Analysis of Environmental Factors Which Affect the Development of Ride-sharing Platform in China Based on ISM model H

Lin Li, Meng Chao

Abstract: ***This paper mainly uses Interpretative Structural Modeling (ISM) to clarify environmental factors which affect the development of ride-sharing platforms in China, and to get their hierarchy and importance sequence. There will be a 7 layers ISM diagram for the environmental factors, from the diagram, industrial economic strength, core technology and support, infrastructure construction, and Internet technology implementation, industry policies, laws and regulations, industry management level are the key factors to affect the development of ride-sharing platform in China.***

Index Terms*: *Keywords: Ride-Sharing Platform; ISM Model; Environmental Factors.

I. INTRODUCTION

The concept of "sharing economy" was first proposed jointly by American Scholars Marcus Felson and JOE L. Spaeth. They described a new way of life and consumption named as "collaborative consumption". The main feature of sharing economy is individuals achieve point-to-point direct transactions of goods and services through third-party platforms [1]. However, the objective conditions at that time made it difficult to put into practice. With the development of network technology, now it is possible to integrate offline idle goods or personal services and provide them to users at a lower price, gradually it become a viable new business model.

As ride-sharing platform, Uber has become the leading enterprise in the sharing economy, its successful experience is the learning target of other sharing economic platforms, and the business model is also representative in sharing economic industry. However, Uber naively believes that the leading business model and business methods in the US market can be seamlessly extended to other countries and regions, without paying attention to localization for the users, in China and even Southeast Asia, Uber suffered a huge defeat and was replaced by DiDi and Grab.

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As the largest ride-sharing platform in China, DiDi was pushed to the turmoil in the second half of 2018 due to security issues, two women were raped and killed by DiDi drivers while riding, and the call to shut down DiDi was endless. In China, ride-sharing platforms, from "Uber" "Kuai Di" "DiDi" sharing the majority market to DiDi merging with the other two and becaming China's largest ride-sharing platform, from DiDi's monopoly status to frequent security issues which is exploded recently. What kind of key environmental factors affect the development of the ride-sharing platform? This paper attempts to find the environmental factors that affect the development of ride-sharing platforms, by searching relevant documents, expert seminars and case studies at various levels, comparing each other, then use the ISM model to clarify their levels and relevance.

II. LITERATURE REVIEW

The ride-sharing platform was first developed in China in 2010, "Yi Dao" is the first ride-sharing platform in China [2]. Then ride-sharing platform has experienced 8 years of development, from "Uber" "Kuai Di" "DiDi" sharing the majority market to DiDi merging with the other two and becaming China's largest ride-sharing platform.

In the study of the development of ride-sharing platform, scholars Fei Fei, Wei Huayi, Wang Yufei, Lu Changxian point out that government regulation and industry policies, industry management level, and protection of public information data security are the important factors in the development of ride-sharing platform [3].

Yang Shuai think that the change of people's consumption concept, the support of network technology, and the establishment of trust mechanism are the key to the success of ride-sharing platform [4].

Botsman think that "the rapid population growth" "the increase in the proportion of urbanization" and "the expansion of the income gap has increased the enthusiasm of private cars drivers to participate in ride-sharing" promote the development of ride-sharing platform [5].

Chen Chi, the CEO and co-founder of "Piggy Short-term Rental" said in Boao Forum for Asia 2018, that for the sharing economy, from the perspective of competition, the scale of the industry is crucial, and no capital investment can

be obtained without exceeding the scale of the competitors [6].

III. METHODOLOGY

A. Overview of Research Methods

Interpretative Structural Modeling (ISM), decomposes the complex system into several subsystem elements, and use people's practical experience and knowledge as well as the help of the computer to finally form a multi-level hierarchical structural model [7]. This model is mainly based on qualitative analysis and belongs to the structural model. It can transform fuzzy ideas and views into intuitive models with good structural relationships. It is especially suitable for system analysis with many variables, complex relationships and unclear structure. By using the ISM model, the environmental factors affecting the development of ride-sharing platform can be clarified, and their levels and relevance can be analyzed.

The basic analysis steps of the ISM model are:

1. Search relevant documents, expert seminars and case studies at various levels, compare each other, and then explore the environmental factors affecting the development of ride-sharing platform.
2. Analyze the identified index factors to determine the mutual relationship among the elements, and then construct the adjacency matrix.
3. Find the reachable matrix by the adjacency matrix.
4. According to the reachability matrix, hierarchically divide the entire structure.
5. According to the hierarchical division, find the directional relationship path diagram between the elements and draw the ISM structure diagram.
6. Through the ISM structure diagram, the environmental factors affecting the development of the ride-sharing platform can be clarified, and their levels and relevance can be analyzed.

B. Environmental Factors Affecting the Development of Ride-Sharing Platform

Through the combing of the literature review in the second chapter, according to PEST analysis, the environmental factors affecting the development of the ride-sharing platform are classified as:

1) Politics

S1 Industry policies, laws and regulations

S2 Industry management level

2) Economy

S3 Industry economic strength

S4 Industry size and attributes

S5 Infrastructure construction

3) Society

S6 Travel mode changes

S7 Public trust in ride-sharing platform

S8 Population density

S9 Enthusiasm of private car drivers participating in ride-sharing

4) Technology

S10 Core technology and support

S11 Internet technology implementation

S12 Establishment of credit mechanism

In order to the analysis of the ISM model, the final target S13 ride-sharing development is added.

C. Solving of the ISM Model Diagram

First of all, S1-S13 is listed in the matrix, and then the influence relationship between each element is analyzed one by one to obtain the adjacency matrix A, as shown in Figure 3-1.

	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**
S1	0	0	0	1	0	0	1	0	0	0	0	1	1
S2	0	0	0	0	0	0	1	0	1	0	0	1	1
S3	0	0	0	1	0	0	0	0	1	1	0	0	1
S4	0	0	0	0	0	0	0	0	0	0	0	0	1
S5	0	0	0	0	0	1	0	1	0	0	1	0	1
S6	0	0	0	0	0	0	0	0	0	0	0	0	1
S7	0	0	0	0	0	1	0	0	1	0	0	0	1
S8	0	0	0	1	0	0	0	0	1	0	0	0	1
S9	0	0	0	0	0	0	0	0	0	0	0	0	1
S10	0	1	0	1	0	1	1	0	1	0	1	1	1
S11	0	1	0	0	0	1	1	0	1	0	0	1	1
S12	0	0	0	0	0	1	1	0	1	0	0	0	1
S13	0	0	0	0	0	0	0	0	0	0	0	0	0

Fig. 3-1 Adjacency Matrix A

Through the software of Matlab, the reachable matrix M is calculated by the adjacency matrix A, as shown in Figure 3-2.

	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**S9**	**S10**	**S11**	**S12**	**S13**
S1	1	0	0	1	0	1	1	0	1	0	0	1	1
S2	0	1	0	0	0	1	1	0	1	0	0	1	1
S3	0	1	1	1	0	1	1	0	1	1	1	1	1
S4	0	0	0	1	0	0	0	0	0	0	0	0	1
S5	0	1	0	1	1	1	1	1	1	0	1	1	1
S6	0	0	0	0	0	1	0	0	0	0	0	0	1
S7	0	0	0	0	0	1	1	0	1	0	0	0	1
S8	0	0	0	1	0	0	0	1	1	0	0	0	1
S9	0	0	0	0	0	0	0	0	1	0	0	0	1
S10	0	1	0	1	0	1	1	0	1	1	1	1	1
S11	0	1	0	0	0	1	1	0	1	0	1	1	1
S12	0	0	0	0	0	1	1	0	1	0	0	1	1
S13	0	0	0	0	0	0	0	0	0	0	0	0	1

Fig. 3-2 Reachable Matrix M

Then, each element will be hierarchically divided, use $R(S_i)$ to represent the reachable set of S_i, and $Q(S_i)$ to represent the set which the elements can reach S_i. If $R(S_i)=R(S_i) \cap Q(S_i)$, it means S_i is the highest level element.

For the first level of the most advanced element, it must be the target S13 ride-sharing development, so L_1={S13}

Exclude S13 and find the highest element of the second layer, as shown in Figure 3-3.

Element i	**$R(S_i)$**	**$Q(S_i)$**	**$R(S_i) \cap Q(S_i)$**
1	1,4,6,7,9,12	1	1

2	2,6,7,9,12	2,3,5,10,11	2
3	2,3,4,6,7,9,10,11,12	3	3
4	4	1,3,4,5,8,10	4
5	2,4,5,6,7,8,9,11,12	5	5
6	6	1,2,3,5,6,7,10,11,12	6
7	6,7,9	1,2,3,5,7,10,11,12	7
8	4,8,9	5,8	8
9	9	1,2,3,5,7,8,9,10,11,12	9
10	2,4,6,7,9,10,11,12	3,10	10
11	2,6,7,9,11,12	3,5,10,11	11
12	6,7,9,12	1,2,3,5,10,11,12	12

Fig. 3-3

L_2= {S4, S6, S9}

Exclude S4, S6, S9 and find the highest element of the third layer, as shown in Figure 3-4.

Element i	$R(S_i)$	$Q(S_i)$	$R(S_i)\cap Q(S_i)$
1	1,7,12	1	1
2	2,7,12	2,3,5,10,11	2
3	2,3,7,10,11,12	3	3
5	2,5,7,8,11,12	5	5
7	7	1,2,3,5,7,10,11,12	7
8	8	5,8	8
10	2,7,10,11,12	3,10	10
11	2,7,11,12	3,5,10,11	11
12	7,12	1,2,3,5,10,11,12	12

Fig. 3-4

L_3= {S7,S8}

Exclude S7,S8 and find the highest element of the fourth layer, as shown in Figure 3-5.

Element i	$R(S_i)$	$Q(S_i)$	$R(S_i)\cap Q(S_i)$
1	1,12	1	1
2	2,12	2,3,5,10,11	2
3	2,3,10,11,12	3	3
5	2,5,11,12	5	5
10	2,10,11,12	3,10	10
11	2,11,12	3,5,10,11	11
12	12	1,2,3,5,10,11,12	12

Fig. 3-5

L_4= {S12}

Exclude S12 and find the highest element of the fifth layer, as shown in Figure 3-6.

Element i	$R(S_i)$	$Q(S_i)$	$R(S_i)\cap Q(S_i)$
1	1	1	1
2	2	2,3,5,10,11	2
3	2,3,10,11	3	3
5	2,5,11	5	5
10	2,10,11	3,10	10
11	2,11	3,5,10,11	11

Fig. 3-6

L_5= {S1, S2}

Exclude S1, S2 and find the highest element of the sixth layer, as shown in Figure 3-7.

Element i	$R(S_i)$	$Q(S_i)$	$R(S_i)\cap Q(S_i)$
3	3,10,11	3	3
5	5,11	5	5
10	10,11	3,10	10
11	11	3,5,10,11	11

Fig. 3-7

L_6= {S11}

Exclude S11 and find the highest element of the seventh layer, as shown in Figure 3-8.

Element i	$R(S_i)$	$Q(S_i)$	$R(S_i)\cap Q(S_i)$
3	3,10	3	3
5	5	5	5
10	10	3,10	10

Fig. 3-8

L_7= {S5, S10}

It can be seen that L_8= {S3}

IV. RESULTS AND FINDINGS

A. Results

According to the layering, the ISM structure diagram can be obtained, as shown in Figure 4-1.

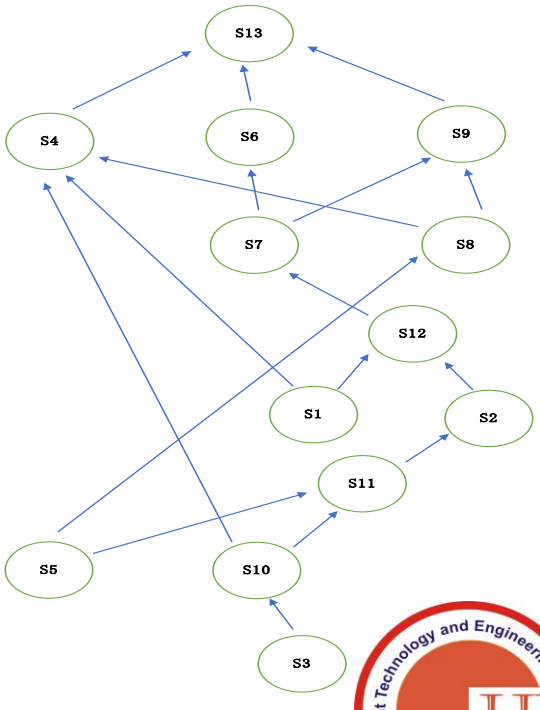

Fig. 4-1 ISM structure diagram

B. Findings

1. The industrial economic strength is located at the 7floor of the structural ISM diagram, indicating that the industrial economic strength is the most fundamental factor affecting the development of the ride-sharing platform, which explains why the demise of countless small ride-sharing platforms have declined over the past eight years. With strong financial strength and subsidies at a loss, DiDi eventually became the largest monopolist of China's ride-sharing platform.
2. Core technology and support, infrastructure construction, and Internet technology implementation are located in the 5th to 6th floors, indicating that these three factors provide possibilities for the development of ride-sharing platform. Government, industry, and enterprises need to invest most of the funds to ensure the continued viability and superiority of ride-sharing platform technology.
3. Although the industry policies, laws and regulations and industry management level are at the fourth level, it must be emphasized that the recent security issue of ride-sharing platform (two crimes of DiDi drivers killing and raping young female passengers) reveals the problems in the management of the entire industry and the vacuum area of government laws and regulations, and have caused the public to have great distrust of the safety of ride-sharing platforms (S7), may even destroy the entire industry. Therefore, the enterprises need to pay attention to management level, and improve the security of the ride-sharing platform through core technology (S10) (such as the introduction of public security alarm system and emergency help system), and the government needs to fill the relevant legal gap.
4. There is a strong connection among the factors affecting the development of ride-sharing platform. In the management process, the internal links between them should not be ignored.

V. CONCLUSION

In summary this study lists the main environmental factors affecting the development of ride-sharing platforms in China through combing the literature, uses the ISM model to clarify their internal relationships and levels, clearly points out the main environmental factors affecting the development of ride-sharing platforms in China are industrial economic strength, core technology and support infrastructure construction, Internet technology implementation, industry policies, laws and regulations, industry management level. The government, whole industry, and enterprises need to focus on these factors to ensure the healthy and sustainable development of the ride-sharing platform.

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