Research on the Impact of Equity Incentive and CSR on Corporate Performance based on Data Mining Method

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Abstract
The agency behavior under the modern enterprise system due to the asymmetric information between the owner and the manager in the two sides cannot be effectively supervision and management, employee stock ownership equity incentive system to gradually solve the problem. In this paper, the authors analyse the impact of equity incentive and CSR on corporate performance based on data mining method. On the basis of reference to previous literature, by taking Chinese manufacturing listed companies as the analysis object, we use cross-sectional data to test the influence of equity incentive to corporate performance. The empirical analysis show that there exists a positive incentive effect in Chinese listed company's employee stock ownership plan, which shows that employee stock ownership plans can really mobilize staff working enthusiasm and ability.

Key words: Equity Incentive, CSR, Corporate Performance, Data Mining

1. INTRODUCTION
According to the stakeholder theory, employees are important stakeholders of the enterprise; corporate social responsibility to employees may be the risk of rising employee turnover rate, recruitment difficulties. Therefore, there are a large number of enterprises to start the implementation of employee stock ownership incentive system. Employee stock ownership incentive is a modern enterprise of a strategic management decision-making behavior, when the business owners and the separation of ownership and management (i.e. the principal agent relationship), in order to ensure that operators can maximize play professional level, and ensuring that it does not damage the interests of the enterprise, allowing employees to hold shares or options of the enterprise in order to solve the information asymmetry problem in corporate governance. The development of capital market in western countries as, equity incentive has been widely used, such as one of the earliest American Equity Incentives mainly used in Silicon Valley and other knowledge innovation enterprises and high-tech enterprises, experience shows that the long-term incentive of enterprise managers and employees showed better effect. Since then Japan, Britain, France, Singapore began to follow, equity incentive system obtained the good development, at present in the global top 500 enterprises, 85% to take equity incentive system, said this system not only an effective solution to the corporate governance in modern capital market, optimizing the relationship between the shareholder (owner), managers and outside investors.

Our country in the capital market has just set up was an early study of equity incentive in listed companies, but ultimately failed to perform, until 2005, equity division reform, the relevant departments of the state introduced equity incentive management approach China Securities Regulatory Commission in December 2005 promulgated the "listed company equity incentive management approach", the Ministry of Finance in February 2006 released the state-owned holding listed companies the implementation of equity incentive pilot scheme, the listed companies in the implementation of equity incentive to clear away the obstacles, from China's employee stock ownership incentive entered the phase of rapid development. But with the increase of professional managers, and enlarge the scale of enterprise, employee stock option motivation to the development of the enterprise, whether there is the significant effect began to be questioned, many scholars think due to equity incentive targets are senior corporate management personnel, these personnel not only stock right incentive, and get higher pay, and a few years China's economic development better, and therefore ability general managers can also basically realize motivating goal set by the owner of the, not reflect the level of incentive objects. In addition, the agency governance will also lead to moral problems, managers to achieve incentive targets, the preparation of false financial statements or spread false information, damage the long-term growth of the listing Corporation and the interests of small and medium investors.

In the existing theoretical research, the study of employee stock ownership incentive is mainly focused on whether there is the incentive effect, the direction of the incentive effect, the strength of the. In the incentive effect, it is divided into direct effect and indirect effect. Direct effects including the effects of the three directions, as the effect based on the convergence of interest hypothesis that agent (operators) equity incentive will expand its consistency and interests among the shareholders, can stimulate the behavior of performance management, finally bring forward the enterprise performance (Abreu, 2015). Entrenchment effect hypothesis pointed out that operators of rent-seeking behavior, equity based incentives may be because of the abuse of
executive and cannot effectively alleviate the agency conflicts, but will exacerbate agency problems, is not conducive to enterprise performance. Also a point of view that is a nonlinear relationship between equity incentive and corporate performance, when the incentive object number of shares less than a certain threshold, the positive incentive effect, and the number of shares more than a certain threshold, negative incentive effects (Shen, 2011; Azadi, 2014). For the indirect effect, it is mainly of equity incentive by what means to improve enterprise performance, managers will reduce dividend payments by expanding investment and increase earnings management, raise the innovation strength to promote enterprise performance improvement, so as to realize the incentive effect. Currently more scholars from the sample data of listed companies of, the equity incentive effect empirical research, such as Huang (2009) research listed companies section data found that employee stock ownership on firm performance has a positive effect, but the management shareholdings influence on firm performance is 4-6 times the ordinary employee stock ownership, but impact on enterprise performance and employee stock ownership there is an inflection point. Kong (2015) using in Shaanxi Province in the unlisted small and medium sized enterprise data analysis found that employee stock ownership plans to significantly improve the corporate performance, the incentive effect of the employee stock ownership plan exist boundary conditions, employees holding number more, the incentive effect of the employee stock ownership plan smaller and smaller. Wang (2015) during the period 2006-2010 implementation of equity incentive of listed companies as a sample, the study found and non-implementation of the equity incentive plan of companies compared to the implementation of equity incentive plan of company performance before and after the implementation in are good, and in the non state owned enterprises is more significant. There are also scholars have studied the effects of external variables of the incentive effects, Chen (2015) study the effect of state ownership and market competition on the relation between equity incentive and corporate performance, found that the equity incentive have incentive effect, but the state-owned holding weakened the effect of the implementation of equity incentive, product market competition will strengthen the positive relationship between equity incentive and firm performance. Wu (2014) analysis of the influence of board characteristics on the governance effect of equity incentive, the study found that the equity incentive policy produced a positive incentive effect, the board of directors shareholding and the proportion of independent directors increase can enhance incentive effect, and the chairman and general manager together while reduce the incentive effect.

This paper chooses Chinese manufacturing listed companies as the analysis object, compared to the previous literature, there are two aspects of innovation, using cross-sectional data, which dependent variable is the equity incentive and corporate performance change amount and on the amount of changes whether there significant difference of paired sample t test analysis; second influences the effect of equity incentive factors, mainly including two aspects of the ownership structure of the firm and macroeconomic environment, the former refers to the internal characteristics of the company, the latter points to the external environment.

2. LARGE-SCALE DATA MINING

2.1 BIRCH algorithm

In general, the single pass scan data set can get better clustering results. Optional follow-up of multiple scan can further improve the quality of clustering. From the statistical point of view, clustering is given a consists of N data points in the data set and a distance measuring functions f (such as computing clusters within each of the two data points between the average distance function), the data set is divided into K clusters (or not given number k, by the algorithm automatically discover the optimal number of clusters), final result is to find a for a data set of the optimal partition, which makes the distance measure function f of the minimum value. From the point of view of machine learning, clustering is an unsupervised learning algorithm, by clustering data into n clusters, which minimizes the distance between points within the cluster. The core of BIRCH method in the micro clustering stage is the construction of CF tree as follows:

\[ CF = (n, LS, SS) \]  
\[ LS = \sum_{i=1}^{n} x_i \]  
\[ SS = \sum_{i=1}^{n} x_i^2 \]

The use of CF (cluster feature) can be derived from a part of Statistics: c
\[ x_0 = \frac{\sum_{i=1}^{n} x_i}{n} = \frac{LS}{n} \]  

(4)

\[ R = \sqrt{\frac{\sum_{i=1}^{n} (x_i - x_0)^2}{n}} = \sqrt{\frac{nSS - 2LS^2 + nLS}{n^2}} \]  

(5)

\[ d = \sqrt{\frac{\sum_{i=1}^{n} \sum_{j=1}^{n} (x_i - x_j)^2}{n(n-1)}} = \sqrt{\frac{2nSS - 2LS^2}{n(n-1)}} \]  

(6)

The average distance of the objects in the cluster was measured by \( d \).

\[ d^* = \sqrt{\frac{SS_1}{N_1} + \frac{SS_2}{N_2} - \frac{2LS_1LS_2}{N_1N_2}} \]  

(7)

### 2.2 Large-scale data mining

In recent years, data mining has attracted great attention of the information industry, the main reason is the existence of a large number of data, can be widely used, and the urgent need to convert these data into useful information and knowledge. Access to information and knowledge can be widely used in a variety of applications, including business management, production control, market analysis, engineering design and scientific exploration. Data mining generally refers to the process of searching for information hiding in the data from a large number of data. Data mining usually and computer science, and through statistics, online analysis processing, information retrieval, machine learning, expert system (rely on past experience rule) and pattern recognition, and many other methods to achieve these goals. Data mining classification as shown in figure 1.

![Data Mining Parcigm](image-url)

**Figure 1.** Data mining classification

The purpose of data mining is to find more high-quality users from the data. Then I continue to explore the guiding methods of data mining model. What is the guidance of the data mining method model, and how to build a model of data mining is important. In constructing a supervised data mining model, first of all to understand and define some models that attempt to estimate the target variables, data mining process as shown in figure 2.
3. MODEL DESIGN AND VARIABLES

3.1 Model building
Currently research on employee stock ownership incentive effects of equity includes the event study and regression model method, which event study method is test incentive behavior impact on stock prices in the short term, such as by using the event study found that listed company equity incentive announcement before and after the issuance of the stock has a significantly positive price effect. The regression model method is mainly to study the influence of the institutional behavior on corporate performance under the background of employee stock ownership and stock ownership incentive. In this paper, we mainly observe the direction and extent of the financial effect of employee stock ownership. Effect of the equity incentive effect more is the use of panel data analysis, namely the return of employees or executives Shareholding on firm performance (indicators). However, the paper considers that hasn't been properly chosen such that the equity incentive, executive stock ownership may not be used to motivate, the body that contains equity. In this paper, we choose the cross section data analysis, each enterprise to select the year of the incentive value, as a result of changes in the performance of enterprises before and after the incentive. Specific models are constructed as follows:

\[
\text{performance}_i = c + \alpha \times \text{esop}_i + \delta \times \text{control}_i + \epsilon_i \tag{1}
\]

Among them is the enterprise performance index, is the equity incentive agent variable, is the control variable, is the constant.

For model (1), if \( \alpha \) is significantly positive, that equity incentive has a significant positive impact on enterprise performance, that is, the existence of positive equity incentive effect, if \( \alpha \) is negative, it shows that the equity incentive has a significant negative impact on corporate performance, that is, the existence of negative equity incentive effect, if the coefficient \( \alpha \) is not significant, it shows that there is no incentive effect. To further explore the third variables of corporate equity incentive effect of, in equation (1) joined the corporate ownership structure with equity incentive proxy variable of the cross term, macroeconomic environment and equity incentive proxy variable of the cross terms, the model are as follows:

\[
\text{performance}_i = c + \alpha \times \text{esop}_i + \beta \times \text{esop}_i \times \text{economy}_i + \delta \times \text{control}_i + \epsilon_i \tag{2}
\]
\[
\text{performance}_i = c + \alpha \times \text{esop}_i \times \text{esop}_i \times \text{control}_i + \epsilon_i \tag{3}
\]

Among them \( \text{esop} \) is the enterprise equity index, \( \text{economy} \) is the macroeconomic indicators, and the rest of the meaning of the variables with the formula (1), \( \text{esop} \times \text{esop} \) is the cross terms of enterprise equity incentive and enterprise equity concentration, and it is the cross terms of enterprise equity incentive and macro economy. In the equation (1), the purpose of introducing the cross term is to examine the influence of internal variables (ownership structure) and external environment (macro economy) on the incentive effects of employee stock ownership. This is mainly to observe the coefficient \( \beta \). In this paper, the least square method (OLS) is used to estimate the above equations.

3.2 Sample selection and variable
In this paper, we select A shares of Listed Companies in China during the period of 2006-2012, the reason why not include samples during the period of 2013-2014. The main consideration is that after 2013, the incentive cannot reflect the changes in the performance of the company's equity incentive. In order to ensure the validity of the data, this paper removed the *ST name of the company in the year. Excluding the three years before and after the equity incentive, this paper mainly takes into account the changes in the performance of the stage (three years) before and after the equity incentive. Finally get 227 enterprises cross section data. Enterprise data are derived from the Tai'an Shenzhen financial database (CSMAR), economic sequence data from the 2015 "China Statistical Yearbook".

1) Enterprise performance: Enterprise performance is refers to the company business results in a certain period of time, the modern enterprise system to measure the enterprise's performance there are many variables, including total return on assets rate (ROA), net assets income rate (ROE), operating margins, earnings per share (EPS), profit growth rate etc.. In the incentive effects of equity research in the literature, many performance appraisal chose indicator associated with net profit, Dong Lijuan (2013) of 150 with equity incentive of enterprise statistics showed that, 82% of the assessment indexes of enterprises net profit growth rate, 72% chose the weighted average return on net assets rate, in addition to 21.3% of the enterprises chose net profit, 12.67% of the enterprises chose operating income growth rate. After drawing on the existing literature, this paper choose the growth rate of net profit as the index of enterprise performance evaluation, which is the proxy variable of the majority of the study of employee stock ownership incentive literature.

2) Corporate equity incentive(esop): the equity incentive, many literatures have choices of executives shareholding accounted for accounted for the total capital ratio of employee stock ownership or total equity ratio measure, this paper argues that this part of the employee stock ownership is not real incentive properties of, part of the shares in the former excitation have held. Therefore, this article choose listed companies to equity incentive for the first time after notice (sent) stake as an employee stock ownership plan index of equity incentive.

3) Ownership structure of enterprises: Ownership structure in the narrow sense is the equity structure, but also refers to the degree of concentration of shares in enterprises. It is generally believed that the more concentrated ownership, is the largest shareholder of enterprise management control and decision-making more assertive, which will increase the risks and benefits of enterprises. In this paper, we choose the proportion of the top five shareholders and measure the ownership structure.

4) Macro economy: This paper chooses the growth rate of gross domestic product (GDP) to measure. For the variable for the effect of equity incentive effect to explain for the macro economy and better that may lead to equity incentive effect is getting better and better, but the "upside" effect exists "distortion".

5) Control variable: This paper selects two variables as the control variables of the enterprise scale and the assets and liabilities structure. Enterprise scale use numerical representation of business income. Assets and liabilities structure use the asset liability ratio (total liabilities / total assets), the greater the asset liability ratio, indicating that the stronger the business use of financial leverage.

4. EMPIRICAL ANALYSIS

4.1 The comparison of enterprise performance before and after the stock ownership incentive

Before using the regression model analysis, firstly, the sample t test of sample enterprises employee ownership equity incentive and net profit growth rate differences were analyzed. The former excitation is refers to enterprises in the released incentive announcement, i.e., motivation, the implementation of the annual) in front of three years, excitation is refers to the enterprise in released incentive announcement back three years (including notice that year). The specific paired samples T test results are shown in table 1. From table 1 can see, 227 enterprises in equity incentive three years ago, the average net profit growth rate is 16.55%, in the three years after the equity incentive, the average net profit growth rate is not 24.10%, the second difference 7.55%. T test statistic value is 2.033, corresponding to a bilateral probability sig values for 0.043<0.05 that China's A-share listed companies in equity incentive and net profit growth rate has increased significantly.

| Table 1. Paired sample T test before and after equity incentive |
|---------------------------------|-----------------|-----------------|-----------------|-----------------|
| sample                          | net profit growth rate | difference | T  | DF  | Sig. (bilateral) |
| Before excitation               | 0.1655            | 0.0755        | 2.033 | 226 | 0.043            |
| After excitation                | 0.2410            |               |      |     |                 |

4.2 Test on the effect of stock incentive of Listed Companies in China
Table 2 shows the cross-sectional data and regression estimation results, including (1) is the estimation results for the full sample enterprises, column (2) - (4) is the sub sample estimation results, including private and state-owned enterprises. Division of the reference in Tàian database of actual control of corporate division standard, enterprise scale division is on business income points for large-scale enterprises (incentive year revenue 10 billion yuan or more) and small scale enterprises (incentive year revenue 10 billion yuan). Table 2 columns (1) for the full sample enterprise estimation results show that goodness degree was 0.667, observation of all the independent variables, the employee stock ownership plan equity incentive variable coefficient for 1.337>0 in 0.01 probability level statistically significant, that equity incentive has a positive promoting role on the performance of enterprises growth, this result and table 1, consistent with the conclusion. For control variables, you can see the enterprises operating income variable coefficient for -1.862<0, at 1% significant level of probability of statistically significant, indicating that larger enterprises, enterprise performance growth is low and even negative growth; assets and liabilities rate variable coefficient for 10.293>0 in 5% significant probability level statistically significant, indicating that the greater the proportion of corporate debt and corporate performance growth is larger.

To observe sub sample estimation results, we can see private enterprises sample ESOP variable coefficient for 7.662>0, at 1% significant level of probability of statistically significant, so for private enterprises, the implementation of employee stock ownership equity incentive can and positive impact on firm performance, and for the state-owned enterprises sample, variable coefficient of ESOP 0.437, in significant 10% probability level but not significant, indicating that state-owned enterprise employee stock ownership incentive effect is not significant. For the control variables, the results are not consistent with the full sample, but the coefficients are the same.

For different size of enterprise, small sample sizes of ESOP variable coefficient for 1.729>0, at 1% significant level of probability of statistically significant, so for the small scale of the enterprise, employee stock ownership plan for enterprise performance have positive effect of equity incentive, for large-scale enterprises, the variable coefficient of ESOP was 0.560, is not significant at the 10% level of probability that large-scale enterprises employee stock ownership incentive effect is not significant. For the control variables, the coefficient of symbols and was basically consistent with the previous column, here no longer repeat one.

| Table 2. The equity incentive effect of Listed Companies in China |
|-------------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| dependent variable | sample          | privately operated | state-owned     | small-scale     | large-scale     |
| column             | (1)             | (2)              | (3)             | (4)             | (5)             |
| esop               | 1.337***        | 7.662***         | 0.437           | 1.729***        | 0.560           |
|                   | (0.000)         | (0.000)          | (0.177)         | (0.001)         | (0.162)         |
| 39.7***            | 126.508***      | -17.537          | 54.903**        | 30.939          |
|                   | (0.006)         | (0.007)          | (0.229)         | (0.020)         | (0.384)         |
| R2                 | 0.667           | 0.499           | 0.629           | 0.589           | 0.641           |
| N                  | 227             | 172             | 39              | 137             | 90              |

4.3 Analysis on the mechanism of stock incentive effect of Listed Companies in China

Table 3 further shows the employee stock ownership plan effect of equity incentive mechanism analysis, that equation (2) and equation (3) of the estimation results, including (1) examines the effect of equity incentive is affected by ownership concentration influence, (2) examines the equity incentive effect is affected by the macro economic development impact. Column (3) - column (6) is a sub sample of the estimated results. For the full sample enterprises, the main observation variables, the variable coefficient of ESOP 4.329>0, at 1% significant level of probability of statistically significant, ESOP and ownership concentration degree oc5 cross terms in the coefficient of variable -0.057<0, and statistically significant at 1% probability level.
The analysis results of the stock incentive effect mechanism under the sample of state-owned enterprises and private enterprises. For private enterprises, when the introduction of equity incentive and ownership concentration degree of cross variable, the variable coefficient of ESOP is 12.483, cross term variable coefficient is -0.148, both in the 5% level of probability of statistically significant, the results with the enterprises in the whole sample results is consistent, indicates that equity more concentrated will weaken the positive effects of equity incentive. When the introduction of equity incentive and macroeconomic time series cross variable, the variable coefficient of ESOP is -0.588, cross term variable coefficient is 0.616, were not significant, but the sign of the coefficients with the sample under the agreement, this paper still think macro economic growth rate rose high-energy invisible to expand the positive effects of equity incentive. For a sample of state-owned enterprises, when the introduction of equity incentive and ownership concentration degree of cross variables, variable coefficient of ESOP was 0.718, cross term variable coefficient is -0.005, two were under 10% probability level is not statistically significant; when the introduction of equity incentive and macroeconomic time series cross variable, the variable coefficient of ESOP 0.642, cross term variable coefficient is 0.020, were not significant, but can calculated and enterprise performance of corporate equity incentive marginal impact is positive. For the enterprise operating income and asset liability ratio of two control variables, the coefficient symbol and the significance of the 2 agreement with the table, here is no longer a detailed statement.

These results indicate that Chinese listed company's employee stock ownership plan, there exists a positive incentive effect. The results and most scholars research conclusion consistent, indicating that ESOP can really mobilize staff Holdings (usually in the senior management incentive objects) working enthusiasm and ability, by strengthening enterprise management, control cost and business strategy, to improve the performance of enterprises. There is a positive incentive effect for private enterprises and state-owned enterprises there is no incentive effect explanation is: for state-owned enterprises, there are two main reasons, one is the actual situation of the state-owned enterprise's equity incentive object for general staff and management personnel of enterprises, especially senior managers, most countries appointed, which is the incentive object can not participate in the decision of enterprise management level, the incentive effect is not obvious, on the other hand,
the state-owned enterprise performance appraisal index target by the relevant departments of the impact, in operation, the strategy and the system is passive, the "hard constraints" makes the incentive objects can not effectively play the level of management, equity incentive in the state-owned enterprises limited in. Behavior and for the general private enterprises, on the contrary, first of all enterprises operating mechanism is more flexible, enterprise equity incentive targets are also the actual management about the business objectives, the "right" (management rights, equity) consistent background makes incentive staff goals and objectives, to fully mobilize the enthusiasm of the management on improving the enthusiasm of enterprise performance.

As for the impact of external variables on the equity incentive effect, the positive effect of ownership concentration will reduce the enterprise equity incentive, this paper considers that there are two factors, one is the top five shareholders, including few business objectives of equity incentive management object, so the five largest shareholder equity ratio is higher. Business decision rights incentive target was smaller (major projects, strategic restructuring still depends on the actual controller), this situation will lead to a positive incentive effect is weakened; the two is more concentrated ownership, itself will occupy the interests of small shareholders, the earnings management is more inclined to the current distribution, but not as the next the capital, more empirical analysis also indicates that the ownership concentration and corporate performance are negatively correlated. Therefore, this endogeneity (incentive and performance may be endogenous problem) has led to the weak effect of incentive. Macro-economic growth to improve the equity incentive effect, apparently in macro-economic upturn, the positive effect of micro enterprise performance, compared with normal (economic) growth rate. At this time behavior of equity incentive for incentive object is concerned with the existence of an "invisible" welfare effects, namely enterprise performance ascending part of is by external economic growth rate.

5. CONCLUSIONS

The agency behavior under the modern enterprise system due to the asymmetric information between the owner and the manager in the two sides cannot be effectively supervision and management, employee stock ownership equity incentive system to gradually solve the problem. However, there are many researches about the effect of employee stock ownership incentive on firm performance, but the conclusion is not uniform. This paper chooses in the period 2006-2012 have the behavior of equity incentive in China A-share listed companies, using paired samples t test and the cross-sectional regression model, analysis of the impact on the effect of employee stock ownership plan effect of equity incentive and external variables. The results show that: the performance of Listed Companies in China before and after the equity incentive (net profit growth rate) has significant growth. Employee stock ownership incentive can have a positive effect on the performance of listed companies, but this effect is more significant for private enterprises and small scale enterprises, while the effect is not obvious for state-owned enterprises and large-scale enterprises. The positive effect of ownership concentration on employee stock ownership incentive is affected by the impact, while the macro economy has a positive effect on the positive effect of equity incentive.

Based on the above conclusions, this paper puts forward some suggestions on the operation of employee stock options:

- Develop a suitable to the enterprise own development incentive program, currently listed companies incentive schemes and similar, no difference, are inspired by the linked object and corporate performance. If the performance of the company in a specified period can be completed the exercise. Although this initiative is indeed able to mobilize the enthusiasm of executives, but whether it is really suitable for the company's development, more difficult to judge. Enterprises from the incentive model and source of capital (stock), incentive object, motivation scale, exercise price, exercise arrangement (period), the exercise conditions (performance appraisal) full investigation and verification.

- Enterprises should strengthen the system construction of employee stock ownership incentive strategy. In determining the incentive plan, major shareholders and decision-making layer to the equity incentive before the implementation, and after exercise are clearly defined, especially for managers (inspired by the top management object) to carry out effective supervision to prevent incentive management personnel take damage to minority shareholders and the company's long-term growth behavior in order to achieve the goal incentive, which can be from salary, performance evaluation and other aspects of the regulation. On the other hand, you can consider the use of reverse repurchase way to implement equity incentive, which can fully mobilize the management level of existing shares executives.

- Continue to improve the laws and regulations on the system of employee stock ownership in china. The securities regulatory authorities should strengthen of equity incentive of listed company information disclosure to crack down on insider information, standardize enterprise bonus system and strict supervision on the behaviors of corporate executives, to develop more in line with the reality of laws and regulations, and effectively protect the interests of small investors. In the equity incentive, it
is not only to give the company a certain right to freedom, but also to allow the market, employees, and investors to effectively supervise the three.

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