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A STUDY OF INCENTIVE ALLOCATION BASED ON HUMAN RESOURCE MANAGEMENT IN MODERN ENTERPRISES

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Abstract: This paper establishes an incentive model for human resource management in modern enterprises by making use of the principal-agent incentive theory. The model established defines the optimal performance different types of employees could create, and the corresponded incentive value. It also addresses different incentive schemes for different performance made by employees.
Keywords: Human resource management; Incentive model; Allocation

1. INTRODUCTION

Incentives, including spiritual and material ones, aim at stimulating personal enthusiasm for hard work. As an organization or group, we cannot rely on the individual member's consciousness to survive and develop, but rather should rely on systems and rules and regulations to guide people's actions. In reality, there are some scenarios that when creative work, or a considerably difficult and important task needs to done, it is impossible to accurately predict the ability of every employee. At the same time, we cannot determine in advance each employee's work attitude and the efforts they are willing make. To solve this problem, it is advisable that incentive criteria be announced beforehand and let everyone make the choice himself.

2. INCENTIVE CONFIGURATION

2.1 Form of incentives

2.1.1 The principal-agent relationship

Let us assign the enterprise as the principal and the employees as the agents, and thus the relationship between work and the employees is the relationship between a principal and agent. In other words, the principal (enterprise) entrusts the agents (employees) with a piece of work.

2.1.2 Incentive contracts

Marking q as the employee's work performance scores, p as corporate incentive price paid to employee performance scores, Ω as a viable incentive configuration sets (all possible contracts), then:

$$\Omega = \{(q, p) : q, p \geq 0\}$$

2.1.3 Incentive aim

Staff q score has a certain effect on enterprise, assumed the effect of business from employees q score is $L(q)$, in which

$$L' > 0 \ , \ L'' < 0 \ , \ L(0) = 0 ,$$

The Enterprise incentive is designed to maximize the $L(q)$.

2.2 Employee information

Enterprise Manager cannot determine in advance the employee work attitudes, work effort or their abilities, but the fact is the consensus of both parties: employees work with fixed costs (Employees

give the same wage expenditures, as a business generally has no right not to pay their wages, and to finish this task also need to pay a fee), as well as marginal labor cost $c \in \{\bar{c}, \underline{c}\}$. Marginal labor cost is to create 1 unit labor costs of performance pay. In the enterprise, within the same working hours, the more labor you contribute, the better performance would be, however, not more reward for the labor.

2.3 Staff remuneration

Under the established conditions of work tasks and work time, better performance requires more labor, and less need of labor remuneration. In reality, more labor cannot get his required proportion, and people get similar pay. Expectations of marginal labor from hard workers are less than easy ones.

2.4 Employee cost function

An employee of any given work tasks may be specified for high efficiency and low cost($\underline{c}$), and the creation of 1 Unit values corresponding to the performance of marginal cost is $\underline{c}$, or of low efficiency and high cost($\bar{c}$), Their probabilities are π and $1-\pi$. So the employee cost function is:

$$\text{in probability } \pi: \ C(q, \underline{c}) = \underline{c}q + C_0$$

$$\text{in probability } 1-\pi: \ C(q, \bar{c}) = \bar{c}q + C_0$$

Here, imagine that employees are aware of their cost type when they make decisions.

3. INCENTIVE MODEL OF ENTERPRISE HUMAN RESOURCE MANAGEMENT UNDER COMPLETE INFORMATION

3.1 The net effect of enterprise

Complete information here refers to the absence of information gap between enterprises and employees, businesses know whether employees will work hard, the cost type is known. At this point, the NET utility is:

$$V(q) = L(q) - C(q, c) = L(q) - (cq + C_0)$$

Enterprises want to maximize the NET utility. According to the theory of unconstrained optimization, optimal levels of performance of employees in enterprises is achieved when marginal cost is equal to the marginal utility of employees (that is, $V'(q) = 0$), Which is:

$$L'(\underline{q}^*) = \underline{c}, \ L'(\bar{q}^*) = \bar{c}$$

On one hand, efficient staff, which creates the net effect is greater than the net effect of inefficiencies created by employees, $\underline{W}^* \geq \overline{W}^*$. Because when $q = \underline{q}^*$, $S(q) - \underline{c}q$ reaches the maximum, and $\bar{c} > \underline{c}$, so

$$\underline{V}^* = S(\underline{q}^*) - \underline{c}\underline{q}^* \geq S(\bar{q}^*) - \underline{c}\bar{q}^* \geq S(\bar{q}^*) - \bar{c}\bar{q}^* = \overline{V}^*$$

On the other hand, we can generally assume that low efficiency and high cost of employee's optimal performance levels created for the enterprise is non-negative, which means

$$\overline{V}^* = L(\bar{q}^*) - (\bar{c}\bar{q}^* + C_0) \geq 0$$

This assumption is based on the fact that tasks assigned to the low efficiency workers are valuable in general, otherwise, within the enterprise, low efficiency would not exist. If no inefficiencies, naturally there is no so-called efficiency.

From $L'(\underline{q}^*) = \underline{c} < L'(\bar{q}^*) = \bar{c}$ and $L''(q) < 0$ we can know that

$$\underline{q}^* > \bar{q}^*$$

which represents the optimal performance of efficient staff is higher than low-efficiency staff.

3.2 Employee participation constraints

Incentive value for Enterprise provided to employees involved in the contract cannot be lower than the opportunity cost when the employees do not participate in contractual relations, which is called participation constraints as an agent. In other words, to allow agents to participate in the work, agent incentive value derived from this work cannot be lower than its participation in the

incentive value of other work, the so-called opportunities value. If opportunities effectiveness level is 0 when employees do not participate in contract, the participation constraints can be expressed as

$$\underline{p} - \underline{c} \geq 0 \ , \ \overline{p} - \overline{c} \geq 0 .$$

3.3 Incentive model of enterprise human resource management

For the implementation of optimal performance in enterprises, they can follow the method below to make work and human motivation configuration:

For high efficiency and low cost of staff ($c = \underline{c}$), Incentive pricing (Performance incentives of value in 1 Unit) is $\underline{p}^* = \underline{c}^*$; The corresponding level of output is $\underline{q}^*$; for the low efficiency and high cost of employee ($c = \overline{c}$), Incentive pricing is $\overline{p}^* = \overline{c}^*$, the corresponding output level is $\overline{q}^*$.

Therefore, optimal incentive under the complete information is: enterprises will not give to any employee any extra incentive. In other words, under the complete information, a client implementation agent is cost-free.

In reality, clients can't always give an efficient agent 0 Incentives, otherwise efficient agents eventually will find that hard work and easy work make difference, so efficient agents will have no "efficient" enthusiasm, low efficiency agents will have no willing to change their enthusiasm. Moreover, complete information does not happen in general, even once, based on the above reasons, there will exists asymmetric information between principals and agents.

4. THE INCENTIVE MODEL OF ENTERPRISE HUMAN RESOURCE MANAGEMENT UNDER ASYMMETRIC INFORMATION

4.1 Encouraging configuration

Asymmetric information reveals that enterprises are not able to ascertain the employee's marginal cost of labor, work effort, and so on. In some cases, perhaps the employee does not know the information before he makes decision. Enterprises want highly efficient (low marginal cost of labor) working employees choose to create high-performance, low performance employees could only create low efficiency, but two types of employees can be motivated by offering different incentives in the future.

Enterprises can provide two different types of incentives (contract) $\{(\underline{p}, \underline{q}); (\overline{p}, \overline{q})\}$ to achieve this objective: looking forward to Type $\underline{c}$ employees' selection, and the Type $\overline{c}$ employees' selection $(\overline{p}, \overline{q})$, and two types of employees cannot be confused. In other words, that is, Type $\underline{c}$ of employees prefer incentive mode $(\underline{p}, \underline{q})$ instead of $(\overline{p}, \overline{q})$, and the Type $\overline{c}$ of employees select $(\overline{p}, \overline{q})$ instead of $(\underline{p}, \underline{q})$. Therefore, incentives $\{(\underline{p}, \underline{q}); (\overline{p}, \overline{q})\}$ should meet the following conditions:

$$(\underline{p} - \underline{c})\underline{q} \geq (\overline{p} - \underline{c})\overline{q} \ , \ (\overline{p} - \overline{c})\overline{q} \geq (\underline{p} - \overline{c})\underline{q}$$

The other hand, the incentives provided by the enterprise should be able to make each type of staff being involved in the initiative, thus, both of the following conditions of participation constraint must be satisfied: $\underline{p} - \underline{c} \geq 0 \ , \ \overline{p} - \overline{c} \geq 0$

Therefore, a set of practical work and human motivation configuration should also meet the participation constraint and incentive compatibility constraint, which characterize the configurations collection and express the asymmetric information between enterprises and employees work and human motivation configuration scope.

From incentive compatibility condition, we can know that $\underline{q} \geq \overline{q}$, low efficiency and high cost performance are relative to low staff requirements. This is also a condition one possible incentive criteria need to be satisfied.

4.2 Information Rent

Under the complete information, enterprises can set up utility for all types of employees receiving additional incentives as 0. However, under the asymmetric information, enterprises are unable to

do this. In fact, when $\underline{p} = \underline{c}, \overline{p} = \overline{c}$ (The 0 Additional incentive effects), a Type $\underline{c}$ employee can mimic Type $\overline{c}$ of employee (selecting $(\overline{p}, \overline{q})$ Incentives) to gain a positive additional effects:

$$(\overline{p} - \underline{c})\overline{q} = (\overline{p} - \overline{c} + \overline{c} - \underline{c})\overline{q} = (\overline{p} - \overline{c})\overline{q} + (\overline{c} - \underline{c})\overline{q} = (\overline{c} - \underline{c})\overline{q} > 0$$

Such proceeds of the employee type $\underline{c}$ is highly efficient information for his rental. Therefore, enterprises must provide for efficient staff that portion of the rent information, otherwise it is not efficient.

Marking $\underline{U} = (\underline{p} - \underline{c})\underline{q}$, $\overline{U} = (\overline{p} - \overline{c})\overline{q}$ represent two types of information rent.

4.3 The optimal incentive configuration of enterprise human resource management

For companies, the question now is how to identify incentives $\{(\underline{p}, \underline{q}); (\overline{p}, \overline{q})\}$ maximizing their effectiveness when meeting participation and incentive compatibility constraint conditions? This problem is a programming problem as follows:

$$\max_{\{(\overline{p}, \overline{q}); (\underline{p}, \underline{q})\}} \pi(L(\underline{q}) - \underline{p}\,\underline{q}) + (1 - \pi)(L(\overline{q}) - \overline{p}\,\overline{q})$$

$$\text{s.t. } (\underline{p} - \underline{c})\underline{q} \geq (\overline{p} - \underline{c})\overline{q}$$

$$(\overline{p} - \overline{c})\overline{q} \geq (\underline{p} - \overline{c})\underline{q}$$

$$\underline{p} - \underline{c} \geq 0$$

$$\overline{p} - \overline{c} \geq 0$$

Using information rent $\underline{U} = (\underline{p} - \underline{c})\underline{q}$, $\overline{U} = (\overline{p} - \overline{c})\overline{q}$ to turn principal objective functions into rental information U and performance levels q function, so the new decision variables for the optimization of $\{(\underline{U}, \underline{q}); (\overline{U}, \overline{q})\}$ and objective function are:

$$[\pi(L(\underline{q}) - \underline{c}\,\underline{q}) + (1 - \pi)(L(\overline{q}) - \overline{c}\,\overline{q})] - [\pi\underline{U} + (1 - \pi)\overline{U}]$$

This transform reconsiders the configuration issues by stressing the combination of information rent and performance level. The first entry stands for the desired configuration, efficiency, and the second for information rents.

Constraint information rent that corresponds to the written form can be modified:

$$\underline{U} \geq \overline{U} + \Delta c\,\overline{q}\,;\ \overline{U} \geq \underline{U} - \Delta c\,\underline{q}$$

$$\underline{U} \geq 0\,;\ \overline{U} \geq 0$$

among which $\Delta c = \overline{c} - \underline{c}$.

At this point, the optimal incentive model of enterprise human resource management is:

$$\max_{\{(\underline{U}, \underline{q}); (\overline{U}, \overline{q})\}} [\pi(L(\underline{q}) - \underline{c}\,\underline{q}) + (1 - \pi)(L(\overline{q}) - \overline{c}\,\overline{q})] - [\pi\underline{U} + (1 - \pi)\overline{U}]$$

$$\underline{U} \geq \overline{U} + \Delta c\,\overline{q} \quad (1)$$

$$\overline{U} \geq \underline{U} - \Delta c\,\underline{q} \quad (2)$$

$$\underline{U} \geq 0 \quad (3)$$

$$\overline{U} \geq 0 \quad (4)$$

4.4 The optimal incentive model of enterprise human resource management solution

In analytical solution of optimal planning for solving the above problem, the main difficulty is that it is an inequality constrained programming problem. If the inequalities become equalities, so we can get an analytical solution.

First of all, from the constraints (1) and (4) we can see:

$$\underline{U} \geq \overline{U} + \Delta c\,\overline{q} \geq \Delta c\,\overline{q} \geq 0$$

It describes constraints (3) is set up automatically, and is a redundant constraint.

Second, the constraint (1) and (2) can be rewritten as follows:

$$\underline{U} - \overline{U} \geq \Delta c\,\overline{q} \quad (1)$$

$$\underline{U} - \overline{U} \leq \Delta c\,\underline{q} \quad (2)$$

and rewrite the target function as:

$$[\pi(L(\underline{q}) - \underline{c}\,\underline{q}) + (1-\pi)(L(\overline{q}) - \overline{c}\,\overline{q})] - [\pi(\underline{U} - \overline{U}) + \overline{U}]$$

When $\underline{U} - \overline{U}$ and $\overline{U}$ are the minimum, the objective function value will be the maximum, and the minimum of $\underline{U} - \overline{U}$ is $\Delta c\,\overline{q}$, $\overline{U}$ minimum is 0, and $\underline{U} - \overline{U} = \Delta c\,\overline{q}$, $\overline{U} = 0$ meet all constraints, so:

$\underline{U} = \Delta c\,\overline{q}$, $\overline{U} = 0$

At this point, the original constraint programming problem becomes the following constraint programming problem-free:

$$\max_{\{(\underline{q};\overline{q})\}} V = [\pi(L(\underline{q}) - \underline{c}\,\underline{q}) + (1-\pi)(L(\overline{q}) - \overline{c}\,\overline{q})] - \pi\Delta c\,\overline{q}$$

It only has one decision variable: levels of performance $\underline{q}$ and $\overline{q}$.

From the comparison of this optimization problem and the optimization under complete information, we can find that under the asymmetric information, corporate objective function must be reduced in the pay to efficient low-cost employee expectations of information rent $\pi\Delta c\,\overline{q}$. Information rent of low efficiency employees is 0. Efficient employees receive information rents has nothing to do with its performance $\underline{q}$, but with performance of low efficiency staff $\overline{q}$. This shows that if there is no inefficiency, naturally there is no efficient, high efficiency of high efficiency is not the source itself, but because of low efficiency. Therefore, efficient information rent has nothing to do with the efficient performance of its own, but being related with low efficiency of performance.

Marking $\frac{\partial V}{\partial \underline{q}} = 0$, $\frac{\partial V}{\partial \overline{q}} = 0$, so

$$L'(\underline{q}) = \underline{c} \tag{5}$$

$$(1-\pi)(L'(\overline{q}) - \overline{c}) = \pi\Delta c \tag{6}$$

Since

$$\frac{\partial^2 V}{\partial \underline{q}^2} = L''(\underline{q}) < 0 \ , \ \frac{\partial^2 V}{\partial \overline{q}^2} < 0 \ , \ \frac{\partial^2 V}{\partial \underline{q}\partial \overline{q}} = 0$$

so, the optimal performance $\underline{q}^{**}$ and $\overline{q}^{**}$ determined by the first-order conditions (5) and (6) must meet the following requirements:

$$L'(\underline{q}^{**}) = \underline{c}$$

$$L'(\overline{q}^{**}) = \overline{c} + \frac{\pi}{1-\pi}\Delta c \ ,$$

the optimal performance under complete information must meet:

$$L'(\underline{q}^{*}) = \underline{c} \ , \ L'(\overline{q}^{*}) = \overline{c} \ .$$

It indicates that for employees of high efficiency and low cost , in two states, their optimal performance is not changed, and for employees of low efficiency and high cost, their performance under the condition of asymmetric information will be less than under complete information (From $L''(q) < 0$, we can see $\overline{q}^{**} < \overline{q}^{*}$)

Since $\underline{q}^{**} = \underline{q}^{*} > \overline{q}^{*} > \overline{q}^{**}$, therefore, under the asymmetric information, the performance of high efficiency and low cost employees will be higher than the low efficiency and high cost of employees.

To sum up, under the condition of asymmetric information, the optimal configuration for work and human motivation is:

(1) For high efficiency and low cost employees, their optimal performance is $\underline{q}^{**} = \underline{q}^{*}$, which meets:

$$L'(\underline{q}^{**}) = \underline{c} \ .$$

For low efficiency and high cost employees, their optimal performance is $\overline{q}^{**} < \overline{q}^{*}$, which meets:

$$L'(\bar{q}^{**}) = \bar{c} + \frac{\pi}{1 - \pi}\Delta c .$$

(2) Only employees of high efficiency and low cost get rental information, its value is

$$\underline{U}^{**} = \Delta c\, \bar{q}^{**} .$$

(3) Employees of high efficiency and low efficiency receive an incentive value as:

$$\underline{c}\underline{q}^{**} + \Delta c\, \bar{q}^{**} \quad , \quad \bar{c}\, \bar{q}^{**} .$$

For a work, performance of enterprise management based on staff may make difference, different incentive value, by their own choice, and choose according to work assignments determined by staff in prior. We expect to strengthen incentives to maximize the managers enthusiasm, initiative and creativity, to enable employees to maximize the potential of play, so that efficiency is further raised to achieve management optimization.

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