Two Patterns of Knowledge Trading

Yi Li, Yuanjie Ni, Wei Liu, Wenxing Yan,
School of Economics and Management, Chongqing University of Posts and Telecommunications, Chongqing 400065, China
yili.cqupt@gmail.com, 1813930016@qq.com, 457719745@qq.com, 394777882@qq.com

Abstract. The knowledge trading between enterprises could be divided into traditional pattern (TP) and E-commerce pattern (ECP). Both two patterns have their own advantages and disadvantages, and enterprises would face the selection. In the paper, mathematical model is constructed to analyze the selection mechanism of two patterns. The result shows that: when some factors increase, the possibility that enterprises choose TP increases; while when some other factors increase, the possibility that enterprises choose ECP increases, too. But when the reserve cost of ECP gets high enough, that will make enterprises more willing to choose the hybrid pattern.

Keywords: knowledge trading, online innovation, E-commerce pattern, traditional pattern, mathematical model.

1 Introduction

In the production and operation activities of enterprises, we often encounter problems that cannot be solved with inner knowledge. If we just depend on the inner power to research and develop the knowledge that we need, it may takes huge cost and long time, so enterprises always need to acquire knowledge from the outside [1-4].

The knowledge trading between enterprises is an important way for enterprises to acquire outside knowledge [5][6].

We could divide the knowledge trading into traditional pattern (TP) and the E-commerce pattern (ECP) according to the medium of exchange. The TP refer to the pattern that the enterprises who are familiar with each other set the trading agreement based on the reciprocal, and then carry on the knowledge transfer offline [5][7]. The ECP refer to the pattern that enterprises publish the need of knowledge on the Internet and outsource the innovation tasks to other enterprises, besides the deal would be completed online. Both two patterns have their own advantages and disadvantages, enterprises would face the dilemma when they have to choose a better pattern. Enterprises should weigh the cost and the profit of two patterns, so that they might make better decision. This paper borrows Liu De’s idea of workers’ selection behavior of knowledge sharing approach and creates mathematical model to analyze enterprises’ selection mechanism of the two knowledge trading patterns [8].
2 The Model

2.1 The description of variables

Table 1. Definition of variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\delta$</td>
<td>The possibility that enterprises could keep the trading relationship after every knowledge trading</td>
</tr>
<tr>
<td>$p$</td>
<td>The possibility that enterprise become the supplier</td>
</tr>
<tr>
<td>$q$</td>
<td>The possibility that enterprise become the demander</td>
</tr>
<tr>
<td>$x$</td>
<td>The distance of knowledge</td>
</tr>
<tr>
<td>$e$</td>
<td>The sharing cost that the supplier pays for trading</td>
</tr>
<tr>
<td>$s$</td>
<td>The searching cost that the demander pays for trading</td>
</tr>
<tr>
<td>$\eta_a$</td>
<td>The supplier’s risk cost</td>
</tr>
<tr>
<td>$c_a$</td>
<td>The supplier’s reserve cost</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>The profit that the demander acquires</td>
</tr>
<tr>
<td>$r$</td>
<td>The reward that the supplier could get</td>
</tr>
<tr>
<td>$f$</td>
<td>The coding cost that the supplier pays for trading</td>
</tr>
<tr>
<td>$\beta$</td>
<td>The agency cost that the demander pays for trading</td>
</tr>
<tr>
<td>$\eta_b$</td>
<td>The supplier’s risk cost</td>
</tr>
<tr>
<td>$c_b$</td>
<td>The supplier’s reserve cost</td>
</tr>
</tbody>
</table>

2.2 The model’s operation process

![Fig. 2. The model’s operation process](image-url)
3 Model analysis

3.1 The critical conditions for enterprises to choose traditional pattern

The conditions that enterprises could choose TP are: the lowest profit in TP is greater than the highest profit in ECP. That is $y(c_a)_{\text{min}} > y(c_b)_{\text{max}}$, and

$$y(c_a)_{\text{min}} = \frac{\sigma}{1-\sigma} \{p(1-x)F(c_e)p(1-x)F(c_e)\} + \frac{\sigma}{1-\sigma} [\alpha - p(1-x)F(c_e)\eta_c - p(1-x)F(c_e)\eta_e - c_a]$$  \hspace{1em} (1)

$$y(c_b)_{\text{max}} = \frac{\sigma}{1-\sigma} \{p(1-x)F(c_b)p(1-x)F(c_b)\} + \frac{\sigma}{1-\sigma} [p(1-x)F(c_b)\alpha - p(1-x)F(c_b)\beta]$$  \hspace{1em} (2)

And we can get the conditions that $y(c_a)_{\text{min}} = y(c_b)_{\text{max}}$ is

$$x_1 = 1 - \frac{1}{A \left\{1 - s - \eta_a - \sqrt{2c_a [\alpha - \beta + r - \eta_b]}\right\}}$$  \hspace{1em} (3)

That means when $x < x_1$, enterprises just choose TP to carry on knowledge trading. For example, when $x_1 = 0.6$, enterprises would carry on knowledge trading with other enterprises that the range of distance of knowledge is 0.6. So the condition that the situation that enterprises just only choose TP exists is $x_1 > 0$. Set

$$c_{b1} = \frac{(1 - s - \eta_a - \frac{1}{A})^2}{2[\alpha - \beta + r - \eta_b]}$$  \hspace{1em} (4)

We can get the condition that enterprises only choose TP: $x < x_1$ and $c_b < c_{b1}$.

3.2 The critical condition that enterprises choose E-commerce pattern

Comparing the highest profit of TP to the lowest profit of ECP, we can get the critical condition that enterprises should only choose ECP is $y(c_b)_{\text{min}} > y(c_a)_{\text{max}}$. $n$

$$y(c_a)_{\text{max}} = \frac{\sigma}{1-\sigma} \{p(1-x)F(c_a)p(1-x)F(c_a)\} + \frac{\sigma}{1-\sigma} [\alpha - p(1-x)F(c_a)\eta_a]$$  \hspace{1em} (5)

$$y(c_b)_{\text{min}} = \frac{\sigma}{1-\sigma} \{p(1-x)F(c_b)p(1-x)F(c_b)\eta_b - p(1-x)\}$$
\[+\frac{\sigma}{1-\sigma}[p(1-x)F(c_h)\alpha - p(1-x)F(c_b)\beta]\]  

(6)

We could get the condition that \(y(c_x)_{max} = y(c_s)_{max}\) is

\[x_2 = 1 - \frac{1-s-\eta}{A}\{(1-s-\eta)^2 - \epsilon_1[\alpha + r - \eta - \beta - 1]\}\]  

(7)

That means when \(x > x_2\), enterprises just choose ECP. When \(x_2 \geq 1\), enterprises wouldn’t only choose ECP, so the condition that only choose TP is \(x_2 < 1\). Set

\[c_{b2} = \frac{(1-s-\eta)^2}{\alpha + r - \beta - \eta - 1}\]  

(8)

We get the condition that enterprises only choose TP is: \(x > x_2\) and \(c_b < c_{b2}\).

### 3.3 The critical condition that enterprises choose hybrid pattern

Because of \(x_2 - x_1 > 0\) and \(c_{b1} < c_{b2}\), we could get condition that enterprises choose hybrid pattern is \(x_1 \leq x \leq x_2\). So we can get the enterprises’ selection mechanism in Table 2.

**Table 2.** The enterprises’ selection mechanism

<table>
<thead>
<tr>
<th>(0 \leq c_b &lt; c_{b1})</th>
<th>(c_{b1} \leq c_b &lt; c_{b2})</th>
<th>(c_{b2} \leq c_b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0 &lt; x_1 &lt; x_2 &lt; 1)</td>
<td>(x_1 \leq 0, x_1 &lt; 1)</td>
<td>(x_1 \leq 0, x_2 \geq 1)</td>
</tr>
</tbody>
</table>

And the specific factors’ change would change and affect the final result on choosing trading patterns.
4 Conclusion

The paper induces the operation characteristics and influence factors of two patterns and construct mathematical model to analyze the trading mechanism. The result shows that when agency fee, risk cost of ECP and trading potential increase, the possibility that enterprises choose TP increase, too; with the increase of the explicitness of knowledge, searching cost, trading incentive, the risk cost of TP and reserve cost of ECP, the possibility that enterprises choose ECP gets increased; when the reserve cost of ECP become big enough, that would make enterprises be more willing to choose hybrid pattern.

The paper analyze the selection of trading patterns under specific situation by constructing model, and the quantitative analysis is used to research the factors that could affect the selection of two patterns, illustrates the selection mechanism more detailed and imitate the operation process of two patterns more realistic.

This research provides theoretical reference to the practice of enterprises management. The supplier should make sure the distance of knowledge and set the appropriate reserve cost, then weigh our the cost and profit and choose the trading pattern; the demander should make sure the searching cost, the agency fee of ECP and trading incentive in order to choose the trading pattern; the network service providers should construct more perfect trading mechanism and credit rating mechanism to decrease the trading risk and agency fee, that would be helpful to enlarge the number of enterprises who choose hybrid pattern.

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References