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Conflict Analysis of the Nanjing Yuhuan and A.O Smith Joint Venture Case*

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Abstract

Purpose –This paper is to study the process of the negative effects of Sino-foreign joint ventures, hoping to find out an effective path in which local enterprises can avoid the risks in the utilization of foreign capital, and ultimately achieve independent innovation.

Research design, data, and methodology –The outflow of assets, the loss of local brands and the "technology hollowing-out" problem brought by joint ventures is becoming more and more serious. Based on conflict analysis graph model, this paper takes Yuhuan joint venture as an example to identify the conflict problem in Sino-foreign joint ventures.

Results –The results of the stability analysis show that establishing joint venture cannot really realize the introduction of technology because the technology is fully controlled by the foreign part. So when introducing foreign capital, local enterprises should participate in R&D and master the initiative.

Conclusions – Local enterprises should pay attention to patent containment and technology blockade of multinationals. Domestic enterprises should try to protect state-owned assets and local brands in Sino-foreign joint ventures. Independent innovation is the most effective strategy for the development of enterprises in China.

Keywords: Sino-Foreign Joint Ventures, Conflict Analysis, Case Study.

JEL Classifications: D21, R32.

1. Introduction

Sino-US joint venture Nanjing A.O. Smith Water Heater Co. is a joint venture established by Nanjing Yuhuan and the United States A.O. Smith Water Heater Company. The company was formally established in February 1996. After a short period of two years and five months of operation, in July 1998 the joint venture was divested and formal disintegrated by Chinese part.

1.1. Overview of the both sides

Nanjing Yuhuan is one of the earliest companies in China to develop and produce domestic gas water heaters. It was also the largest specialized enterprises to produce gas, and its products won the first place several times in the national testing and evaluation contests. Because of the reliable quality and sales network all over the country, Yuhuan became recognized brand-name products in China. A.O. Smith is a company listed on the New York Stock Exchange (NYSE), which is the leading manufacturer of commercial water heaters in North America, and one of the largest manufacturers of domestic water heaters. A.O. Smith had large-scale, high technology and extensive sales network in the world.

1.2. Motivation of the both sides

As we can see, even before the joint venture, Nanjing Yuhuan was prestigious in China and was one of the largest manufacturers of water heaters. But around 1994, the domestic water heater market was increasingly competitive. The market position of Yuhuan was severely challenged by the domestic and foreign products. Yuhuan hoped to learn the prevailing "grafting" mode from the state-owned enterprises. "Grafting" mode is to introduce foreign capital

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and advanced technology through cooperation with multinational companies, in order to improve their own development. In short, capital, technology was involved in the direct purpose of Nanjing Yuhuan M&A, and the market was its ultimate goal.

For A.O. Smith, it saw the rapid development and huge growth potential of China's water heater market. At that time, Yuhuan had the brand effects, the perfect marketing and service network and the mature production and management system in the Chinese market. So A.O. Smith chose to cooperate with Yuhuan, with the purpose of spending the lowest cost and shortest time to cut into and control the market.

Ostensibly the motivation of the two sides had a common strategic interests of the market. But Yuhuan wanted to get the support of capital and technology from the foreign part while learning advanced management system. A.O. Smith did not like its own core technology leaked. It hoped to open the Chinese market with minimal cost, so it must ensure the absolute right of the joint venture company. As we can see, there was a clear contradiction in terms of capital, technology and management.

1.3. Joint venture operation and failure

In February 1996, the two sides reached a consensus on joint ventures. Sino-US joint venture Nanjing A.O. Smith water heater Co. (hereinafter referred to as the joint venture) also came into being. The proportion of joint venture investment between Yuhuan and A.O. Smith was 20% and 80%. Management was appointed in strict accordance with the proportion of investment, so the control was absolutely held by A.O. Smith. In the contract, Yuhuan was required to transfer all its products produced, sold, designed or commissioned by other companies in the last 3 years. At the same time, Yuhuan should transfer its trademark and the documents signed with cooperation companies for current manufacture or production of machine tools, repair parts, production parts and components. Also, Yuhuan was committed not to participate in the domestic design, manufacture or sale of any product, nor to assist others in the design, manufacture or sale. But A.O. Smith and its related companies retained its rights to sell water heaters in China.

Although on the surface Sino-US cooperation was similar to the traditional joint venture, but Yuhuan had invested all assets (including equipment, sales channels, cooperative relations, trademarks, production licenses, technical and managerial personnel, and skilled workers) into the joint venture. Yuhuan became a shell company in fact, all sources of income depended on the joint venture.

The operating results of the joint venture were unexpected. After two years of operation, the losses of the joint venture accounted for 71.5% of the registered capital of the joint venture company, which led to the collapse of Yuhuan's previous cooperation purpose. Yuhuan in August 1997 on the joint venture company launched an investigation, and found that A.O. Smith had a suspect transfer of profits. So Yuhuan refused to accept the financial budget plan with a huge loss of $ 7.2 million in 1998, and took the initiative to propose a compromise: If it exceeds $ 3 million (the joint venture's maximum amount of bankruptcy losses), the joint venture would be reorganized by Yuhuan, and the excess would be borne by Yuhuan, but it was rejected by the foreign part. In the case that the two sides could not be coordinated, plus "Yuhuan" trademark was frozen, Yuhuan required divestment conversion. But the foreign part required that Yuhuan must share losses according to the proportion of investment before divestment. Yuhuan had no choice but to file for bankruptcy. Because the bankruptcy would greatly affect the A.O. Smith's stock price, the foreign side was forced to accept the withdrawal of Yuhuan. In July 31, 1998, the two sides signed a divestment swap agreement, and the Sino-US joint venture Nanjing A.O. Smith Water Heater Co. officially disintegrated.

2. Literature Review

Joint venture, especially Sino - foreign joint venture, is an important way to introduce foreign capital and advanced technology. It can absorb funds for the expansion of reproduction, introduce technology for technological transformation, and introduce advanced management tools and related experience to expand sales channels. From the 80s of the last century, China began to carry out the "market for technology" industrial policy. During the span of thirty years, the implementation of this policy has led to the rapid influx of foreign investment in China's market, and set up a large number of Sino-foreign joint ventures. Our country has introduced the largest foreign investment among developing countries for years. Foreign investment has already become an academic hot spot for its role in economic growth, industrial structure upgrading, capital accumulation, employment and other aspects.

Direct investment of multinationals mainly promotes technical progress of host countries through competition effects, demonstration and imitating effects, personnel training and movement effects, as well as front-to-back relevance effects. It also helps to solve the problem of capital and employment, which is conducive to establishing a modern enterprise system and adjusting industrial structure. Especially for the emerging developing countries, through joint ventures with multinational corporations, domestic enterprises get access to advanced technology, management experience and human resources from foreign part(Ye, 2014; Piening et al., 2016), thereby enhancing the competitive advantage of enterprises. Joint ventures can also have a positive impact on stock prices (Jun et al., 2015), and increase shareholder wealth of listed companies. However, some scholars found that the technology spillover effects of Sino-foreign joint ventures on China both short-term and long-term were not significant when they do data analysis in specific case of joint ventures (Xing et al., 2009). In cases where effects are significant, it is also the "catfish effect" and the positive competitive effects, rather than technological diffusion, which contribute to the improvement of technology. In the high-tech industry, the R&D absorptive capacity is relatively low, and the foreign-funded activities are showing significant reverse technological diffusion. Some scholars even found that a large number of foreign investment through joint ventures could easily lead to the loss of state-owned assets and local brands, and decrease of self-development capacity (Zhang, 2008). It is easy to form a high degree of dependence on foreign part, which can result in wholly foreign-owned and industry monopoly (Zhao, 2004). The technical control of the foreign industry will lead to the lack of stamina in industry development, and ultimately affect economic security (Lin, 2014). Therefore, many scholars use the game analysis and other methods to study the static and dynamic problems in Sino-foreign joint ventures about cultural differences (Zhao et al., 2014; Johansson et al., 2016; Huu Le Nguyen et al., 2016), the control of multinational corporations in China (Hao Wang et al., 2005; Tianjing Dai et al., 2011), the effect of ownership structure on joint venture performance (Liu et al., 2014; Westman et al., 2016) and so on. Hoping to find a way to get rid of “wholly foreign-owned”, achieve a win-win situation for Chinese and foreign enterprises, and get a channel in which Chinese enterprises in the joint venture can play a competitive advantage.

China, as an emerging economy in developing countries, can be expected for a long time in the future that it still needs to attract foreign investment to promote economic development. Joint venture is a major way to attract foreign investment. Therefore, it is of theoretical and practical significance to analyze how Chinese enterprises should make decisions in order to obtain the positive effects of joint ventures, avoid the control of foreign parties and the loss of brands in the process of Sino-foreign joint ventures. Nanjing Yuhuan joint venture case is a typical case of Sino-foreign joint ventures, and is a case of failure. The loss of assets, brand visibility plummeted, market share reduction before the disintegration of the joint venture company, are all the bad influence which scholars proposed may bring by the joint venture. This paper selected Yuhuan joint venture, and used the graph model for conflict resolution, short for GMCR, to analyze the conflict and the evolutionary path of Sino-foreign joint venture. We want to study the process of these negative effects, hoping to find out an effective path in which local enterprises can avoid the risks in the utilization of foreign capital, and ultimately achieve independent innovation.

3. Conflict Model

Conflict analysis is a systematic structural system that studies strategic conflicts and their important characteristics. It can describe the possible strategic interaction between different decision makers (short for DM), and explore the possible equilibrium solutions. Conflict analysis belongs to the game theory of Central Asian game theory. According to the relative preference information of decision makers, it will be difficult to quantitatively describe the problem model, but it is a good solution to the multi-person multi-objective decision-making problems. The decision maker (N), the feasible state (S), the preference (P), and the state transition diagram (G) (Wu, 2015) are the four basic elements of the conflict model.

In the case of Nanjing Yuhuan joint venture, the initial purpose of Yuhuan was to use the spillover effect of advanced technology and management experience from foreign enterprises. Yuhuan wished to achieve a stable development in the long term. However, contrary to expectations, during the operation of the joint venture company, whether Yuhuan had got the technology was questionable. But after the merging, the decline in business visibility and market share was an indisputable fact. To the worse, Yuhuan was controlled by the foreign part, resulting in the loss of assets and brand. Joint venture is a dynamic and complex process in which decision makers and the choices they face are very different. In this case, the main decision makers are divided into A.O. Smith (DM1), Nanjing Yuhuan (DM2) and joint venture (DM3). In order to systematically analyze and explain the causes and processes of this conflict, this paper conducts the following two stages of conflict analysis based on the main contradiction of the two sides. Phase one is the signing phase of the contract. This stage is mainly to determine the joint venture form. The main contradiction is the capital and technology. The second stage is the operational phase, which is divided into two parts according to the characteristics of the conflict: technology introduce (the main contradiction point is technology) and business decision-making (the main contradiction is the trademark, profit and management rights). The different decision makers involved in the different stages, the decision-making and the decision tree are also different. The following is the model built for each stage.

3.1. Phase I: Contract Signing Phase (1995.9-1996.2)

In September 1995, Nanjing Yuhuan and A.O. Smith began negotiations on the joint venture, mainly on the joint venture contract, trademark licensing transfer, the transfer of suppliers, the company charter and other aspects. This stage, featuring signing of the contract, was ended until the joint venture established in February 1996. Since the joint venture had not yet been established, there were only two policymakers at this stage: A.O. Smith (DM1) and Yuhuan (DM2).

Before the signing of the contract, the parties of the joint venture mainly consulted on capital, technology, shares, management and product development. As the management rights and whether to participate in research and development at this stage were not obvious, so they were temporarily not considered in the model. So at this stage, for A.O. Smith, there were two main decisions: one was whether to cooperate with domestic leading enterprises (i.e., Yuhuan), and the other was whether fully transfer its technology to China; For Nanjing Yuhuan, the most important strategic decision was whether to devote all or part of its assets into the joint venture. The decision information of this stage is shown in <Table 1>.

In this case, A.O. Smith chose to cooperate with Nanjing Yuhuan, but only opened up its technical documents at McIntyre in South Carolina and Juarez factory in Mexico (Li, 2000) and did not transfer the entire technology. Yuhuan chose to enter all its assets into the joint venture, including its equipment, technology, marketing channels, trademarks, production licenses, factory (leasing), personnel, and so on. Yuhuan had actually become a shell company, constituting a full sense of the overall foreign joint venture or overall grafting. Yuhuan's total profits could only come from joint ventures, entirely dependent on the joint venture, which had laid the foreshadow for subsequent failure.

<Table 1> Decision information for contract signing issues

Decision Maker	Decision
A.O. Smith.	1. All technology transfer
	2. Partial technology transfer
	3. Cooperate with domestic leading enterprises
Nanjing Yuhuan	1. All assets into the joint venture
	2. Part of the assets into the joint venture

3.2. Phase II: Joint Venture Operation (1995.9-1996.2)

Taking into account the complexity of business process, in order to facilitate the accurate analysis, according to the main contradiction of the problem, this issue is divided into two parts. Through the Sino-foreign joint ventures, the Chinese part wishes to obtain advanced technology. So the first part analyzes whether technology had been obtained. In the process of joint ventures, many enterprises like Yuhuan such as Procter & Gamble and Jiehua finally become wholly foreign-owned enterprises, with the loss of assets and decline of brand awareness. In order to study the causes of this problem, the second part mainly analyzes other issues of business decision-making.

3.2.1. Technology Introduction

In this question, A.O. Smith (DM1) faced only one decision, that was, whether to provide advanced technology. Some study shows that there is a double threshold effect on the influence of technology country gap on FDI technology spillover. In other words, when the technology gap between the two countries is within the threshold, the real core technology inflows will be effective (Yu, 2012). So, if the technological gap between the two countries is too large, foreign enterprises can produce more obvious technology spillovers even without providing advanced technology (Wang, 1992). Therefore, for A.O. Smith, the main decision they need to decide was whether necessary to provide the true core of the advanced technology.

For Nanjing Yuhuan (DM2), the most important decision in the process of joint venture, in order to digest and assimilate advanced technology, was whether to participate in the R&D. It was stipulated in the contract that Yuhuan could not participate in the design, manufacture and sale of gas fast water heaters or gas and electric capacity water heaters during the term of this agreement, and could not assist others in the design, manufacture or sale of any fast gas water heater products. This regulation was the prominent direct impact on the effect of technology import, so we consider it as the important decision-making of Yuhuan.

For the joint venture (DM3), the decision was whether to import the equipment directly from the US or to produce independently, which in one way determined the effect of technology spillovers. If the joint venture chooses to produce related equipment independently, not only can reduce the cost of imports, but also improve the quality and R&D level of employees.

<Table 2> Decision-making information on technology introduction issues

Decision Maker	Decision
A.O. Smith	1. Provide advanced technology
Nanjing Yuhuan	1. Participate in development work
Joint venture	1. Import related equipment from the United States
	2. Produce related equipment independently

3.2.2. Business decision-making

In the management of joint ventures, trademark, profit and management decision-making power issues are also important contradictions. Two consecutive years’ losses of the joint venture caused severe market decline. In the 1997 "Jiangsu famous brand" assessment, "Yuhuan" trademark almost failed, resulting in a huge reputation crisis. In publicity, the joint venture only used "Yuhuan" trademark in the beginning to enter the market, then rarely used it. In 1996, A.O. Smith's advertising cost was 200 million yuan, while the “Yuhuan” brand promotion cost only 20,000 yuan. In 1997, A.O Smith brand advertising cost rose to 3 million yuan, while “Yuhuan” brand advertising basically no. The joint venture decided no longer use "Yuhuan" trademark later in the production of water heater products.

Another conflict was that A.O. Smith used the joint venture to transfer profit. In 1997, Nanjing Yuhuan did a survey. They found a substantial increase in planned sales in 1998, and some products were no longer imported. The joint venture produced it independently, so production costs should be significantly reduced. However, according to the plan for 1998, sales costs would account for 71% of sales. The proportion was significantly higher. At the same time, there was a high level of planned operating expenses and false accounting for financial expenses in 1998. According to the circumstances, the market price of 15-gallon displacement water heater was 2210 Yuan per piece; the purchase price was 1,800 Yuan per piece for joint venture. But the price of the same products in Japan Tada Company imported from the United States was only 1440 Yuan per piece, lower than the joint venture's purchase price. For this situation, Yuhuan thought A.O. Smith conducted a profit transfer operation.

Therefore, in this stage the main decision of A.O. Smith was whether to publicize Chinese brand and whether to use the joint venture for profit transfer. For Nanjing Yuhuan, although they proposed remedial measures when the joint venture faced financial losses in successive years, they failed because A.O. Smith held the absolute right. So itis an important decision-making related to future development that Chinese enterprises should occupy a dominant position in the process of joint-venture. Confronted with such a fierce conflict, the joint venture's decision was whether to divest and disintegrate.

<Table 3> Decision information for business decision-making issues

Decision Maker	Decision
A.O Smith	1. Promote China's brand
	2. Transfer profit
Nanjing Yuhuan	1. Master joint venture dominance
Joint venture	1. Disintegration of withdrawals

4. Conflict Analysis and Equilibrium Solution

Conflict analysis theory assumes that decision makers are rational, and decision-making behavior is independent of each other. Each decision maker determines their next choice according to the current situation. To analyze and predict the results of the final equilibrium on the basis of such a research hypothesis is the stability analysis. For a decision maker, the main problem with stability analysis is whether a decision maker who can be moved from a state will choose to move away from that state. So a stable state is that the decision maker will not strongly demand the unilateral removal from this state. If all decision makers are stable at a state point, then the state is considered stable for all decision makers. The state point is said to be a point of equilibrium, which is a balanced solution of decision conflict analysis (Han, 2012). Fang and Hipel (1993) divides the stability under simple preferences into four basic types according to different decision styles and backgrounds: Nash stability, GMR stability, SMR stability, and SEQ stability. In Nash stability, the decision makers think the state they chose is the final state. In GMR stability, the decision makers think that the opponent will counterattack them at all costs. When they think their choice can cause the opponent to counterattack, it is stable. SMR stability is similar to GMR stability, but the decision makers think they have the opportunity to fight back, and the conflict will end in their own counterattack. SEQ stability is similar to GMR stability too, but this time the opponent will consider themselves, which means the counterattack should bring benefits to themselves, rather than at all costs. If the state satisfies four equilibrium conditions simultaneously, it is considered to be a strong equilibrium solution. If the state satisfies two of the equilibrium conditions, it is considered to be a weak equilibrium solution.

Based on the case of Nanjing Yuhuan and A.O. Smith joint venture, using conflict analysis method we construct three conflict models for contract signing problem, technology introduce problem and business decision-making problem to analyze the contradictions, decision makers and decision-making information in each question respectively. In this section, we analyze the information of preference, state transition and so on, and use the GMCR software to solve the equilibrium solution.

4.1. Contract signing conflict and equilibrium solution

The contract signing problem involved two decision makers, which is A.O. Smith and Nanjing Yuhuan. There are eight states (see <Table 4>) left after dealing with the decision-making information of the two decision makers. At this stage, the most important thing for A.O. Smith was to protect their own technology patents. And then in order to have better access to the Chinese market, A.O. Smith obviously preferred to cooperate with Yuhuan and hoped that Yuhuan could put all the funds into the joint venture. So A.O Smith's preference information is as follows:

$$S_4 > S_3 > S_2 > S_1 > S_8 > S_7 > S_6 > S_5$$

For Nanjing Yuhuan, according to its final decision, we can see that its purpose was to cooperate with foreign enterprises. A.O. Smith transferring all the technology to the joint venture was Yuhuan’s first priority. Investing part of the funds was Yuhuan’s second choice. So its preference information is as follows:

$$S_8 > S_7 > S_4 > S_3 > S_6 > S_5 > S_2 > S_1$$

The decision-making information of decision makers and their preference information at this stage are shown in <Table 4>. <Figure 1> shows the graph model formed by state transition in this problem.

It can be observed in the equilibrium solution of the contract signing problem that the state 4 formed in the Nanjing Yuhuan joint venture case is not a balanced solution. So, from the contract signing phase, the state is not optimal. It can be seen from the strong equilibrium solution (5, 6, 7, 8) at the contract signing stage that only A.O Smith transfer all the technology to the joint venture can form a stable equilibrium solution. Under the premise of cooperation, if Yuhuan puts all the assets into the joint venture, then only A.O. Smith also provides all the technology can achieve a strong equilibrium. As a general rule, domestic enterprises (especially state-owned enterprises that dominate the domestic market) should not opt for joint ventures with all their assets, since multinationals with advanced technology to a large extent will not devote all the technology to develop in the domestic market after the joint venture. The engagement of domestic enterprises is equivalent to losing the capital, market channels and other resources to the foreign part.

4.2. Technology introduction conflict and equilibrium solution

The technology introduction problem involved three decision makers, which is A.O. Smith, Nanjing Yuhuan and the joint venture. There are eight states (see <Table 5>) left after dealing with the decision-making information of the three decision makers. At this stage, A.O. Smith still wanted to protect technology patents. So at first A.O. Smith did not want Yuhuan could participate in R&D to learn related technologies, and then did not want to provide advanced technology. Also A.O Smith hoped that the joint venture could import equipment from the United States to seek greater benefits. So A.O Smith's preference information is as follows:

$$S_2 > S_1 > S_6 > S_5 > S_4 > S_3 > S_8 > S_7$$

For Nanjing Yuhuan, when the contract was signed, it was stipulated that Yuhuan could not participate in the development work. In this context, A.O. Smith providing advanced technology ranked first in Yuhuan's agenda. And then, it ranked second that the joint venture company could independently produce equipment to save costs and improve staff capacity. So its preference information is as follows:

$$S_5 > S_6 > S_1 > S_2 > S_7 > S_8 > S_3 > S_4$$

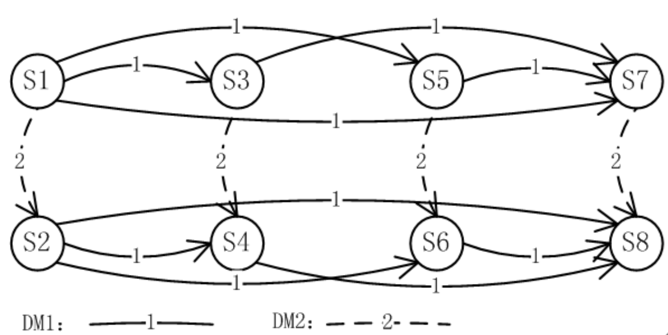
For the joint venture, its preference was consistent with A.O. Smith because A.O. Smith had 80% of the shares and management appointments were based on shares:

$$S_2 > S_1 > S_6 > S_5 > S_4 > S_3 > S_8 > S_7$$

<Table 4> Model of contract signing problem and equilibrium solution

Decision Maker	Decision	State							
		1	2	3	4	5	6	7	8
A.O Smith.	1. All technology transfer	N	N	N	N	Y	Y	Y	Y
	2. Partial technology transfer	Y	Y	Y	Y	N	N	N	N
	3. Cooperate with domestic leading enterprises	N	N	Y	Y	N	N	Y	Y
	Preference	4	3	2	1	8	7	6	5
Nanjing Yuhuan	1. All assets into the joint venture	N	Y	N	Y	N	Y	N	Y
	2. Part of the assets into the joint venture	Y	N	Y	N	Y	N	Y	N
	Preference	8	7	4	3	6	5	2	1
	Equilibrium solution	Ø	Ø	Ø	Ø	NGRQ	NGRQ	NGRQ	NGRQ

Note: N means that the state is Nash equilibrium solution, G is the GMR equilibrium solution, R is the SMR equilibrium solution, and Q is the SEQ equilibrium solution. (Same as in the table below)



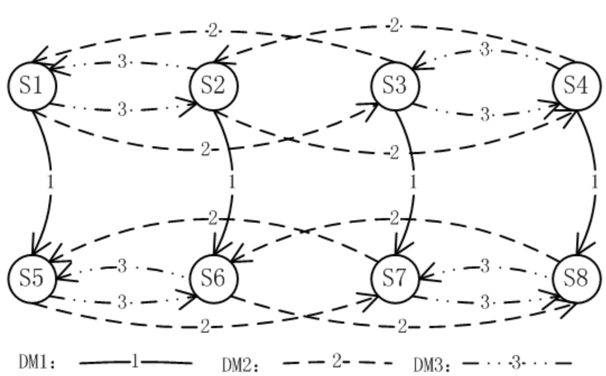
<Figure 1> Graph model of contract signing problem

<Table 5> Model of technology introduction and equilibrium solution

Decision Maker	Decision	State							
		1	2	3	4	5	6	7	8
A.O. Smith	1. Provide advanced technology	N	N	N	N	Y	Y	Y	Y
	Preference	2	1	6	5	4	3	8	7
Nanjing Yuhuan	1. Participate in development work	N	N	Y	Y	N	N	Y	Y
	Preference	3	4	7	8	1	2	5	6
Joint venture	1. Import related equipment from the United States	N	Y	N	Y	N	Y	N	Y
	2. Produce related equipment independently	Y	N	Y	N	Y	N	Y	N
	Preference	2	1	6	5	4	3	8	7
	Equilibrium solution	Ø	Ø	GR	GR	Ø	Ø	NGRQ	GR

The decision-making information of decision makers and their preference information at this stage are shown in <Table 5>. <Figure 2> shows the graph model formed by state transition in this problem.

In the technology introduce problem, the main discussion is whether domestic enterprises have imported technology and the release of the local enterprise R&D capabilities. In this case, Yuhuan could not participate in the development work because of the contract restriction, which means local enterprises cannot participate in the development of related products, so it can only be analyzed in the state 1,2,5,6. It can be seen that the state local enterprise cannot participate in research and development is impossible to achieve a balanced solution. Only multinationals providing advanced technology and local firms participating in R&D can achieve a balanced solution. Since A.O. Smith only opened the technical information of McIntyre in South Carolina and Juarez factory in Mexico to Yuhuan, it can be inferred that A.O. Smith did not provide authentic core technology. So the joint venture was at state 1 before the disintegration, reaching no equilibrium conditions. Yuhuan restarted the water heater production after the divestment. A few months later, Yuhuan researched a new brand to put on the market and got a turn for better development. So we can see that although introducing foreign capital will bring a certain degree of technology spillovers, but the majority of multinational companies will implement technical blockade. If local enterprises cannot participate in R&D, foreign investment will inhibit the ability of independent innovation.



<Figure 2> Graph model of technology introduction problem

4.3. Business decision-making conflict and equilibrium solution

The business decision-making problem involved three decision makers too, which is A.O. Smith, Nanjing Yuhuan and the joint venture. There are nine states (see <Table 6>) left after dealing with the decision-making information of the three decision makers. If the joint venture chose to disaggregate, it would be the same regardless of what decision the other two decision makers made. So we merge them into state S9. At this stage, grasping the decision-making power came as A.O. Smith's first choice, which meant Yuhuan couldn't be dominated. Then transferring profits to get more revenue came as its second choice. For brand promotion, A.O. Smith tended to promote "A.O. Smith" rather than "Yuhuan". So the preference of A.O. Smith is as follows:

$$S_3 > S_7 > S_1 > S_5 > S_4 > S_8 > S_2 > S_6 > S_9$$

For Nanjing Yuhuan, it was the most important thing to master the dominant position of the joint venture. A.O. Smith increasing the publicity of "Yuhuan" brand was in the second place. Thirdly, A.O. Smith did not use the joint venture for profit transfer. So its preference information is as follows:

$$S_6 > S_8 > S_2 > S_4 > S_5 > S_7 > S_1 > S_3 > S_9$$

For the joint venture, from actual situation of the case we can see that A.O. Smith couldn't decide the disinvestment of the joint venture alone. So at this stage, the joint venture's preference was no longer fully consistent with A.O. Smith, but was more similar to A.O. Smith in the premise of not breaking up as far as possible. The preference information is as follows:

$$S_1 > S_3 > S_7 > S_5 > S_4 > S_2 > S_8 > S_6 > S_9$$

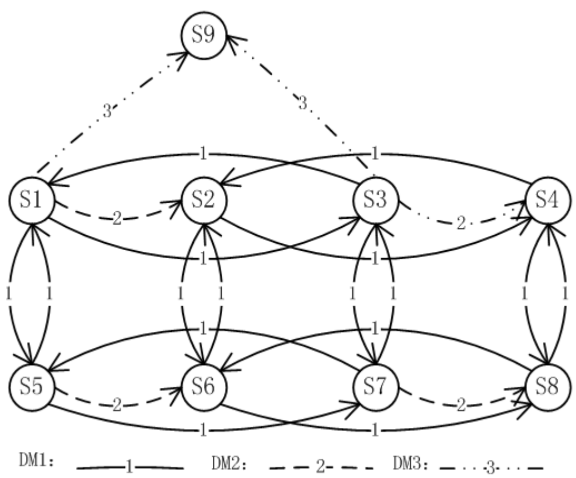
The decision-making information of decision makers and their preference information at this stage are shown in <Table 6>. <Figure 3> shows the graph model formed by state transition in this problem.

<Table 6> Model of business decision-making problem and equilibrium solution

Decision Maker	Decision	State								
		1	2	3	4	5	6	7	8	9
A.O. Smith	1. Promote China's brand	N	N	N	N	Y	Y	Y	Y	-
	2. Transfer profit	N	N	Y	Y	N	N	Y	Y	-
	Preference	3	7	1	5	4	8	2	6	9
Nanjing Yuhuan	1. Master joint venture dominance	N	Y	N	Y	N	Y	N	Y	-
	Preference	7	3	8	4	5	1	6	2	9
Joint venture	1. Disintegration of withdrawals	N	N	N	N	N	N	N	N	Y
	Preference	1	6	2	5	4	8	3	7	9
	Equilibrium solution	Ø	NGRQ	Ø	NGRQ	GR	GR	GR	NGRQ	NGRQ

We can see from the joint venture contract that Yuhuan accounted for only 20% of the shares, while A.O. Smith accounted for 80%, so Yuhuan did not grasp the dominant position of the joint venture. In the process of production and operation, the preference of the joint venture was similar to that of A.O. Smith, resulting in a wholly foreign-owned enterprise. Conflict analysis shows that, without considering the disintegration of the joint venture, the strong equilibrium solution 2, 4, and 8 are dominated by Chinese enterprise. Therefore, the state of foreign holdings cannot achieve a balanced and stable state.

Through the above analysis, we can find out that no matter it can bring advanced technology from abroad through joint venture or not, because of the strong technical blockade, the R&D capability of local enterprises has not been improved. On the contrary, it leads to the loss of assets, brands and market share of local enterprises, resulting in "hollow technology" and wholly foreign-owned. In addition, foreign investment in the domestic market is possible to form a monopoly, which means the industry will be completely in the hands of foreign enterprises and local enterprises no longer have the ability to influence decision-making. From the decision-making of Yuhuan after the disinvestment, we can see that independent innovation is the key to get out of this dilemma.



<Figure 3> Graph model of business decision-making problem

5. Conclusion and Policy Implications

This paper constructs a conflict analysis graph model with Nanjing Yuhuan joint venture case as an example to identify and analyze the conflict problem in Sino-foreign joint venture. It aims to provide ideas and suggestions for China to utilize foreign capital, avoid risks and promote independent innovation.

5.1. Conclusion

Based on Nanjing Yuhuan and A.O. Smith joint venture case, we can obtain the following conclusions combined with the results of the conflict analysis graph model and the stability analysis: (1) Sino-foreign joint ventures cannot really realize the technology introduction when the Chinese side can’t occupy the dominance. After establishing the joint venture, the technology is still in the full control of the foreign part. (2) Lacking scientific joint venture strategy, Sino-foreign joint ventures will lead local enterprises to lose assets, and decline local brand awareness. (3) It is an effective way to achieve independent innovation for local enterprises to participate in research and master the initiative.

5.2. Policy implications

Based on the conclusion of the above analysis, this paper argues that local enterprises should pay attention to the following points when utilizing foreign capital: (1) Local enterprises should pay attention to patent containment and technology blockade of multinationals. Chinese enterprises introduce foreign capital to learn advanced technology, but multinational companies will not provide the core technology. They will take out technical blockade and inhibit technology spillover. Domestic enterprises should make preventive measures in advance. The state should improve the patent protection system. (2) Domestic enterprises should try to protect state-owned assets and local brands in Sino-foreign joint ventures. Multinational companies tend to use the funds, brands and sales channels of domestic enterprises to enter the market at the minimum cost while removing a competitive barrier. After the joint venture, local brands will be basically abandoned. In the signing of joint venture contracts, local enterprises should put forward the relevant requirements to prevent these phenomena. (3) The success of Nanjing Yuhuan after the joint venture broke up shows that independent innovation is the most effective strategy for the development of enterprises in China. So even if the local enterprises choose joint ventures, they should take the initiative to participate in R&D, rather than rely entirely on foreign technology. (4) In the Sino-foreign joint ventures, even if the local enterprises cannot occupy a dominant position, at least they should guarantee the equal shares with the foreign part. So they will not be in a weak position in business decision-making or completely controlled by the foreign part.

Although this paper selected Nanjing Yuhuan and A.O. Smith joint venture case to conduct conflict analysis, the case study itself has some limitations. The universality of the conclusions in this paper has some limitations that cannot be neglected. Besides, this paper only selected one case, so the suggestions based on the path evolution are simple and have restrictions too. We should do more research to analyze the problems involved in the Sino-foreign joint ventures.

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