

A New Economic Innovation Paradigm Model Based on Dimension Competitive Entropy

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Abstract: Most researchers have paid more attention to the technologic innovation, when the topic of the innovation was talked. Actually, especially when we promote the development of digital economy, the innovative paradigm is very different from traditional economy to companies, industry. In this paper, the knowledge of natural science is combined with the knowledge of literature to construct the new paradigm model function. The model is formulated by combining the main ideas of Three-Body Problem which has been written by the Cixin Liu. And, a new economical innovation paradigm model is proposed by the dimension innovation, which based on the dimension competitive entropy, which is proposed to describe the innovation competitive power of an enterprise. The attacking by reducing the core dimension and thinking by increasing the new core dimension are formulated with the mathematic function. In the experiment, the model is tested using the simulated data to prove the innovation paradigm model useful to a company.

1. Introduction

To classical economics theory to national innovation system theory and the latest development of evolutionary economics, the research on innovation paradigm in western economics and management has experienced three stages^[1]. The first stage corresponds to the linear innovation model of neoclassical school and endogenous growth theory, and believes that the externality of innovation is the key content of innovation strategy. The second stage begins with the proposal and development of national innovation system theory. After the 1970s, Nelson analyzed there were non-equilibrium and dynamic complex economic system in the technological innovation, and put forward the technology paradigm of “management–search–environment selection” from micro to macro^[2]. In 1987, Freeman proposed the concept of national innovation system, which was put forward for the first time in the study of Japan's technology policy and economic performance^[3]. In 1992, Lund Vall believed that the core of the national innovation system is the interaction between producers and users^[4]. In 1997, the OECD held that the core of the national innovation system was to emphasize the technical cooperation and interaction between enterprises, universities, research institutes and other relevant institutions. During this period, the government played an important role in the innovation process from top to bottom^[5]. These papers^[6-7] believe that the open innovation theory and triple helix theory of innovation on politics, industry and Science were the key and important theoretical support to the national innovation system. Now, the research on innovation paradigm has entered the third stage, and its theoretical mainstream is inherited from evolutionary economics, and there are many new development.

In the digital economy, many companies have been not defeated by these companies, which are in the same industry. They have been defeated by the third company in other cross-field or cross-industry. It can not be found because it is not in the same industry. The enemy which they believe always, is not the real enemy. This is the character of the digital economy competition. Many

productions have lost its competitiveness or advantages in the market. Because, the real enemy is the company in other field which they have advanced dimension and high level civilization. Just like the Tencent is the real enemy to the China Unicom and China Mobile, when they have competed for many years. The China Unicom has regarded the China Mobile as its competitor. But the real enemy is the Tencent. Because it is very easy and convenient through WeiXin app, when we want to communicate with friends or colleague. The voice communication and SMS are rarely used by more younger people. So, the Tencent have take more profit through internet, while the China Unicom have lost more application scenarios, which they can get more profit.

This phenomenon is very normal and usually happened in the digital economy. It's none of your business to destroy you. Many companies do not can find their real competitor. The cross field or industry company attacking is not easy to be found and to be defence, because they have advanced value dimension. In other words, because they are the advanced civilization than the lower level of civilization, they have more advantages and competitive power than the lower level of the civilization, just like the scene in the famous science fiction of the Three-Body Problem which has been written by the Cixin Liu. Actually they have the critical and high dimension, which can make the advantages of the dimension to defeat their competitors. And they can take more profits using their highly civilization.

2. Innovation of the Dimension

2.1 Dimension

Dimension is the number of independent parameters in mathematics to describe the problem. In the field of physics and philosophy, the number of independent space-time coordinates. In the field of innovation to a company, the dimension is the factors or some aspects to reflect the competitive power of the company. With the help of those factors, the company can get more profit than other company. In traditional commerce field, every commodity is composed of quality, service and price. It is in the three dimensions. Different business models have been bred because different permutations and combinations of the three dimensions. Now, with the developing of the internet, the information as a new dimension is used by internet companies, just like UBER, Baidu, Alibaba, etc. These companies which have mastered the fourth dimension have become high-level civilization forms in the traditional business model. They can launch dimension reduction attack on low-level business civilization in the high-dimensional world. So, the dimension is important to the company competition.

2.2 Innovation of the Dimension

There usually are some innovations on the product, technology, business model and the organization, etc, in the tradition innovation field. When we talk about innovation, the most topic or content is about the technology innovation. The technology is the most important innovation aspect to a company. Actually, the innovation has many aspects, just like aspects mentioned above. Besides these, the innovation of dimension to set up the value ecosystem system of the field, is also important and always is ignored by most companies. The innovation of dimension is to create a new dimension, which is used to get more profit. For example, the internet platform is used by Alibaba and TaoBao, which is regarded as a new dimension to convenient people shopping or doing business. Most traditional companies use the Information asymmetry to earn price difference of the goods. Now, The information is get easy. More peoples can get more opportunity to doing business by suing the internet. The threshold of doing business or start up new business is lower by the internet to the small company. Most companies create a new dimension using the internet to get more advantages by establish a high dimension value network.

Just like the TikTok company, it established a new high dimension civil than the traditional internet company like BAT(Baidu,Alibaba,Tencent) by the artificial intelligence algorithm. The push choice is the biggest feature of the TikTok which use push algorithm to change the world. The

push algorithm can calculate your preferences information according to your behaviours on their platform and directly show your love product or content to you. We are no longer need to bother to make a choice. In comparison, this is more in line with the characteristics of human nature, because we do not even need to make a choice. The algorithm directly helps users to calculate and make a decision instead of user. So, the Tiktok company uses the higher algorithm to change the world.

The traditional internet companies, which are represented by BAT, are characterized by choice to change the world. They put everything to the users and let users choose according to the users will. Many of them will choose what they like. This is choice to change the world.

3. Dimension Competitive Entropy

In the physical world or the real world, information entropy is a parameter to describe the disorder of things. The greater of the entropy, the more chaotic of a system. To describe the competitive power of the dimension innovation, we use the entropy to quantization according to the character of the digital economy. Because, in the digital economy, most competitors are the companies, that are in a different industry with itself. Many entrepreneurs believe that companies in the same industry are competitive with each other. At last, they have found the real enemy is the company in the other industry. The real competitors are the companies which are in the cross-industry. Because there are many different dimensions, advantages in the cross-industry. So, it is very easy to establish a new dimension which is the advantage to get new market. The product is used by more customers.

We use the P_j , which describes the probability of the j dimension. $0 \leq P_j \leq 1$. If the $P_j = 0$, it means there are not j dimension in the enterprise. If the $P_j = 1$, it means the j dimension is the core dimension in the enterprise. The $j \in (1,2,3,\dots,m)$ means different dimension of a company, just like price, quality of the product. H_i that is calculated by the function 1, means the competitive ability of the No ^{i} company. $i \in (1,2,3,\dots,n)$ stands for the related companies. We use the function to calculate the competitive entropy of all dimension in a company. The greater of the H_i , the more competitive of the enterprise or company.

$$H_i = -\sum_{j=1}^{j=m} P_{ij} \ln P_{ij} \quad (1)$$

$$\text{Where the } \sum_{i=1}^{i=n} P_{ij} = 1.$$

4. Innovation Paradigm Model

4.1 Thinking by Increasing Dimension

Imagine the universe or the competition between companies as a forest, patrolled by numberless and nameless predators. In this forest, stealth is survival. Any civilisation that reveals its location is preyed.

According to the dimension definition in the digital economy, any problem, to achieve the optimization of the problem, or to maximize the goal, must be more inseparable from the core many factors. These factors can be called dimensions. First of all, we must make clear the problem or goal, through the definition and analysis of the problem. Then we can find the core factors and dimensions that affect the goal. At last, we can think about how to improve or reduce the dimension. In the process of thinking, we should not only think clearly about all the dimensions of a company, but also think clearly about the positive and negative forces between the dimensions. More dimensions should be thought when we analysis the problem. The difficulty of dimension increasing thinking is that it may not only be a simple problem decomposition and linear thinking, but also there are correlation and influence between dimensions, a three-dimensional network

structure is formed.

4.2 Attacking by Reducing Dimension

Dimension reduction reduces the core dimension of the competitor to increase market share. Take three-dimensional space as an example to analyse. If a person adapts to the three-dimensional space, once one dimension is removed and enters the two-dimensional world, then he cannot survive in the new space. Similarly, once an enterprise adapts to the core competitiveness of traditional sales channels, brands and other dimensions, if these dimensions is removed, the enterprise will be like a fish out of the water, a tree without roots and difficult to survive. Without these dimensions of traditional competitive advantage, for these traditional enterprises, they will be attacked by dimension reduction of the new internet enterprise.

If a competitor of the enterprise is pulled into a lower dimension competition mode, it will make the competitor lose the original competitiveness dimension and finally be defeated. The core of dimension reduction attack is to use high dimension thinking to find the new and core dimension that can defeated the competitors, by directly reducing the competitiveness of competitors in this dimension to zero.

4.3 Innovation Paradigm Model

In the digital ecosystem, the competitive relationship is less. The cooperation and coevolution relationships are more between companies. The core competitiveness of a company is the core dimension in a company. There are more cooperative developments between the companies of the point, line, plane and stereoscopic dimension in a value-system. We use the function 2 to stand for attacking paradigm by assigning different weight to dimension, which related companies in same industry or cross-industry have.

$$P_{ij}^t = W_{ij}^t \cdot P_{ij}^{t-1} \quad (2)$$

This function stands for the attacking paradigm by changing the probability of the dimension. W_{ij}^t is the attacking weight matrix of the probability at the time t . We use the W_{ij}^t to quantify the increasing and reducing dimension.

$$W^t = \begin{bmatrix} w_{1,1}^t, w_{1,2}^t \cdots w_{1,m}^t \\ w_{2,1}^t, w_{2,2}^t \cdots w_{2,m}^t \\ \vdots \quad \vdots \quad \cdots \quad \vdots \\ w_{n,1}^t, w_{n,2}^t \cdots w_{n,m}^t \end{bmatrix} \quad (3)$$

P_{ij}^t and P_{ij}^{t-1} mean the probability of the j dimension at different $t, t-1$ time to the i enterprise. The probability of the same dimension, which these related companies have, must be normalized by the follow line function.

$$P_{ij}^t = \frac{P_{ij}^t}{\sum_{i=1}^n P_{ij}^t} \quad (4)$$

The $\sum_{i=1}^n P_{ij}^t$ is the sum value of the P_{ij}^t at all competitive dimensions to the i enterprise. After weight matrix multiply the probability of the dimension of the enterprise. We calculate the new probability in the new stages to the i enterprise.

5. Experiment

In this paper, we use the simulation experiment by setting $n = 5, m = 4$. The initial state of the

probability of dimension is set as follow P^{t-1} .

$$P^{t-1} = \begin{bmatrix} 0.2,0.1,0.6,0.1 \\ 0.1,0.2,0.1,0.2 \\ 0.4,0.1,0.1,0.1 \\ 0.2,0.5,0.1,0.1 \\ 0.1,0.1,0.1,0.5 \end{bmatrix}$$

The corresponding dimension competitive entropy is the follow value H^{t-1} . The value of the weight matrix is set as follow W^t .

$$H^{t-1} = \begin{bmatrix} 1.57 \\ 1.59 \\ 1.52 \\ 1.63 \\ 1.50 \end{bmatrix}, \text{and } W^t = \begin{bmatrix} 2,3,7,5 \\ 2,3,5,8 \\ 3,5,4,6 \\ 3,4,9,8 \\ 7,8,3,4 \end{bmatrix}$$

Through the function mentioned above, we capsulated the matrix P^t value as follow with normalization. The corresponding dimension competitive entropy is follow value H^t .

$$P^t = \begin{bmatrix} 0.13,0.07,0.67,0.09 \\ 0.06,0.14,0.08,0.29 \\ 0.39,0.12,0.06,0.11 \\ 0.19,0.48,0.14,0.15 \\ 0.23,0.19,0.05,0.36 \end{bmatrix}, H^t = \begin{bmatrix} 1.36 \\ 1.46 \\ 1.50 \\ 1.77 \\ 1.68 \end{bmatrix}$$

At the next stages $t+1$, the weight is as follow. According to the function mentioned above, the P_{ij}^{t+1} is the follow. The corresponding dimension competitive entropy is the follow value H^{t+1} .

$$W^{t+1} = \begin{bmatrix} 1,4,3,8 \\ 7,6,4,7 \\ 8,9,4,5 \\ 1,3,9,4 \\ 9,1,5,2 \end{bmatrix}, P^{t+1} = \begin{bmatrix} 0.02,0.07,0.49,0.16 \\ 0.08,0.22,0.08,0.44 \\ 0.52,0.28,0.06,0.12 \\ 0.03,0.38,0.31,0.13 \\ 0.35,0.05,0.06,0.15 \end{bmatrix}, H^{t+1} = \begin{bmatrix} 1.32 \\ 1.57 \\ 1.62 \\ 1.59 \\ 1.40 \end{bmatrix}$$

We can see that the dimension competitive entropy is changed by changing the attacking weight matrix. The competitive power of company is changed by set different weight. At t time, the No.4 company is the most competitive power company. At $t+1$ time, the No.3 company has the most competitive power. The figure 1 shows the competitive power H of the different company at different T time, which is expressed using 1,2,3 number.

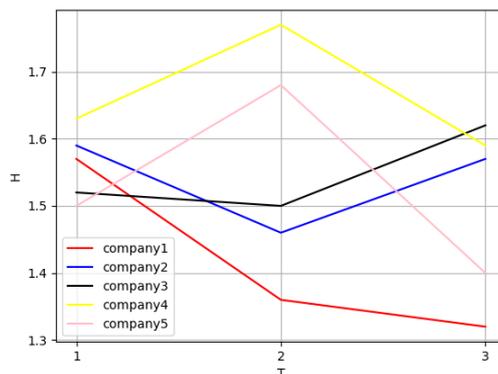


Fig.1 The h of Different Company At Different t Time.

If a new dimension, which makes the existing dimensions of other enterprises fail to work, is created by *i* enterprise. The *i* enterprise can get more opportunities to get more profit of customers in the new value network. We can simulate the result through change the weight of the existing dimension. The bigger weight is set to the new core dimension. So, the experiment proves the function and the model is reasonable.

6. Conclusion

In this paper, the dimension competitive entropy is formulated by mathematics to describe the innovation. The new economic innovation paradigm model, which based on the dimension competitive entropy, is firstly proposed to quantitative analysis of the innovation. Company can use the paradigm model to compete and attack by reducing dimension. This is the achievements of interdisciplinary research by combining the literature and nature science. The experiment proves the paradigm model is reasonable and workable to innovate.

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