Evaluation on the Synergistic Effect of Production, Sales and R & D after Enterprise's M & A

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Abstract. In the current economic environment, synergy is becoming a trend of business management and research on evaluating synergistic effect of enterprises is in need. So the author innovatively established an evaluation model of production, sales and R&D synergistic effect from the positive and negative synergistic effect aspects. In the consideration of enterprises' stakeholders' interests, enterprises' risks and development prospects, 6 primary indexes and 34 secondary indexes were selected with the method of questionnaire survey. Then AHP method and experts scoring are adopted to design the scoring criteria and calculate the weight of indexes. Finally an evaluation model named PAN was established to evaluate the production, sales and R&D synergistic effect. The established model can help enterprises identify their advantages and disadvantages, and it plays an important role in optimizing the enterprises' synergistic management.

Introduction

In current economic environment, it's difficult for enterprises to complete all the processes on the product value chain, such as raw material sourcing, product designing, product developing, products selling relying solely on their own strength[1]. Therefore, some enterprises attempt to accomplish the business processes of production, sales and R & D (Research and Develop) by M&A to achieve the business goal of stable development in long-term. Production, Sales and R & D Synergy is a new management method with information technology on the basis of "synergy theory" in current business environment[2]. Research of production, sales and R & D synergistic effect and evaluation system is beneficial for enterprises to improve the management pattern including response to changing market conditions rapidly, reduce production cost, improve the quality of products etc[3].

Literature Review

Synergistic Effects

Synergistic effects were proposed firstly by the American scholar Ansoff in the 1960s. He pointed out that synergy consisted of ROI (rate of investment) and super-additivity, thus enterprises' overall value may be greater than the sum of parts' value in synergy[4]. Japanese scholar Itami proposed that the true cause of synergy is not complementary synergistic effect but the enterprise's unique resources, such as trademarks, customer recognition, corporate culture etc. They bring more lasting and irreplaceable competitive advantages to enterprises because of the inimitable synergistic effect. Sirower claimed that synergy must be considered in a competitive environment. And it should be the part which the benefits of enterprise after M&A exceed the sum of acquiring enterprise and the acquired enterprise when they were both as independent[5].

Chinese scholars mainly research the synergistic effect from the aspects of finance, intangible assets, operation and management, etc. Feng expounded the importance of financial synergy to enterprises' synergistic management and value creation after analyzing the relationship between the financial control and financial synergy[6]. Liu deemed from the intangible assets aspect that the expansion of qualified intangible assets like the brand superiority, technology proprietary, and enterprise culture, contributes to synergy after M & A[7]. Yang analyzed the influence factors of synergy from the innovative strategies and technical capabilities[8].

In summary, existing studies on synergistic effect consist of two parts: internal enterprise synergistic effect and the synergistic effect between enterprises[9]. And most scholars only pay attention to the positive effect of synergy, ignoring the existence of negative synergistic effect. And research about production, sales and R & D synergistic effects after M&A is limited. Therefore, the author proposed a new direction, evaluating synergistic effect of production, sales and R&D after M&A from both positive and negative aspects. It's the innovation and value of this study.

Synergistic Effect Evaluation Model

There are two main evaluation models of synergistic effect [10]. One is the net present value evaluation model, the other is M&A synergies model. And these two models mentioned have their own defects. The net present value evaluation model can't reflect the enterprise's actual operating conditions and it ignores enterprises' social responsibilities. As for the M&A synergies model, the calculation result has a large dependence on stock prices. Therefore, it's necessary and innovative to establish a comprehensive evaluation model of production, Sales and R & D synergistic effect after M&A.

Index System of Production, Sales and R & D Synergistic Effect

Index Selection

After the interview and investigation of six enterprises and some experts, indexes of production, sales and R & D synergy were picked. Then questionnaire survey was adopted to select indexes from production synergy, sales synergy and R&D synergy aspects. The following is the questionnaire result of experts' opinion about the importance sequence of evaluation indexes.

Tab.1 The Importance Sequence of Indexes

Dimension	Positive synergy index	Weight	Negative synergy index	Weight
Production synergy	Qualified rate	90.36%	Risk of organizational culture clash	72.69%
	Productivity	85.45%	Values conflict risk	83.54%
	Rate of production cost reduction	82.00%	Legal risk	40.56%
	Information technology advancement	30.12%	Technical risks	86.00%
	Employee satisfaction	81.45%	Ethical and moral risks	78.96%
	Social environmental friendliness	87.65%	Loss of property risks	83.64%
	Technical advancement	76.75%		
Sales synergy	Production sales rate	89.34%	Risk of organizational culture clash	83.55%
	Employee satisfaction	65.35%	Values conflict risk	69.56%
	Logistics and warehousing efficiency	68.54%	Legal risk	81.46%
	Customer Satisfaction	90.50%	Technical risks	50.85%
	Information degree	46.58%	Ethical and moral risks	70.24%
	Advertising promotion	82.65%	Loss of property risks	30.58%
	Frequency of joint activity	20.56%		
	Brand extension	20.56%		
	Rate of sales cost reduction	80.56%		
R&D synergy	Processing information ability	40.25%	Risk of organizational culture clash	91.56%
	Employee satisfaction	50.86%	Values conflict risk	83.17%
	Technical advancement	86.56%	Legal risk	78.62%
	R & D process rationality	86.52%	Technical risks	89.43%
	Rate of new production developing	91.36%	Ethical and moral risks	83.46%
	Rate of R&D cost reduction	82.45%	Loss of property risks	75.35%

Index System Establishing

After the importance sequencing, index with the least importance was eliminated. And the other indexes were appraised with Likert scale and 1-10 points methods form the positive and negative synergistic effect of production, sales and R&D respects.

The content of scoring criteria is given as following:

Tab.2 Production, Sales and R&D Synergy Effect Evaluation System

Positive synergy effect evaluation system						
First-class indicators	Second-class indicators	Criteria				
		10-9[point]	8-7[point]	6-5[point]	4-3[point]	2-1[point]
Production positive synergy effect	Qualified rate	Strongly high	High	Neither high nor low	Low	Strongly low
	Productivity	Strongly high	High	Neither high nor low	Low	Strongly low
	Rate of production cost reduction	Strongly high	High	Neither high nor low	Low	Strongly low
	Employee satisfaction	Strongly satisfied	Satisfied	Neither satisfied nor unsatisfied	Unsatisfied	Strongly unsatisfied
	Social environmental friendliness	Strongly friendly	Friendly	Neither friendly nor unfriendly	Unfriendly	Strongly unfriendly
	Technical advancement	Strongly advanced	Advanced	Neither advanced nor backward	Backward	Strongly backward
Sales positive synergy effect	Production sales rate	Strongly high	High	Neither high nor low	Low	Strongly low
	Employee satisfaction	Strongly satisfied	Satisfied	Neither satisfied nor unsatisfied	Unsatisfied	Strongly unsatisfied
	Logistics and warehousing efficiency	Strongly high	High	Neither high nor low	Low	Strongly low
	Customer Satisfaction	Strongly satisfied	Satisfied	Neither satisfied nor unsatisfied	Unsatisfied	Strongly unsatisfied
	Information degree	Strongly high	High	Neither high nor low	Low	Strongly low
	Advertising promotion	Strongly high	High	Neither high nor low	Low	Strongly low
	Rate of sales cost reduction	Strongly high	High	Neither high nor low	Low	Strongly low
R&D positive synergy effect	Employee satisfaction	Strongly satisfied	Satisfied	Neither satisfied nor unsatisfied	Unsatisfied	Strongly unsatisfied
	Technical advancement	Strongly advanced	Advanced	Neither advanced nor backward	Backward	Strongly backward
	R & D process rationality	Strongly rational	rational	Neither rational nor irrational	Irrational	Strongly irrational
	Rate of new production developing	Strongly high	High	Neither high nor low	Low	Strongly low
	Rate of R&D cost reduction	Strongly high	High	Neither high nor low	Low	Strongly low
Negative synergy effect evaluation system						
First-class indicators	Second-class indicators	Degree of risks				
		[10-9]point	[8-7]point	[6-5]point	[4-3]point	[2-1]point
Production negative synergy effect	Risk of organizational culture clash	Level 1	Level 2	Level 3	Level 4	Level 5
	Values conflict risk	Level 1	Level 2	Level 3	Level 4	Level 5
	Technical risks	Level 1	Level 2	Level 3	Level 4	Level 5
	Ethical and moral risks	Level 1	Level 2	Level 3	Level 4	Level 5
	Loss of property risks	Level 1	Level 2	Level 3	Level 4	Level 5
Sales negative synergy effect	Risk of organizational culture clash	Level 1	Level 2	Level 3	Level 4	Level 5
	Values conflict risk	Level 1	Level 2	Level 3	Level 4	Level 5
	Legal risk	Level 1	Level 2	Level 3	Level 4	Level 5
	Technical risks	Level 1	Level 2	Level 3	Level 4	Level 5
	Ethical and moral risks	Level 1	Level 2	Level 3	Level 4	Level 5
R&D negative synergy effect	Risk of organizational culture clash	Level 1	Level 2	Level 3	Level 4	Level 5
	Values conflict risk	Level 1	Level 2	Level 3	Level 4	Level 5
	Legal risk	Level 1	Level 2	Level 3	Level 4	Level 5
	Technical risks	Level 1	Level 2	Level 3	Level 4	Level 5
	Ethical and moral risks	Level 1	Level 2	Level 3	Level 4	Level 5

As shown in table 2, the index system is composed of 6 primary indexes, 34 secondary indexes and scoring criteria. And the index system has some advantages: First, the index system is integral.

Enterprises can know both advantages and disadvantages. Second, the system use much more non-financial indexes indicating that enterprises should also pay attention to social responsibility and long-term development. It is more scientific and rational. Third, Likert five-scale method is used to estimate some qualitative indexes. It's more accurate.

Index Weight

As for the index weight, there are many methods to calculate it in existing literatures, like 0-1 method (forced decision), multi-proportional scoring, DARE method, experts scoring, analytic hierarchy process (AHP), etc. These calculation methods are affected by subjective factors in varying degrees. The scientificity and rationality of calculation results can't be guaranteed without a hierarchical index system. In consequence, experts scoring and AHP method are used to calculate the weight. It can reduce the influence of subjective factors and help establish a hierarchical, integral and accurate index system.

Production, Sales and R&D Synergy Effect Evaluation Model

According analysis, a PAN model was established to evaluate production, sales and R&D synergistic effect after M&A from positive synergistic effect and negative synergistic effect. And PAN model is named by the initials of positive and negative.

Model Building

PAN model is meaningful, which considers enterprise risk and the prospects for business development.

$$\begin{aligned} &\text{PAN}=\text{Effects of positive synergy}/\text{Effects of negative synergy}=P/N \\ &=(M_1\times P_1+M_2\times P_2+M_3\times P_3)/(R_1\times N_1+R_2\times N_2+R_3\times N_3) \end{aligned} \quad (1)$$

In the formula 1, PAN is enterprise production, sales and R&D synergy effect
Effects of positive synergy:

$$P=M_1\times P_1+M_2\times P_2+M_3\times P_3,\ \ M_1+M_2+M_3=1 \quad (2)$$

P_1: Production positive synergistic effect
P_2:R&D positive synergistic effect
P_3: Sales positive synergistic effect
M_1: Weight of production positive synergistic effect
M_2: Weight of R&D positive synergistic effect
M_3: Weight of sales positive synergistic effect
Effects of negative synergy:

$$R=R_1\times N_1+R_2\times N_2+R_3\times N_3,\ \ R_1+R_2+R_3=1 \quad (3)$$

N_1: Production negative synergistic effect
N_2:R&D negative synergistic effect
N_3: Sales negative synergistic effect
R_1: Weight of production negative synergistic effect
R_2: Weight of R&D negative synergistic effect
R_3: Weight of sales negative synergistic effect

Explaining of Evaluation Model Result

According to formula 1, the result of PAN model is the ratio of positive synergistic effect and negative synergistic effect. And the result has 3 cases.

(1) PAN >1. It means that positive synergistic effect is greater than negative synergistic effect

after merger. And the enterprise is in good development. (2) PAN=1. It means that positive synergistic effect is same as negative synergistic effect after merger. So the enterprise should take some measures for better developing in this period. (3) PAN< 1. It means that positive synergistic effect is less than negative synergistic effect after merger. It usually happens at the beginning or end of production, sales and R&D synergy. At the beginning of synergy, each department needs to take time to coordinate and run, so some mistakes are unavoidable. At the end of synergy, existing cooperative mode can't vary with the changing of enterprise's needs.

Conclusion

After researching the existing literatures, the author innovatively established an evaluation model of production, sales and R&D synergistic effect from the positive and negative synergistic effect aspects. 6 primary indexes and 34 secondary indexes were selected with the method of questionnaire survey. Then AHP method and experts scoring are adopted to design the scoring criteria and calculate the weight. Finally a practical evaluation model named PAN was established to evaluate the production, sales and R&D synergistic effect. In the meantime, this evaluation model also has some defects. The author only did investigation for several enterprises and interviewed some experts when selecting index. The evaluation model of production, sales and R & D synergistic effect may not be suitable for all industries and enterprises. Further empirical research about the universality of the evaluation model is needed.

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