Value Innovation Circulation of Construction Enterprises: *a Chinese Case*

Jingxiao zhang

School of Civil Engineering
Chang'an university,
Xi'an, China, 710064
zhangjingxiao964@yahoo.com.cn

Tianhua zhou

School of Civil Engineering
Chang'an university,
Xi'an, China, 710064
zhangjingxiao964@126.com

Hui LI

School of Management
Xi'an University of Architecture
& Technology,
Xi'an, China, 710055
Lihui9922@126.com

Abstract—Although it is true that the issues of low added value growth and disco responding status in the international construction market for China Construction market have been dealt with extensively from different perspectives, studies on the value innovation combined with Deming cycle of TQM are few. This study tackles the issues by analyzing the relative theory to purify the broader concepts of value innovation, then, integrates the Deming Cycle of TQM by analyzing the relationship between innovation and TQM. During this retrospect, the combined point is identified to build the value innovation circulation model for China Construction Industry and the criteria of decision making for the value innovation based on the classic theory of marginal value and the four steps of value innovation. Then, the marginal value in the five conditions is compared. It shows that two necessary and sufficient conditions and one necessary condition about the decision criteria are certificated in the value innovation of China Construction industry (VICI). Finally, the study provides the model of the VICI evolvement to explain the running of value innovation circulation, and it also further puts forward the element transition matrix of CIVI to interpret the change of the buyers' claim in the circulation of the CIVI reasonability and the inner mechanism of value innovation circulation. The study provides useful references for further studies that explore the value innovation used in the China construction industry and those used in other construction industries.

Keywords- Construction industry, Decision principle, Marginal utility, Value innovation

I. INTRODUCTION

It needs the continual evolvement for certain industry to form, develop and reshape, which is the final result of the interaction between the realism construct and naturalism evolvement. Obviously, it includes construction industry of China, which is the traditional pillar industry. The primary issues facing with China construction industry could be expressed as follows: the low value-added program space and the blinded complete ness among the companies as well the unhealthy face in the international construction market. If not all, improving the vale-added and finding the approach to the construction nitch market are the rational alternative strategic actions. The top 225 international contractors to some degree reflect the ability and opportunity of construction enterprise to poses the new market. While this market is full of more completeness contractor than the contractor of China, so, how does construction enterprise to exploit the new space in the

rivalries market? What the Criteria for the contractors to successfully explore the new market? And how does contractors to keep the interests in these markets as a pioneer not as a martyr? The aim of this paper is to continually introduce the theory of value innovation into China construction industry on the basis of models of value innovation in China Construction Industry (zhang jing-xiao [1]). At the same time, using the theory of marginal value, the second object of the paper tries to implement the decision criteria for the construction enterprises' value innovation. Obviously, value innovation of Construction Company is of dynamic in order to poses the industries benefits' highland. So the Deming cycle of total quality management TQM (TQM) is reengineered to underpin the circulation theory of value innovation in China Construction Industry and realize the sustain development of construction enterprises. From the customer and product perspective, there is a similar significant common ground to realize the innovations for company. However, it is just linked to one facet of things, based on the principles that there are a great many kinds of involvement to construct the value and methods to breakthrough the neck for the new products' forming coming from the combinations of factors of products. So, it is true that the integration of two approaches will strength the value innovation capability and be good to the nitch exploration for China construction industry.

In the sector 2, the relative theory of value innovation will be briefly viewed and explained the corresponding new definition about value innovation to what extent to be used with the fact about China Construction Industry; in the sector 3, we will retrospect the related literatures to discuss the innovation in the TQM and Deming Cycle, and show the perspective to construct the value innovation circulation model. The aim of the model is to theoretically interpret the necessary actions for the sustain growth of China Construction Industry. At the same time, in the section 4, by using the marginal value of construction enterprises, the decision criteria will be discussed. The transform matrix for the elements of value innovation will be constructed in this section as well, which will further reveal the running mechanism of this matrix. Then, conclusions will be summarized in the last section.

II. THE RELATIVE THEORY OF VALUE INNOVATION

The aim of Value innovation is to find the nitch to explore and enjoy the low cost and difference [2, 3]. Herein, we won't

be limited in this scope; based on the actives to pursuit the value in the Chinese construction industry, it is easier to broad the definition and integrate the relative construction actives for the building, where one of these links could be a foundation to reveal the value-added growth. So, the participant involved in the construction should be gave attention, not only the building but also the people, environment, technology and society and not only construction industry but informal construction sector.

For construction industry, in the next 50 years, construction economic should focus on maximizing economic, environmental and social value of the built environment [4]. Value management could also provide a general path for value innovation. To a larger degree, value management has been widely used to meet challenges arising from the construction industry, which has been showed that interactive value management system (IVMS) has a positive influence on idea generation in VM workshops [5]. And it is essential to optimize the implementation of value management processes (VMPs) to facilitate the implementation of the VMPs on the construction industry and maximize the potential benefits to a particular project [6]. Through identifying the key competitiveness indicators (KCIs) for contractor competitiveness in the Chinese construction market, then, on which an index value is used to indicate the relative significance of various competitiveness indicators, are built [7]. Based on [7], by using the comparative and relative difference among Construction Company, a corresponding value growth strategy and innovation blue schedule will be identified. One of the primary goals of value innovation is to pursue the low cost, reducing the high costs of accidents and injuries to the construction industry is a rock way. It was revealed that the total costs of accidents had risen to somewhere between 7.9% and 15.0% of total costs of nonresidential, new construction [8] and the float consumption in non-critical activities is also one of the complicated delays to assess on a project's duration and cost [9] as well as Qualifications-based selection (QBS) [10], which promises project delivery at reduced cost and time, and higher quality and can therefore become the catalyst for technology adoption. Especially, a ten year study of construction performance has resulted in a conclusion that construction industry performance problems are being caused by the client's delivery process [11].

From what have discussed, we could find that there are a lot of links could be barrier to the value innovation, in other words, value innovation including the inner dig for the construction actives, and the pursuing for the transition value from other markets and contractors as well the nursing for the social environment and companies' living capability. This will be further showed in the following paper.

III. INNOVATION AND DEMING CYCLE OF TQM

After the literatures review about innovation and Deming cycle of TQM, it is true that TQM will drive the innovation to realize the added-value, not only the PDCA, PIDCAM, STQM, and BIC, but also QFD, TRIZ and TOC, which be kept the similar principles to reconstruct the elements to improve the quality performance, process innovation, organizational implementation to integrate organization, environment and

product. From this perspective, Deming wheel could be organic fused into the new value innovation definition and the four steps offered by W. C. Kim & R. Manborgne [2, 3]. These principles must be also suitable to the China construction industry.

ZHANG J X [1] puts forward the hypothesis, which is the double logic relation of the value innovation of construction industry of China (VICI). Under this suppose, from the philosophy view, the paper advances that the main body of the VICI is construction enterprise, and the research content is the relation between construction enterprise and the construction client as well as between construction enterprise and nature. In the frame of Neoclassic Economic, the paper divides the model of value innovation between construction enterprise and construction client into two kinds that one is based on the supply and the other is based on the demand. The study further shows that one of two kinds is marked into four kinds with the positivist research in the construction industry. However, the feature of the construction industry decides that on the premise of nature and man-oriented, VICI could be created. While construction enterprise may remold the present rivalrous elements to arrive at value innovation, then, it will surpass the present market to gain excess windfall profit, that is to say, construction enterprise creates the new demand under the present rivalrousness.

In views of the evolvement of construction industry, the market of VICI is dynamic. It means that the market given up before today, with the development of the demand of buyers and the technology, it will be a generous niche tomorrow. If only in views of the demand, VICI could stabilize the inclination of the demand to continually poses the niche. So, the new market of CIVI is dynamic, and VICI is in a dynamic circulation, in which the construction industry constantly evolves from the traditional industry space to the new industry space.

IV. CIRCULATION OF VICI

It is an important way to continually exploit the niche with the circulation of VICI for construction enterprise. It is logical that VICI and the circulation of VICI will be reached in the same process with each other. Then, it is seen that VICI and the circulation of VICI have the same main body and research content. While the main body of the VICI is construction enterprise, and research contents are the relationships between the construction enterprise and the construction client as well as between construction enterprise and nature. It means that VICI must take the nature into consideration. VICI could be created on the premise of nature and man-oriented. So, the main body of circulation of VICI refers to construction enterprise and research content involves the relationships between the construction enterprise and the construction client as well as between construction enterprise and nature. It also needs take the nature into consideration on the premise of nature and man-oriented.

4.1 Steps of VICI Circulation

W. C. Kim & R. Manborgne[3] note that when the action of construction enterprise has an active influence on itself cost structure and the desire of buyers, VICI can be created in this inter-junction between itself cost structure and the desire of buyers. Construction enterprise could winkle or reduce the

rivalries elements to save the cost, at the same time, it may add or create some elements without example to improve the value of buyers. This means that VICI could be reaches by the following steps: reducing, creating, winking and adding the rivalries element of construction industry.

More generally, the new space of VICI could be schematized by the following steps: first, what element should be reduced under the standard of industry? Second, what element should be added above the standard of industry? Third, what element should be created without example? Fourth, what element in the nature of product should be winkled? Obviously, if construction enterprise need solve the second condition or the third condition, it will surpass the limit of construction industry of China to pursue the desires of buyers. Thus, does construction enterprise surely arrive at the new space of value innovation when the four steps completely realized? What is the principle of the circulation of VICI?

4.2 Decision criteria for the Circulation of VICI

Suppose that construction enterprise is an economic man, pursues the most utility of market, and VICI is based on the desires of buyers, however, the marginal utility of buyers is diminishing value. Again, when the construction does not carry value innovation through, the aggregate of the desires of buyers is $X = (x_1, x_2, x_3, \dots, x_i, \dots, x_n)$, x_i expresses the desires of buyer i , $i \leq n$, n as the aggregate of buyers. The market utility of construction enterprise $U = U(x_1, x_2, x_3, \dots, x_i, \dots, x_n)$, marginal value of buyers is called $\frac{\partial U}{\partial X}$, the condition of equilibrium as follows:

$$\frac{\partial u^*}{\partial x^*} = \frac{\partial u_1^*}{\partial x_1^*} = \frac{\partial u_2^*}{\partial x_2^*} = \dots = \frac{\partial u_i^*}{\partial x_i^*} = \dots = \frac{\partial u_n^*}{\partial x_n^*}. \quad \text{After}$$

the survey of the desires of buyers, construction enterprise finds that the inclination of buyers has been changed. At this time, the demand of buyers' value is established by the aggregate as follows: $Y = (y_1, y_2, y_3, \dots, y_k, \dots, y_m)$,

y_k expresses the desires of buyer k , $k \leq m$, m as the news aggregate of buyers. The market utility of construction enterprise $U^* = U^*(y_1, y_2, y_3, \dots, y_k, \dots, y_m)$, marginal value of buyers is called $\frac{\partial U^*}{\partial Y}$, the condition of equilibrium as follows:

$$\frac{\partial u^*}{\partial y^*} = \frac{\partial u_1^*}{\partial y_1^*} = \frac{\partial u_2^*}{\partial y_2^*} = \dots = \frac{\partial u_k^*}{\partial y_k^*} = \dots = \frac{\partial u_m^*}{\partial y_m^*}.$$

Note, again, further suppose that Value innovation of construction enterprise could be realized by one of four steps. Under this condition, if construction enterprise reduces some rivalrous element under the standard of industry, the value of buyers may be represented as the demand aggregate $X_j = (x_1, x_2, x_3, \dots, x_i, \dots, x_{n_j})$, the market utility of construction enterprise as $U_j = U(x_1, x_2, x_3, \dots, x_i, \dots, x_{n_j})$,

marginal value of buyers is called $\frac{\partial U_j}{\partial X_j}$, the condition of

$$\text{equilibrium as follows: } \frac{\partial u_j^*}{\partial x_j^*} = \frac{\partial u_{j1}^*}{\partial x_{j1}^*} = \frac{\partial u_{j2}^*}{\partial x_{j2}^*} = \dots = \frac{\partial u_{ji}^*}{\partial x_{ji}^*} = \dots = \frac{\partial u_{jn_j}^*}{\partial x_{jn_j}^*}.$$

Obviously, $n^j < n$. If the condition $\frac{\partial U_j}{\partial X_j} > \frac{\partial U}{\partial X}$ is realized,

we could say that one of value innovation of construction enterprise is achieved.

4.3 Mechanism of Circulation of VICI

The barriers of the nitch will be break out by the following completers; at last, the nitch may become a desert of the completers. So, the forth goers have to keep its eye on the potential nitch and cultivate it. It also adapts to construction enterprise of China. Compared with the construction industry of Europe, Japan and USA, the enterprise of construction industry of China almost has the same power of production.

Figure 1. Evolutions of circulation of VICI.

Once an enterprise realize the value innovation, the number of the following will be very great, absolutely. In order to avoid this thing, the forth-oer has to continually pursue the nitch and the potential nitch, from the traditional space of industry to the new space of industry by implement the steps of VICI from time to time. This process could be showed in the Fig.1.

In the Fig.1, traditional space of industry represents the existing market space before implementing the neo-VICI, while new space of industry represents the market which construction enterprise is about to posses in the future after implementing the VICI. Of course, there exist a relative relationship between the traditional space of industry and new

	Winkle	Transform Space	Add
Transform Space	Transform Space	Transform Space	Transform Space
Reduce	Transform Space	Create	

Figure 2. Tranform matrix of VICI element

space of industry. In the figure 2, the ladder represents the phases of the circulation of VICI. In fact, there are a great number of phases in the process of the circulation of VICI. The straight-line with a arrow expresses the pulse of VICI. With the help of this pulse, construction enterprise could take

the steps of VICI each time, and the space of industry could be transferred. The curve-line with an arrow shows the steps of VICI for construction enterprises.

The demand of buyers is in the non-line dynamic change, so, the circulation of VICI based on the demand of buyers has to be in the same change, correspondingly. The evolvement about VICI has to reduce, add, create and winkle some elements of industry, and the relationships between these elements have been explained in the Fig.2. In the Fig.2, the shadow represents the transform space in which some rivalrous elements temporally are ignored, while they could convert to the elements in the circulation of VICI. That is to say, the ignored elements and the existing elements in the circulation of VICI at each time are allocated in the two spaces, one is the space of ignored elements and the other is that of existing elements.

V. A CHINESE CASE

Let take Industrial Engineering Company of MCC20, China for example. The 20th Metallurgical Construction Corp., China is subordinate to MCC20, who is mainly engaged in industrial engineering such as industrial plants, exhibition centers, clean room engineering and other relevant projects. It possesses the equipment & human esthetics of HQ, expanding the business on behalf of MCC20. They are an integrated company which includes engineering consultation, building & process design, equipments purchasing, construction and project management.

At first, they focus on the international customers, such as P&G (China) Co.,Ltd, Shanghai Yaohua Pilkington Glass Co.,Ltd, Pilkington, Imerys fine Co.Ltd and Wal-mart General merchandise Ltd and so on. For long time, they provide their quality service to Baosteel, CWGC, Wal-mart, Imerys, TSMC, Volkswagen, Panasonic and bell etc. Good credit and 50-year's technology make us more reliable

How to make Industrial Engineering Company of MCC20 (China) become excellence among the peers? From the beginning to now, they take the VICI strategies. It could be explained by their market actions and customer services. I.e. for examples, their customer focus, your concern is their first concern; your suggestion is what they need. Customer is always the central point and it's also their motivation.

During the Early Period, it is Mid-sized non-metallurgical enterprise is their target, it's also their advantage. In the Developing Period: "Turn-Key" project becomes their main service, in this period they own a large quantity of clients. So, Industrial Engineering Company of MCC20 takes HQ as the strong backing, it is specializing industrial engineering, each kind of steel structure, the ret-form structure industrial factory (chemical engineering, medicine, electronics...etc.), the industrial building (various business meeting exhibition center, exhibit the building, the stadium building), the cleaning room engineering (clean factory of chemical engineering, biological engineering clean room, medicine clean room, micro-electronics cleaning room) and other industrial engineering. He tries to expand the international market by the unique service & design. They believe that their construction experience, professional technique and their management mode will finally lead us to success.

Although they take the EPC like other construction companies, some differences are seen, which could be concluded as: first, General Contract: Operating General Contract is their core business; great experience on the general contract brings us more confidence and profit. Second, Design & management: They create their own mode on the construction to combine design and management. They offer this service to their clients and to make the project more profitable. Third, Strategy: The construction market reformed when China joined WTO. It's a great challenge to them that the construction market in China globally, their aims for international project so they'll attract more talented people to join them and also bring up a group of young age to make them stronger. They are capable to execute all kinds of international project independently; we can offer different clients on construction planning, feasibility of the research, consultancy, design, tendering, construction management, equipment purchasing & installation, building decoration and after-service. The quality is top class both domestically and overseas. They keep their promise and their company motto is "customer focus", they build their own brand and try to build a good image of their company. They'll do their best to develop themselves to a creative and technical company with good service and management. It's the arena for the talent. And service mode is that the future construction market is not only competitive on the product but the service. Their target is to provide High-Tech and quality service to any possible client. Therefore, to be creative and designable is their long-term objective. Their service includes: feasibility research, consultancy, construction management, facilities purchasing & installation and after-service.

All in all, their success could be said to create fortune, to build high quality construction and to bring more opportunities for talented people, every building they made is just like art work. Their idea will be shown on every inch of their "work".

VI. CONCLUSIONS

It is an important way to continually exploit the niche with the circulation of VICI for construction enterprise. What are the decision principles for the circulation of VICI at each time? Suppose that construction enterprise is an economic man, pursues the most utility of market, and VICI is based on the desires of buyers, however, the marginal utility of buyers is diminishing value. Based on the theory of marginal utility, the decision principles of VICI are established. Comparing with marginal value of value innovation in the five different ways, we have proofed the two necessary and sufficient conditions and one necessary condition. Note, this decision principles is effective for value innovation each time. The demand of buyers is in the non-line dynamic change, so, the circulation of VICI based on the demand of buyers has to be in the same change, correspondingly. At last, we explain this process by the model of the VICI evolvement, and it also puts forward the element transition matrix of CIVI to interpret the change of the buyers' claim in the circulation of the CIVI reasonability.

ACKNOWLEDGMENT

Thanks for the Shaanxi Department of Education Science Fund, Shaanxi Province, P.R. China (Grant No. 08WJ18), and professor Yi-fan Tang's kindness and help, and assistant professor Han-yan xie(university of Arkansas Little Rock ,USA) 's constructive suggestion.

REFERENCES

- [1] Zhang jing-xiao. Study on the model of value innovation in China Construction Industry, Proceedings of 2007 international conference on construction & real estate management, Bristol UK, August 21st -22nd, 2007
- [2] W. C. Kim & R. Manborgne. Value innovation: the Strategy Logic of High Growth. Harvard Business Review, January-February, 1979. pages103~112
- [3] W. C. Kim & R. Manborgne. Strategy, Value Innovation and the Knowledge Economy, Sloan Management Review, Spring, 1999. pages41~54
- [4] Raymond E. Levitt, CEM Research for the Next 50 Years: Maximizing Economic, Environmental, and Societal Value of the Built Environment, Journal of Construction Engineering and Management, September, 2007, pages619-628
- [5] Fan Shichao, Shen Qiping, Lin Gongbo. Comparative Study of Idea Generation between Traditional Value Management Workshops and GDSS-Supported Workshops, Journal of Construction Engineering and Management, October, 2007, pages 816-825
- [6] Hee Sung Cha, James T. O'Connor. Optimizing Implementation of Value Management Processes for Capital Projects, Journal of Construction Engineering and Management, February, 2005, pages 239-251
- [7] Shen Li-Yin, Lu Wei-Sheng, Michael C. H. Yam. Contractor Key Competitiveness Indicators: A China Study, Journal of Construction Engineering and Management, April, 2006, pages 416-424
- [8] John G. Evereet, Peter B. Frank Jr. Costs of accidents and injuries to the construction industry, Journal of Construction Engineering and Management, June, 1996, pages158-164
- [9] Zafer I. Sakka, Sameh M. El-Sayegh. Float Consumption Impact on Cost and Schedule in the Construction Industry, Journal of Construction Engineering and Management, February, 2007, pages124-130
- [10] Symeon Christodoulou, Lisa Palmer Barrett, F.H. (Bud) Griffis, Max Okungbowa. In Pursuit of Catalysts for New Technology- A Case for Qualification Based Selective (QBS) of Professional A/E Services, Architectural Engineering, 116, 35 (2003), pages 1-4
- [11] Kenneth T. Sullivan, David Greenwood, Jacob Kovell, Charles Egbu. Source of construction industry instability and performance problems, Construction Research Congress, 183, 79 (2005), pages 1-10