A Model to Identify Evolution Phase of E-Service Industry Cluster

Hui-jun NI
State Grid of China Technology College, Jinan, Shandong, China
missnihuijun@163.com

Keywords: E-Service Industry Cluster, Identification Model, PAEI Analysis.

Abstract. With rapid development of new generation information technology, E-Service industry in clusters accelerates evolution progress. The paper constructs a model to identify the evolution phase of E-service cluster system based on PAEI analysis. At the end, a case “E-service industry in Jinan high-tech district” is analyzed and the result helps it sustain development.

Introduction

The rapid development of the new generation information technology such as big data, cloud computing, Internet of things and the mobile Internet further promote the integration of E-service and the entity economy in depth. E-service industry has become an important force leading economic growth, promoting industrial restructuring and driving economic transformation and upgrading. Industry cluster become to be a major organization form of E-service industry. The academic study of E-service cluster is only based on a low level. Many theories have not been demonstrated completely. Based on the above background, this paper selects E-service industry cluster as the research object, and builds the model to identify evolution phase to guide sustainable development of E-service industry cluster.

Literature Review

Industry Cluster Development and Evolution

Industry cluster is the geographical convergence of lots of enterprises in the same industry and some interrelated industries, and even some backup institutions. Anthony J. Venables found that geography adjacency or concentration promoted the economy. Shao-bo mu built a model how to sustain growth for industry cluster with self-organization theory and dynamic ability theory, and pointed that self-organization was prerequisites of clusters’ sustainable growth. Bergman, Feser pointed out that the growth of cluster was divided into potential stage, appearing stage, existing stage and decline stage. Deng Jun thought that innovation and learning were power of cluster evolution, and studied cooperative innovation and knowledge sharing in the cluster with evolutionary game theory.

E-service Industry Development Model and Evolution Theory

Mingxiao Bo divided E-service industry into two categories: basic services and integrated services. Zhichao liu analyzed the E-service value on big data, and summed up E-service mode, including: personalized guide service, vertical niche services and data services. Tichy, G divided cluster life cycle into four phases: formative phase, growth phase, maturity phase and petrify phase or regenerative phase according to the theory of product life cycle. According to enterprise development flexibility and controlled ability, Eddie partitioned the growth into three: growth stage, maturation stage and decline stage, and life cycle phase depends on composite state of four kinds of function (executive function, P for short; administrative executive function, A for short; innovation function, E for short; and integrating functions, I for short).
PAEI Function Analysis in Different Development Phase of E-Service Industry

With PAEI analysis tool, the paper predicts PAEI characteristics of E-service industrial clusters system at different stages, and keeps E-service clusters system sustainable development.

**Formative Phase**

The obvious feature of this phase is paEi. E-services just focus on their homogeneous services with little communication and cooperation. Increasing gradually in transaction volume, more E-services facilities are highly concentrated in cluster system, and P function has been strengthened. At the same time, innovation functions begin to emerge as competition intensified. In this section, composite state is from paEi - paEi - paEi.As a result, “Market for Lemons” occurs and management disorder and operation efficiency turn instantly into a systemic crisis.

**Growth Phase**

Some leading E-enterprises attract a large number of e-commerce services to gather, both similar service enterprises and vertical integration enterprise. Derivative E-services begin to emerge. The cluster enterprises connect more closely to form a complete vertical and horizontal collaboration network. Cluster administrative executive ability increased significantly at the expense of a single enterprise. The obvious feature of this phase is PAei.

**Maturity Phase**

E-service industry clusters reach the largest scale with a complete system of industry value. Cluster learning, especially silent knowledge begins to be taken seriously, improves innovation level of cluster system, characterized by PAEi.

**Petrify phase**

In this phase, imitating has dominated E-enterprises behavior. "Free rider", intrinsic rigidity, network cost caused by moral hazard and opportunistic are all increasingly protruding. The obvious feature of this phase is PAei - PAei - A-.If petrify is timely adjusted, cluster will probably continue to implement regeneration.

A Identified Model on Evolution Phase of E-Service Industry Cluster

**Measurement on PAEI**

**Measure to P function.** P function shows in what degree E-Service cluster satisfies the need of market, customers and stakeholders, more concretely, it’s the degree of appeal that E-Service cluster to its users. P function can be measured by E-organization spatial concentration.

**Measure to A function.** In E-Service cluster growth phase, A function is becoming an important function. Three parameters are of prime importance: connection degree of elements, standardization and effectiveness of rules.

**Measure to E function.** E function is the symbol of creative potential, which is measured by number of major scientific and technological achievements, the invention patent applications and number of scientific papers included by SC, EI and ISTP.

**Measurement to I function.** I function seeks for maximizing long–run profit. The main function is to help form a mutually dependent, affinity culture, and flexible organisms. It can be evaluated via the cultural integration, the depth and intensity of cooperation and integrity level.

**Building a Identified Model on Evolution Phase**

An identified Model on Evolution Phase of E-Service Industry Cluster is as Tab.1. Follows.
Table 1. An identified Model on Evolution Phase of E-Service Industry Cluster.

<table>
<thead>
<tr>
<th>Function Element</th>
<th>Variables</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>P</td>
<td>SR</td>
<td>SR = \frac{\text{Turnover of a particular category of E-organizations}}{\text{sum of areas in a cluster}} \frac{\text{Turnover of a particular category of organizations in district}}{\text{sum of areas in district}}</td>
</tr>
<tr>
<td>CR</td>
<td></td>
<td>CR = \frac{\text{sum of E-organizations in cluster}}{\text{sum of cluster areas in cluster}} \frac{\text{sum of organizations in district}}{\text{sum of areas in district}}</td>
</tr>
<tr>
<td>A</td>
<td>G</td>
<td>G = \sum_{i} (X_i - S_i)^2</td>
</tr>
<tr>
<td>OBS</td>
<td></td>
<td>OBS = \frac{\text{Gross trading amounts of E-service in one industry with external cluster partners}}{\text{Gross trading amounts of E-service in one industry within cluster partners}}</td>
</tr>
<tr>
<td>RI</td>
<td></td>
<td>The effectiveness of the government policy</td>
</tr>
<tr>
<td>CM</td>
<td></td>
<td>Degree of management standardization of E-service cluster</td>
</tr>
<tr>
<td>E</td>
<td>EI</td>
<td>CR = \frac{\text{the total number of achievements in major technology and patents in one cluster}}{\text{the total number of scientific institutions in one cluster}} \frac{\text{the total number of achievements in major technology and patent in one district}}{\text{the total number of scientific institutions in one district}}</td>
</tr>
<tr>
<td>CL</td>
<td></td>
<td>Knowledge transformation among cluster partners</td>
</tr>
<tr>
<td>I</td>
<td>CI</td>
<td>Cultural integration</td>
</tr>
<tr>
<td></td>
<td>OI</td>
<td>Depth and intensity of cooperation</td>
</tr>
<tr>
<td></td>
<td>CR</td>
<td>Integrity level</td>
</tr>
</tbody>
</table>

Reliability and Validity Analysis

In this study, the paper used SPSS13.0 to explore factor analysis. KMO coefficients 0.86 and Barlett's spherical efficiency indicates the sample is suitable for factor analysis. Orthogonal rotating to load matrix show that all data is collected into four factor more than 1 eigenvalue with insufficient loading 78.51% of total variance is explained. The Cronbach's α coefficients are all above the minimum of acceptable value and indicate good reliability.

An Application Case

The model is applied to the Jinan high-tech cluster, whose E-commerce industry has vigorous development. Jinan high-tech cluster will promote development of E-commerce industry with "seven service platform" and "two core base" construction as the focus.

Model Application

In this paper, the methods that combined with export estimation and fuzzy comprehensive evaluation are adopted.

Indicators Remarks: \( v = (v_1, v_2, v_3, v_4, v_5) = (1, 2, 3, 4, 5) \)
The Index Weight Vectors:

\[
\begin{bmatrix}
    w_p \\
    w_i \\
    w_e \\
    w_t
\end{bmatrix} = \begin{bmatrix}
    0.56, 0.44 \\
    0.5, 0.26, 0.14, 0.1 \\
    0.45, 0.55 \\
    0.2, 0.2, 0.6
\end{bmatrix}
\]

\[ B_p = (0.0, 0.036, 0.212, 0.624, 0.286) \]

The Fuzzy Evaluation Matrix:

\[ B_A = (0.05, 0.20, 0.176, 0.16, 0.113) \]
\[ B_E = (0.21, 0.36, 0.31, 0.10, 0.12) \]
\[ B_I = (0.11, 0.20, 0.19, 0.11, 0.02) \]

Meanwhile, the results from fuzzy comprehensive evaluation were analyzed by weighted average method.

\[ D_p = 4.24 ; D_A = 2.19 ; D_E = 3.39 ; D_I = 2.15 \] (1)

**Analysis and Conclusion**

E-commerce industry of Jinan high-tech cluster is at an early stage in its cycle, formative phase of cluster life cycle. The value of P is 4.24, nearly up to an ideal value; meanwhile the function of E is beginning to show. According to the theory of cluster life cycle, the next stage is growth phase. not only the manager should pay much more creative cultivation, but also much more administration, and make preparation and underlay from formative phase to growth phase. Pay attention to strengthen administrative functions, and pay attention to cultivate innovation function for the system from growth stage to mature stage.

**References**


320