysis yield valuable insights regarding firms' internal characteristics, in addition to the role of investment climate variables that explain variations in TFP across agricultural

firms in Hanoi.

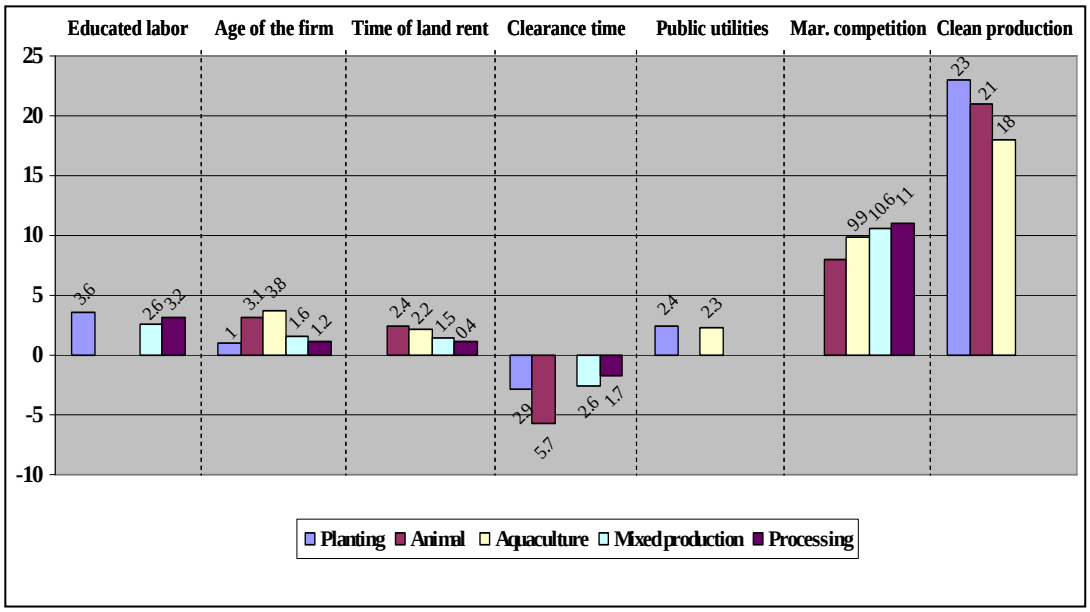

Fig. 1. Effect of the factors on TFP (in percent)

Regarding firm characteristics, educated labor and age of the firm affect productivity. In the case of Hanoi, a single firm characteristic, educated labor, is shown to have profound effect on TFP. Productivity increases by 3.62%, 2.61%, and 3.2% for planting, mixed, and processing respectively when number of years of education was increased by 1 year. One other firm characteristic is age. Due to greater experience and the long-term established customer relationships, as well as changing slowly in production and demand in agriculture, older firms have higher productivity compared with younger firms in all business lines.

Among the investment climate variables, administrative clearance time and has a strong negative effect on TFP for four of the five business lines. On the other hand, market competition and time of land rent have strong positive effects on TFP for almost business lines. A particularly interesting result is the strong positive effect of certification of clean production on productivity. This indicator is probably an encouragement for food security. Poor infrastructure and utility services have positive effects on productivity but it is not so high.

On the other hand, Hanoi is blessed with abundant natural resources for agricultural production. Its fertile land, moderate weather, abundant water (except during a few dry months), and irrigation and drainage systems are all favorable for agricultural activities in and around the city besides qualified labor force and a network of public institutions. These resources impact enormously on sustainable agricultural development. It contributes a large percentage of fresh food to the residents and engages a large number of people in its production, processing and marketing activities.

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